Ministry of Planning and Strategic Investment
Democratic Republic of Timor-Leste

The Project for Study on Dili Urban Master Plan in the Democratic Republic of Timor-Leste

Final Report
Part II: The Master Plan

October 2016

Japan International Cooperation Agency (JICA)

Nippon Koei Co., Ltd.

Pacet Corp.

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Source: JICA Website

PART II: THE MASTER PLAN

EXECUTIVE SUMMARY

8. VISION, FRAMEWORK, AND URBAN STRUCTURE

Vision

8.1 The Dili Metropolitan Area (DMA) Vision is formulated with reference to the related plans and inputs from stakeholders. Both the counterparts and the JICA Project Team (JPT) proposed the "beloved and brilliant national capital" as an idea of vision, supported by four pillars such as "robust economic hub", "high-quality of life", "rich social and cultural center", and "healthy and eco-friendly society". The four viewpoints, namely: "linkage", "human resources", "sustainability", and "resilience", should be addressed to realize DMA Vision 2030, when development strategy and programs/projects are formulated.

Framework

8.2 Based on the detailed review and analysis of the projection of the Census 2010 mentioned in Section 8.1 above, the five projection scenarios are considered for the project area, namely: Case-1: Rapid Migration Scenario (annual average growth rate of 5.77%), Case-2: Census Scenario (4.61%), Case-3: Moderate Migration Scenario (3.94%), Case-4: Minimum Migration Scenario (3.03%), and Case-5: No Migration Scenario (2.48%).

8.3 As a macroeconomic framework, the four growth scenarios are created based on the past growth performance, SDP target, and the future perspective of the national economy. High growth scenario targets an annual average gross domestic product (GDP) growth rate of 11.2% after 2021 towards 2030, moderate growth of 8.3%, low growth of 6.4%, and lowest growth of 5.6%.

8.4 JPT proposed that Case-3: Moderate Migration Scenario for the population projection and the moderate growth case for GDP projection be adopted as development framework of the project area in the Working Group-3 Socio-Economy, noting that the moderate case (in line with the SDP target) could be the growth target rather than the aggressive high case and the bit inactive low case. Verification study by the project team concludes that the combination of both scenarios is the most suitable development framework. The result of the projections is summarized in the table below.

Projection Result of Population and GDP

Adopted Scenarios	2010	2015	2020	2025	2030	Annual Avg. Growth Rate
Population: Case-3: Moderate Migration	223,793	283,034	351,137	422,524	492,251	3.94%
GDP (USD million): Moderate Growth	934	1,526	2,428	3,863	6,145	9.9%
Per Capita GDP (USD): Moderate Growth	858	1,195	1,666	2,322	3,237	6.9%

Source: JICA Project Team projected based on Census 2010 and SDP

Regional Spatial Direction for DMA

8.5 The Timor-Leste Strategic Development Plan (2011-2030) (hereinafter referred to as "SDP") as the upper development planning framework describes the key spatial development strategies. On the other hand, the National Spatial Plan of Timor-Leste (hereinafter referred to as "PNOT") is currently under discussion and has not been approved yet. In this context, the following are main development directions to be reflected into the Dili Urban Master Plan, taking account of the spatial development strategies of SDP to formulate "equitable development", "regional

development corridors", "national strategic zones", and "sustainable agriculture production zone and forest conservation zones":

- Promoting international (regional) linkage
- Leading and stimulating regional socioeconomic development on the regional development corridors
- Integrating effective socioeconomic development mechanism taking account of urban-rural linkage and access network
- Formulating attractive and competitive core as the capital for national socioeconomic development
- Establishing effective administrative coordination mechanism beyond administrative jurisdictions (municipality)

Urban Structure

8.6 JPT took the steps below to propose the spatial structure plan of DMA through the evaluation of scenarios in the strategic environmental assessment (SEA). JPT took two types of evaluations applicable to the development visions and in the environmental and social impacts. The National Directorate of Housing and Urban Planning (DNHPU) of the Ministry of Public Works, Transportation, and Communication (MoPWTC) (now belonging to Ministry of Planning and Strategic Investment (MPSI)) explained the process and results of the evaluations in the 2nd Public Consultation meetings held in Dili, Hera and Tibar in December 2014.

i) Set-up of the spatial structure scenarios
ii) Evaluation of the scenarios applicable or suitable to the development visions
iii) Evaluation of the scenarios in environmental and social impacts
iv) Overall evaluation
v) Proposed mitigation measures
vi) Public involvement (public consultation meetings)

8.7 JPT set up three spatial structure scenarios for DMA by referring to the three scenarios of population projection cases, namely: maximum (case-1), proposed (case-3), and minimum (case-5), as three alternatives to compare as shown below.

- Scenario 1: This alternative represented by "do-nothing case" under case-1 (600,000-700,000 population, 97 person/ha on average) would require maximization of urban development in association with large investment cost to manage lands involving possible natural hazard prone areas.
- Scenario 2: Alternative 2 with concept of "urban cluster growth" development under case-3 (450,000-550,000 population, 75 person/ha on average) expects moderate utilization of land within habitable lands to formulate main urban center and satellite town developments in Hera and Tibar.
- Scenario 3: In conjunction with case-5 population growth (350,000-400,000 population, 52 person/ha on average) where every urban development will absorb certain magnitude of population and employment in each major town of Timor-Leste such as Baucau and Suai will be achieved in 2030, Scenario 3 would enable to form "compact city" without major large settlement in Tibar and Hera.

8.8 Three spatial structure scenarios for DMA were assessed quantitatively by eight indicators for sustainable development taking account of the achievement of the "development vision" and the "anticipated impacts" of the indicators. The indicators were defined as measures for achieving "development vision" supported by four pillars of "robust economic hub", "health and eco-friendly society", "high quality of life", and "rich social and culture center". The results indicated that Scenario 2 was the most suitable urban structure of DMA for the visions as it was

balanced among the development visions.

8.9 Evaluation of the scenarios in terms of environmental and social impacts: In comparison, the size of the population is the main point of view to determine the differences in the environmental and social impacts among the scenarios. As a result, Scenario 1 should be avoided, as the most adverse impacts are expected in the densely-populated area. Scenario 3 is a comparatively better scenario, as the scenario is expected to cause the least negative impacts on pollution and natural environment, and can maintain the present conditions, but the positive impacts on socioeconomic development such as agglomeration effects and synergistic effects are low. On the other hand, Scenario 2 is also favorable because it has the most positive impacts on social environment such as activation of local economy, efficient land use, and preservation and protection of cultural heritage; and has medium adverse impacts on the pollution and natural environment. Scenario 2 is balanced in terms of the adverse impacts and the positive impacts on the environmental and social conditions. Meanwhile, the adverse impacts on pollution and nature of Scenario 2 can be reduced and mitigated.

8.10 Evaluating holistically these three scenarios through the two types of evaluations based on the views of development visions and environmental impacts, JPT proposes Scenario 2 as the appropriate urban spatial structure of DMA.

- Scenario 1 is the worst scenario and should be avoided as the urban spatial structure of DMA. The scenario is not applicable to realize the development visions and will raise adverse impacts on environmental and social conditions.
- Scenario 2 is best for the development visions of DMA and has the most positive impacts on the social environment with medium adverse impacts on pollution and natural environment.
- Scenario 3 is also decent in terms of the environmental and social impacts; however, it will require large investment cost over time for successful economic development distribution to the entire country against the current trend of social migration into Dili. Besides, this is still inefficient and ineffective in terms of land use of DMA especially for Hera and Tibar.

Development Road Map

8.11 JPT defines development roadmap as a road map or a development path of the project area to attain development vision and to form the proposed urban structure during the planning period. The planning period is divided into three phases in the roadmap. In this project, JPT set three phases, namely: i) Phase 1: 2015-2020, ii) Phase 2: 2021-2025, and iii) Phase 3: 2026-2030. The roadmap narrates possible events, activities to be achieved, possible changes due to the events, and the activities by item such as spatial pattern, socio-economy, and infrastructure for each phase.

8.12 JPT narrates the development roadmap for the optimum development scenario based on the analysis results of the socio-economy and spatial patterns. The overviews of the road map for each phase are as follows:

Phase 1: 2015-2020

Foundation for developing socio-economy is to be established through infrastructure development and capacity development from 2015 to 2020. Both population and GDP growth rates in Phase 1 are higher than those in other phases.

Phase 2: 2021-2025

Phase 2 is the beginning stage to fully utilize the systems, human resources, and infrastructure, which are to be developed in Phase 1. Phase 2 is the stage to start and roll out economic development. Major infrastructure developments are to be completed in the

previous phase, but some developments will continue in Phase 2. Both population growth and GDP growth will slightly slow down in this phase.

Phase 3: 2026-2030

Sustainability and further promotion of developments in Phase 2 will be ensured in Phase 3. Population growth in Phase 3 will slow down a little compared to Phase 2, and GDP growth rate in this phase will maintain the rate in the previous phase. The accumulated outputs of developments from Phase 1 to Phase 3 will contribute in attaining the "DMA Vision 2030".

9. URBAN LAND USE PLAN

Land Use Policy

9.1 Land use policies shown below are set and defined as implementable framework for land use planning involving several essential planning measures such as "density formulation", "use classification", and "use distribution".

- Establishing compact urban form with optimum dense settlement
- Self-sustaining oriented urban function in each urban area of Dili, Hera, and Tibar
- Introducing mixed use measure
- Strengthening resilient land use by protection of sensitive areas
- Securing lands and spaces for key infrastructure and public facilities
- Supporting efficient mobility network and public transportation system in association with adequate land use
- Organizing efficient industrial spaces for competitive economic development
- Enhancing green network and recreational spaces as part of attractive urban environment and contribution to climate change adaptation
- Formulating historical urban center by adequate land use and control to foster capital's heritage environment

Land Use Framework

9.2 The development framework of Case 3 population projection is assessed by land capacity of DMA through development suitability analysis on whether the future population in DMA would be appropriately absorbed by the available lands. Consequently, Case 3 population projection would be within the possible range of land capacity of DMA to accommodate 500,000 people. The following tables, which are the bases for land use planning, show the population and employment frameworks by each administrative post.

Target Population for Dili Metropolitan Area

Municipality	Administrative Post (e.g. sub-district)	2014*	2020	2025	2030	AAGR (14-30)
Dili	Vera Cruz	36,230	39,850	43,420	47,500	1.7%
	Nain Feto	27,830	29,690	31,410	33,200	1.1%
	Dom Aleixo	125,230	160,630	202,480	252,400	4.5%
	Cristo Rei	62,940	78,090	94,920	116,900	3.9%
Liquica	Bazartete / (Tibar)	5,400	13,500	25,000	50,000	14.9%
Total		257,630	321,760	397,230	500,000	4.2%

Note: Population in 2014 is estimated based on the Population and Housing Census 2010 (DGS).
Source: JICA Project Team

Target Employment for Dili Metropolitan Area

Indicators	2010	2015	2020	2025	2030	AAGR
GRDP (million USD)	707	1,124	1,789	2,845	4,527	9.7%
Labor Force (15 – 64 years) (A)	146,278	173,962	210,152	256,702	321,111	4.0%
Target Employment (B)	57,197	72,110	90,910	114,620	144,500	4.7%
Target Unemployment (C)	12,934	13,530	14,160	14,800	15,500	--
Total as Target Economically Active (D)	70,131	85,640	105,070	129,420	160,000	--
Labor Force Participation Rate (D/A)	48%	49%	50%	50%	50%	--
Unemployment Rate (C/A)	9%	8%	7%	6%	5%	--
Labor Productivity (GDP per Employment)	12,361	15,587	19,679	24,821	31,329	--

Source: JICA Project Team

Spatial Strategy and Land Use Policy

9.3 Land use policies shown below are set and defined as implementable framework for land use planning involving several essential planning measures.

- Establishing compact urban form with optimum dense settlement
- Self-sustained oriented urban function in each urban area of Dili, Hera, and Tibar
- Introducing mixed use measure
- Strengthening resilient land use by protection of sensitive areas
- Securing lands and spaces for key infrastructure and public facilities
- Supporting efficient mobility network and public transportation system in association with adequate land use
- Organizing efficient industrial spaces for competitive economic development
- Enhancing green network and recreational spaces as part of attractive urban environment and contribution to climate change adaptation
- Formulating historical urban center by adequate land use and control to foster capital's heritage environment

Proposed Land Use Plan for Dili Metropolitan Area

9.4 The framework of population and employment is set for land use planning as shown in the tables below.

Target Population by Urban Block in DMA

Urban Block		2014*	2020	2025	2030	AAGR	Distribution (%)	
Main	Sub category						2014*	2030
Urban Center	Urban Center-E	25,940	27,990	29,890	31,900	1.3%	10.1%	8.7%
	Urban Center-W	17,810	18,750	19,610	20,500	0.9%	6.9%	5.8%
	Sub-total	*43,750*	*46,740*	*49,500*	*52,400*	*1.1%*	*17.0%*	*14.5%*
Center Fringe	Center Fringe-E	41,210	49,070	56,820	65,800	3.0%	16.0%	15.3%
	Center Fringe-W	57,030	70,850	84,980	102,000	3.7%	22.1%	22.0%
	Center Fringe-N	18,160	18,960	19,680	20,400	0.7%	7.0%	5.9%
	Sub-total	*116,400*	*138,880*	*161,480*	*188,200*	*3.0%*	*45.2%*	*43.2%*
Suburban	Suburban-E	900	1,200	1,550	2,000	5.3%	0.3%	0.4%
	Suburban-W	81,050	105,150	135,450	171,400	4.8%	31.5%	32.7%
	Sub-total	*81,950*	*106,350*	*137,000*	*173,400*	*4.8%*	*31.8%*	*33.1%*
Satellite Town	Satellite-Hera	10,130	16,290	24,250	36,000	8.2%	3.9%	5.1%
	Satellite-Tibar	5,400	13,500	25,000	50,000	14.9%	2.1%	4.2%
	Sub-total	*15,530*	*29,790*	*49,250*	*86,000*	*11.3%*	*6.0%*	*9.3%*
Total		257,630	321,760	397,230	500,000	4.2%	100.0%	100.0%

Note: Population in 2014 is estimated based on Census 2010 (DGS) and existing land use survey conducted by JPT.
Source: JICA Project Team

Target Employment by Urban Block in DMA

Urban Block		2014*	2020	2025	2030	AAGR	Distribution (%)	
Main	Sub category						2014*	2030
Urban Center	Urban Center-E	7,961	10,200	12,735	16,040	4.5%	11.4%	11.1%
	Urban Center-W	5,919	7,485	9,180	11,350	4.2%	8.5%	7.8%
	Sub-total	*13,881*	*17,684*	*21,915*	*27,390*	*4.3%*	*19.8%*	*18.9%*
Center Fringe	Center Fringe-E	10,617	12,780	15,050	18,410	3.5%	15.2%	12.7%
	Center Fringe-W	15,632	18,710	21,850	25,220	3.0%	22.3%	17.4%
	Center Fringe-N	5,262	5,550	5,825	6,150	1.0%	7.5%	4.2%
	Sub-total	*31,511*	*37,040*	*42,725*	*49,780*	*2.9%*	*45.0%*	*34.3%*
Suburban	Suburban-E	281	520	1,330	3,430	16.9%	0.4%	2.4%
	Suburban-W	21,152	26,520	32,970	41,420	4.3%	30.2%	28.6%
	Sub-total	*21,433*	*27,040*	*34,300*	*44,850*	*4.7%*	*30.6%*	*30.9%*
Satellite Town	Satellite-Hera	2,180	2,530	4,190	7,760	8.3%	3.1%	5.4%
	Satellite-Tibar	1,004	2,690	6,400	15,220	18.5%	1.4%	10.5%
	Sub-total	*3,185*	*5,220*	*10,590*	*22,980*	*13.1%*	*4.5%*	*15.8%*
Total		70,010	86,985	109,530	145,000	4.7%	100.0%	100.0%

Note: Employment in 2014 is estimated based on Census 2010 (DGS) and existing land use survey conducted by JPT.
Source: JICA Project Team

Land Use Allocation

9.5 Future residential, commercial and business, industry, public facility and green and open spaces land use allocations are set as shown in the table below.

Proposed Land Use Allocation by Use Classification in 2030 in DMA

Urban Block	Land Use Class	I Rural		II: Residential			III: Commercial & Business				IV:Industry		V: Public		VI: Green & Open Space				RD	Total
	Sub-block	AG	RR	RL	RM	RMX	UCB	NCB	CCB	TR	IZ	QI	PU	HE	PSO	NF	ONA	W		
URBAN	Urban Center-E	0	0	0	21	133	30	0	11	0	0	0	36	0	9	0	0	1	38	280
CENTER	Urban Center-W	0	0	27	6	65	20	0	17	0	0	0	62	4	11	33	17	0	39	299
	Sub-total	**0**	**0**	**27**	**27**	**198**	**50**	**0**	**28**	**0**	**0**	**0**	**98**	**4**	**19**	**33**	**17**	**2**	**76**	**579**
CENTER	Center Fringe-E	0	18	112	214	8	0	0	18	0	0	8	32	16	30	775	109	18	68	1,426
FRINGE	Center Fringe-W	0	1	41	240	75	0	0	67	0	0	0	81	0	29	174	259	11	86	1,067
	Center Fringe-N	0	57	86	52	0	0	6	8	0	0	0	23	1	8	551	204	7	41	1,042
	Sub-total	**0**	**76**	**239**	**506**	**83**	**0**	**6**	**93**	**0**	**0**	**8**	**136**	**16**	**67**	**1,500**	**572**	**36**	**196**	**3,535**
SUBURBAN	Suburban-E	0	7	22	0	48	0	0	0	0	0	0	1	0	2	110	287	1	14	491
	Suburban-W	22	99	67	343	125	33	11	86	0	0	65	210	14	137	1,897	1,369	196	233	4,909
	Sub-total	**22**	**106**	**89**	**343**	**173**	**33**	**11**	**86**	**0**	**0**	**65**	**211**	**14**	**140**	**2,007**	**1,656**	**197**	**248**	**5,401**
SATELLITE	Satellite-Hera	89	16	95	115	20	10	0	17	30	0	10	93	128	71	2,447	765	98	120	4,121
TOWN	Satellite-Tibar	0	13	56	140	36	9	2	29	11	77	0	77	0	74	2,561	959	60	119	4,224
	Sub-total	**89**	**28**	**151**	**255**	**56**	**18**	**2**	**45**	**41**	**77**	**10**	**170**	**128**	**145**	**5,008**	**1,723**	**159**	**240**	**8,345**
	Total	**112**	**211**	**507**	**1,131**	**511**	**101**	**19**	**253**	**41**	**77**	**83**	**614**	**162**	**371**	**8,548**	**3,968**	**393**	**759**	**17,860**

Note: AG=Agriculture, RR=Rural Residence, RL=Low-density Residential, MR=Medium-density Residential, RMX=Mixed Use (R+CB), UCB=Urban Commercial Business Center, NCB=Neighborhood Business Commercial Center, CCB=Corridor Commercial and Business, TR=Tourism and Recreation Area, IZ= Industrial Zone, QI=Quai-industrial Area, PU=Key Public Facilities, HE=Higher Education, PSO=Park, Sports and Open Spaces, NF=Natural and Forest Area, ONA = Other Nature Area, W=Water Body

Source: JICA Project Team

Proposed Land Use Class and Plan for Dili Metropolitan Area

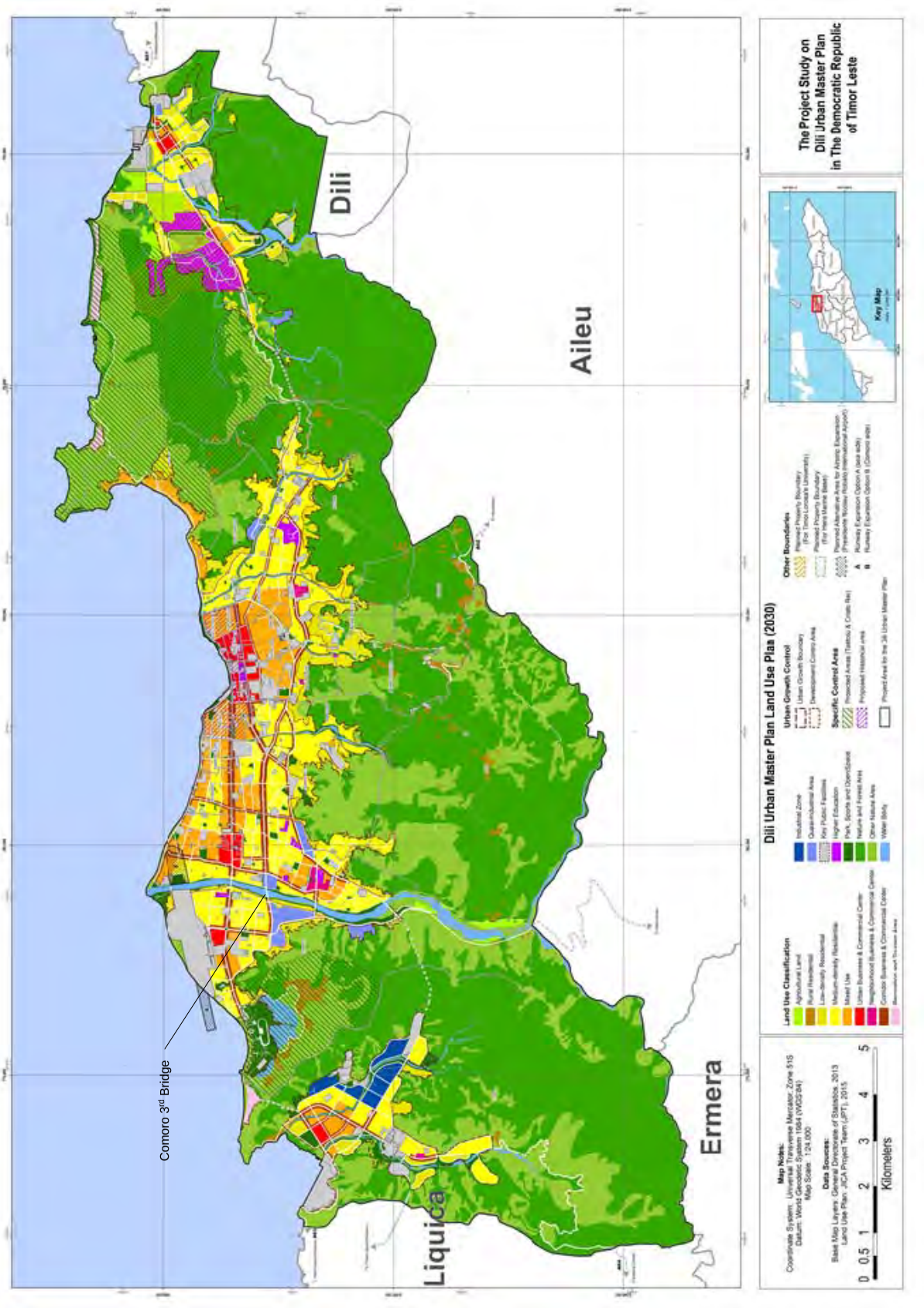
9.6 The use classification for land use plan which may also be intended for zoning category for development control mentioned in the succeeding section is proposed as seen in the following table. The draft of land use plan in 2030 is illustrated in the figure after the table below.

Proposed Land Use Classification with Coding System for DMA

Plan Use Class	Sub-class	Code	Color	Reference
Class I: Rural (100)	Agriculture land	110: AG		
	Rural residential	120: RR		Low density in slope areas
Class II: Residential (200)	Low-density residential	210: RL		Mainly in slope areas in DMA
	Medium- to high-density residential	220: RM		
	Mixed use	230: RMX		Residential + Commercial and Business
Class II: Commercial and Business (300)	Urban center commercial-business	310: UCB		
	Corridor commercial-business	320: CCB		
	Neighborhood commercial-business	330: NCB		
	Tourism and recreation area	340: TR		
Class IV: Industry (400)	Industrial zone	410: IZ		Applicable to SEZ
	Quasi-industrial area	420: QI		Light industry + others
Class V: Public Use (500)	Key public facilities	510: code		See code list below
	Higher education	520: HE		
Class VI: Green and Open Space (600)	Park, sports and open space	610: PSO		
	Nature and forest area	620: NF		
	Other nature areas	630: ONA		Bush, grass land, coastal area
	Water surface	640: W		

Class/Sub-clas	Cod	Description
Key Public Facilities (510)	GO	Key government / institutions / administration / security by large site
	RH	Key healthcare facilities with large site (hospital, healthcare center, welfare facilities)
	PU	Key utilities (large site for plant facilities for water supply, sewerage treatment, disposal)
	CE	Key cemetery
	TF	Key transportation facilities (terminal, large depot, other transport facilities)
	AP	Airport facilities

Note: Each code is shown in each parcel of land use sub-class on the map with scale of 1/25,000
Source: JICA Project Team



Source: JICA Project Team

Proposed Land Use Plan in 2030 for Dili Metropolitan Area

10. TRANSPORT DEVELOPMENT PLAN

Road and Public Transportation Plan

10.1 Future traffic demand is forecasted based on the traffic survey analysis in order to specify the problems in the Dili traffic network.

Summary of Forecasted Case

No.	Year	Forecasted Case	Project	Effect of Project Introduction
Case-1	2030	On-going project	・Comoro No. 3 is opened	・Relieve the congestion among urban area, Comoro, and Tibar
Case-2	2030	Do-minimum	・Comoro No. 3 is opened. ・The problems of parking and microlet boarding and alighting are removed. ・Road widening is conducted around the nearby urban area.	・Relieve the congestion among urban area, Comoro and Tibar. ・Relieve the congestion at urban area.
Case-3	2030	Bypass project	・Projects of do-minimum case are completed. ・New bypass road is constructed to connect Tibar to the ring road of the city center.	・Remove the traffic congestion from Tibar to Hera and other cities. ・Relieve the congestion at urban area
Case-4	2030	Mass transit project	・Projects of do-minimum case are completed. ・Bus rapid transit (BRT) is introduced through the main road.	・Support the urban planning through TOD to reduce the increasing number of private cars
Case-5	2030	Do-maximum	・All projects mentioned above are completed.	・Total effect of the four cases above.

Source: JICA Project Team.

Results of analysis in 2030 are as follows:

- Do-nothing case : Peak time congestion happens in the urban area.
- Case-1 (On-going project) : Congestion in Comoro area is still evident; nevertheless, it is partially relieved compared to the do-nothing case. Congestion in the urban area still occurs due to no countermeasure
- Case-2 (Do-minimum) : Congestion is somewhat mitigated inside the city center; however, congestion problems still remain on the ring road and around the city center.
- Case-3 (Bypass project) : New bypass roads have a big effect on the alleviation of traffic congestion.
- Case-4 (BRT project) : There is alleviation of traffic congestion around the BRT alignment. However, the road along the BRT alignment is still congested due to lack of road capacity.
- Case-5 (Do-maximum) : The problems on traffic congestion are obviously solved in this case.

10.2 Development policies of the transportation sector in DMA to cope up with the future problems and issues of the transportation sector are as follows:

- Improvement of the road network and improvement of traffic regulation to cope with the increase in the future traffic demand.
- Promotion of mass transit to reduce the traffic volume of private cars and motorcycles.
- Harmonization of road and mass transit facilities developments with urban development.

10.3 Six projects for road and public transportation sector are proposed as follows:

- Development of off-street parking and fringe parking
- Improvement of ring road

- Road widening of the current road network between Comoro and central business district (CBD)
- New bypass development
- Improvement of Tibar Road between Tibar and Comoro
- Improvement of mass transit

Improvement of mass transit consists of the improvement of microlet service, formation of organization, introduction of priority lane, introduction of large size bus, and introduction of BRT.

Seaport

10.4 Seaport sector plan is prepared based on the premise that the Tibar New Port will be constructed in line with the proposed construction schedule under public-private partnership (PPP) scheme and all cargoes except passengers, which are treated in the existing Dili Port will be transferred to the Tibar New Port gradually from 2018 and completely by 2020. It is recommended that Dili Port be converted to a dedicated "Passenger Terminal" with international cruise and domestic ferry terminals.

10.5 The current terminal facilities of Dili Port cannot accommodate the future demand of passengers. Accordingly, a domestic ferry terminal, international cruise terminal, and public transportation terminal need to be constructed. In addition, a specific land use plan and development plan for Dili Port and the surrounding areas have not been prepared. Harmonious future development of Dili Port with surrounding areas is necessary.

10.6 Efficient land use is required at Dili Port and coastal area near the port after main logistic functions are transferred to Tibar Port. The following two developments as development policies are recommended:

- Future development of Dili Port
- Waterfront redevelopment of coastal area

10.7 Seven projects for seaport sector are proposed.

- Domestic ferry terminal and other related facilities project
- International cruise terminal and other related facilities project
- Comprehensive bus terminal and other related facilities project
- Development of security facilities and system project
- Pilot and tugboat base development project
- Seaside tourism center construction project
- Formulation of waterfront redevelopment plan of coastal area

Airport

10.8 The President Nicolau Lobato International Airport (PNLIA) in Dili handles around 187,282 passengers and 239 t cargo in 2013 for international air traffic in Timor-Leste. PNLIA is located in the west side of Dili City with one 1,850 m runway, four exit taxiways, and three separated passenger terminal buildings for departure, arrival and VIP. Current facilities are in poor condition that passenger building becomes a narrow space for proper passenger services and also runway length is only 1,850 m, which is too short to enable large aircraft to reach key destinations without payload restrictions. Also, airport main facilities do not meet the international standards on airport/aviation safety and security.

10.9 Air traffic demand forecast has been prepared under the International Finance Corporation (IFC)

project and Asian Development Bank (ADB) based on the historical data and economic growth rate. The passenger volume in 2030 will reach more than double of the current number of around 400,000 passengers in Timor-Leste. Presently, the capacity of the existing airport facility has already been exceeded and has suffered inadequate operation in terms of the arrival of aircraft at the terminal building due to its narrow space.

10.10 Timor-Leste established the Strategic Development Plan (SDP) 2011-2030 and prepared the policy under "Overview and Challenges" and "Strategy and Actions" for the airport sector and the main features of PNLIA are listed as follows:

- Runway expansion to 2,500 m long and 45 m wide to host large aircraft such as Airbus 330.
- Construction of the modern new terminal facility

10.11 The development of PNLIA is not only for the resolution of current issues and problems but also for the contribution to the related pillars of DMA Vision such as "robust economic hub." JPT particularly established the policy for PNLIA development as "safe and comfortable airport" in accordance with the International Civil Aviation Organization (ICAO) standard and secure the appropriate service level under the International Air Transport Association (IATA) manual.

10.12 JPT proposed the PNLIA Development Project Phase 1 for short term and Phase 2 for long term project.

11. URBAN INFRASTRUCTURE DEVELOPMENT PLAN

Disaster Management

11.1 Timor-Leste is highly vulnerable to natural disasters such as floods, strong winds, landslides, droughts, cyclones, earthquakes, and tsunamis. Based on the disaster records of DesIventar[1], in Dili, the most frequent natural disasters are floods, strong winds, and landslides. Also, earthquake and tsunami are necessary to be considered as possible disasters for preparedness.

11.2 According to the National Disaster Risk Management Policy (NDRMP), DMA, which is composed of Dili Municipality and Tibar Suco of Liquicia Municipality, should establish the disaster management commissions (DMCs) at the municipality/district, administrative post, suco level. Dili Municipality as well as four of the six administrative posts, and five among the 31 sucos have established DMCs. Liquicia Municipality has established its municipality DMC and Bazartete Administrative Post DMC, but suco DMC has not been established at Tibar Suco as of January 2015.

11.3 According to the NDRMP, the following are necessary to be considered as development policies:

- To promote mainstreaming of disaster risk management (DRM) for every sector;
- To prepare clear functions and responsibilities of line ministries and agencies and each line ministry or agency should develop its action plan;
- To strengthen the institutional and technical capacities at the national level in order to carry out the DRM responsibilities;
- To establish monitoring systems for hydro-meteorological and geological hazards;
- To develop capacities of technical staff of MPWTC to cope with the hydro-meteorological hazards, tropical storms, and floods;

[1] Disaster Inventory System of the effects of disasters supported by UNISDR, UNDP, and others.

- To develop capacities of technical staff of the Ministry of Petroleum and Mineral Resources Public Works to cope with geological hazards, landslides, and earthquakes.

11.4 The following five projects for DRM are proposed:

- Implementation of hazards, risks and vulnerability assessment on DMA
- Installation of monitoring equipment for hydro-meteorological and geological hazards
- Capacity development of hydro-meteorological and geological staff for weather forecasting and early warning systems
- Review of the Drainage Master Plan from watershed management aspects and implementation of flood control measures for the five rivers in Dili
- Formulation of flood and sediment control master plan for the rivers in Hera and Tibar and implementation of priority measures

Water Sector

11.5 JPT carried out the demand projection of water supply. The basis of unit water consumption for domestic, commercial, and industrial usage is the conditions mentioned in Dili Sanitation and Drainage Master Plan (DSDMP), utilized in the works of the National Directorate of Water Supply (DNSA) and stipulated in Law No. 4 2004. The basis of infiltration amount is the conditions mentioned in DSDMP. The basis of the population is the projection in the DSDMP and that of the study team. The estimated demand is approximately 160,000 m^3/day. It is more than three times of the capacity of the water supply.

11.6 In the water sector, the evaluation of the water resource for water supply is the highest priority. Providing the water supply capacity is one of the indispensable conditions for the feasibility study (F/S) of urban development such as residential area, commercial area, and industrial area. For the appropriate master plan of the water supply, reflecting the information of the other urban development plan is necessary.

11.7 The improvement of the existing water supply system is also important to get the people's confidence. It changes the situation on the tariff system and water conservation. From the situation, the improvement needs to continuously progress in parallel with the establishment of the capacity and the master plan. The effect indicator in the water sector is to meet the water supply period of 24 hours by 2030.

11.8 The following seven projects including the “Survey on the Capacity of the Groundwater for Water Supply” are proposed for the water supply sector. Projects for the survey of the water resource and the establishment of the master plan for water supply need to be carried out as soon as possible.

- Survey on the capacity of the groundwater for water supply
- Master plan of water supply
- Reconstruction of the distribution network
- Strengthening of the responsible organization for water supply
- Establishing the standard for the structural aspect of the facilities
- Modification of the master plan for water supply
- Development of the water supply facilities

Sewerage Sector

11.9 Based on the conditions of DSDMP and the population studied by the study team, the study team has estimated the amount of wastewater to be treated in 2030. The amount was approximately 140,000 m^3/day. As little capacity of the wastewater treatment system is

available in the project area, the development of the sewerage system is an urgent issue. On the other hand, the development of the sewerage system need to proceed steadily, because the strengthening of the responsible organization and the people's understanding of the sewerage system are necessary at the same time.

11.10 As for the development policy, DSDMP has been established already. The policy should utilize the development of the sewerage system and it will expand to the peripheral area considering the future urban development plan for the residential, commercial and industrial area. The effect indicator of sewerage is the sewerage system capacity of 138,800 m^3/day.

11.11 The following six projects are proposed for sewerage sector. Development of the community sewerage treatment systems (CSTS) and decentralized wastewater treatment plants has priority in accordance with DSDMP. Strengthening the National Directorate of Basic Sanitation (DNSB) is also necessary for the management of the projects, planning, design, and maintenance. Project for the people's understanding of the sewerage system is necessary through interview with the communities about the current situation and instruction about hygiene issues related to the sewerage system.

- Construction of CSTS
- Construction of the decentralized water treatment plant
- Strengthening of DNSB
- Establishing the standard of the sewerage system for buildings
- Review and revision of DSDMP
- Communicating with communities on sewerage system and instruction to the communities for cooperative maintenance of the sewerage system

Drainage Sector

11.12 In the drainage sector, the development of the drainage system in the Dili urban area has already started from 1994. The existing drainage system has been available in Dili urban area. Its capacity, however, is insufficient due to lack of maintenance and under requirement of the design. Thus, DSDMP has been established mainly to improve the existing drainage facilities. In Hera and Tibar, the drainage system, as complementary road structure, is only available.

11.13 Basically, the development policy of the drainage system follows DSDMP. Development plans in other sectors for the development of residential, commercial, and industrial areas are under preparation. The development policy of the drainage system needs to be adjusted considering the urban development plans of other sectors. For the development of the sewerage system, strengthening the responsible organization for the drainage system is indispensable through reviewing the existing master plan, site visit, and communicating with the community. The effect indicator of the drainage sector is to improve the capacity of the drainage system up to rainfall with return period of five years.

11.14 JPT proposes the following seven projects for the drainage sector. The project for restoring the capacity of the existing facilities through the removal of dust and dirt in the drainage channels, improving the inclination of channels, and increasing the section of channels has high priority to mitigate the inundation.

- Removal of dust and dirt from drainage channels, improvement of inclination of drainage channels, and re-shaping of section of drainage channels
- Establishment of standard on kerb, rainwater collection pits and connection pipelines to drainage system between the responsible organizations for roads and drainage system
- Instructing communities for cooperative maintenance of the drainage system
- Survey of rainfall

- Strengthening of DNSB
- Study and construction of retention ponds
- Review and revision of DSDMP

Solid Waste Management

11.15 DMA is projected to generate 108 t of municipal solid waste in 2015 and 235 t by 2030. It currently implements the collecting and dumping system which covers four out of the six administrative posts, namely: Cristo Rei, Dom Aleixo, Vera Cruz, and Nain Feto. The collected waste is disposed in Tibar Dumpsite,which is located in the Municipality of Liquica.

11.16 The system is confronted by major problems such as i) Negative environmental conditions at the Tibar Dumpsite; ii) Inefficient and inadequate collection; and iii) Illegal dumping.

11.17 JPT proposes the following ten projects. The improvement of the Tibar Dumpsite conditions and operations has been prioritized for immediate implementation due to the urgency of mitigating the negative environmental conditions.

- Improvement of Tibar Dumpsite conditions and operations
- Improvement of waste collection
- Regulatory strengthening
- Information, education and communication (IEC) campaign and social preparation
- Capacity building on solid waste management (SWM)
- Development of new sanitary landfill
- Closure of Tibar Dumpsite
- Acquisition of compactor trucks
- Imposition of fees for waste collection
- New technology for waste treatment

Power Supply

11.18 The future power demand of DMA by 2017 will be 55.6 MW. It will exceed the current capacity of Dili Substation. The Dili Substation should be upgraded by installing one 31.3 MVA transformer in spare space to meet the load demand before 2017 as proposed in Section 11.5.3 of this report. However, after upgrading the Dili Substation with a total capacity of 94.5 MVA (equivalent to 80.3 MW), the future power demand of DMA will exceed this capacity by 2021.

11.19 The development policy of the power sector to achieve the vision and urban structure is as follows:

- Reliable and sufficient power source to all Dili and surrounding areas
- Affordable and lowest possible cost of distribution network
- Improve management and operation of power system
- Renewable energy sources

11.20 JPT proposes the following five projects to be carried out by 2030 to achieve the development policy set for the power sector. “Upgrade Dili Substation” is the project for meeting the load demand before 2017, but the project cannot meet the future demand after 2021. As such, the other four projects are also proposed to meet the future demand by 2030.

- Upgrade Dili Substation

- Extension of distribution network
- Development of 150/20 kV 3 x 63 MVA substation
- Development of SCADA2 system for distribution network
- Development of renewable energy

Telecommunication

11.21 Following the trend of ASEAN countries, the internet penetration ratio demand in DMA will reach 60.65% in 2030. Although the current available international communication bandwidth capacity for Dili is 1,365 Mbps, the estimated international capacity will be 3,865 Mbps in 2020.This forecast shows that the international communication bandwidth capacity will exceed the current capacity before 2020. Currently, the international connectivity of Timor-Leste is provided only through satellite links and microwave links and there are no submarine fiber links connecting to Timor-Leste. Therefore, internet speed is slow with higher cost.

11.22 JPT set up the following policies for the development of telecommunications in Dili to achieve the vision and urban structure:

- Reliable and affordable mobile phone coverage provided to all Dili and surrounding areas.
- High speed and reliable communications network and its connectivity
- E-government
- Policy, regulation, and institution development

11.23 JPT proposes the following six projects to be carried out by 2030 to achieve the development policy set for the telecommunications sector:

- Development of submarine fiber links
- Development of optic trunk communication network
- Development of national information and communication technology (ICT) center
- Development of e-government
- Development of domain management system
- Establishment of government data center with cyber security

12. URBAN MANAGEMENT PLAN

Institutional Arrangement

12.2 Institutional arrangement for urban development management is proposed as follows: (i) development control measures; and (ii) development promotion measures.

12.3 Since land is limited in DMA, land use efficiency has to be improved. Development control measures cover land development permit, building permit, which is regulated through guidance on control of “development zone” and “conservation zone”, and development standard. For development zone, building use, building size, and bulk control will be applied. For conservation zone, protected zone and utilization zone will be designated as control.

12.4 Together with development control measures, development promotion measures have to be implemented. Development promotion measures will include the establishment of urban

[2] SCADA stands for Supervisory Control and Data Acquisition.

development project (e.g., land re-development project, land re-adjustment project), execution of housing policy, strengthening of land policy, and promotion of infrastructure development in Hera and Tibar, which aims to accelerate urban development and also to guide development to realize structure plan and land use plan.

Organizational Development

12.5 Even though Timor-Leste Government is preparing to establish municipal government and the responsibility and role of central government and municipal government are still not determined, policy and guidance of spatial management have to be established and strengthened.

12.6 The main organizations and operations in spatial management in DMA consist of: (i) MPSI (main body is Housing and Urban Planning Directorate); and (ii) Municipalities (Dili and Liquica).

12.7 The main duties of DNHPU are to prepare the national spatial plan, local spatial plan, urban plan and housing plan, and to implement and manage the approved projects and programs in the plans. There is no document showing the detailed contents of the duties. The most detailed one is the Ministerial Decree of the Ministry of Public Works, No. 25 / December 11, 2013.

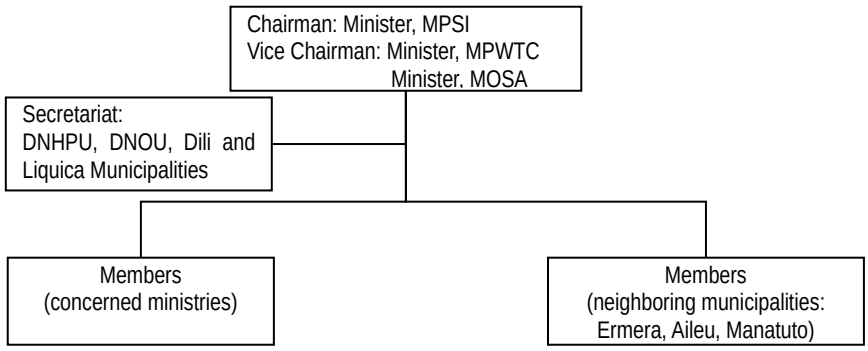
12.8 After the Dili Urban Master Plan is approved, it will enter the so-called stage of plan implementation or plan operation including plan dissemination, land use management, and urban development. The following job descriptions are considered necessary for DNHPU to perform alone, and to be performed through coordination and collaboration with the other relevant organizations:

- Duties related to plan dissemination: Publicity of the spatial management plan
- Duties related to land use management: Development permission regulations, building control regulations, land transaction regulation and data management
- Duties related to promotion of urban development: Urban facilities development, infrastructure development, and urban development projects.
- Other duties: Duties regarding transportation and city park, and townscape

12.9 The following are the duties that can be transferred to the local government.

- Implementation and management of urban development and planning to be proposed in accordance with the Spatial Planning Law (urban master plan and land use planning)
- Administration of urban infrastructure services such as cleaning, garbage, water supply, and road maintenance.
- Building permission

12.10 Currently, the spatial management coordination mechanism for inter-regional (municipal) does not exist. The Ministry of State Administration (MOSA) is responsible for local government and MPSI is responsible for spatial management. Coordination body composed of concerned central government and local government has to be established to improve spatial management coordination. Responsibility of the coordination board covers interregional matters such as transport development including road and public transport, water supply and sanitation, disaster management, solid waste management, and large-scale development.



Source: JICA Project Team

Proposed Structure of Coordination Board

Human Resources Development

12.11 The purpose of human resource development for this project period is to acquire basic knowhow during the stage of plan formulation. Human resource development is conducted through mainly on-the-job-training (OJT), and Working Group meetings and training in Japan for the selected counterpart (C/P). These trainings have raised the motivation of C/P for the work and increased the basic knowledge on spatial management. Based on these results and experiences, a human resource development plan which will be necessary after the completion of this project is proposed.

12.12 The following points of view are required for human resources capacity development:

- Acquisition of knowhow regarding spatial management in general
- Acquisition of knowhow regarding planning skills
- Acquisition of knowhow regarding the management of land use control
- Acquisition of knowhow regarding the implementation of projects such as urban facilities and infrastructure facilities and urbanization development.
- Acquisition of knowhow regarding database management

Database Management

12.13 Goal and road map toward sufficient database management are shown as follows:

- To be an initial model of geographic information system (GIS) database system for urban planning to be replicated by the local government
- To be the foundation and initial GIS platform within the DNHPU in promoting step-wise development, from initiation to full implementation, and from desktop to multi-user and web-based platforms of GIS database systems in the country
- To be an instrument for capacity development for GIS management toward establishment of certain central information functions
- To be a tool for data dissemination/sharing to be enhanced in the future for more effective urban management

13. ENVIRONMENT AND SOCIAL CONSIDERATION

Strategic Environmental Assessment (SEA)

13.1 JPT considered examining the alternatives of urban structure plans as the main target of SEA in

the Project. For the comparison of the alternatives, JPT conducted preliminary scoping to choose likely items with potentially significant impacts (positive/negative) due to the urban developments, and briefly explained them in the 1st public consultation meetings with the main C/P, i.e., DNHPU of MPSI. By considering the opinions of the participants, the indicators were decided on the following: i) waste, ii) water pollution, iii) air pollution, iv) protected areas/flora/fauna (deforestation), v) soil erosion/hydrological situation (flood), vi) groundwater, vii) involuntary resettlement, viii) local economy, ix) land use, and x) culture.

13.2 JPT proposed three scenarios for the spatial structure plans of DMA. These alternative scenarios were evaluated and compared in the SEA process through the two types of evaluations depending on the perspectives of the development visions and environmental and social impacts. Regarding the evaluation in terms of the environmental and social impacts, three scenarios were mainly evaluated in a qualitative manner by each expected impact.

13.3 Based on the evaluation results, JPT proposes Scenario 2 as the appropriate urban structure for DMA in Section 8.3.3. Meanwhile, DNHPU conducted the 2nd public consultation meetings at Dili, Hera and Tibar in December 2014, and explained the following topics: (i) current position and planning issues, (ii) draft development visions, (iii) draft urban structure scenarios of DMA, and (iv) evaluation of the urban structure scenarios of DMA, in the meetings with support from JPT. Based on the meetings, Scenario 2 was the best among the three scenarios as the urban structure of DMA.

13.4 Other general opinion on the importance of immediate establishment and enforcement of the land law and spatial planning law for land use control was also stated in the meetings. Meanwhile, specific local opinions were stated as follows:

- Dili: conservation of local culture and historical heritages, Portuguese colonial buildings
- Hera: land security control (protection of coastal area and protected areas, land use control including prevention of informal settlement and their resettlement)
- Tibar: necessity of alternative route between Tibar and Dili, land acquisition in a proper manner, treatment of solid waste at the landfill site

13.5 Meanwhile, Scenario 2 can raise several adverse impacts although it can bring positive impacts particularly on the local economy, land use, and culture. Thus, mitigation measures are proposed to avoid, minimize, or compensate the adverse impacts of Scenario 2.

Initial Environmental Evaluation (IEE)

13.6 The JPT proposes six possible projects in the road and public transportation plan, which include four priority projects in the short term and two in the medium to long term. Neither a pre-feasibility nor an F/S is included in the scope of the project. Consequently, the project alignments and scales are still not clear particularly for the medium to long term. Thus, the JPT studied the IEE for the six possible projects at the early level of planning. First, the scoping was done based on site reconnaissance of the environmental and social conditions of DMA. The study methods were mainly on site reconnaissance, hearing with relevant organizations, suco chiefs or nearby residents because data availability was limited in Timor-Leste.

13.7 Major negative impacts are anticipated such as “involuntary resettlement” during the pre-construction phase and “pollution” during the construction phase. As the proposed projects are located in the urban area, they will exert little impact on the natural environment. However, as the medium- to long-term projects include new road sections, the scale of resettlement can grow, while it can be smaller in the priority projects because the existing roads are mainly used and improved.

13.8 Pollution: The air/water pollution due to chemical substance has not been very serious because not many factories are located in the project sites/routes. However, air quality deterioration due to the daily generation of exhaust gas and dust from the passing vehicles is a concern. Therefore,

air pollution from the construction sites should be minimized to avoid worsening the existing situation by implementing the safeguard measures for environmental management. Meanwhile, based on the results of traffic demand analysis by JPT, the nitrogen oxide (NOx) volume along the project routes were estimated so that the NOx volume of the do-maximum case in 2030 including the project route was less than that of the do-nothing case. The projects can contribute to reduce air pollution due to automobile exhaust fumes.

13.9 Natural Environment: Little natural environment can be seen in the project sites/routes because they are located in the Dili urban area. Typical trees of Timor-Leste were planted along the streets and in the residential area, which include monkeypod tree, leucaena, ficus microcarpa, cotton tree, mango, banana, and coconut trees. These trees can be cut for construction works.

13.10 Social Environment: As the lands in the project sites/routes were used for residential and commercial land, the projects can demand land acquisition, temporary relocation or involuntary resettlement according to the project locations. Besides, inadequate compensation led by lack of legal procedures of land acquisition can cause loss of livelihoods, difficulty to recover livelihoods, and/or degradation of previous living conditions of relocated people. Meanwhile, the construction activities will require workers, and this can provide a temporary boost for local employment. The neighborhood service sector can benefit from providing food and beverages. Additionally, as the traffic congestion will be alleviated, the accessibility to the roadside can be enhanced, and it can lead to revitalizing the roadside businesses.

13.11 Besides, the construction works can temporarily require relocation of the existing roadside social infrastructure (water pipes, electric wires, telecommunication cables, drains, street lamps, or wells/boreholes). The government buildings and public facilities in the project sites/routes can also be affected by the project alignment or scale. Meanwhile, as the traffic volume will be decreased on the project sites/routes, the reduced traffic congestion can improve the accessibility for the public services located along the project routes. Regarding another expected impact on structures, as there are architectural heritages from Portuguese colonization period especially in the Dili City center, the construction activities can affect them in some locations.

13.12 It was noted that there was lack of safety gears and break for workers in the construction sites, and the dust is accumulating from construction vehicles. Therefore, health hazards and accidents involving workers and the local people can be temporarily expected. Meanwhile, as the traffic volume will be decreased on project sites/routes, traffic accidents can be reduced. However, the entire traffic speed will be slightly increased and traffic safety should be promoted to prevent traffic accidents for drivers, citizens, and students.

13.13 Mitigation Measures/Monitoring: In the pre-construction phase, land acquisition and resettlement are the major adverse impacts from the proposed projects. These will be basically mitigated in accordance with the resettlement action plan (RAP) which will be prepared by the Directorate of Roads, Bridges, and Flood Control (DRBFC) in the F/S stage preferably for the draft and during the design stage for finalization. On the other hand, for the adverse impacts on the natural environment and pollution expected in the construction phase, the mitigation measures are incorporated into the environmental safeguards in the standard specifications to provide environmental countermeasures and actions to perform any civil works under the contract required by the DRBFC. Besides, the monitoring items can be the land acquisition and resettlement implementation activities, pollution generated during the construction (air/water pollution, noise and vibration, waste), damages/rehabilitations of public structures (social infrastructures and services, cultural heritages), working conditions, and accidents

Land Acquisition and Resettlement

13.14 JPT proposes the possible projects in the road and public transportation sector at the planning level before F/S phase. Therefore, the alignments, scales, and right of way (ROW) of the projects have not been studied and proposed yet in the project. However, as the possible projects

are located in the urbanized area, land acquisition and resettlement will be expected to some extent.

13.15 Compensation Policies: The affected persons are compensated based on the draft expropriation law, the JICA Guidelines and the World Bank (WB) OP 4.12. Major compensation policies are cash compensation at full replacement cost for owners of lands, structures (including informal occupants), perennial trees, and standing crops. The transition period (between displacement and livelihood restoration) is also supported. Damages of community or public structures, displacement and damages of social infrastructure are compensated with rehabilitation.

13.16 Implementation Structure: The land acquisition and resettlement will be led and implemented by a RAP implementing committee consisting of the DRBFC and the DNTPSC. The Project Support Unit (PSU) will be established with an international consultant and a local consultant in order to entirely support the Project Implementation Unit (PIU). A Grievance Redress Committee (GRC) is established for the grievance redress mechanism. As suco chiefs have traditionally dealt with land issues at the suco level in Timor-Leste, the chiefs will become members of the GRC as the representatives to cope with the grievances from the affected persons. Meanwhile, the Environmental Licensing and Monitoring Committee consisting of DRBFC, National Directorate for Environment (NDE), and the National Directorate of Forestry (NDF), will lead the monitoring for the land acquisition and resettlement activities.

13.17 Implementation Schedule: An implementation schedule of land acquisition and resettlement is still unclear because the feasibility studies have not been implemented for the proposed projects. The DRBFC, the expected project proponent, will draft the RAPs in the feasibility studies, and will start to establish the implementation structure. Cooperating with the DNTPSC, the inventory works and property evaluation will be done, and the RAP will be updated and finalized during the design phase. According to the RAP, negotiation, contract, payment, relocation and clearance will be completed before the start of construction. Although the RAP implementation cost was not calculated, the MPWTC will provide the necessary budget to ensure the mitigation commitments including compensation and monitoring programs.

14. ACTION PLAN

14.1 The action plan has two types, namely: i) action plan for priority project implementation, ii) action plan to be implemented by DNHPU. The target year of action plan is in the year 2020. The action plan shows the necessary projects or activities to be implemented by 2020, and execution agency for each activity and project. To carry out policies and plans on land use, infrastructure development, and urban management, the execution agencies in association with other concerned organizations are required to take actions based on the action plan.

14.2 Implementation of the action plan is the very first stage of the master plan implementation to achieve the proposed urban structure and vision 2030. The implementation of the action plan is important and will influence the activities in the next phases starting from 2021.

14.3 The type i) action plan mainly covers short-term projects of the infrastructure plan and urban management plan to be implemented between 2015 and 2020. Actions based on the action plan will influence the projects and activities to be implemented in the medium and long term as well as land use plan, urban structure plan, and development vision 2030.

14.4 There are 39 projects to be implemented by 2020 as short-term projects. Among the 39 projects, 19 priority projects have been proposed. The action plan for priority projects in order to focus on important projects and actions have also been prepared.

14.5 There are 19 priority projects including both construction projects and soft components such as capacity development. Period between 2016 and 2017 is the preparation stage which includes conducting of feasibility study, detailed design, and bidding for most of the priority projects. Construction will start in 2018 for the projects of seaport, solid waste management, power, and

telecommunication. It will take a long time for road projects to execute preparatory works including F/S, detailed design, and land acquisition.

14.6 The funding scheme of the priority projects is classified into three, namely: i) public, ii) private, and iii) both public and private such as PPP. The estimated total cost of the priority projects is USD 229.9 million. If it is assumed that the total cost would be used for five years, the annual cost is USD 45.98 million, estimated to be 19-38% of the infrastructure fund annually allocated to the Dili Municipality for 2016-2019. The Government of Timor-Leste (GoTL) should diversify the source of fund for its priority projects into external loans, grants, and private sector involvement, and not only rely on the infrastructure fund that is initially financed through petroleum fund.

14.7 The following are the actions to be taken by DNHPU for the time being:

- Establishment and operation of coordination board
- Publicity and communication
  - Holding public meetings for explanation of the master plan
  - Distribution of the master plan to the concerned stakeholders
- Urban development management
  - Updating of database
  - Internal training for DNHPU staff
- Arrangements for the implementation of urban development projects

Action Plan on Priority Projects Implementation

	Project Name	2016	2017	2018	2019	2020	2021-	Execution Agency	Total Cost (million US)	Possible Funding Source	Remarks
Urban Management Project											
1	Dili Urban Development Management Project	Arrangement		Implementation				DNHUP, MPSI	2.00	Public	
Transport Development Projects											
2	Development of off street parking and fringe parking		Feasibility Study	Detailed Design		Bidding and Land Acquisition	up to 2022	DNRBFC, MoPWTC	13.00	PPP or Private	2023-2024 Construction 2025 Commencement of Operation
3	Improvement of Ring-road and traffic management in CBD		Feasibility Study	Detailed		Bidding and Land Acquisition	up to 2022	DNRBFC, MoPWTC	19.80	Public	2023-2024 Construction 2025 Commencement of Operation
4	Road widening of current road network between Comoro and CBD		Feasibility Study	Detailed Design		Bidding and Land Acquisition	up to 2022	DNRBFC, MoPWTC	15.50	Public	2023-2024 Construction 2025 Commencement of Operation
5	Improvement of Mass transit		Feasibility Study Coordination for Organization Formation		Introduction of Bus Vehicle Improvement of Bus Stop			DNRBFC, MoPWTC	24.00	Public or PPP	2022-2024 Introduction of Priority Lane 2025-2030 Introduction of BRT
6	Domestic Ferry Terminal and other related Facilities Project		Detailed Design and Bidding		Construction			APOTIL	10.50	Public	
7	International Cruise Terminal and other related Facilities Project		Detailed Design and Bidding		Construction	Construction		APOTIL	3.00	Public	
8	Comprehensive Bus Terminal and other related Facilities Project		Detailed Design and Bidding				up to 2025	APOTIL	3.90	Public	Establishment of Inland Bus System
9	President Nicolau Lobato International Airport Development Project (1)		PPP Feasibility Study and Detailed Design		Construction			AACTL	100.00	Public	
Urban Infrastructure Projects											
10	Hazards, Risks and Vulnerability Assessment on Dili Metropolitan Area		Preparation	Collection of basic data at Suco Level	Hazard Analysis, Preparation of Hazard Map		Risks and vulnerability assessment	National Disaster Management Committee	1.60	Public	
11	Survey on the Capacity of the Ground Water for Water Supply		Survey					DNWQC, MoPWTC	2.00	Public	
12	Establishing the Standard of the Sewerage System for Buildings		Survey					DNSB, MoPWTC	1.00	Public	
13	Establishment of Standard on Kerb, Rainwater Collection Pits and Connection Pipelines		Survey					DNSB and DNRBFC, MoPWTC	0.50	Public	
14	Improvement of Tibar Dumpsite Conditions and Operations		Environment Assessment	Establishment of Materials Recovery Facility				Sanitation Dept., MoSA	2.40	Public	Improvement of internal access road; Site grading, compaction and soil cover
15	Upgrade Dili substation		Feasibility Study and Detail Design	Bidding and Construction	Commencement of Operation			EDTL	1.00	Public	
16	Extension distribution network		Feasibility Study	Detailed Design	Bidding	Construction	Commencement of Operation	EDTL	6.20	Public	
17	Development of Submarine Fiber Link		Feasibility Study	Detailed Design	Bidding	Construction	Commencement of Operation	NDIT, MoPWTC	16.50	Public	
18	Development of Optic Trunk Communication Network		Feasibility Study	Detailed Design	Bidding	Construction	Commencement of Operation	NDIT, MoPWTC	1.00	PPP	
19	Development of National ICT Center		Feasibility Study	Detailed Design	Bidding	Construction	Commencement of Operation	NDIT, MoPWTC	6.00	Public	
							Total Cost		229.90		

Source: JICA Project Team

15. CONCLUSION AND RECCOMENDATION

Conclusion

15.1 Dili Urban Master Plan covers the development vision, structure plan, land use plan, transport development plan, infrastructure development plan, urban management plan, and action plan. Through the process of the master plan formulation, a series of working group meetings and public consultation meetings were conducted.

- Vision: DMA Vision 2030, "beloved and brilliant national capital", supported by four pillars, namely: "robust economic hub", "high quality of life", "rich social and cultural center", and "healthy and eco-friendly society", was proposed. To form the four pillars, four viewpoints, namely: "linkage", "human resources", "sustainability", and "resilience" are to be addressed.
- Urban Structure: The concept of "urban cluster growth" development with 450,000-550,000 population is expected through moderate utilization of land within habitable lands to formulate main urban center and satellite town developments in Hera and Tibar. Dili would play the national center role in leading political, administrative, business-commercial and national level urban services such as national health center, national cultural center, while Hera and Tibar would play satellite town roles in serving each core urban function of university in Hera and industrial zone in Tibar enabling them to formulate self-sustaining city.
- Land Use: Land use policies including "establishing compact urban form with optimum dense settlement" and "strengthening resilient land use by protection of sensitive areas" are set and defined as implementable framework for land use planning involving several essential planning measures such as "density formulation", "use classification", and "use distribution".
- Transport Development Plan: Transport development plan covers road and transportation plan including road network improvement and promotion of mass transit; seaport sector plan including future development of Dili Port and waterfront redevelopment of coastal area; and airport sector plan including the development of PNLIA as "safe and comfortable airport".
- Urban Infrastructure Development Plan: Infrastructure development plan covers disaster management, water supply, sewerage and drainage, solid waste management, power supply, and telecommunications. The plan contributes to the pillars of DMA Vision 2030 such as "robust economic hub", "high quality of life", and "healthy and eco-friendly society".
- Urban Management Plan: Both the counterparts and JPT developed urban management plan for efficient implementation of the Dili Urban Master Plan. Urban management plan addresses institutional arrangement, organizational development, human resources development, and database management. Among them, the establishment of the coordination board is key to improve spatial management coordination.
- Priority Projects: Both the counterparts and JPT identified 19 priority projects as the projects to be urgently implemented among the 39 proposed projects. The priority projects include both construction projects and soft components such as capacity development.
- Action Plan: Two types of action plan, namely, i) action plan for priority project implementation, and ii) action plan to be implemented by DNHPU, are formulated. The action plan shows the necessary projects or activities to be implemented in year 2020, and execution agency for each activity and project.

15.2 JPT has transferred the technology on six themes, namely: land use, urban management, socio-economy, road and public transportation, infrastructure, and environment, to the counterparts through daily discussions, working group meetings, and stakeholder meetings to formulate the master plan.

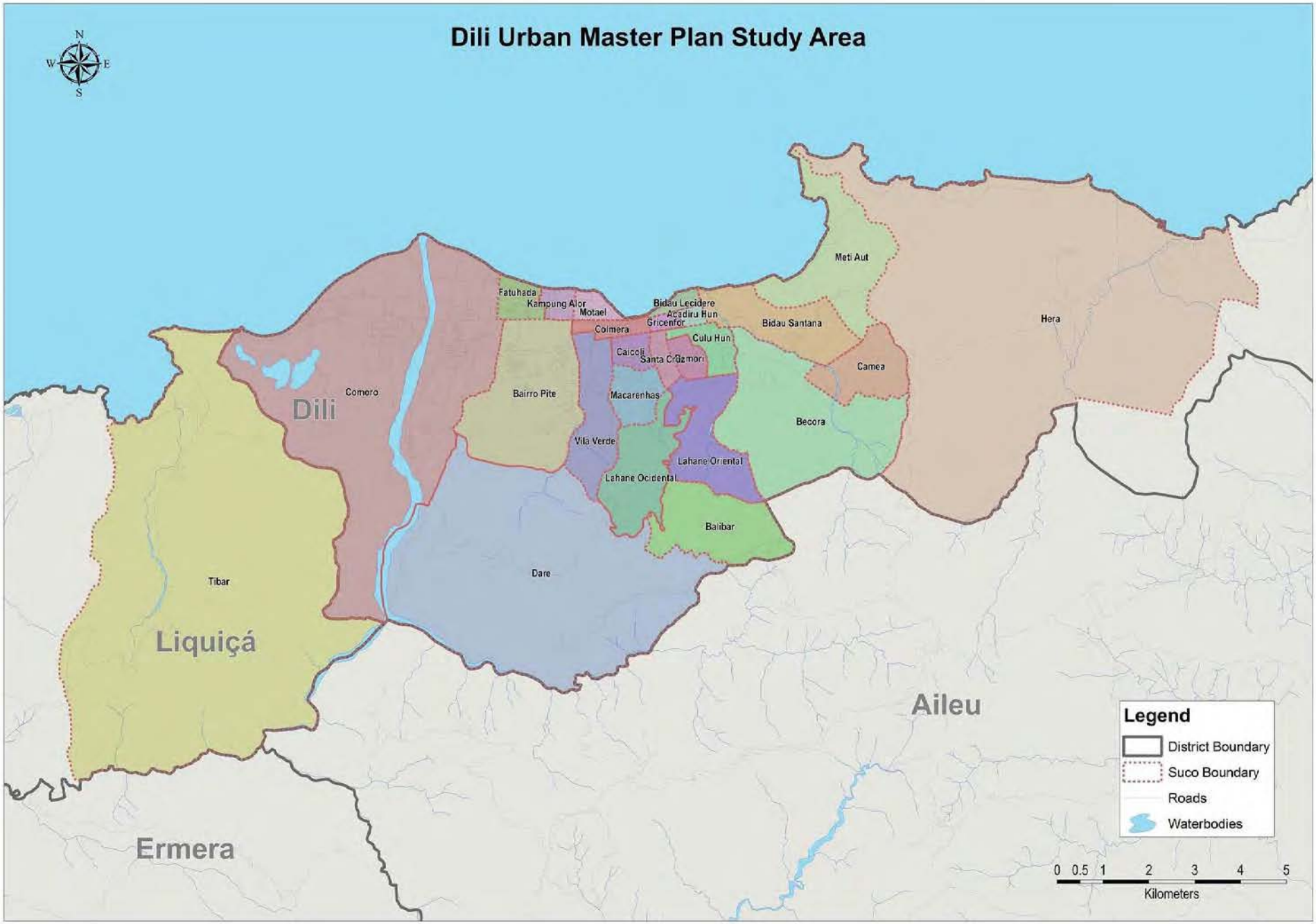
Recommendation

15.3 It is recommended that GoTL implement the Dili Urban Master Plan to achieve DMA Vision 2030, i.e., "beloved and brilliant national capital". In order to ensure the smooth implementation of the master plan, the following recommendations are prepared:

Recommendations

Recommendations	Actions
(1) Formation of Urban Cluster in DMA	Formation of main urban center and satellite town in Hera and Tibar should be promoted. To form this structure, new port development in Tibar and relocation of the *Universidade Nacional Timor Lorosa'e* (UNTL) campus to Hera are major conditions. GoTL should continue its on-going efforts on these developments in Tibar and Hera.
(2) Implementation of Priority Projects	Implementation of priority projects is the important initial step to achieve DMA Vision 2030. The executing agencies of GoTL for each proposed priority project should take initiative to implement the priority projects. Feasibility study including economic/financial evaluation, environmental impact assessment, should be duly conducted for the projects implementation.
(3) Environmental and Social Consideration	To minimize the expected negative impacts, GoTL should take mitigation measures on solid waste management, water quality control, air pollution control, resettlement, and land use management.
(4) Establishment and Operation of Coordination Board	GoTL should establish a coordination board which manages the master plan and monitors and evaluates the proposed projects. This board plays important roles in implementation stage.
(5) Strengthening of Urban Development Management	For efficient implementation of Dili Urban Master Plan, urban development management has to be strengthened. Urban development management includes institutional arrangement, human resources development, and database management plan.
(6) Implementation of the Master Plan	MPSI is responsible for implementation of the master plan, including establishment of the coordination board, publicity and communication, urban development management and arrangements for implementation of urban development projects.

Source: JICA Project Team



Location Map

The Project for Dili Urban Master Plan in the Democratic Republic of Timor-Leste

Final Report
Part II: The Master Plan

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ABBREVIATIONS

AACTL	Autoridade de Aviação Civil de Timor-Leste/Civil Aviation Authority of Timor-Leste
ACC	Adaptation to Climate Change
ADB	Asian Development Bank
ADIGO	Australian Defense Imagery & Geospatial Organization
ADN	Agencia de Desevolvimentto Nacional (National Development Agency)
ADSL	Asymmetric Digital Subscriber Line
AIP	Aeronautical Information Publication
ALGIS	Agriculture Land GIS Unit; Ministry of Agriculture and Fishery
ANATL	Administração de Navigação Aérea de Timor-Leste (Air Navigation Administration Timor-Leste)
ANC	National Communications Authority
APORTIL	Administração dos Portos de Timor-Leste
ARCOM	Communications Regulatory Authority
ASEAN	Association of Southeast Asian Nations
AusAID	Australian Aid
BAS	Business Activity Survey
BOM	Australian Bureau of Meteorology
BOO	Build-Own-Operate
BOT	Build-Operate-Transfer
BRT	Bus Rapid Transit
BTO	Build-Transfer-Operate
BTS	base transceiver stations
C/P	Counterparts
CIGD	Inter-Ministerial Commission for Disaster Risk Management
CPS	Country Partner Strategy
CSTS	Community Sewerage Treatment System
DDMCs	District Disaster Management Commissions
DGES	General Directorate of Higher Education, Ministry of Education
DGS	General Directorate of Statistics, Ministry of Finance
DMA	Dili Metropolitan Area
DMC	Disaster Management Center
DMP	Dili Metropolitan Area Urban Master Plan
DNCQA	National Directorate for Water Quality Control, Ministry of Public Works (reconstructed to MOPWTC)
DNE	National Directorate of Environment, Ministry of Commerce, Industry and Environment
DNE	DN das Edificações (National Directorate of Building), Ministry of Public Works (reconstructed to MOPWTC)

DNEP CC	DN de Estradas, Pontes e Controlo de Cheias (National Directorate of Road, Bridges and Flood Control), Ministry of Public Works (reconstructed to MOPWTC)
DNHPU	DN da Habitação e Planeamento Urbano (National Directorate of Housing and Urban Planning), Ministry of Planning and Strategic Investment
DNRH	DN de Recursos Humanos (National Directorate of Human Resources)
DNSA	National Directorate Water Supply Services, Ministry of Public Works (reconstructed to MOPWTC)
DNSB	National Directorate Sanitation Services, Ministry of Public Works (reconstructed to MOPWTC)
DNTM	National Directorate of Maritime Transport, Ministry of Transportation and Communication (reconstructed to MOPWTC)
DNTP	National Directorate of Land, Property and Cadastre, Ministry of Justice
DNTPSC	National Directorate of Land and Property and Cadastral Services, Ministry of Justice
DOC	Disaster Operation Center
DRBFC	National Directorate for Road, Bridge and Flood Control, Ministry of Public Works (reconstructed to MOPWTC)
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DSDMP	Dili Sanitation and Drainage Master Plan
EDTL	Electricity of Timor-Leste
EMIS	Education Management Information System Unit, Ministry of Education
ETTA	East Timor Transitional Administration
GDP	Gross Domestic Product
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoTL	Government of Timor-Leste
GRDP	Gross Regional Domestic Product
HDPE	High Density Polyethylene
HOV	High Occupancy Vehicle
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IFC	International Finance Corporation
IGE	Institute of Equipment Management
INCOIS	Indian National Center for Ocean Information Services
IPG	Institution of Petroleum and Geology, Ministry of Petroleum and Mineral Resources
ITS	Intelligent Transportation System
ITU	International Telecommunication Union
JICA	Japan International Cooperation Agency
JICA STRADA	JICA System for Traffic Demand Analysis
JPT	JICA Project Team
KFW	Kreditanstalt für Wiederaufbau

LFP	Labor Force Participation
LiDAR	Light Detection and Ranging
LRT	Light Rail Transit
MBKG	Badan Meteorologi, Klimatologi, dan Geofisika
MCIE	Ministry of Commerce, Industry and Environment
MLIT	Ministry of Land, Infrastructure, Transport and Tourism in Japan
MOE	Ministry of Education
MOF	Ministry of Finance
MOH	Ministry of Health
MOI	Ministry of Infrastructure (reconstructed to MOPW)
MOJ	Ministry of Justice
MoPW	Ministry of Public Works (reconstructed to MOPWTC)
MOSA	Ministry of State Administration
MOT	Ministry of Tourism
MOTC	Ministry of Transportation and Communication (reconstructed to MOPWTC)
MPMR	Ministry of Petroleum and Mineral Resources
MPS	Major Projects Secretariat
MPSI	Ministry of Planning and Strategic Investment
MSL	Mean Sea Level
MSS	Ministry of Social Solidarity
MSW	municipal solid waste
NDMD	National Disaster Management Directorate
NESP	National Education Strategic Plan 2011-2030
NHSSP	National Health Sector Strategic Plan 2011-2030
NMT	Non-Motorized Transport
O&M	Operation & Maintenance
OD	Origin and Destination
OJT	On-the-Job Training
PDD	Development Program of Decentralization
PDID	Integrated District Development Plan
PET	Polyethylene terephthalate
PMU	Project Management Unit
PNDS	National Suco Development Plan
PNLIA	President Nicolau Lobato International Airport
PPP	Public Private Partnership
R/D	Record of Discussion
R4D	Roads for Developments
RO	Rehabilitate-Operate

RTTL	Radio and Television of Timor-Leste
SC	Steering Committee
SDP	Timor-Leste Strategic Development Plan 2011-2030
SEAPRI	Secretariat of State for Support and Promotion of Private Sector
SEPFOPE	Secretariat of State for Vocational Training and Employment
SERVE	Registry and Verification of Enterprises Service
SISCa	Integrated Community Health Services
SKM	Sinclair Knight Merz
SNE	National Electricity System
SPTL	Spatial Planning of Timor-Leste
SWM	Solid Waste Management
TDM	Traffic Demand Management
TFTL	Telecom Fund of Timor-Leste
THR	Threshold
TVTL	Television of Timor-Leste
UASB	Upflow Anaerobic Sludge Blanket (Waste Water Treatment Method)
UNDP	United Nations Development Programme
UNTAET	United Nations Transitional Administration in East Timor
UNTL	National University of Timor Lorosa'e
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
WACS	waste characterization study
WB	World Bank
WCP	Water Consumption per Capita
WG	Working Group
WHO	World Health Organization
WTP	Water Treatment Plant (Water Supply)
WWTP	Waste Water Treatment Plant (Sewerage)

CHAPTER 8 : DEVELOPMENT VISION, STRUCTURE PLAN AND DEVELOPMENT ROADMAP

8.1 Development Vision

8.1.1 Development Vision Formulation Procedure

A vision is a distant view of the plan and goals, and what to do to achieve these in the future. The development vision of Dili Metropolitan Area (DMA) is formulated with reference to related plans and inputs from stakeholders. The following are the steps for development vision formulation:

- Compile various ideas from the youth by holding the 1st Urban Planning Workshop;
- Share and understand the ideas, views, and values of Timor-Leste by reviewing the Constitution and Strategic Development Plan (SDP);
- Discuss the ideas and image of Dili in 2030 through internal technical discussion and working group; and
- Compile various ideas and prepare the development vision based on the working group discussion.

8.1.2 Discussed Ideas for Vision Formulation

(1) Constitution of the Democratic Republic of Timor-Leste

The Constitution is a principle that shows how the nation should be shaped, so it is important to learn the principle and values specified in the Constitution. The articles related with Dili Urban Master Plan are extracted in Table 8.1.1.

Table 8.1.1 Relevant Articles of the Constitution

Section	Article
Section 6 Objectives of the State	d) To guarantee the development of the economy and the progress of science and technology.
	e) To promote the building of a society based on social justice by establishing material and spiritual welfare of citizens.
	g) To assert and value the personality and the cultural heritage of the Timor-Leste people.
	i) To promote the harmonious and integrated development of the sectors and regions and the fair distribution of the national product.
Section 19 Youth	2. The State shall promote education, health, and vocational training for the youth as may be practicable.
Section 61 Environment	3. The State should promote actions aimed at protecting the environment and safeguarding the sustainable development of the economy.

Source: Constitution of the Democratic Republic of Timor-Leste

In addition to the above articles, the meaning of the national flag of Timor-Leste was also learned in the technical discussion. Section 15 of the Constitution specifies the national flag.

- Yellow: the traces of colonialism in Timor-Leste's history;
- Black: the obscurantism that needs to be overcome;
- Red: the struggle for national liberation; and
- White: peace.

A white star of five ends, meaning the light that guides.

Source: Web Portal of the Government of Timor-Leste

Figure 8.1.1 National Flag of Timor-Leste

(2) Strategic Development Plan

The Strategic Development Plan (SDP) defines a path to implement the national strategy during the period from 2010 to 2030. DMA Vision 2030 should be consistent with the vision of SDP. According to SDP, the vision in the 2002 National Development Plan and 'Timor-Leste 2020, Our Nation Our Future' is just as relevant today. The key and relevant ideas of the vision are summarized in Table 8.1.2.

Table 8.1.2 Key and Relevant Ideas of Vision for SDP

Page	Key Sentences
Page 11	Timor-Leste will be a prosperous society with adequate food, shelter, and clothing for all people.
	People will be literate, knowledgeable, and skilled. They will be healthy and living long, productive lives.
	People will no longer be isolated.
	Production and employment will increase in all sectors.
	Living standard and service will improve.

Source: Timor-Leste Strategic Development Plan 2011-2030

(3) Output of the 1st Urban Planning Workshop

The 1st Urban Planning Workshop was held on June 7, 2014, to collect ideas from the young generation for future vision of Dili Metropolitan Area toward 2030. The ideas of future vision were expressed as their dream. A number of the ideas were collected. The collective ideas are shown in Table 8.1.3.

Table 8.1.3 Collective Ideas in the 1st Urban Planning Workshop

	Ideas
	*We would like to have the following in DMA by 2030* ● Sports playground ● Monorail/sky train ● Good drainage ● Parking space ● Public toilet ● Accessibility for the disabled ● New seaport and new airport ● Zoological garden ● National library ● Clean beach side ● Water supply for every family ● Cultural park ● Pedestrian bridge and street light

Source: JICA Project Team based on the results of the 1st Urban Planning Workshop

(4) Technical Discussion

The officials of the National Directorate of Housing and Urban Planning showed the ideas of DMA Vision during the technical discussion meeting on August 18, 2014. They presented the definition of the vision, past and present situation of Dili, hinterland area of Dili (Tibar and Hera), and the proposal of DMA Vision 2030. Table 8.1.4 shows the proposed ideas of DMA Vision 2030. Ideas such as park area and science center support the formation of "CIDADE DOBEN". "CIDADE DOBEN" is the expression in Tetun language, which means "Love Town" in English.

Table 8.1.4 Proposed Ideas of DMA Vision 2030 in the Technical Discussion

Ideas
DMA Vision 2030 "CIDADE DOBEN"
● Park area
● Commercial area
● Science center
● Area for education
● New infrastructure for the Nicolau Lobato International Airport
● Bridge of Ponte de CPLP
● Halte and station
● Free of traffic jam
● Free of flooding
● Free of housing degradation
● Park for recreation

Source: JICA Project Team based on the results of the technical discussion on August 18, 2014

(5) Compiled Ideas for the Vision

The keywords extracted from the ideas mentioned in the above (1) to (4) were classified into groups. All these ideas serve as basis for the DMA Vision 2030 as mentioned in Table 8.1.5. Table 8.1.5 shows the results of the classification. Four groups, i.e.: i) economy, ii) society, iii) living, and iv) environment were formed during the process of classification.

Table 8.1.5 Classification of Collected Ideas for the DMA Vision 2030

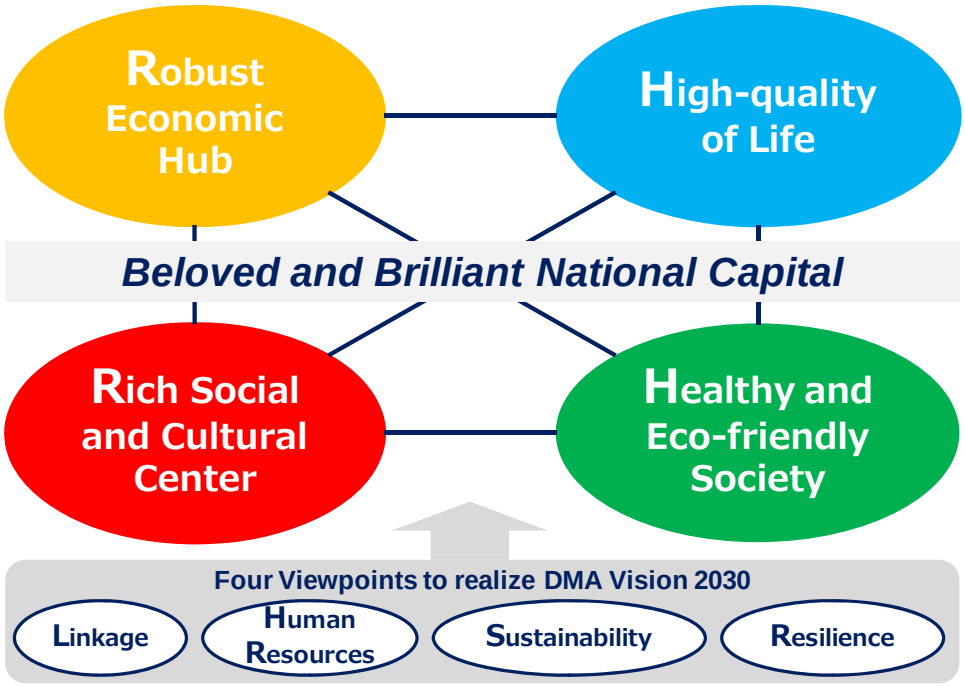
Category	Key Words	Reference
Economy	Economic development	Constitution
	Science and technology	Constitution and technical discussion
	Skilled	SDP
	Production and employment	
	New seaport	SDP and UPW
	New airport	UPW and technical discussion
	Commercial area	Technical discussion
	Bridge of Ponte de CPLP	
Living	Living standard	SDP
	Monorail/sky train	UPW
	Water supply for every family	
	Pedestrian bridge	
	Street light	
	Parking space	UPW and technical discussion
	Good drainage/free of flooding	
	Halte and station	Technical discussion
	Free of traffic jam	
	Free of housing degradation	
Society	Material and spiritual welfare	Constitution
	Cultural heritage	
	Harmonization and integration	
	Youth (education, health, training)	
	Prosperous	SDP
	Literate	
	Knowledgeable	
	No isolation	
	Sports playground	UPW

Category	Key Words	Reference
Society	Zoological garden	
	National library	
	International hospital	
	Accessibility for the disabled	
	Cultural park	
	Area for education	Technical discussion
Environment	Protecting the environment	Constitution
	Sustainable development	
	Healthy	SDP
	Public toilet	UPW
	Clean beach side	
	Park for recreation	Technical discussion

Note: UPW stands for the 1st Urban Planning Workshop
Source: JICA Project Team

8.1.3 DMA Vision 2030

The development vision is prepared as shown in Figure 8.1.1.



Source: JICA Project Team

Figure 8.1.1 DMA Vision 2030

As a result of the compilation of the discussed ideas, both the counterparts and the JICA Project Team proposed “Beloved and Brilliant National Capital” as the idea of the vision, supported by four pillars, namely: “Robust Economic Hub”, “High Quality of Life”, “Rich Social and Cultural Center”, and “Healthy and Eco-friendly Society”. The four viewpoints to realize DMA Vision 2030 should be addressed when the development strategy and programs/projects are formulated.

(1) Vision: Beloved and Brilliant National Capital

“Beloved” comes from “CIDADE DOBEN” conceptualized by the members of the National Directorate of Housing and Urban Planning, Ministry of Public Works. “CIDADE DOBEN” means

"Love Town" in Tetun language. DMA should be loved by all citizens and visitors by realizing the four pillars of the vision mentioned below. "Beloved" is associated with the pillars of "Rich Social and Cultural Center" and "Healthy and Eco-friendly Society". "Brilliant" comes from the star in the national flag of Timor-Leste. "Brilliant" is associated with the pillars of "Robust Economic Hub" and "High Quality of Life".

(2) Four Pillars Supporting the Vision

Table 8.1.6 summarizes the four pillars of DMA Vision 2030. Key ideas shown in the table are the concrete ideas for each pillar. These ideas are collective and important ideas raised by the stakeholders in several meetings such as technical discussion meetings, working group meetings, and workshops.

Table 8.1.6 Four Pillars of DMA Vision 2030

Pillars	Description	Key Ideas
	DMA should be the economic hub of the nation, by promoting knowledge-based industry and tourism industry; realizing smooth flow of logistics; accelerating flow of people, commodity, capital, and information. Trade within DMA and with other areas of the nation and other countries will be promoted. DMA should also be the largest consumption center in the nation.	• Economic development • Science and technology • Production and employment • Gateway of development (seaport and airport)
	DMA should provide citizens and visitors comfortable life and basic human needs by improving mobility through mitigating traffic jam; providing better living environment through upgrading the housing units; providing sufficient water, power supply, and telecommunication. Disaster prevention including flood control should also be reinforced.	• Water supply for every family • Free of housing degradation • Parking space • Free of traffic jam
	Social and cultural life should be enriched by enhancing cultural value, promoting sports and education. Historic preservation, improving sports facilities, upgrading educational facilities, and providing learning opportunities should be encouraged. DMA should be the center of social and cultural activities in the nation.	• Cultural heritage • Area for education • Cultural park • No isolation
	Lives of the citizens and visitors should be healthy by providing space for relaxing and playing; enjoying nature; ensuring safety and security; and improving sanitation. The bountiful nature such as beautiful sea and mountains should be protected. Natural resources should be utilized wisely.	• Clean beach side • Public toilet • Protecting the environment

Source: JICA Project Team

After the formulation of this master plan, JPT set the following major effective indicators and goals for each pillar of the vision to monitor the achievement and progress of attaining the vision as shown in Table 8.1.7.

Table 8.1.7 Major Effective Indicators for the Four Pillars of DMA Vision 2030

Pillar	Major Effective Indicator	Goal (2030)	Page for Reference	Remarks
Robust Economic Hub	GRDP	USD 4,527 million	P9-2~P9-3	
	Employment (%)	144,500 persons (50%)	P9-2~P9-3	
	Ferry terminal development at the Dili Port	3 dedicated ferry berths for operation of 3 ferries	P10-15	
	Annual air passenger volume	500,000 passengers	P10-21	
	Air terminal service level	Good level of service	P10-20,21	
High Quality of Life	Average travel speed in major road in DMA	More than 20 km/h	P10-9	
	Average congestion rate in major road in DMA	Less than 1.0	P10-9	
	Public awareness on hazards, risks and vulnerability to natural disasters	Most people have increased awareness about hazards, risks, and vulnerability to natural disasters and possible to protect themselves from natural disasters.	P11-3	
	Regional early warning systems	Regional early warning systems for natural disasters are to be established	P11-3	
	Period of water supply	24 hours	P11-11	Related with "Healthy and Eco-friendly Society"
	Capacity of drainage facilities	To meet the capacity for 5-year return period	P11-19	
	Power plant capacity	346 MW	P11-36	Related with "Robust Economic Hub"
	150/20 kV substations for DMA	258 MVA	P11-36	
	Capacity of substation	295.0 MVA	P11-37	
	20 kV transmission lines	447.3 km	P11-37	
	Mobile phone penetration ratio	100%	P11-45	
	Internet user	303,250 users	P11-46	
	International communication bandwidth (Mbps)	14,148 Mbps	P11-46	
Rich Socio-cultural Center	Formation of historic district	Historic center is formed at Urban Center Block	P9-11	
	Enrollment rate at basic schools	100%	P9-24	
	Enrollment rate at secondary school	100%	P9-24	
	Park area per capita	7 m^2/person	P9-27	Related with "Healthy and Eco-friendly Society"
	Area for park, sports and open spaces	371 ha	P9-27	
Healthy and Eco-friendly Society	Natural forest area	8,548 ha	P9-28	
	Area of water body	393 ha	P9-28	
	Amount of treated wastewater	138,800 m^3/day	P11-19	
	Collected waste	211 ton/day	P11-27	
	Recycled waste	32.8 ton/day	P11-27	
	Burning of waste	None	P11-27	
	Unsanitary waste picking	None	P11-27	
	MRF operation	21 ton/day	P11-27	
	Open dumping	0 ton/day	P11-27	
	Disposal at SLF	190 ton/day	P11-27	

Source: JICA Project Team

(3) Four Viewpoints to be Addressed

Four viewpoints shown in Table 8.1.88 should be addressed to form the four pillars of DMA Vision 2030. These are also the premise in the realization of the vision. These four viewpoints are to be addressed in the process of formulating urban structure plan and projects for each sector.

Table 8.1.8 Four Viewpoints to Realize DMA Vision 2030

Viewpoint	Description
Linkage	To form a robust economic hub and rich social and cultural center, linkage between DMA and other areas of the nation as well as with other countries should be strengthened.
Human Resources	Human resource development is of great importance in each program under all four pillars. Each program should consider how human resources should be developed.
Sustainability	Sustainability between development and environment for all four pillars should be ensured. Wise use of natural resources and minimizing negative effects to natural environment should be taken into account in the development.
Resilience	DMA should have resilient structure to keep functioning as the national capital when natural disaster such as flood happens. Resilient structure supports the formation of a robust economic hub, maintaining high-quality of life, and sustaining healthy and eco-friendly society.

Source: JICA Project Team

(4) Verification of Vision from the Viewpoints of Planning Issues

All concerned stakeholders are required to make great efforts to realize DMA Vision 2030. To attain the vision, it is required to solve the planning issues mentioned in Chapter 7 which contribute to the vision. Implementing the programs and projects to be proposed in this master plan will solve the planning issues. Connection between the planning issues and the vision is necessary to ensure consistency among the vision, development strategy, programs, and projects in this master plan. As such, it is important to verify if solving the planning issues will contribute to the vision. The following Table 8.1.9 shows the verification on how solving the issues will contribute to attain the pillars of the vision.

Table 8.1.9 Contribution of Solving the Main Issues to the Related Pillars of the Vision (1/2)

Theme	Main Issues	Contribution to Related Pillars of Vision	Related Pillars of Vision
1. Land use	Response to the large burden on lands of DMA due to the continuous population increase	Well-organized urban management by controlling inappropriate urban sprawl into fragile land in the hilly areas and implementing efficient land use in built-up areas will contribute to the protection of green area and enhancement of disaster prevention in hilly area.	• High Quality of Life • Healthy and Eco-friendly Society
2. Institution	Proper spatial management and building control and infrastructure development	Spatial management tool, including land use control rule and infrastructure development mechanism, is expected to contribute to efficient land use and urban infrastructure for promoting economic activity and improving quality of life	• Robust Economic Hub • High Quality of Life
3. Socio-economy	Response to the expected high population density and high unemployment rate in Dili	Regionally-balanced development in Timor-Leste will contribute to modest population growth in DMA thereby enhancing smooth flow of people and inter-regional trade as well as trade with the rest of the world	• Robust Economic Hub

Table 8.1.10 Contribution of Solving the Main Issues to Related Pillars of the Vision (2/2)

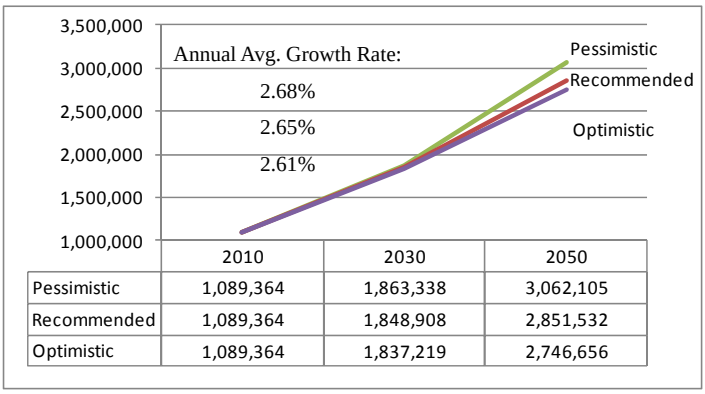
Theme	Main Issues	Contribution to Related Pillars of Vision	Related Pillars of Vision
4. Road and public transportation	Response to increase in transportation demand	Traffic demand management leads to smooth and efficient traffic flow which contributes to promote economic activity and to improve the environment	• Robust Economic Hub • High Quality of Life • Healthy and Eco-friendly Society
5. Infrastructure			
(1) Seaport	Smooth implementation of Tibar New Port Project under PPP scheme	Promotion of seaport development through removal of uncertain factors by clarifying role-sharing between public and private sectors will improve logistics condition and promote industrial activities	• Robust Economic Hub
(2) Airport	Improve safety and capacity of airport facilities such as runways, lighting system, terminal building	Improvement of the President Nicolau Lobato International Airport will improve the logistics condition and promote economic activities including tourism	• Robust Economic Hub
(3) Disaster prevention	Provision of proper prevention measures, preparedness, and timely information to the people at risk	Improvement of institutional and technical level and district/sub-district level for disaster risk management (DRM) and enhancement of the mainstreaming of DRM in the sector programs are expected to contribute to the reduction of disaster risks and ensuring safety and security.	• High Quality of Life • Healthy and Eco-friendly Society
(4) Water supply	Grasping maximum potential of the water resources in DMA in planning water supply facilities	Evaluation of the capability of water resource development for urban development is essential to sustain economic activities and daily lives of the citizens	• Robust Economic Hub • High Quality of Life
(5) Sewerage/Drainage	• Improve the channel inlet and flow condition through removal of dust and garbage on the channels • Revise the Dili Sewerage Master Plan (DSMP) based on the latest urban development plan	• Prevention of damage to people's property and transportation. • Mitigation of water-borne infection. • Achievement of sustainable water environment	• High Quality of Life • Healthy and Eco-friendly Society
(6) Solid waste management	Reducing health and safety risks of waste pickers, workers, and inhabitants near the dumpsite in Tibar	Rehabilitation and proper closure of Tibar dumpsite and development of an environmentally acceptable disposal facility which will improve sanitation conditions of the city and reduce health risks of workers and nearby inhabitants	• Healthy and Eco-friendly Society
(7) Power Supply	Improvement of distribution network	Securing stable power supply through the improvement of distribution network is essential for economic activity and people's life.	• Robust Economic Hub • High Quality of Life
(8) Telecommunication	Speeding up of internet connection	Speeding up internet connection by upgrading fiber trunk network with submarine cable is essential for economic activity and social activity	• Robust Economic Hub • High Quality of Life
6.Environment	Response to disordered development especially for tourism development in protected areas	Establishment of entire project approval system with legislations is expected to achieve proper social and natural condition management which contributes to the conservation and utilization of protected areas.	• Healthy and Eco-friendly Society

Source: JICA Project Team

8.2 Development Framework

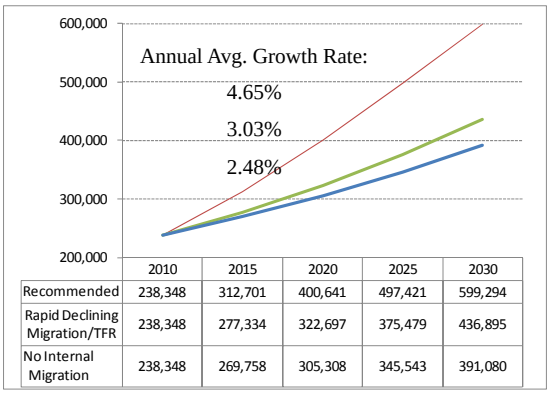
8.2.1 Overview of Population Projection by the Census 2010

The Timor-Leste 2010 Population and Housing Census conducted population projection for Timor-Leste and Dili Municipality. This projection was conducted by the National Statistics Directorate, Ministry of Finance with the financial and human resource support of the United Nations Population Fund (UNFPA). The cohort method is employed as mentioned below using the software which has been developed by the U.S. Bureau of Statistics and commonly used worldwide. Fertility and mortality estimations which are the cores of the method are undertaken with reference to the result of the Demographic and Health Survey 2009-2010 conducted under the United States Agency for International Development (USAID) support. Data for internal migration are utilized in two points of the Census 2004 and 2010, which suggest that projection quality will be better than ever before. Based on these facts, the projection in the Census 2010 has a certain level of validity. The result of the projection is presented in Figure 8.2.1 below.



	2010	2030	2050
Pessimistic	1,089,364	1,863,338	3,062,105
Recommended	1,089,364	1,848,908	2,851,532
Optimistic	1,089,364	1,837,219	2,746,656

Timor-Leste



	2010	2015	2020	2025	2030
Recommended	238,348	312,701	400,641	497,421	599,294
Rapid Declining Migration/TFR	238,348	277,334	322,697	375,479	436,895
No Internal Migration	238,348	269,758	305,308	345,543	391,080

Dili Municipality

Source: Timor-Leste 2010 Population and Housing Census, Vol. 8 Population Projection

Figure 8.2.1 Population Projection 2010-2050 for Timor-Leste and 2010-2030 for Dili Municipality

Key features of the projection above are:

1) The cohort method is used and defined as:
Population growth = Natural growth + Social growth = (Birth – Death) + (In – Out migrations)

2) In- and out-migrations across the international border are not taken into account for the national level projection[1], while the municipality level projection includes internal migration over the municipality borders.

3) Three scenarios labeled as “Recommended”, “Pessimistic”, and “Optimistic” are exercised for the national level. “Recommended” scenario is based on the most likely assumption regarding fertility and mortality trends in the future, whereas “Pessimistic” and “Optimistic” scenario are based on the maximum and minimum values, respectively, that fertility and mortality rates may take in the future.

[1] International migration (foreign-born population) is recognized. It is estimated at 11,345 in 2004 and 11,547 in 2010, which means that incremental population was only 202 in six years. Therefore, the Census projection concluded that it is negligible.

4) The natural growth components with various birth and death rates have little impact on the growth changes up to year 2030 in all three scenarios.

5) Only "Recommended" scenario toward 2030 is considered for the municipality level projection accounting for internal migration. The population of Dili Municipality will grow much faster than the national level and this is mostly due to population inflow from other municipality.

6) The projection for Dili Municipality for "Recommended" scenario assumes that annual net migration to Dili Municipality would increase by 1.0% for 2010-2025 and 0.5% for 2026-2030. Annual growth rate is estimated at 4.65%.

7) No migration scenario and rapid declining migration scenario for Dili Municipality are also projected as plausible scenarios, in which growth rates result in 2.48% and 3.03%, respectively.

8.2.2 Population Projection for the Project Area[2]

(1) Projection Scenarios

From the fact that 46% of the total population in Dili Municipality is estimated as migrants from other municipalities, and the natural growth component has less impact on growth change, internal migration will be key to project the future population in the project area. Based on the detailed review and analysis of the projection of the Census 2010 mentioned earlier, the following projection scenarios are considered for the project area.

Table 8.2.1 Five Scenarios of Population Projection for the Project Area

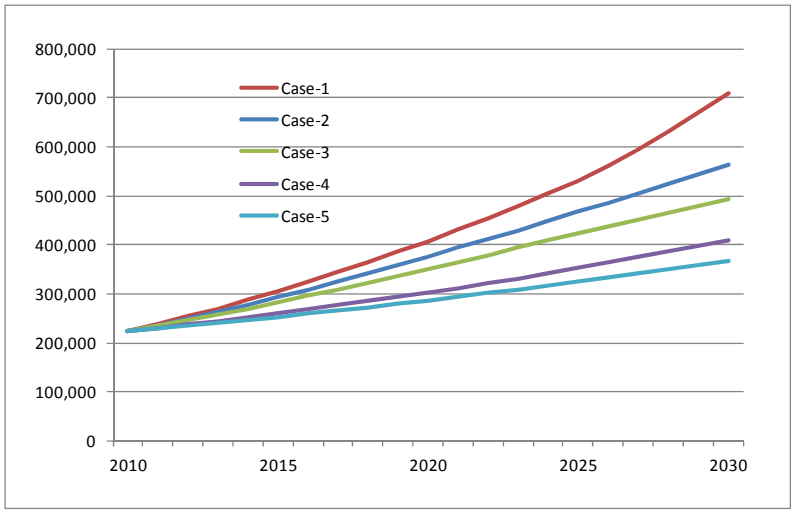
Case	Scenario	Assumption and Description
Case-1	Rapid Migration Scenario	This scenario is based on Case-2 below with higher net migration rates which increase by 1.5% for 2011-2025 and 1.0% for 2026-2030, while holding the same natural growth factors in Case-2. This scenario will encompass more rapid in-migration to Dili Metropolitan Area seeking for education and employment, which will result in great population pressure in the area.
Case-2	Census Scenario	This scenario is based on the "Recommended" scenario of the Census 2010. The assumption is that net-migration will increase by 1.0% for 2011-2025 and 0.5% for 2026-2030, based on past observation during 2005-2010, and birth rate (Total Fertility Rate: TFR) will also decline gradually from 4.4 to 3.2 per woman toward 2030.
Case-3	Moderate Migration Scenario	This scenario is based on Case-2 above with lower net-migration rates which increase by 0.5% for 2011-2025 and 0.25% for 2026-2030, while holding the same natural growth factors in Case-2. This scenario will project more moderate in-migration to Dili Metropolitan Area and population pressure will be less than those of Case-1 and Case-2.
Case-4	Minimum Migration Scenario	This scenario is based on the assumption that birth rate will decline to the replacement level (2.14 per woman) toward 2030 and net-migration will also decline linearly to zero in 2025.
Case-5	No Migration Scenario	Assumption is that there would be no migration occurring in Dili Metropolitan Area, and population growth is only accounted for the natural factors of birth and death. Therefore, this provides the possibly minimum growth picture toward 2030.

Source: JICA Project Team

[2] Project area refers to the target area of the master plan not including Atauro, Metinaro but Suco Tibar of Liquisa Municipality.

(2) Results of the Projection

The projection results for the five scenarios are presented in Figure 8.2.2 below.



Source: JICA Project Team

Figure 8.2.2 Population Projection by Five Scenarios for the Project Area 2010-2030

Table 8.2.2 Population Projection by Five Scenarios for the Project Area 2010-2030

Case	2010	2015	2020	2025	2030	Annual Average Growth Rate (Exponential)
Case-1	223,793	305,425	407,479	529,291	708,948	5.77%
Case-2	223,793	293,605	376,174	467,045	562,697	4.61%
Case-3	223,793	283,034	351,137	422,524	492,251	3.94%
Case-4	223,793	260,398	302,991	352,550	410,215	3.03%
Case-5	223,793	253,285	286,664	324,442	367,198	2.48%

Source: JICA Project Team

The following Table 8.2.3 presents further selected key figures by scenarios according to the projection.

Table 8.2.3 Selected Key Figures for the Projection by Five Scenarios

Key Item	2010	2030	2030	2030	2030	2030
	Base	Case-1	Case-2	Case-3	Case-4	Case-5
Age 0-14	77,515	249,245	197,828	173,061	144,220	129,096
Age 15-64	141,903	440,084	349,298	305,569	254,644	227,941
Age 65+	4,375	19,618	15,571	13,622	11,352	10,161
Students 1)	80,955	229,355	182,040	159,250	132,710	118,794
Economically Active 2)	66,877	242,046	192,114	168,063	140,054	125,368
Employed	55,272	220,262	174,824	152,937	127,449	114,084
Unemployed	11,604	21,784	17,290	15,126	12,605	11,283
No. of Households	33,163	118,668	97,245	86,431	72,027	64,474
Population Density (person/km^2)	1,253	3,969	3,150	2,756	2,297	2,056

Note: 1) Number of students is estimated based on the assumption that 80% of age group 5-24 will be attending any sort of school.
2) Economically active population is estimated based on the assumption that 55% of Labor Force Participation Rate is achieved in 2030. Employed and unemployed population is based on the assumption that unemployment rate is achieved at 9% in 2030.

Source: JICA Project Team

(3) Interpretation of the Projected Scenarios

Table 8.2.4 below outlines the interpretations that can be possibly withdrawn from each scenario[3].

Table 8.2.4 Interpretation of the Five Scenarios as Results of the Projection

Case	Scenario	Description
Case-1	Rapid Migration Scenario	This scenario gives the largest population of about 700,000 with an annual average growth rate of 5.8%, which is higher than the past record (4.8%). Nearly half of the population will originate from other areas of Timor-Leste. Job creation pressure is the highest. This scenario will occur if the government policy failed to realize rural development and other programs that target economic development and poverty alleviation in the other municipalities nationwide. As a result of failure, Dili Metropolitan Area will attract migrants from the rest of the country for job opportunity in addition to educational needs. It is suggested that this case should be avoided.
Case-2	Census Scenario	This scenario takes annual average growth rate of 4.6%, which is slightly lower than the past record of 4.8%. Population will be around 560,000 in 2030. Potential labor force will become approximately three times of that in 2010. About 35% of the population will originate from other municipalities. This scenario is very possible when government programs are implemented as planned over the country, and the benefits are evenly distributed to urban and rural areas. This scenario could be one of the most plausible scenarios among others.
Case-3	Moderate Migration Scenario	Basically, this scenario is based on Case-2 above with lower (slower) migration into Dili Metropolitan Area, achieving annual average growth rate of 3.9% and population of little below 500,000 in 2030. Potential labor force will become less than three times of that in 2010. Migrant population will share 25% of the total. This scenario is also very possible, for instance when government programs are similarly successful like Case-2, and private sector development is also achieved in parallel with human capital development. In this case, one may imagine that considerable number of students or vocational trainees in Dili may choose to return to their home municipalities for job recruitment after graduation.
Case-4	Minimum Migration Scenario	This scenario is also primarily based on Case-2 above with much lower (slower) migration and rapid birth rate decline, achieving an annual average growth rate of 3.0% and population of little above 400,000 in 2030. Potential labor force will become more than double of that in 2010. Other different assumption based on the above three cases is the more rapid decline in birth rate at which women will give less births (2-3 children per woman). Decline of the rapid birth rate can be observed when socioeconomic conditions are improved and well-matured. Possibility of this scenario depends on how fast economic growth can be achieved to a certain level.
Case-5	No Migration Scenario	This scenario will achieve annual average growth rate of 2.48% This is almost the same level achieved in the past at the national level (2.4% for 2004-2010) and less than the projected growth rate for national level (2.65% for 2010-2030). It can only be achieved when internal migration across the municipality boundaries is banned, while such migration policy is merely successful. As noted earlier, this scenario provides the minimum population growth picture in the future and it is very much unlikely to occur. In turn, it gives a minimum benchmark where population in the project area will be at a certain level above this scenario.

Source: JICA Project Team

Rural-urban migration levels remain high due to the widespread unemployment among the substantial young population nationwide. To deal with these levels of migration, there is a vital need to develop the non-oil economy in a sustainable manner. This requires facilitating investment and substantial improvements in infrastructure at the national level, which is expected to enhance private sector growth as well.

[3] According to the municipality development plan in the course of decentralization of public sector, it is assumed that 280 government officers will be located from Dili to other 14 districts. Extra scenario including this factor is examined. However, the impact on the population growth turned to be negligibly small. Therefore, this extra scenario is omitted from further analysis, whereas the impact and effect of municipality development are already embedded within the migration declining scenarios of Cases-2 and 3.

8.2.3 Macroeconomic Framework

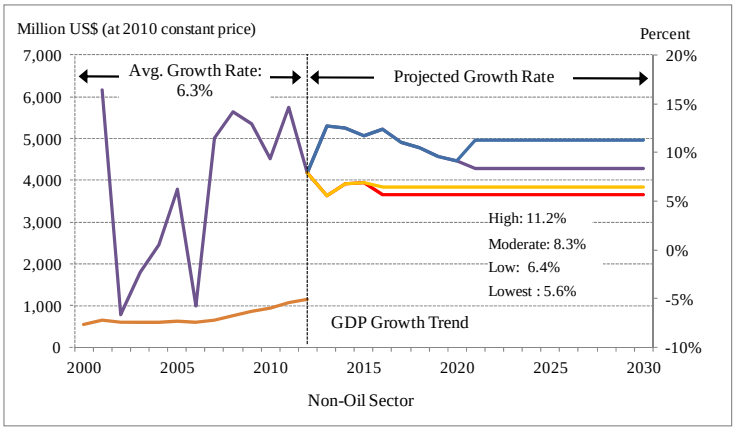
Non-oil sector has just started growing since around 2006-2007. Annual average growth rate performed at 6.3% for the period of 2000-2012. Based on the past performance and SDP targets, the following growth scenarios are constructed:

Table 8.2.5 Gross Domestic Product Growth Scenarios

Scenario	Description
High Growth	This scenario is based on 11.2% from 2021 onwards, assuming a higher proportion of private sector investment and increased productivity (SDP 2011-2030).
Moderate Growth	This scenario is based on 8.3% from 2021 onwards, assuming to exhibit moderate growth of private sector investment (SDP 2011-2030).
Low Growth	This scenario is based on the mean growth rate projected by the World Economic Outlook 2014 and State Budget 2015 for 2013-2015. Average growth rate at 6.4% by both projection for 2013-2015 is taken for the rest of the period of 2015-2030.
Lowest Growth	This scenario is based on the mean growth rate projected by the World Economic Outlook 2014 and State Budget 2015 for 2012-2015 (same as Low Growth Scenario). After 2015, 5.6%, which is adapted from "ASEAN 2030 toward a Borderless Economic Community 2012" by ADB, is applied toward 2030.

Source: JICA Project Team

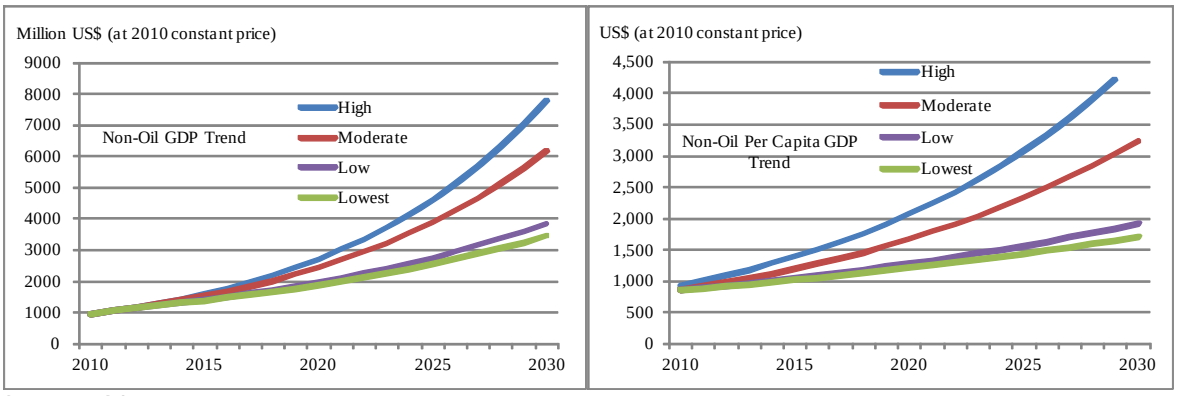
Figure 8.2.3 below illustrates the above growth rates and the past gross domestic product (GDP) growth trend.



Source: JICA Project Team

Figure 8.2.3 GDP Growth Rate Scenarios for 2010-2030

Based on the four scenarios, GDP and per capita GDP growths are projected as illustrated in Figure 8.2.4 below and the result is summarized in Table 8.2.6.



Source: JICA Project Team

Figure 8.2.4 GDP Growth Trend with Compounded Growth Rates for the Four Scenarios (2010-2030)

Table 8.2.6 GDP Projection Results for the Four Scenarios

Item	Case	2010	2015	2020	2025	2030	Annual Average Growth
Non-oil GDP (USD in mil.)	High	934	1,588	2,699	4,586	7,795	11.2%
	Moderate	934	1,526	2,428	3,863	6,145	9.9%
	Low	934	1,410	1,967	2,744	3,827	7.3%
	Lowest	934	1,386	1,878	2,545	3,449	6.7%
Non-oil Per Capita GDP (USD)	High	858	1,277	1,902	2,832	4,216	8.3%
	Moderate	858	1,195	1,666	2,322	3,237	6.9%
	Low	858	1,048	1,281	1,565	1,913	4.1%
	Lowest	858	1,018	1,209	1,435	1,704	3.5%

Source: JICA Project Team

Per capita GDP growth is usually lower than GDP growth rate while gross regional domestic product (GRDP) of Dili Metropolitan Area should grow faster (higher growth rate) than GDP growth rate, since it has already shared and will continue to share large proportions to GDP value in the future and play a leading role in economic development of Timor-Leste. However, the data of GRDP is currently not available because the Government of Timor-Leste still has difficulty to calculate and produce GRDP account.

8.2.4 Proposed Development Framework

The JICA Project Team proposed that Case-3 for the population projection and the Moderate Growth Case for GDP projection be adopted as development framework of the project area in the Working Group-3 Socio-economy, noting that the Moderate Growth Case (in line with the SDP target) could be the growth target rather than the aggressive High Growth Case and the bit inactive Low Growth Case.

Regarding the validity of the proposal, it is further examined by verification study presented in Appendix 3. Underlying concept applied to the verification study is that population in the future is a function of natural growth, social growth and economic growth, which can be expressed as:

Appropriate Size of Population in the Future =

(Natural Growth + Social Growth) x Economic Growth

According to the result, combination of Case-3 and the Moderate Growth Case is concluded as the most suitable development framework. On the other hand, in case of targeting the Census scenario, Case-2 (about 560,000 population in 2030), the verification study implies that the GDP growth would need to achieve far above the High Growth Case that is one alternative target set by the SDP. However, the Ministry of Finance recently made a retrospective comment that the High Growth Case was too high considering the recent economic conditions. Therefore, the Moderate Growth Case is more reasonable to maintain the target within the SDP and the abovementioned combination can be confirmed as the development framework for the master plan.

8.3 Proposal and Discussion of Alternative Structure Plans

8.3.1 Regional Spatial Development Context for the Dili Metropolitan Area (DMA)

(1) Current Regional Context for DMA

Dili as the capital of Timor-Leste is located in the middle of the Pacific Region and the Association of Southeast Asian Nations (ASEAN) Region. Having a geo-strategic position in the country, it has been considered as one of the country's potential location in terms of bridge-head in the two regions.

According to the Government of Timor-Leste (hereinafter referred to as GoTL), the accession to ASEAN is under preparation in which economic development would be expected to stimulate trade of Timor-Leste with ASEAN countries, although it requires vigorous efforts on arrangements and actions to address conditional requirement. On the other hand, historical and cultural ties between neighboring countries (e.g., Australia and Indonesia) and with the Community of Portuguese Language Countries (*Comunidade dos Países de Língua Portuguesa*: CPLP[4]) where people have the official language of Portuguese would also be expected to consolidate further relationship.

Dili Municipality has been playing a pivotal role in politics, government administration, and social and economic services as the capital city, where urban population shared 42.6% of the total urban population, and economic output value shared also 96% of the total economic output value in the country according to the national statistics.

Table 8.3.1 also shows that the population concentration in Dili Municipality is predominant with clear indicators of highest net-migration into Dili Municipality and a huge gap between Dili urban population in 2010 (192,692 excluding Metinaro Administrative Post) and other urban population in the country, in which the highest urban population is only 20,852 in Baucau Municipality.

Table 8.3.1 Existing Conditions of DMA and Neighboring Districts

Administrative Area			Area (km^2)	Population 2010	Gross Density Pop/km^2	Distance from Dili Center	Urban Population (2010)		Net Migration 2010
	Municipality	Administrative Post					Population	share(%)	
Dili Metropolitan Area	Dili	Cristo Rei	65.3	54,936	841	13 km	39,283	71.5%	--
		Main Feto	5.2	26,592	5,163	0 km	24,499	92.1%	--
		Vera Cruz	32.7	34,015	1,040	1 km	26,243	77.2%	--
		Dom Aleixo	33.1	105,154	3,175	6 km	102,627	97.6%	--
		sub-total	136.3	220,697	1,619	--	192,652	87.3%	83,521
	Liquica	Bazartete (Tibar)	42.3	3,096	73	13 km	0	0.0%	--
		Total	**178.6**	**223,793**	**1,253**	**--**	**192,652**	**86.1%**	--
Neighboring Municipality	Liquica		551.0	63,403	115	36 km	5,081	8.0%	-3,109
	Manatuto		1,786.0	42,742	24	66 km	9,096	21.3%	-4,883
	Aileu		676.0	44,325	66	47 km	3,576	8.1%	-2,264
	Ermera		771.0	117,064	152	62 km	7,780	6.6%	-8,349
		Total	**3,784.0**	**267,534**	**71**	**--**	**25,533**	**9.5%**	**-18,605**
		Ground Total	3,962.6	491,327	124	--	218,185	44.4%	--

Source: JICA Project Teambased on Population and Housing Census 2010 / National Statistics Directorate (DGS) Ministry of Finance (MOF)

[4] CPLP: Comunidade dos Países de Língua Portuguesa or Community of Portuguese Language Countries covering nine member states of Angola, Brazil, Cape Verde, Guinea-Bissau, Equatorial Guinea, Mozambique, Portugal, São Tomé and Príncipe, and Timor-Leste

(2) Upper Planning Framework for the Dili Metropolitan Area

The Timor-Leste National Development Strategy (2011-2030) (hereinafter referred to as SDP), as the upper development planning framework, illustrates key spatial development strategies as shown below. On the other hand, the National Spatial Plan of Timor-Leste (hereinafter referred to as PNOT) is currently under discussion and has not been approved yet. The following are significant policies and development directions mainly for each plan to be reflected into DMP:

1) Timor-Leste Strategic Development Plan (2011-2030) (SDP) and DMA

- **Short-term Goal**: The SDP describes its short-term goal to guide the acceleration of sustainable economic growth and equitable development from the national level to suco level, while protecting Timor-Leste's biodiversity and natural environment in conservation zones.
- **Regional Development Corridors**: These corridors aim to identify the potential for developing local resources, opportunities to encourage economic growth and activities, and investments to reduce development gaps among the regions and between urban and rural areas. DMA belongs to the Northern Regional Development Corridor stretching from Liquica to Baucau, while another corridor, the Southern Regional Development Corridor, will be promoted from Suai to Beaco.
- **National Strategic Zones:** Six zones in the country are expected to be the engines of the national economic growth. DMA belongs to the "Dili-Tibar-Hera Zone" having a variety of potentially significant economic development sectors with key transportation hub functions (seaports and airports).
- **Sustainable Agriculture Production Zones and Forest Conservation Zones**: These two zones aim to ensure agriculture sector development harmonizing natural environment consisting of rivers and catchments, forests and soils necessary for healthy and productive agricultural farms. DMA having large mountainous areas with forest including protected areas needs to consider disaster management including Forest Conservation Zone rather than agricultural production.

2) National Spatial Plan of Timor-Leste (PNOT)

- **Urban Rural System**: The PNOT describes specific position of Dili as Level One (main urban center of Dili only) of the Urban Rural System.
- **Infrastructure and Facilities System**: It is described by common ideas of infrastructure system, taking into account the SDP spatial direction in terms of road, transportation, energy, etc. DMA is not mentioned specifically in this system except for the seaport and airport in Dili.
- **Spatial Model**: It is emphasized by developments in other urban areas as the secondary level cities to consider negative impacts of Dili concentration. DMA is considered through the regional approach promoting two satellite cities of Liquica and Metinaro.

(3) Regional Spatial Development Directions for DMA

1) Spatial Development Framework Options for Regional Setting of DMA

As reviewed in the previous sections, achieving the goals of equitable development in the country becomes a big challenge by filling the big gaps between Dili and other cities in practical and realistic manners. Spatial carrying capacity for DMA on the other hand, would be another issue for future spatial development in DMA. Therefore, regional setting for DMA including other cities at the national level would be significant to direct the balanced future spatial formation between DMA and other urban centers.

The examination of the three regional setting options shown in Table 8.3.2 seeks an appropriate option for DMA development in combination with the development scenario and its proposed framework (population) in the previous section.

Table 8.3.2 Options for Regional Spatial Development for DMA Regional Setting

Role and Spatial Development Framework for DMA	Development Considerations		Development Framework Adaptation
	Opportunities/Advantages	Constraints/Disadvantages	
Option 1: Dili Growth Pole (Trend-base)	• High opportunity with advantages of efficient utilization of both human resources and well-developed infrastructure	• In-balanced national development • High negative pressure on environment on limited habitable land	• Case-1: Rapid migration scenario
Option 2: Urban Cluster Growth (Organized Control)	• Maximizing Dili advantages in order to distribute and share the wealth and development outputs to others • Establishing cluster cooperation mechanism with adjacent urban centers (Hera, Tibar)	• Requiring well-organized management of inflow population to Dili and its urban development control	• Case-3: Moderate migration scenario
Option 3: Multi-poles Growth (Mandate Dispersed)	• Equitable national development in association with all other urban development centers • Environment sustainability by less development impact	• Large investment cost and time for successful settlement and economic development distribution to the entire country addressing private sector requirement	• Case-5: No migration scenario

Source: JICA Project Team

Based on the comparison of options, it can be assessed that Option 2, which is urban cluster growth, would be an appropriate option for the regional setting of DMA to avoid over concentration to Dili and to consider potential and competitive opportunities of DMA.

2) Regional Spatial Development Direction for DMA

According to the examination of regional setting for DMA, the directions of spatial development of DMA can be set by the following regional approaches:

<u>Promoting international (regional) linkage</u>

- Spatial structure for DMA should support the national program of accession to ASEAN to be enhanced by organizing an effective spatial development for economic development such as post-oil/gas industrial development promotion;

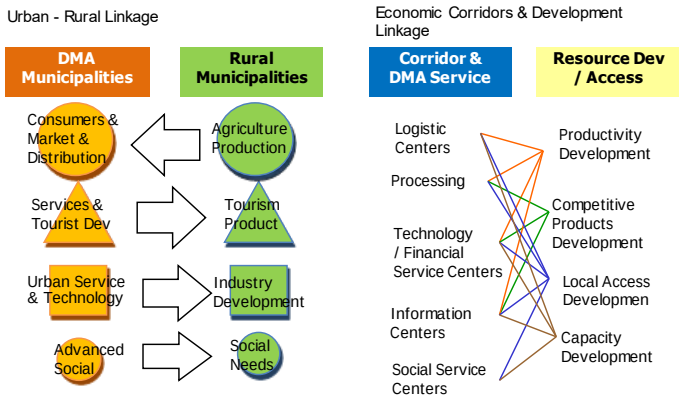
- Utilizing the advantage of geo-strategic position of Timor-Leste and DMA, regional markets and their countries (e.g., East Asia, Oceania, South Asia) would be promoted; and
- Current projects of the government such as the Tibar New Seaport Project and the Dili International Airport Improvement Project would be some of the most essential national transportation hubs to promote international trade.

Leading and stimulating regional socio-economic development in the Regional Development Corridors

- The DMA is required to materialize the national development framework as one of the key "HUBs" of developments of the "Northern Regional Development Corridor" and the "National Strategic Zone: Dili-Tibar-Hera" in association with the north-south link development.
- National linkage should be strengthened to formulate strong socio-economic ties between DMA and other towns and cities of the country.

Integrating effective socio-economic development mechanism taking into account the urban-rural linkage and access network

- Areas along the economic corridors of national roads linking with DMA would provide opportunity for socio-economic development, taking advantage of easy access to major markets of Dili and international markets as well as transportation of agricultural products and natural resources in the hinterlands.
- Utilizing socio-economic ties between urban and rural area, it should be enhanced and consolidated by DMA initiation taking into account the mutual function and role of linking with consumers and producers.



Source: JICA Project Team

Figure 8.3.1 Urban-Rural Linkage for Regional Socio-economic Development

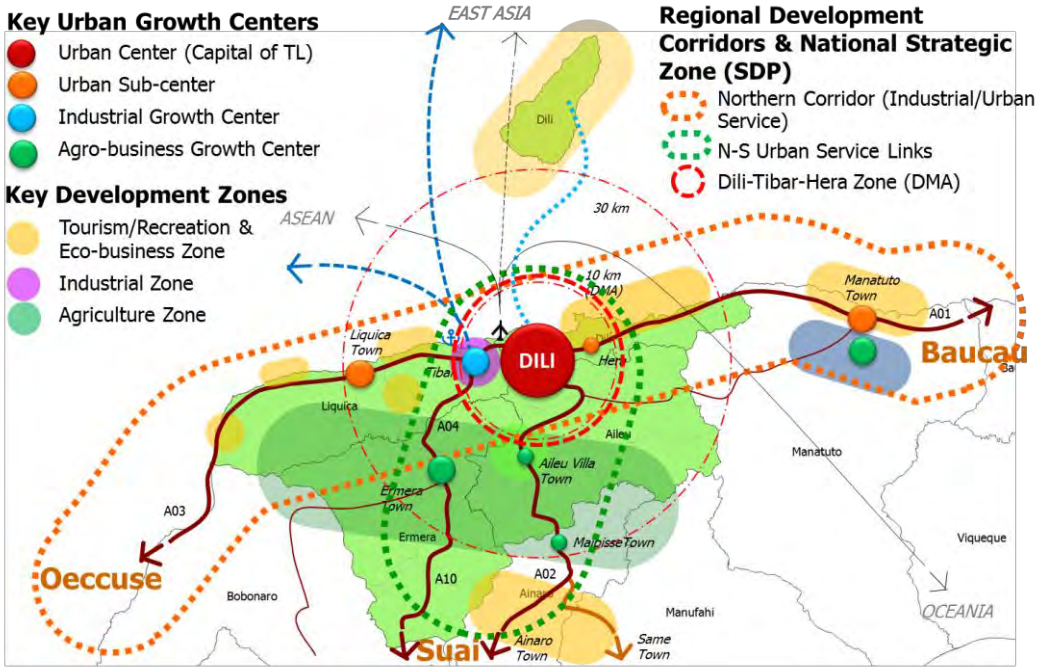
Formulating attractive and competitive core as the capital for national socio-economic development

- Dili, which is the historical and cultural center and the heart of the country, would play an important role not only as cultural gateway for visitors but also in depicting an image of an attractive city to other countries.
- Competitiveness, which is becoming a keyword for cities in the world, induces economic investment; however, this would require sufficient urban services, infrastructure and unique character of urban environment with value added element.

Establishing an effective administrative coordination mechanism beyond administrative jurisdictions (municipality)

- The plan management and operation for DMA would be required to pay special attention to the planned area covering the two municipalities of Dili and Liquica, while the government will promote the de-concentration program for municipalities under the decentralization policy.
- Regarding the relationship and entity for urban activity within DMA, single administrative management for urban services would be one of the choices in terms of service provider's capability and efficient operation of urban services.

These approaches are considered into the conceptual spatial direction for DMA, and a regional spatial scheme is illustrated in Figure 8.3.2. Especially, DMA is expected to play a pivotal role in stimulating socio-economic development across the country through the four national trunk roads of A01 (Dili - Baucau), A03 (Dili - Liquica - Oeccuse) as part of the Northern Economic Corridor, north-south urban link by A04/A10 {Dili (Tibar) - Ermera - Suai}, and A02 (Dili - Ainaro/Same - Suai).



Source: JICA Project Team

Figure 8.3.2 Regional Setting for DMA Spatial Development

8.3.2 Strategic Environment Assessment for Alternative Spatial Structure for DMA

The following steps are proposed for the spatial structure plan of DMA through evaluation of the scenarios in the Strategic Environment Assessment (SEA). This was undertaken using two types of evaluation applicable to the development visions and in the environmental and social impacts.

Each Public Consultation Meeting (2nd) in Dili, Hera, and Tibar was held in December 2014 and organized by the National Directorate of Housing and Urban Planning (DNHPU) of the Ministry of Public Works, Transportation and Communications (MoPWTC) supported by the JPT, where the process and results of evaluations of SEA were explained and discussed. Further details of (v) Proposed Mitigation Measures and (vi) Public Involvement (Public Consultation Meetings) are described in Chapter 13.

STEP-1: Setup of the Spatial Structure Scenarios

STEP-2: Technical Evaluation of the Scenarios in terms of Applicability or Suitability to the Development Visions

STEP-3: Technical Evaluation of the Scenarios in terms of Environmental and Social Impacts

STEP-4: Overall Technical Evaluation

STEP-5: Proposed Mitigation Measures

STEP-6: Public Involvement (Public Consultation Meetings) and Final Evaluation

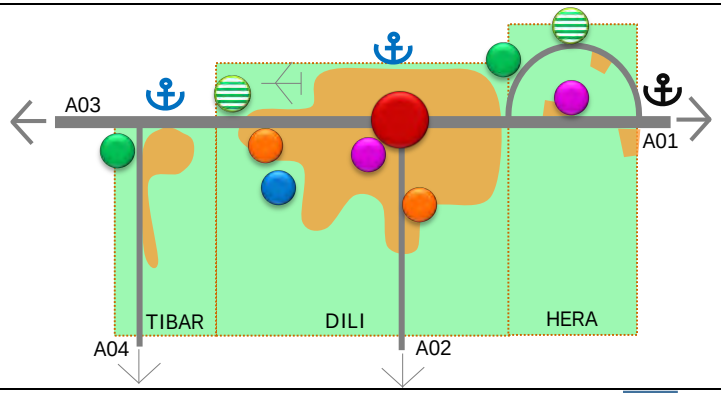
(1) Spatial Structure Scenarios for DMA

Three spatial structure scenarios for DMA were setup referring to the three population projection cases, namely: maximum (case-1), proposed (case-3), and minimum (case-5), explained in Section 8.2 as three alternatives to be compared as shown below.

- **Scenario 1**: This alternative represented by "*do-nothing case*" under Case-1 (600,000 - 700,000 population) would require maximization of urban development in association with large investment cost to manage lands with possible natural hazard prone areas.
- **Scenario 2**: Alternative 2 with concept of "*Urban Cluster Growth*" development under Case-3 (450,000 - 550,000 population) is expected to have moderate utilization of land within the habitable lands to formulate the main urban center and satellite town developments in Hera and Tibar. Dili would play the national center role in leading political, administrative, business, commercial, and urban services at the national level such as national health center, national cultural center, while Hera and Tibar would play satellite town roles in serving each core urban function of the university in Hera and industrial zone in Tibar enabling them to formulate a self-sustaining city.
- **Scenario 3**: In conjunction with Case-5 population growth (350,000 - 400,000 population), in case that every urban development that can absorb certain magnitude of population and employment in each major town of Timor-Leste such as Baucau and Suai would be achieved in 2030, Scenario 3 would enable the formulation of a "*Compact City*" without major large settlement in Tibar and Hera.

Table 8.3.3 Changes of Spatial Structure with Three Alternative Scenarios

Existing Conditions of DMA

Existing DMA	Existing Spatial Structure	Name	Population 2010	Habitable Land (ha)	Net Density (pop/ha)	Vulnerability
Conceptual Spatial Structure 2010 Politic Administrative Center Industry Business Center Commercial Center Tourism Resort Tourism Resort Plan Knowledge Center Existing Settlement Commercial Sea Port Naval Base & Port Key Airport		Dili	213,321	3,805	56.1	DMA is divided by physical barriers of mountains. Flat plain areas in DMA belong geologically to alluvium layer in general involving high level of groundwater, subsidence prone area, and weak soil bearing capacity against earthquake. Inundation and flood in the rainy season are potential risks. Mountain and hilly areas have potential risks of erosion and landslide.
		Hera	7,376	1,566	4.7	
		Tibar	3,096	1,328	2.3	
		Total	223,793	6,698	33.4	
		Urban Functions Overconcentration in Dili				

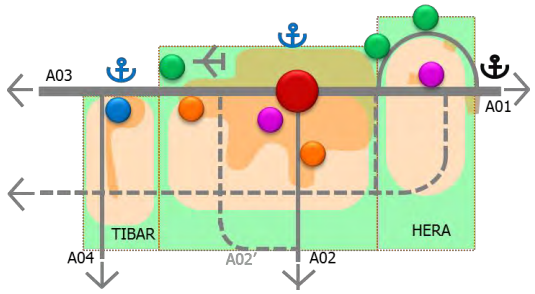
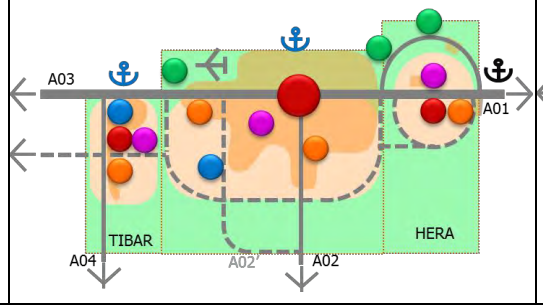
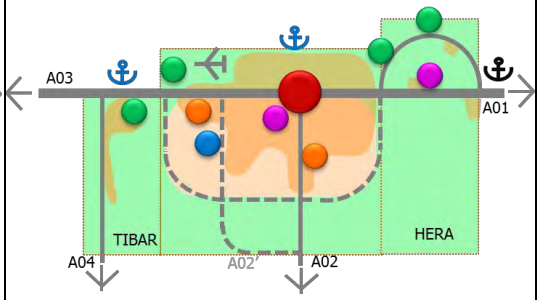
Spatial Structure Scenarios	Scenario 1: Urban Maximization as Dili Growth Pole	Scenario 2: Urban Cluster Development (Well-organized Control)	Scenario 3: Compact City Development (Multi-growth Pole)
Conceptual Spatial Structure 2030			
	Legend	Politic Administrative Center (PAC) Industry Business Center (IBC) Commercial Center (CC) Tourism Resort (TR) Knowledge Center (KC)	Residential function Existing Settlement Commercial Sea Port Naval Base & Port Key Airport

Table 8.3.4 Characteristics of Scenarios

Scenarios	Scenario 1: Urban Maximization as Dili Growth Pole	Scenario 2: Urban Cluster Development (Well-organized Control)	Scenario 3: Compact City Development (Multi-growth Pole)
Character	"Do-nothing case" would require maximization of urban development in association with large investment cost to manage lands having possible natural hazard prone areas.	"Urban Cluster Growth" development is expected by moderate utilization of land within habitable lands to formulate the main urban center and satellite town developments in Hera and Tibar.	"Compact City" without major settlement in Tibar and Hera is formulated if every urban development in each major town of Timor-Leste such as Baucau and Suai would be achieved in 2030 to absorb certain magnitude of population and employment.
Population	DMA: 650,000 (600,000-700,000) Dili: 476,000, Hera: 94,000, Tibar: 80,000	DMA: 500,000 (450,000-550,000) Dili: 401,000, Hera: 32,000, Tibar: 67,000	DMA: 350,000 (350,000-400,000) Dili: 329,000, Hera: 11,000, Tibar: 10,000
Gross Density	Highest density: 97 person/ha, Land area: 6,698 ha Dili: 125, Hera: 60, Tibar: 60	Moderate density: 75 person/ha, Land area: 6,698 ha Dili: 105, Hera: 20, Tibar: 50	Lowest density: 92 person/ha, Land area: 3,805 ha Dili: 87, Hera: 7, Tibar: 7
Central and Local Government Administration	Central government facilities are located in Dili. Local government has a possibility to manage DMA as new local administration covering Hera and Tibar.	Some central governments can be distributed to satellite cities of Hera and Tibar. Local administration and urban services should be formulated to serve the local communities.	Liquica and Dili municipalities will maintain their jurisdiction where UNTL and Tibar Port will be taken cared of by each jurisdictive administration of Liquica and Dili.
Residence	Maximizing settlement in three areas of Dili, Hera, and Tibar as far as their residence absorption capacity. Settlement density will require high status to cope up with the biggest population.	Well-organized distribution of settlement by organizing appropriate density according to each environment capacity in Dili, Hera, and Tibar.	Minimum concentration of settlement in the Dili urban area with higher density than the present time, while Hera and Tibar allow only limited or existing settlement.
Urban Service	Key urban services will be expected to be accumulated in Dili but local commercial businesses will be distributed to Dili, Hera, and Tibar.	Key urban services will be formulated in each urban area as a self-sustaining city, where urban facilities would be enhanced by each urban character such as Campus City, Tibar Industrial City, etc. taking account of synergy effects.	As this plan considers single function in Hera with UNTL and Tibar with Tibar Port and some logistics, key urban services would not be required, while Dili will provide key urban services.
Industry/ Commercial/ Business	At least current plans for business development will be achieved mainly in Dili area while market-oriented development where large population is settled, will also generate ad-hoc development in every place.	Major industrial developments are expected to be guided to the most efficient and effective location taking into account logistics and accessibility to gateways (sea and air) and highways, while key commercial and business functions are also required to be distributed to each urban area to formulate an attractive urban area.	Based on the expectation of other economic development in towns and cities outside of Dili, Dili might play smaller role in promoting economic development than other alternatives. Industry development follows the existing plans while commercial business development would be modest in Dili.
Infrastructure	All infrastructure should be provided to cope with large demands by expected population without deterioration of living environment or living standard. These large infrastructure services may diminish opportunities of other remote cities' public investment.	Infrastructure investment will be optimized to fit with appropriate urbanization without large-scale infrastructure development, except for trunk road network formulation to secure redundant road network linking Dili-Hera-Tibar cities.	This urban structure will be able to minimize urban infrastructure investment through maximization of existing stocks and just a minimum infrastructure to cope with additional increase in population. But of course, infrastructure should be improved to achieve quality of life in urban areas.

Source: JICA Project Team

(2) Evaluation of Scenarios for DMA Spatial Structure

1) Evaluation of the Scenarios in terms of Applicability or Suitability to the Vision

Indicators for Evaluation

- Three spatial structure scenarios for DMA were assessed qualitatively by indicators for sustainable development taking into account the "Development Vision" to be achieved and "anticipated impacts" of the indicators. The indicators were defined as measures for achieving the "Development Vision" supported by four pillars, namely: "Robust Economic Hub", "Health and Eco-friendly Society", "High quality of Life" and "Rich Social and Culture Center".
- The four viewpoints of "Linkage", "Human Resources", "Sustainability", and "Resilience" in Section 8.1 become keywords to set up the assessment indicators. Table 8.3.5 defines the assessment indicators as more concrete terms enabling to contribute to planning tools. Table 8.3.6 shows the matrix of functional relations between the development vision and eight indicators.

Table 8.3.5 Evaluation Indicators based on Four Viewpoints for Development Vision Pillars

Viewpoint	Assessment Indicators
1. Resilience	A. Urban Structure Redundancy (infrastructure / land use)
	B. Environment Vulnerability Preparedness
2. Linkage	C. Regional Development Inclusiveness
	D. Effective Transportation and Logistic System Applicability
3. Sustainability	E. Socio-economic Diversity and Investment Efficiency
	F. Living Environment Sustainability
4. Human Resource	G. Urban Management Capacity and Effectiveness
	H. Potential Synergy Effect on Creative and Attractive Human Development by Local Resource

Source: JICA Project Team

Table 8.3.6 Evaluation Indicators' Matrix by Four Viewpoints and Development Vision Pillars

Viewpoints	1. Resilience		2. Linkage		3.Sustainability		4. Human Resource	
Vision \ Indicator	A	B	C	D	E	F	G	H
1. Robust Economic Hub	◎	◎	●	●	●	○	◎	◎
2. High Quality of Life	●	●	◎	●	◎	●	◎	●
3. Rich Social & Cultural Center	○	○	◎	○	○	◎	○	●
4. Health & Eco-friendly Society	●	●	○	○	◎	●	●	◎

Legend: ●= Essential Element, ◎ = Supportive, ○ = Supplemental
Source: JICA Project Team

Evaluation

Assessments and summary of the three scenarios are shown in Table 8.3.7. The indicators were evaluated by comparative assessment among scenarios. As a result, Scenario 2 was the most suitable urban structure of DMA for the achievement of the development visions.

- **Scenario 1**: This scenario would generate the worst conditions to be avoided in terms of negative development impacts, if "do-nothing" situation happens.
- **Scenario 2**: This development is favorable to be achieved in collaboration with possible development of other towns in the country with the establishment of desirable regional development mechanism led by DMA development.
- **Scenario 3**: This requires vigorous development efforts of other towns, in which development can absorb population increase and generate economic development not solely concentrated in Dili, which might be the second favorable choice of DMA development.

Table 8.3.7 Evaluation of the Scenarios in terms of Applicability or Suitability to the Visions
-continued-

Assessment Indicators		Scenario 1		Scenario 2		Scenario 3	
Basic Indicator	Population	600,000-700,000		450,000-550,000		350,000-400,000	
	Density	97 person / ha (average)		75 person / ha (average)		92 person / ha (average)	
A. Urban Structure Sustainability and Redundancy		C	Due to large population settlement triggering few open spaces and buffer areas, urban area would not be able to cope with urban disaster and expect to increase casualties	A	Desirable urban structure and scale to cope up with adequate density and green areas, by a flexible sustainable urban function in Dili, Tibar, and Hera	B	Due to single function in Hera (University) and Tibar (Port), urbanization will generate unsustainable urbanization triggering undesirable commuting experience and traffic congestion
B. Environment Vulnerability Preparedness Applicability		C	In order to absorb future large population, utilization of hazard prone areas will be imposed for its settlement.	B	Possible urban structure and scale to achieve resilient urban structure by optimum intervention on natural environment and minimum natural disaster	A	Favorable urban structure with minimum development especially in Hera and Tibar without encroachment on naturally vulnerable lands
C. Regional Development Inclusiveness		B	Growth pole development may affect negatively local rural economic development without benefits in adjacent districts.	A	Distributed urban cluster developments in DMA are expected to stimulate hinterland districts for rural economic development inclusively	C	Because of expectation to develop urban centers widely in Timor-Leste, inclusive development may comparatively have less impact than Scenario 2
D. Effective Transportation/ Logistic System Applicability		C	Due to large population, dispersed urban functions contribute to anticipated chronic traffic congestion resulting to inefficient urban services and economic activities.	A	Efficient intra-traffic flow and commuting without large through traffic are expected due to closer distance between work and living place	B	Increase inter- and intra-traffic between Dili and other towns of Hera and Tibar without sufficient settlement in each working area

Assessment Indicators	Scenario 1		Scenario 2		Scenario 3	
E. Socio-economic Diversity and Investment Efficiency	B	There would be negative impacts of both potential diversified activities and latent vulnerability by generating informal sector activities in spite of large investment to be required.	A	In combination with living and working places in each urban area of Dili, Hera, and Tibar as self-sustaining cities, various socio-economic activities are expected; an efficient investment for compact cities.	C	Small-scale population may comparatively be able to generate less socio-economic diversity with possible minimum investment
F. Living Environment Sustainability	C	Anticipated disordered living area with worse and imposed high-density living conditions in association with insufficient infrastructure and urban services	B	Harmonized settlement by providing a work and living place package with green areas and services will be a favorable living environment in each urban center of Dili, Hera, and Tibar	A	Best living environment in terms of settlement density and biodiversity formulation but Hera and Tibar require necessary commuting
G. Urban Management Capacity and Effectiveness	C	Difficult to fill the management gap due to the large demand of urban infrastructure and management capacity	A	Compact cluster settlement through a balanced urban function with optimum infrastructure investment may allow effective urban management	B	Better management by compact settlement but dispersed function in Tibar and Hera require well-organized management
H. Potential Synergy Effect on Creative and Attractive Human Development	C	Possible deterioration of historical and traditional environment due to highly dense urban development may give negative impact on cultural and social attractiveness of the capital of Dili	A	Balanced development may allow favorable environment to foster attractive social and cultural activities in each center of Dili, Tibar, and Hera	B	Less population and its social and cultural activities in the capital of Dili may be decent than Scenario 2
Overall Evaluation	C	In spite of its potential to be a growth pole, negative impacts will become big.	A	Recommendable to achieve sustainable urban development	B	Second choice if other urban town developments are achievable

Note: A: the most applicable or suitable, B: less suitable than A in terms of applicability, C: the least applicable or suitable
Source: JICA Project Team

2) Evaluation of Scenarios in terms of Environmental and Social Impacts

Indicators of Likely Impacts

- The following likely impacts were derived from the opinions in the public consultations held in Dili, Hera, and Tibar.
- Pollution: Waste, Water Pollution, Air Pollution, Noise and Vibration, Offensive Odor, Soil Contamination
- Natural Environment: Protected Areas, Soil Erosion, Hydrological Situation (Flood), Flora/Fauna (Deforestation), Groundwater

- Social Environment: Involuntary Resettlement, Local Economy, Land Use, Culture, Hazard/Infectious Diseases, Poor People, Accidents

The following likely impacts (positive or negative) as the indicators are evaluated to compare the scenarios of spatial structures for the appropriate urban structure plan of DMA.

- The preliminary scoping and opinions in the public consultation are "more important likely impacts"; and
- Cumulative impacts; broader and long-term perspective; therefore, the items of likely impacts especially expected in the construction (temporary) phase were excluded from the indicators for the SEA.

As a result, the following indicators were set up for the evaluation of the scenarios:

- Pollution: Waste, Water Pollution, Air Pollution
- Natural Environment: Protected Areas, Soil Erosion, Hydrological Situation (Flood), Flora/Fauna (Deforestation), Groundwater
- Social Environment: Involuntary Resettlement, Local Economy, Land Use, Culture

Evaluation

Table 8.3.8 shows the results of the evaluation of the three scenarios. In the comparison, size of the population is the main point in determining the differences of environmental and social impacts among the scenarios, except the common presumption of infrastructure improvement for all scenarios.

As a result, Scenario 1 should be avoided as most adverse impacts are expected in the densely-populated area. Scenario 3 is comparatively better scenario, as the scenario is expected to cause the least negative impacts on pollution and natural environment, and can maintain the present conditions; however, Scenario 3 would also presume small-scale urbanization, as the leading urban center for non-oil/gas industry, that cannot generate effective synergy effect in economic development although environmentally better condition.

On the other hand, Scenario 2 is also favorable because it has the most positive impacts on socio-economic environment, and has medium adverse impacts on pollution and natural environment. Scenario 2 is balanced in terms of adverse impacts and positive impacts on the environmental and social conditions. Meanwhile, the adverse impacts on pollution and nature of Scenario 2 can be reduced and mitigated.

- Scenario 1: This scenario has the largest population following the existing urbanization trend and is represented by "do-nothing case". This can raise the most adverse impacts on the natural and social environment in the DMA.
- Scenario 2: This scenario has the most positive impacts on local economy development, land use management, and culture although it has medium adverse impacts on pollution and natural environment.
- Scenario 3: This scenario has the smallest population and particularly prominent for the least adverse impacts on pollution and natural environment.

Table 8.3.8 Evaluation and Comparison of Scenarios

Assessment Indicators		Scenario 1: Urban Maximization as Dili Growth Pole	Scenario 2: Urban Cluster Development (Well-organized Control)	Scenario 3: Compact City Development (Multi-growth Pole)
Pollution	Waste	The population growth and economic activities will increase solid waste production; thus, insufficient capacity of the existing waste disposal system will pose a problem. Risks of over capacity and solid waste pollution are expected based on population size as follows:		
		The scenario will generate the greatest amount of solid waste , and might result to over capacity of waste disposal site even if the sanitary landfill (terraced) is established at the Tibar Dumpsite.	The scenario will generate medium amount of solid waste , and it may be managed if the sanitary landfill (terraced) is established at the Tibar Dumpsite.	The scenario will generate the least amount of solid waste, and it may be managed if the sanitary landfill (terraced) is established at the Tibar Dumpsite.
	Rating	C	B	A
	Water Pollution	Population growth and economic activities will generate more wastewater, and wastewater discharged directly into the drainage without treatment can deteriorate the quality of surface water and groundwater (contamination) if the wastewater treatment system is not appropriately planned and established. Risks of water pollution are expected according to population size as follows:		
		The scenario will generate the largest wastewater volume, and it can have the highest risk for water pollution.	The scenario will generate medium wastewater volume, and it can have the medium risk for water pollution.	The scenario will generate the least wastewater volume, and it can have the lowest risk for water pollution.
	Rating	C	B	A
	Air Pollution	Increase of traffic volume due to population growth and urban developments will generate more emission. Risks of air pollution are expected according to vehicular traffic volume as follows:		
		The scenario will generate the most emission (NOx) from the largest vehicular traffic volume.	The scenario will generate medium emission (NOx) from the medium vehicular traffic volume although least commuter traffic is expected between Dili and Hera or Tibar.	The scenario will generate the least emission (NOx) from the least vehicular traffic volume.
	Rating	C	B	A
Natural Environment	Protected Areas/ Flora/Fauna (Deforestation)	Population and economic growths will require more land for residence, industries and infrastructure and those developments can affect the biodiversity in the protected areas or forests. Risks to utilize these areas are expected as follows:		
		The scenario will require the largest demand of land, and it can result in disordered urbanization with excessive residential density. The scenario can face an increased risk for penetration to the protected areas and deforestation.	This scenario will require medium demand of land, and “Urban Cluster” development can be managed with effective land and spatial uses with the minimum land utilization.	This scenario will require minimum demand of urban development projects and lands, and it can have the least risk for penetration to the protected areas and deforestation.
	Rating	C	B	A
	Soil Erosion/ Hydrological Situation (Flood)	Population and economic growths will require more land for residence, industries and infrastructure and it may utilize the hazard-prone areas. Risks to utilize the hilly areas which can cause soil erosion or flash flood are expected as follows:		
		The scenario will require the largest demand of land, and it can raise disordered urbanization with excessive	This scenario will require medium demand of land, and “Urban Cluster” development can be managed with effective	This scenario will require the minimum demand of urban development projects and lands, and it can have the least risk for

Assessment Indicators		Scenario 1: Urban Maximization as Dili Growth Pole	Scenario 2: Urban Cluster Development (Well-organized Control)	Scenario 3: Compact City Development (Multi-growth Pole)
		residential density. The scenario can result in disordered utilization on the hilly areas.	land and spatial uses with the minimum land utilization out of the hilly areas.	encroachment on the hilly areas.
	Rating	C	B	A
	Groundwater	Groundwater development will be required in finding a source of water supply because the future demand of water supply will be over the existing water supply capacity. Risks of groundwater resource depletion are expected as follows:		
		The scenario will require the largest water demand due to population growth, and it can have the highest risk for groundwater resource depletion.	The scenario will require medium water demand due to population growth, and it can have medium risk for groundwater resource depletion.	The scenario will require the minimum water demand due to population growth, and it can have the least risk for groundwater resource depletion.
	Rating	C	B	A
Social Environment	Involuntary Resettlement	Population and economic growths will boost more demand on land for residence, industries, and infrastructure and these will demand more lands for development and redevelopment for intensive land use in the limited space. Risks of land acquisition and resettlement are expected as follows:		
		This scenario will require the largest demand of land, and it can have the most risks of land acquisition and resettlement.	This scenario will require medium demand of land, and it can have medium risks of land acquisition and resettlement.	This scenario will require the minimum demand of land, and it can have the least risks of land acquisition and resettlement.
	Rating	C	B	A
	Local Economy	The construction projects will activate the construction and service sectors. These projects will demand a lot of workers (especially unskilled), and it can provide a temporary boost to the local employment and service activities for the construction workers (accommodation, foods and beverages). As the urban development including infrastructure can facilitate efficient logistics and transportation, and local economic growth, local people can obtain opportunities of employment and/or to establish new businesses. However, the demand of land acquisition and resettlement can raise the risks of loss of livelihood, difficulty to recover livelihood, and/or degradation of previous living conditions of relocated people. Impacts on the local economy are expected as follows:		
		This scenario will generate the largest industrial productivity with the largest market but it can raise the highest risk of degradation of livelihood by land acquisition and resettlement. The impact is totally rated as medium.	This scenario will generate medium industrial productivity and raise medium risk of degradation of livelihood. The impact is totally rated as the largest.	This scenario will generate minimum industrial productivity although the risks of degradation of livelihood are the lowest. The impact is totally rated as the least.
	Rating	B	A	C
	Land Use	Population and economic growths will require more land for residence, industries, and infrastructure and these developments will demand more lands. These land requirements can affect the effective land use on the limited land of DMA as follows:		
		This scenario will require the largest demand of land, and it can generate excessive residential density, and raise disordered urbanization and difficulty of effective land use management particularly in Dili.	This scenario will require medium demand of land, and "Urban Cluster" development can be managed with effective land and spatial uses with the minimum land utilization.	This scenario will require the minimum demand of land, but still rather inefficient land and spatial uses due to single function in Tibar and Hera.

Assessment Indicators		Scenario 1: Urban Maximization as Dili Growth Pole	Scenario 2: Urban Cluster Development (Well-organized Control)	Scenario 3: Compact City Development (Multi-growth Pole)
	Rating	C	A	B
	Culture	There are architectural heritages of Portuguese colonization period and local sacred/holy places although these locations are unclear. Population growth, residential demand, and economic activities will require urban development projects and lands. Risks of deterioration or loss of cultural heritages or these attractions are expected as follows:		
		This scenario will require the largest demand of urban development projects and lands, and it can raise the most adverse impacts on cultural heritages, the risks of deterioration or loss of cultural heritages or these attractions.	This scenario will require medium demand of urban development projects and lands. However, "Urban Cluster" development that brings homes and work places in closer proximity to each other promotes settlement of the population in each center of Dili, Hera and Tibar. The residents can foster attractive social culture activities and it can promote conservation and utilization of the cultural heritages.	This scenario will require the minimum demand of urban development projects and lands and the least adverse impacts on cultural heritages are expected. However, cultural activities would be less among local people and the commuters.
	Rating	C	A	B
Evaluation		This scenario can raise the largest adverse impacts on the environmental and social conditions of DMA, and is the scenario to be avoided.	Considering its positive impacts on the social environment, this scenario is the most appropriate urban structure of DMA although adverse impacts are medium among the three scenarios.	This scenario can most reduce adverse impacts on pollution, natural and social environments of DMA due to the least population pressure although positive impacts on social environment are less than Scenario 2.
		C	B	A

Note: A: comparatively less adverse impacts or more positive impacts, B: comparatively medium impacts, C: comparatively more adverse impacts or less positive impacts
Source: JICA Project Team

1) Overall Technical Evaluation

After the evaluation of these three scenarios through the two types of evaluation in view of "Development Visions" and "environmental impacts", Scenario 2 is evaluated as the appropriate urban spatial structure of DMA. Scenario 2 could be recommended as the best for the development visions of DMA and can provide positive impacts on the social environment, especially on local economy development, land use management, and culture, while Scenario 3 would presume that small-scale urbanization as the leading urban center for non-oil/gas industry cannot generate effective synergistic effect in economic development although environmentally better condition. Meanwhile, Scenario 2 will raise adverse impacts but it can be reduced and mitigated. The mitigation measures are proposed for Scenario 2 in Chapter 13.

- Scenario 1 is the worst scenario and should be avoided as the urban spatial structure of DMA. The scenario is not applicable to realize the development visions and will raise adverse impacts on the environmental and social conditions.

- Scenario 2 is the best for the development visions of DMA and has the most positive impacts on the social environment with medium adverse impacts on pollution and natural environment.
- Scenario 3 is also decent in terms of the environmental and social impacts; however, it will require large investment cost over time for successful economic development distribution over the entire country against the current trend of social migration into Dili. However, this still leads to an inefficient and ineffective land use of DMA especially for Hera and Tibar.

2) Final Evaluation through Public Consultation

The results of technical evaluation were presented by DNHPU, and hearing was conducted in each public consultation meeting in Dili, Hera, and Tibar. Participants in every public consultation expressed favorable opinions in general on Scenario 2 as the best spatial structure for DMA, although they gave some concerns about the implementation issues of institutional arrangements, land tenure issues, and infrastructure. Details of the public consultation meetings are presented in Section 13.3.1.

After review of the results of public consultations, the final evaluation was made and Scenario 2 was selected as the proposed spatial structure for DMA.

8.3.3 Proposed Spatial Structure for DMA

This section aims at formulating the physical spatial structure based on Scenario 2 in order to fit with the physical conditions and socio-economic framework. This spatial structure for DMA plays an essential role in directing and organizing physical structure including land use pattern, key infrastructure framework, and urban management in an integrated manner. And the following spatial development strategies can be set in order to realize “the spatial structure of Scenario 2”.

(1) Spatial Structure Development Strategy for DMA

1) Formulating Resilient Urban Structure in Harmony with Nature Backbone

- The natural settings of “green mountain” and “water (sea and rivers)” of DMA are strong backbones of DMA spatial structure as attractive and innate features to be protected and strengthened while urban settlement should be resilient taking into account the fragile natural features that can generate natural hazards that sometimes destroy people’s settlement.
- Infrastructure and urban facilities as artificial structure of DMA should be improved and strengthened by resilient means such as redundant and sustainable green infrastructure to support socio-economic activities.

2) Enhancing Gateway / Hub Development to Encourage Economic Development

- The respective development and improvement of the New Tibar Port and the international airport in DMA, which both serve as gateway and hub for the domestic and international exchanging of people and products, need to be enhanced by intra- and inter-road and transport network and services to support economic development in the country.

- Inland depot, logistics function, and passenger transportation terminal are required in appropriate places and certain areas, taking into account traffic efficiency and negative environment impacts.

3) Establishing Smart Growth Management and Development

- Maximizing limited lands for urbanization is an essential issue of DMA development. Growth management through formulation of appropriate development density and mixed use, and organization of new development in compact land use patterns is inevitable. Existing historic buildings need to be preserved for the unique identities of local neighborhoods. All these growth management measures should be effectively applied to the DMA urban development.

4) Securing Sustainable and Efficient Mobility

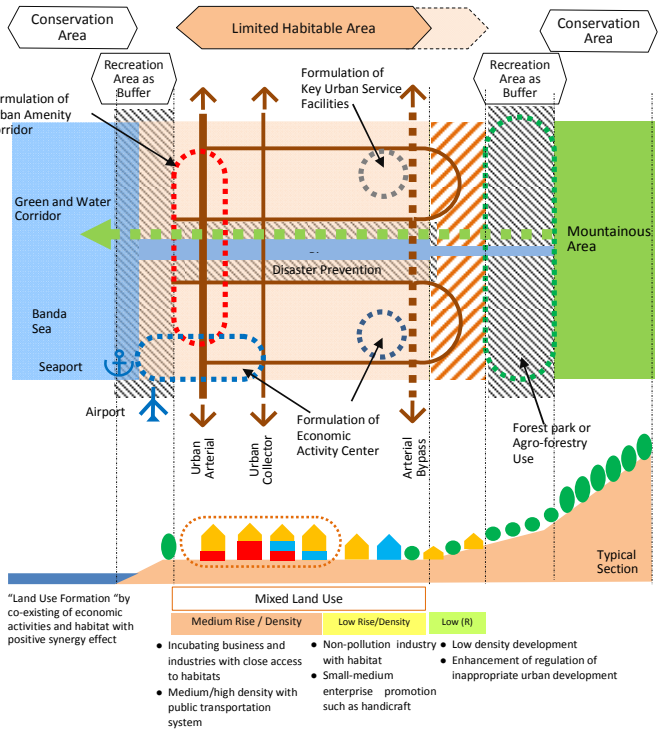
- In DMA, especially Dili, traffic congestion has become one of the critical issues to secure efficient transportation mobility and accessibility. To facilitate people's movement in DMA from their living places to working or learning places, DMA should lead the way with a variety of transportation means, especially public transit and other eco-friendly mobility measures including pedestrian network formulation.

- In conjunction with people's mobility, parking space adversely affects not only road capacity but also land use for off-road space provision. Appropriate parking system would be an important means to achieve sustainable mobility system in DMA.

5) Formulating Livable Living and Working Environment

- Despite embracing fundamental issues on land tenure and lack of infrastructure in DMA, the living environment should address more efficient and effective settlement with higher density development. DMA is required to introduce a new living lifestyle in association with the development of quality of life.

- Mixed use principle to accommodate higher density securing short-time commuting between living and working places in association with attractive public spaces, would be applicable to DMA urban development.



Source: JICA Project Team

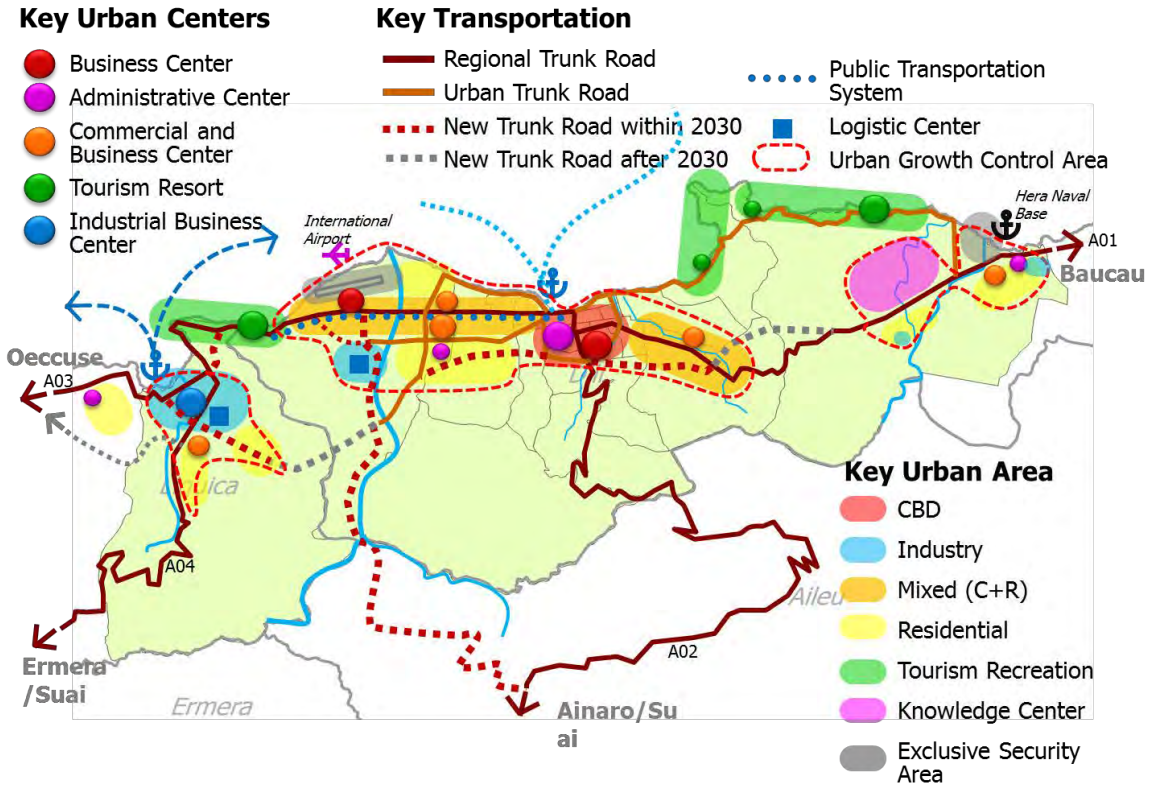
Figure 8.3.3 Conceptual Image of DMA Typical Urban Structure (Plan and Section)

6) Enhancing Beauty and Attractiveness of the Nation's Capital

- One of the key themes is the appearance and image of the capital of Timor-Leste. The city's physical design conveys the values and qualities which people aspire for as a nation.
- The fundamental concept of beauty and/or attractiveness within DMA must be reflected appropriately on the design of architecture, urban design, and planning, while historical heritages and cultural assets should be sustained and enhanced through attractive uses.

(2) Proposed Spatial Structure for DMA

The proposed spatial structure for DMA is illustrated in Figure 8.3.4. This proposed spatial structure of DMA becomes the basis of the land use planning in Chapter 9, for which the detailed spatial planning was discussed and elaborated through discussions with the Timor-Leste side.



Source: JICA Project Team

Figure 8.3.4 Preliminary Scheme for DMA Spatial Structure Development

8.4 Development Roadmap

The JPT defines development roadmap as a road map or a development path of the project area to attain the development vision during the planning period. The planning period is divided into three phases in the roadmap. In this project, JPT sets three phases, namely: i) Phase 1: 2015-2020, ii) Phase 2: 2021-2025, and iii) Phase 3: 2026-2030. The roadmap narrates possible events, activities to be achieved, possible changes due to the events and activities by item such as spatial pattern, socio-economy, and infrastructure, among others, for each phase.

Here, the JPT narrates the development roadmap for the optimum development scenario based on the analysis results of the socio-economy and spatial patterns. The optimum scenario consists of the following cases/scenarios of the socio-economy and spatial structure.

Table 8.4.1 Key Composition of Optimum Development Scenario

Item	Optimum Case/Scenario	Key Description	Reference (Chapter Number in this Report)
Population	Case 3 (Moderate Migration Scenario)	492,251 as of 2030 351,137 as of 2020 Annual Average Growth Rate: 3.94%	8.2.2
GDP growth	Middle Case	Growth rate (2021-2030): 8.3%	8.2.3
Spatial structure	Scenario 2	Urban Cluster Development (well-organized control)	8.3.3

Source: JICA Project Team

The development roadmap for the optimum development scenario is shown in Table 2.4.2. In the table, items of economic development and economic infrastructure are associated with the “Robust Economic Hub” pillar. Item of quality of life is associated with the “High Quality of Life” pillar, and the item of socio-cultural infrastructure is associated with the “Rich Socio-cultural Center” pillar. Item of health and environment is associated with the “Healthy and Eco-friendly Society” pillar. Items of spatial development and governance are related with all four pillars. Item of development outside DMA influences the “Robust Economic Hub” pillar.

Four viewpoints in the development vision are the points to be addressed in the process of project formulation. As for the projects and phenomena related with the viewpoints in the table, (L) are related with “Linkage”; (H) are related with “Human Resources”; (S) are related with “Sustainability”; and (R) are related with “Resilience”.

Table 8.4.2 DMA Development Roadmap for Optimum Scenario

	Phase 1: 2015-2020	Phase 2: 2021-2025	Phase 3: 2026-2030
Basic approach	Establishment of foundation for socio-economic activities	Starting and rolling out of economic development	Expansion of sustainable economic development
Population growth (annual average)	4.31%	3.70%	3.05%
GDP growth rate (annual average)	10.51%	8.30%	8.30%
Economic development	• Institutional development and preparation to be ASEAN member (S) • Promotion of import substitution (S) • Acceleration of construction industry (S) • Marketing for tourism industry (S) • Fostering of intellectual industry (S), (H) • Fostering of private enterprises (S), (H)	• Revitalization of international trade and transaction as ASEAN member (S) • Revitalization of internal trade in Timor-Leste (S) • Advancement of tourism industry (increase in number of tourists) (S) • Improvement of high education institution (H)	• Continuation and expansion of international trade and transaction (S) • Enhancement of national capital functions and alteration to cosmopolitan city (S) • Formation of center for tourism industry (S) • Agglomeration of intellectual industry (S), (H) • Revitalization of private businesses(S)

	Phase 1: 2015-2020	Phase 2: 2021-2025	Phase 3: 2026-2030
Spatial development	• Enhancement of functions in core cities (L), (R) • Formation of basic infrastructure network (L), (R) • Progress of development in habitable area (S)	• Development of urban cluster by shifting some urban functions to satellite cities (L), (R) • Redevelopment and mix land use development in existing urban areas in Dili (S)	• Promotion of strategic development to encourage synergistic effect through cluster development (L), (S) • Development of residential and commercial functions in Hera and Tibar (S) • Attainment of optimum land use development in the existing urban areas in Dili (S)
Economic infrastructure	• Improvement of existing seaport (L), (R) • Development of new seaport (L), (R) • Improvement of existing airport (L) • Development of road networks in Dili (L)	• Start of operation of new passenger terminal at the existing port (L), (R) • Start of full operation at new seaport (L), (R) • Development of public transportation in Dili (L)	• Development of backland at the new seaport (L), (S) • Development of by-pass roads in DMA (L), (R)
Socio-cultural infrastructure	• Start of campus relocation of the National University of Timor-Leste (H) • Development of inventory for cultural heritage (S) • Planning of cultural facilities (S)	• Completion of campus relocation of the National University of Timor-Leste (H) • Preservation and rehabilitation of cultural heritage (S) • Development of cultural facilities (S)	• Enhancement of academic and research functions (H) • Formation of aesthetic district by utilizing cultural heritage (S) • Fostering culture (S)
Quality of life/	• Human resource development for disaster prevention (H), (R) • Basic works for water supply facilities development (H) • Basic works for drainage facilities (H), (R) • Improvement of distribution facilities and substations (S) • Improvement of communication networks (L), (S)	• Development of systems and facilities for disaster prevention (R) • Continuation of basic works for water supply facilities development (H) • Continuation of basic works for drainage facilities (H) • Increase in capacity of distribution facilities and substations (S) • Development of E-government (L), (S)	• Mitigation of damage brought about by natural disaster (R) • Development of water supply facilities and realization of 24-hour water supply (H), (S) • Increase in capacity of drainage facilities (H), (R) • Development of renewable energy (S) • Ensuring security in network communication (S)
Health and environment	• Preparation of development guidelines for sidewalk and bicycle lane (S) • Preparation of guideline for development control (S) • Capacity development for organizations in charge of sewerage (H), (S) • Improvement of landfill and capacity development for organizations in charge of solid waste management (H), (S)	• Development of sidewalk and bicycle lane (S) • Enforcement of development control for protected areas (S) • Continuation of capacity development for organizations in charge of sewerage and update of sewerage master plan (H), (S) • Construction of new sanitary landfill (H), (S)	• Ensure safety and health promotion for pedestrians and bicycle users (S) • Protection of forest and marine environment (S) • Decrease in water-borne diseases (S) • Efficient solid waste management (H), (S)
Governance	• Development of legal systems for urban growth management (H), (S) • Capacity development for organization and officials at the national government level (H), (S) • Preparation for decentralization (H), (S)	• Development of management system for urban growth (H), (S) • Start of decentralization (H), (S) • Capacity development for organization and officials at the local government level (H), (S)	• Enhancement of urban growth management system (H), (S) • Promotion of local governance (H), (S)

	Phase 1: 2015-2020	Phase 2: 2021-2025	Phase 3: 2026-2030
Development outside DMA	• Improvement and expansion of technology for agriculture (H), (S) • Development of main national roads (L)	• Improvement of productivity of agricultural products (S) • Improvement of access between urban areas and rural areas (L)	• Promotion of agriculture (S) • Enhancement of smooth flow of logistics and transportation between urban areas and rural areas (L)

Note: (L): Linkage, (H): Human Resources, (S): Sustainability, (R): Resilience
Source: JICA Project Team

(1) Phase 1: 2015-2020

Foundation for developing socio-economy is to be established through infrastructure development and capacity development from 2015 to 2020. Both population and GDP growth rates in Phase 1 are higher than those in other phases.

1) Economic development

- Timor-Leste will be a member country of the Association of Southeast Asian Nations (ASEAN) between 2015 and 2020. The construction industry due to increase in infrastructure development will be active. Fostering of tourism industry and intellectual industry will be progressing in parallel with fostering of private enterprises.

2) Spatial structure

- Urban functions will remain in Dili and population will also increase mainly in Dili. Implementation of development projects will start in Hera and Tibar to prepare the transfer of some urban functions to these areas.

3) Economic infrastructure

- Improvement of the existing seaport and airport as well as development of new seaport will be implemented to enhance the functions of logistic and transportation hubs and gateways not only for DMA but also for Timor-Leste. To mitigate the traffic congestion, road network in DMA is also to be developed.

4) Socio-cultural and life infrastructure

- Based on the master plan of the National University of Timor-Leste, most of the departments located in Dili will start moving gradually to Hera, where currently only the engineering department is located. The movement to enhance the cultural value in Dili also starts. The movements will encourage the enhancement of cultural heritage including historical buildings built in Portuguese era and activities such as music, art, sports, etc.

5) Quality of life/environment

- To mitigate the damage of natural disaster, human resource development will start. This is due to the fact that people in Timor-Leste have limited knowledge and skills on disaster prevention. Human resource development should have the highest priority for disaster prevention in Phase 1. To create safe and comfortable city, development of

sidewalk and bicycle lane should be one of the measures. As a first step, development guideline for sidewalk and bicycle lane will be prepared in Phase 1. Environmental infrastructure such as sewerage should be developed to keep DMA clean.

6) Governance

- Capacity development for human resources in a variety of areas will be intensively implemented for the development of DMA. JPT assumes that decentralization will be started after 2021, so preparation for decentralization such as concept and supporting legal systems should start in Phase 1. In parallel with this preparation, capacity for the organization and officials of the national government will be developed. As for the urban planning field, legal systems for urban growth management will be established.

7) Development outside DMA

- To sustain the increase in population and seek for import substitute, enhancement of productivity in agriculture should be of great importance in Timor-Leste. In Phase 1, the technology on agriculture and irrigation should be diffused outside DMA, where the main industry is agriculture. Improving access from production areas to markets supports the agriculture sector; thus, development of main national road is the first step to improve the access and will be a key action in Phase 1.

(2) Phase 2: 2021-2025

Phase 2 is the beginning stage to fully utilize the systems, human resources, and infrastructure which are to be developed in Phase 1. Phase 2 is the stage to start and roll out economic development. Since major infrastructure developments are to be completed in the previous phase, both population growth and GDP growth will slow down a little in this phase.

1) Economic development

- As one of the ASEAN countries, Timor-Leste will have firmer relationship with the other ten countries than before. Both international and internal trades will be revitalized. To meet the increase in number of visitors from other countries, tourism industry will be developed in Phase 2. Import substitution for food and improvement of high education institution will be carried out to mitigate excessive import; the JPT can now see the importance of human resources who will sustain the society.

2) Spatial structure

- Some urban functions will be moved to sub-centers such as Hera and Tibar. These sub-centers will shape the urban cluster as national capital in conjunction with Dili. In the inner city of Dili, urban redevelopment and mixed land use will be promoted for efficient land use in response to the increase in demand of land due to population increase.

3) Economic infrastructure

- New seaport development and existing seaport improvement will be completed in the previous phase. Full operation will start in these seaports. These seaports will be ready to function as logistic and transportation hub and be able to meet the increase in

demand of international trade. To mitigate traffic congestion in Dili, public transportation will be developed in this phase.

4) Socio-cultural and life infrastructure

- All targeted departments of the National University of Timor-Leste will be relocated completely to Hera in this phase, so population in Hera will start to increase. Preservation and rehabilitation of cultural heritages will progress and cultural facilities will be developed in this phase.

5) Quality of life/environment

- After human resource development for disaster prevention in Phase 1, Phase 2 is the stage to develop the systems and facilities to mitigate the damage of natural disaster. The systems include warning and evacuation systems for flood, earthquake, and tsunami, among others, and the facilities include sabo works, evacuation centers, and others. Development of sidewalk and bicycle lanes will progress, and Dili will become a friendly city for vulnerable road users such as old people and children. Water environment will also be improved due to the progress of sewerage projects implemented in the previous phase.

6) Governance

- Decentralization of the government will start in this phase. Accordingly, the target groups of capacity development will shift from national government to local government. The management system will be developed for urban growth management. Land use control will be implemented in this phase, by following the laws and regulations enacted in the previous phase. This implementation is linked with spatial structure to encourage sub-center development.

7) Development outside DMA

- As a result of technology introduction all over the nation in Phase 1, improvement of productivity in agriculture is expected in Phase 2. Accessibility between urban and rural areas will be largely improved in this phase due to the national roads development to be implemented in Phase 1. These events will contribute to the import substitution for food and revitalization of internal trade.

(3) Phase 3: 2026-2030

Sustainability and further promotion of developments in Phase 2 will be ensured in Phase 3. Population growth in Phase 3 will slow down a little compared with Phase 2, and GDP growth rate in this phase will be the same as in the previous phase. The accumulated outputs of developments from Phase 1 to Phase 3 will contribute in attaining the “DMA Vision 2030”.

1) Economic development

- The relationship with other ASEAN countries will be stable, so related trade and transaction will increase. Accordingly, Timor-Leste will be more widely known than now and visitors including tourists will increase. Dili will play an important role as a

center of tourism. To sustain the economy, revitalization of private business as well as public efforts is necessary.

2) Spatial structure

- Cluster will be formed in Phase 3. Residential and commercial functions will be fully introduced in Hera and Tibar in this phase. As a result, academic and research functions in Hera and logistic and industrial functions will be enhanced. Hera and Tibar will be sub-centers to form the urban cluster of national capital by combining with Dili.

3) Economic infrastructure

- Backland of the new seaport will be developed in Tibar for logistic and industrial related sectors. To make smooth logistic flow and ensure resilience of DMA, a bypass road will be developed in this phase between Dili and Tibar, which are now connected by only one road with large curves along the coastal line.

4) Socio-cultural and life infrastructure

- Software such as curriculums, programs, and activities will be enhanced to strengthen the academic and research functions in this phase. Aesthetic districts in the inner-city of Dili will be designated where cultural heritages should be preserved, and both citizens and visitors will enjoy the beauty of landscape utilizing cultural heritage. Through these efforts, culture of Timor-Leste will be well fostered.

5) Quality of life/environment

- The continuous efforts in the previous phases for disaster prevention will bring about mitigation of damage by natural disaster. People in DMA will have safer life than today. People in DMA will be able to use the sidewalk and bicycle lanes safely; therefore, safety and health promotion for citizens will be secured. Natural environment in the mountains and marine will be protected. Water-borne diseases will decrease. These changes will lead to high quality of life and eco-friendly society in DMA.

6) Governance

- The decentralization process will be stable and local governance will be promoted in this stage. Local governments, such as district, sub-district, and suco, are required to have ownership and take initiatives to develop their own territory with least dependence on the national government. Urban growth management will be well experienced in this phase.

7) Development outside DMA

- Promotion of agriculture will be sustained in this phase by sustaining high-level productivity to be enhanced in the previous phase. Smooth movement in logistics and transportation between urban areas and rural areas will be realized. These changes will influence the decrease of in-migration to urban areas. This will be one of the main factors to slowdown population growth in this phase.

CHAPTER 9：LAND USE PLAN

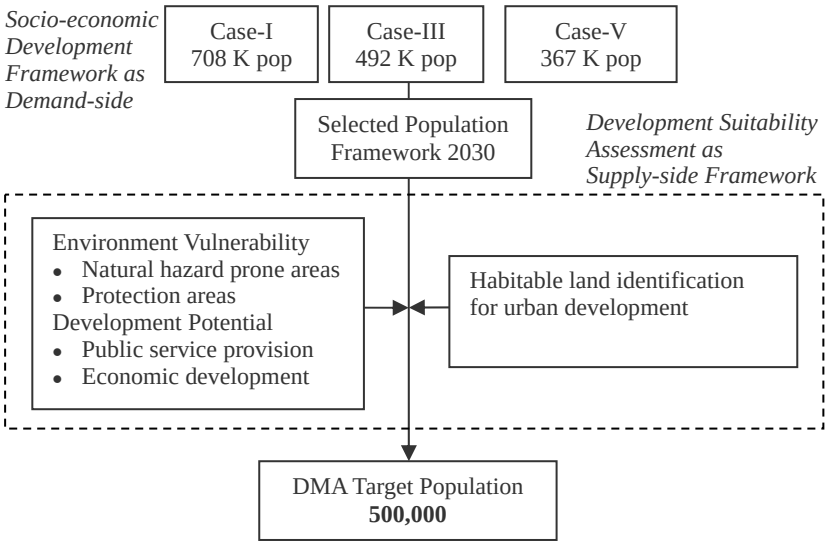
9.1 Land Use Framework

9.1.1 Demand-side Framework for DMA

(1) Spatial Frame Setting and Approach

According to the socio-economic development framework assessed in the previous Section 8.2, the Case 3 projection of population for the Dili Metropolitan Area (DMA) in 2030 is adopted for the target population framework for DMA.

The development framework of Case 3 population projection is assessed by land capacity of DMA through the development suitability analysis described in Section 9.1.2 whether or not the future population in DMA would be able to be accommodated in the available lands. Consequently, Case 3 population projection would be within the possible range of land capacity of DMA to accommodate population of 500,000.



Source: JICA Project Team

Figure 9.1.1 Flowchart for Target Population Setting Process for Dili Metropolitan Area

(2) Population Target Framework for DMA

Table 9.1.1 indicates the future population of DMA; Population of 500,000 is targeted for the year 2030, in which the annual average growth rate of the total population is 4.2% from 2014 to 2030. Although each population distribution by the administrative post (AP) (e.g., sub-district) is described in the further section in detail, majority of the population distribution is in Dom Aleixo AP with higher

growth rate followed by Cristo Rei AP taking account of the available spaces for further urban development and density formulation.

Table 9.1.1 Target Population for Dili Metropolitan Area

Municipality	Administrative Post (e.g., sub-district)	2014*	2020	2025	2030	AAGR (14-30)
Dili	Vera Cruz	36,230	39,850	43,420	47,500	1.7%
	Nain Feto	27,830	29,690	31,410	33,200	1.1%
	Dom Aleixo	125,230	160,630	202,480	252,400	4.5%
	Cristo Rei	62,940	78,090	94,920	116,900	3.9%
Liquica	Bazartete / (Tibar)	5,400	13,500	25,000	50,000	14.9%
Total		257,630	321,760	397,230	500,000	4.2%

Note: *Population in 2014 is estimated based on the Population and Housing Census 2010 (DGS).
Source: JICA Project Team

(3) Employment Target Framework for DMA

1) Target Employment

The target employment based on the economic development framework in the previous Section 8.2 is set, although future employments for DMA are estimated based on several assumptions referring to the employment conditions in the Association of Southeast Asian Nations (ASEAN) countries due to insufficient historical and relevant economic data such as the gross regional domestic product (GRDP) for DMA. The following considerations below are taken as target premises for assumptions.

- Unemployment rate: Unemployment rate, as defined by the International Labor Organization (ILO) (unemployment/cohort labor force) of 9% in DMA (2010), which plays the driving force role in the non-oil/gas sector, is comparatively worse than the average of ASEAN countries of 4.5%. The target rate in 2030 is set at 5% to achieve the ASEAN countries' average.

- Labor force participation rate (LFPR): Current rate in DMA (2010) is indicated as 48% by the Census 2010[1], while rates in ASEAN countries indicate higher (65% ~ 78%) in general because of high agriculture sector employment achievement, informal sector flexibility and other reasons. East Asia countries (e.g., Japan, Korea) have lower rates (59% ~ 61%). The LFPR in DMA is assumed to be moderate and less than that of the ASEAN countries because of the DMA urban area.

- Labor productivity: Industry in DMA is expected to be the driving force of non-oil/gas sector economic development such as logistics, agro-industry, and manufacturing. Therefore, its productivity is expected to increase gradually rather than the rapid increment of employment in terms of in-between status of capital-intensive industry and labor-intensive industry, while the GRDP increase might be a result of productivity improvement by existing and new industries.

The target employment in DMA as shown in Table 9.1.2 would reach up to around 145,000 as a result of the target GRDP assumption in 2030, while the target unemployment rate is set at 5% in 2030 and LFPR is set at 50% in 2030.

[1] Population and Housing Census 2010, General Directorate of Statistics (DGS), Ministry of Finance (MOF)

Table 9.1.2 Target Employment for Dili Metropolitan Area

Indicators	2010	2015	2020	2025	2030	AAGR
GRDP (million USD)	707	1,124	1,789	2,845	4,527	9.7%
Labor Force (15 – 64 years) (A)	146,278	173,962	210,152	256,702	321,111	4.0%
Target Employment (B)	57,197	72,110	90,910	114,620	144,500	4.7%
Target Unemployment (C)	12,934	13,530	14,160	14,800	15,500	--
Total as Target Economically Active (D)	70,131	85,640	105,070	129,420	160,000	--
Labor Force Participation Rate (D/A)	48%	49%	50%	50%	50%	--
Unemployment Rate (C/A)	9%	8%	7%	6%	5%	--
Labor Productivity (GDP per Employment)	12,361	15,587	19,679	24,821	31,329	--

Source: JICA Project Team

2) Employment Sector Distribution

Based on the statistical data in 2010 by the General Directorate of Statistics (DGS) of Ministry of Finance, the employment by industrial sector in 2014 is estimated as shown in Table 9.1.3. The majority of employment is shared by the tertiary sector called as the service industries. Although some factories are located in Dili, they contribute to few employments in the secondary sector. Primary sector including agriculture, fishery, and mining (construction material) shares merely 4% of the total employment because of predominant urban settlement without agricultural and fishery sector productions such as in small paddy fields, less mountainous agricultural fields, and few fishing villages in DMA.

In this context, the industrial sector does not expect drastic change of employment composition in 2030; however, the secondary sector expects more shares in conjunction with the Tibar New Seaport development as a national project stimulating relevant industrial sector development in DMA.

Table 9.1.3 Target Employment Sector Distribution in DMA

Category	2014*	Share (%)	2030	Share (%)
Primary	2,761	3.9%	1,070	0.7%
Secondary	7,815	11.2%	20,585	14.2%
Tertiary	59,433	84.9%	123,345	85.1%
Total	70,010	100.0%	145,000	100.0%

Note: Figures in 2014 is estimated by JPT based on the Census 2010.
Source: JICA Project Team

(4) Dili Industrial Development

The Ministry of Commerce, Industry and Environment (MCIE) has developed the draft final report on “Promoting Resource-based Industrialization in Timor-Leste” for industrial policies supported by the United Nations Development Programme (UNDP). The industrial policies in the report were proposed such that the government needs to promote priority sectors to be industrialized toward 2030 through agriculture, mining, and tourism as potential resource-based development in the country in line with Strategic Development Plan (SDP).

The report also proposes that the focus in DMA shall be on the industrial sectors shown in Table 9.1.4, while export-oriented processing industry are promoted in Oecussi and petro-chemical industry in the southern coast of the country.

Table 9.1.4 Proposed Industrial Development Policies for Relevant Area of DMA

Proposal	Contents	Candidate Location
Industrial Development 1	Agro-processing industry： Aiming at fostering import substitution industry with products of rice, corn, cooking oil, flour milling, livestock food Aiming at promoting export-oriented agro-products of coffee and peanut..	Surroundings in Dili
Industrial Development 2	Aiming at promoting import substitution industry for construction sector with cement, concrete, wood building material.	Surroundings in Dili
Science Park Development	Aiming at promoting to develop products and services through research and development-based approach through the establishment of Science Park. Target sector is not only the manufacturing sector but also all the other industries in Timor-Leste	Surroundings in Dili (with conditions of alliance with universities, international institution)

Source： Promoting Resource-Based Industrialization in Timor-Leste (Draft Report), MCIE/UNDP August 2014.

As the report does not mention the specific location for these industries other than Dili surroundings and these developments may require intensive lands, it is considered that appropriate location for the industrial development 1 and 2 could be in Tibar, and Science Park could be in Hera in conjunction with the new campus of Universidade Nacional Timor Lorosa'e (UNTL).

Regarding the economic development in Timor-Leste, DMA could play a considerable role in leading or supporting the secondary and tertiary sector in the country through providing human resources and services for logistics, meeting, incentives, conference and exhibition (MICE), passenger transportation, accommodation, financing, education and training, and tourism. Therefore, the composition of economic sector by the tertiary and secondary sectors in DMA would not be changed drastically, although there would be possible contribution of small increase of GRDP and employment by the secondary sector. Appendix 4 shows an examination of potential industrial sectors.

9.1.2 Supply-side Framework: Development Suitability Assessment

(1) Methodology of Development Suitability Assessment

The development suitability is assessed by two analysis components, namely, "environment vulnerability analysis" with consideration of the supply-side capacity and "socio-economic development potential analysis" with consideration of the demand-side possibility. The following steps are taken in the analysis process. Detailed technical explanation is described in Appendix 5 (Development Suitability Analysis).

1) Overall Land Suitability Analysis for DMA

- Each analysis of environment vulnerability and socio-economic development necessity and potentiality is evaluated by quantitative value with certain weighting factors, and each rating score is aggregated as total rating for the component. Two analyses components are also aggregated into integrated rating score as overall land suitability scoring for all lands in the DMA.
- Environment Vulnerability Analysis: This analysis applied to the whole project area to identify the habitable land that is defined by vulnerable factors of slope, flood prone area, nature protected areas is carried out within DMA. The habitable land is evaluated by cumulative rated scores through overlaying factors aggregation.

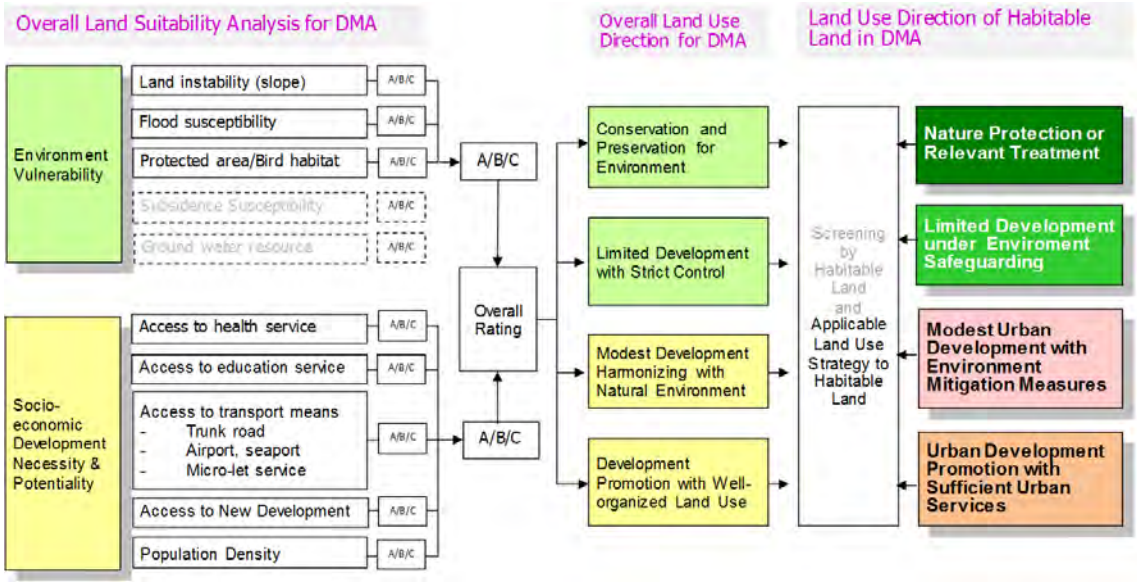
- Socio-economic Development Necessity and Potentiality: This analysis considers the accessibility to public services and new development area where proximity to facilities of public services such as education, health and transport, and population density as potential demand for services are evaluated.

2) Overall Land Use Direction for DMA

This analysis would give future land use directions through degree of intervention from "Conservation" to "Development" in conjunction with the result of the land suitability analysis in terms of land development capacity and its development potential for the whole territory of DMA.

3) Land Use Direction of Habitable Land in DMA

This analysis would give future land use directions through certain measures for the habitable land in DMA in terms of land development management in which the relevant authorities relating to environment conservation, agriculture development, industrial development, and urban planning should be involved.



Note: A/B/C indicates evaluation scores with "A" as highest score, "B" as intermediate and "C" as lowest score.
Source: JICA Project Team

Figure 9.1.2 Flowchart for Development Suitability Assessment for Dili Metropolitan Area

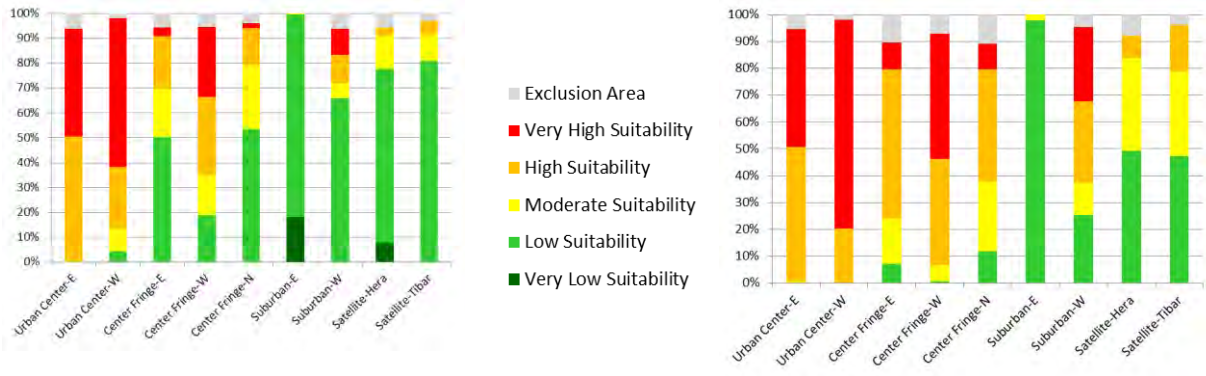
(2) Result of Overall Land Suitability Assessment for DMA

The assessment results are shown by tables and maps on "land suitability" for the whole DMA area and "development suitability" within the habitable land areas in DMA. Majority of lands of DMA is evaluated with "very low" and "low suitability" (66% out of total lands of DMA) due to predominant occupation by steep mountains.
Looking into the habitable lands considering slope condition under 15°, one third of the total habitable lands are evaluated as "very low" and "low suitability". These areas in the plain lands of Hera and Tibar have river channels penetrating into the plain lands. Around 60% of total habitable lands were evaluated as "very high suitability", "high suitability", and "moderate suitability", and this is where existing settlement and future urban development could be accommodated.

Table 9.1.5 Indicative Land Area Based on Land Suitability Analyses for DMA

Evaluation area	Suitability Rating Areas (ha)						Unit: ha
	Very Low Suitability	Low Suitability	Moderate Suitability	High Suitability	Very High Suitability	Exclusion Area	Grand Total
Study area	419	11,403	2,059	1,926	1,182	871	17,860
Share (%)	2.3%	63.8%	11.5%	10.8%	6.6%	4.9%	100.0%
Habitable Land	2	2,021	1,364	1,729	1,178	406	6,699
Share (%)	0.0%	30.2%	20.4%	25.8%	17.6%	6.1%	100.0%

Source: JICA Project Team

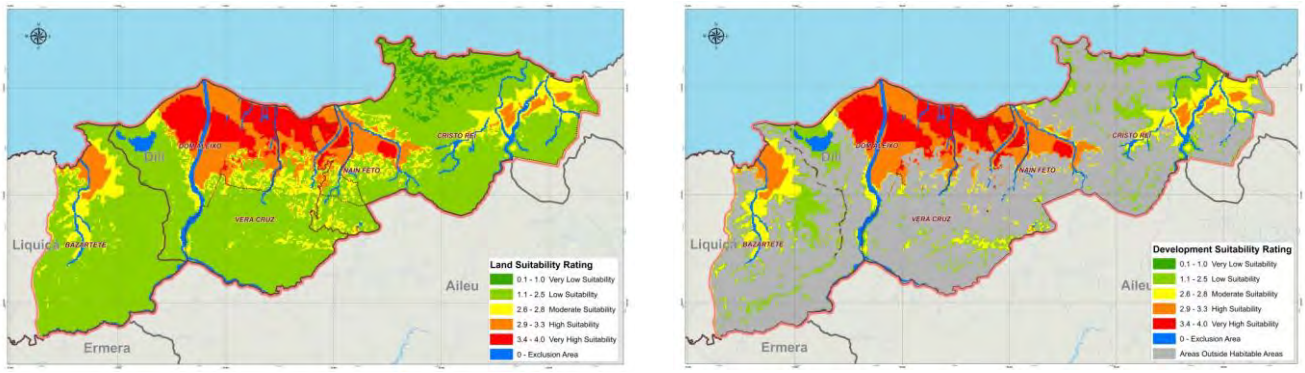


Land Suitability Rating for Whole DMA

Development Suitability Rating for Habitable Land in DMA

Source: JICA Project Team

Figure 9.1.3 Land Suitability in DMA and Development Suitability in Habitable Land



Land Suitability Rating for Whole DMA

Development Suitability Rating for Habitable Land in DMA

Source: JICA Project Team

Figure 9.1.4 Land Suitability Map in DMA and Development Suitability in Habitable Land

(3) Implication of Suitability Assessment by Direction of Land Management Policy for DMA

Appropriate land management for DMA can be referred to the result of this suitability analysis. The rating value for lands could suggest desirable direction of land management toward future urban development and environmental conservation. The following directions for the land management of DMA are proposed based on the assessment results and land use direction for conservation and development. Figure 9.1.5 illustrates the indicative map for land management policy for DMA.

1) Lands for Nature Protection and Relevant Treatment

Natural environment conservation areas including the existing protected areas (Cristo Rei, Tasitolu) and potential areas should apply to lands rated with "very low suitability" as inevitable criteria and/or some "low suitability". And those lands should be secured and enforced by certain institutional protection measures to be established (e.g., forest reserve area, watershed protection, coastal protection, river riparian protection, wildlife protection)

2) Lands for Limited Development under Environment Safeguarding

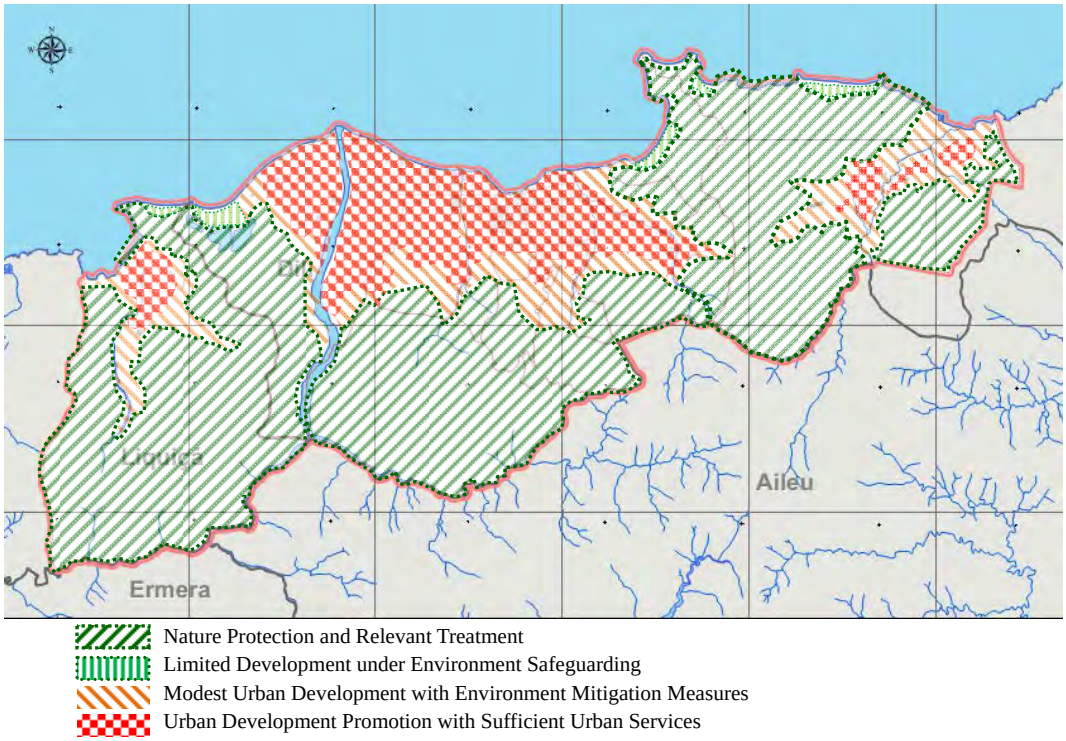
Taking account of the inevitable economic development, utilizing the potential natural resources in DMA, limited development such as tourism sector development or citizen's recreation place can be allowed in this category, but with full consideration and measure of environmental protection. These areas would take place in lands mainly with "low suitability" and some case in "very low suitability" rating category.

3) Lands for Modest Urban Development with Environment Mitigation Measures

This type of lands, mainly lands rated with "moderate suitability", would give urban development opportunity to accommodate future population increase taking account of the necessary mitigation measures including certain infrastructure preventing negative impacts on the environment and natural hazard protection.

4) Lands for Urban Development Promotion with Sufficient Urban Services

In order to accommodate future population demand, lands with "very high suitability" and "high suitability" including some lands of "moderate suitability" are potential candidates for target areas to promote future urban development including existing settlements improvement. Urban services should be secured sufficiently in these lands as the most desirable urban development areas.



Source: JICA Project Team

Figure 9.1.5 Direction of Land Management Policy for DMA

(4) Suggested Measures of Land Management Policy for DMA

The land management policies for DMA previously mentioned can be applied to land use planning indirectly and zoning scheme formulation directly as one of the planning framework. The density element, in which low density development is an example, would be one of the useful measures in land use planning that can be applied to the areas through the policies of "Limited Development Under Environment Safeguarding" or "Modest Urban Development with Environment Mitigation Measures" to formulate desirable environment formulation.

On the other hand, development regulations in a zoning scheme would also be applicable measures based on each policy for land management to control and guide toward appropriate land utilization and activities. Table 9.1.4 illustrates such applicable measures in land use planning and zoning scheme formulation according to the areas of each land management policy.

Table 9.1.6 Suggested Measures in line with Land Management Policies

Land Management Policy	Considerations by Applicable Land Management Measures	
	Land Use Planning	Zoning Planning
1. Nature protection and relevant treatment	• Nature-based land use class	• Applying strict nature protection measures to this area
2. Limited development under environment safeguarding	• Land use to utilize natural resources such as recreation and tourism	• Applying development regulations and controls for construction • Guidelines for negative impacts mitigation measures
3. Modest urban development with environment mitigation measures	• Land use by low-density development	
4.Urban development promotion with sufficient urban services	• Land use for intensive economic activities such as business commercial, industry, and medium dense residential.	• Applying use controls and promotion measures by each urban activity • Applying building form controls

Source: JICA Project Team

9.2 Spatial Strategy and Land Use Policy

Land use planning refers to influencing the future distribution of socioeconomic activities into physical spaces. It is undertaken by creating rational spatial organization with land uses and linkages to balance socioeconomic development demands with environment capacity. It also involves measures to coordinate with other sectoral development plans, especially the transportation system as one of the essential sectors, and to guide socioeconomic activities created by market force through the regulation of private sector activities and to secure public entities for public urban services.

9.2.1 Spatial Development Strategy for Dili Metropolitan Area (DMA)

The spatial development strategies are formulated in consistency with the viewpoints of resilience, sustainability, linkage, and human resource to embody the DMA Development Vision 2030. Three strategies relate directly to spatial development aspects through urban structure, transportation network and environment, while a viewpoint of human resource can be interpreted by supporting strategies for spatial development.

On the other hand, the key considerations for formulation of spatial development strategies are how to achieve efficient land use due to limited land in DMA surrounded by mountainous areas, how to support economic development shouldering significant role in leading non-oil industry, and how to secure safety without natural disasters and attractive living environment. These considerations stipulate tangible policies for land use formulation in DMA in the next paragraph. Figure 9.2.1 shows the relationship among development vision, viewpoint of spatial development strategies, and their concrete measures through land use policies.

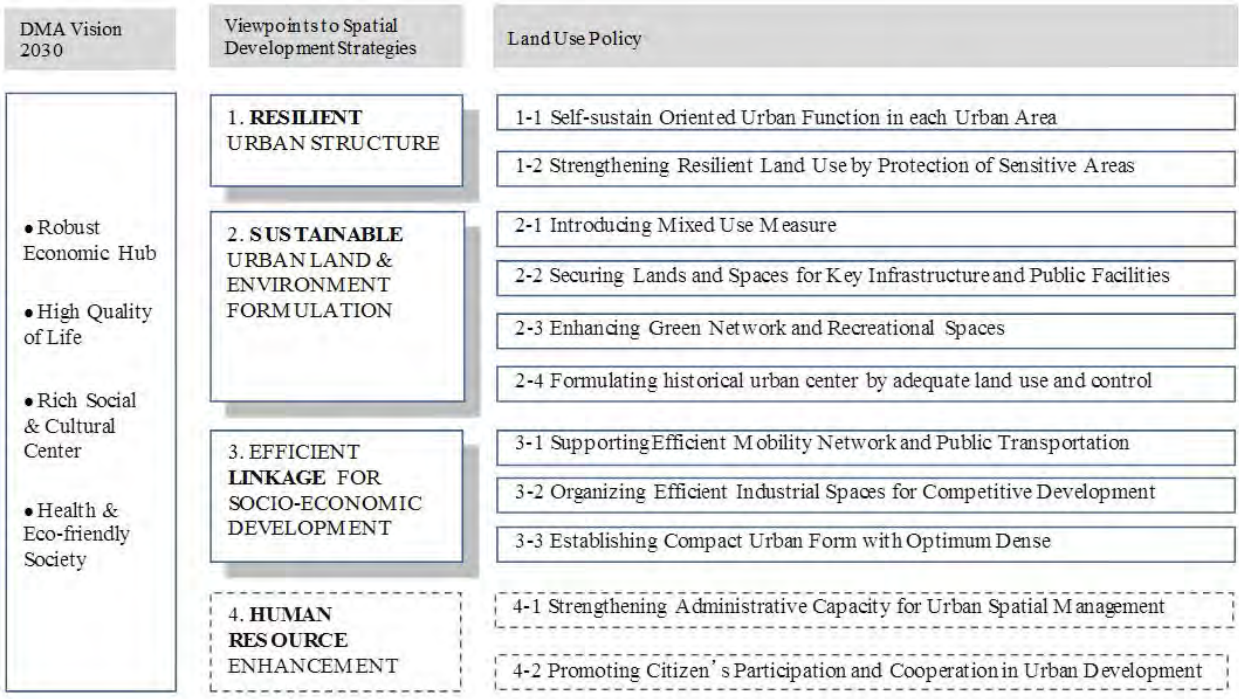


Figure 9.2.1 Spatial Development Strategy from Viewpoints to Achieve Development Visions

9.2.2 Land Use Policy

According to the spatial development strategies, the following land use policies are set and defined as implementable framework for land use planning involving several essential planning measures such as "density formulation", "use classification" and "use distribution".

1) Self-sustaining Oriented Urban Function in Each Urban Area of Dili, Hera and Tibar

- Urban development in each urban area in Dili, Hera, and Tibar should have certain urban services as self-sustaining urban areas in any way possible except for the capital function in Dili, where residents can enjoy necessary urban services for working and living, rather than mono-use urban area (e.g., commuter town, industry zone, or university zone only) minimizing unnecessary trips to other urban areas.
- Some central government facilities are also expected to contribute to appropriate urban formulation through the relocation of relevant functions to foster synergy development effect (e.g., industrial government agencies are candidates to relocate in Tibar area, relevant government agencies for higher education to Hera).
- Each urban area can be linked with each other to supplement each urban function with necessary facilities as a whole of DMA in line with urban conurbation concept.

2) Strengthening Resilient Land Use by Protection of Sensitive Areas

- Lands in steep slopes, hillsides, and ridgelines encroached by settlement in DMA are one of the most fragile areas where natural hazards such as landslide and erosion are prone to be generated. Steep slopes, hillsides and ridgelines in DMA should be secured through strict control for development in association with the buffering areas by green and open spaces.
- Waterfront sites along the sea coast and river sides encroached by some settlements in DMA are also areas prone to erosion or water storms (e.g., high waves, river flood, inundation). These waterfront areas should be considered through appropriate setback for settlement with necessary embankment and service roads.
- Mountain ranges with rivers as hinterlands of urban areas in DMA shape large watershed areas to be protected for water resource and prevention of natural hazards. The watershed areas should be protected and regulated by certain measures.

3) Introducing Mixed Use Measure

- Mixed land use measure for land use would be one of the most important elements to achieve the compact urban form, to which both new urban settlement and existing settlement are applied.
- Mixed use measure could enable urban lands to stimulate and encourage business and commercial activities because of the close and convenient location setting with synergy effects and consumers' convenience.
- Public facilities are no exception for mixed use measure in order to achieve efficient land use. There are actual cases of their combination with cultural facilities, administrative facilities, and multi-ministry facilities in Japan and other countries, where users are able to access them conveniently.

4) Securing Lands and Spaces for Key Infrastructure and Public Facilities

- Trunk roads and key utilities would play essential roles in ensuring efficient and effective socioeconomic activities in the future. These lands and spaces should be secured by appropriate measures from the public interest point of view.
- Coping with future population demands in DMA, lands and spaces for public facilities, especially schools would be one of the most important elements to be assured through dense multi-story building, expropriation, or other innovative land utilization measures such as land trust system, and long-term concession.
- Land expropriation for public interests by adequate measure would become essential part of urban administration in DMA to achieve smooth and effective implementation for public projects. Integrated urban development involving substitution lands for this purpose would be one of the effective measures.

5) Enhancing Green Network and Recreational Spaces as Part of the Attractive Urban Environment and Contribution to Climate Change Adaptation

- Trees and green spaces should be retained and created to formulate linkage and spots (park and recreational spaces) as part of ecological green system.
- Park system for livable living environment should be established and enhanced to serve local community public spaces such as children's park and sports park, which shall be connected through green walkway along the riverside or mall's pedestrian.

6) Formulating Historical Urban Center by Adequate Land Use and Control to Foster Capital's Heritage Environment

- Historical monuments and heritages identified and listed by the State Secretary of Art and Culture are expected in the near future to be registered as national heritages under the new decree/law. The area in the city center where the historical buildings are scattered densely as mainly governmental facilities would be promoted by the Historical Center of Timor-Leste with certain regulation not only to protect building themselves but also to safeguard historical environment.
- In addition, land use planning for the historical center would play a significant role in formulating attractive and comfortable urban environment through traffic management in the area, such as public parking system, pedestrian network, and land use encouragement such as historical building conversion to attractive culture or commercial facilities, and urban design to fit with historical building landscape.

7) Supporting Efficient Mobility Network and Public Transportation System in Association with Adequate Land Use

- Public transport system has contributed to efficient urban mobility in urban centers in the world. Dili is expected to introduce more efficient road network and public transportation system where urban development should be integrated to support them with appropriate land use and density distribution. The transit oriented development (TOD) with medium or high-density and mixed use could be applied along the areas through the routes and station areas of the public transportation system.
- Commercial and business with medium-high density development use can be promoted along the major streets (e.g., national highways, primary urban roads) taking the

advantage of good accessibility in order to encourage efficient commercial and business activities.

- Pedestrian network supported by sufficient parking system, which is recognized as one of the effective measures not only to achieve safe and attractive mobility environment, but also to promote and encourage business and commercial activities should be introduced into key urban areas such as commercial business centers, Dili historical center, waterfront, and riverfront areas. Parking system could be located at fringe by off-street ideally or on-street site parking in key urban areas where traffic control is desirable to be introduced in combination with pedestrian network.

8) Organizing Efficient Industrial Spaces for Competitive Economic Development

- Competitive environment for industrial development requires not only the provision of good infrastructure but also an efficient spatial organization such as proximity to gateways (seaport and airport) and good linkage through national highways for regional distribution of products and trade.
- Special Economic Zone (SEZ) with attractive incentives and sufficient infrastructure needs to be applied to organized industrial areas enabling the foreign direct investment (FDI) to tap into Dili industries in competitive business and production.

9) Establishing Compact Urban Form with Optimum Dense Settlement

- Medium density development is an inevitable condition in flat lands for DMA development and should be the principle of urbanization to cope with future population increase without natural environmental degradation by inadequate urbanization.
- TOD concept will play a supportive role in achieving the compact urban form through efficient medium/high density land use proximity to transit.
- Efficient land utilization by maximization of land use such as efficient building coverage and multiple function of building to achieve desirable urban form formulation, where public investment and consumption such as infrastructure, public facilities, and energy could be economized and minimized.
- Vacant and abandoned lands should be utilized in line with appropriate land use utilization plan, while necessary policy and measure should be taken for land tenures with unknown status.

10) Strengthening Administrative Capacity for Urban Spatial Management

- Land use plan could be achieved and implemented through land use zoning with regulations and incentives to control and promote socioeconomic activities and developments of infrastructure and public facilities in DMA. In order to manage and operate land use zoning and public investments appropriately, technical officers and their organizations are required to improve and develop their capacity to operate, monitor, and modify them effectively.
- In line with the decentralization policy of the government, the urban spatial management is also expected to be devolved to local governments (municipalities) gradually in the long term. The capacity of the central government (DNHPU[2]/DNB[3]), which plays an

2 National Directorate of Housing and Urban Planning (Ministry of Planning and Strategic Investment: MPSI)

important role and function in supervising and guiding technical skills in urban administration (urban planning and management), should be enhanced by certain programs including mentoring, guideline formulation, and standardization.

11) Promoting Citizen's Participation and Cooperation in Urban Development

- Urban planning and its implementation have faced difficulty in appropriately achieving its goal and objectives without citizen or community's participation and cooperation nowadays. Especially, urban development may sometimes bring negative impacts to communities such as involuntary resettlement due to infrastructure projects or large land developments. Sharing planning information and involvement from initial stage of the project should be ensured through participatory mechanism in urban planning and development.
- Dissemination of land use zoning is also inevitable to get citizen's understandings and cooperation and to bring their socioeconomic activities including construction into compliance with regulations.

9.2.3 Policy Measures for Land Use Planning and Their Implementation

Land use policies aforementioned will be interpreted into certain land use planning measures such as land use plan classification, land use intensity (density), location setting and implementation measures such as development control and regulation and/or with development incentives and supportive public investments (e.g., infrastructure, public facilities). Table 9.2.1 shows the relative measures for planning and implementation of each land use policy.

Table 9.2.1 Policy Measures for Land Use Planning and Their Implementation

Land Use Policy	Land Use Planning Measures			Implementation	
	Land Use Class	Use Intensity	Location Setting	Development Control	Public Investment
Self-sustaining Oriented Urban Function in Each Urban Area (Dili, Hera, Tibar)	●	○	◎	◎	●
Strengthening Resilient Land Use by **Protection of Sensitive Areas**	◎	◎	●	●	◎
Introducing **Mixed Use** Measure	●	●	◎	◎	◎
Securing Lands and Spaces for **Key Infrastructure and Public Facilities**	○	◎	●	◎	●
Enhancing **Green Network and Recreational Spaces** as part of Attractive Urban Environment and Contribution to Climate Change Adaptation	○	○	●	●	●
Formulating **Historical Urban Center** by adequate land use and control to foster Capital's Heritage Environment	◎	◎	◎	●	◎
Supporting **Efficient Mobility Network and Public Transportation System** in Association with Adequate Land Use	◎	●	◎	◎	●
Organizing **Efficient Industrial Spaces** for Competitive Economic Development	◎	●	●	●	●
Establishing **Compact Urban Form** with Optimum Dense Settlement	◎	●	●	●	●
Strengthening Administrative Capacity for Urban Spatial Management	●	●	●	●	●
Promoting Citizen's Participation and Cooperation in Development	●	◎	◎	●	●

Legend: ●= Essential Element, ◎ = Supportive, ○ = Supplemental

Source : JICA Project Team

3 National Directorate of Building (Ministry of Public Works, Transportation and Communications: MoPWTC)

9.3 Proposed Land Use Plan for Dili Metropolitan Area

9.3.1 Spatial Distribution Framework

(1) Urban Block Formulation

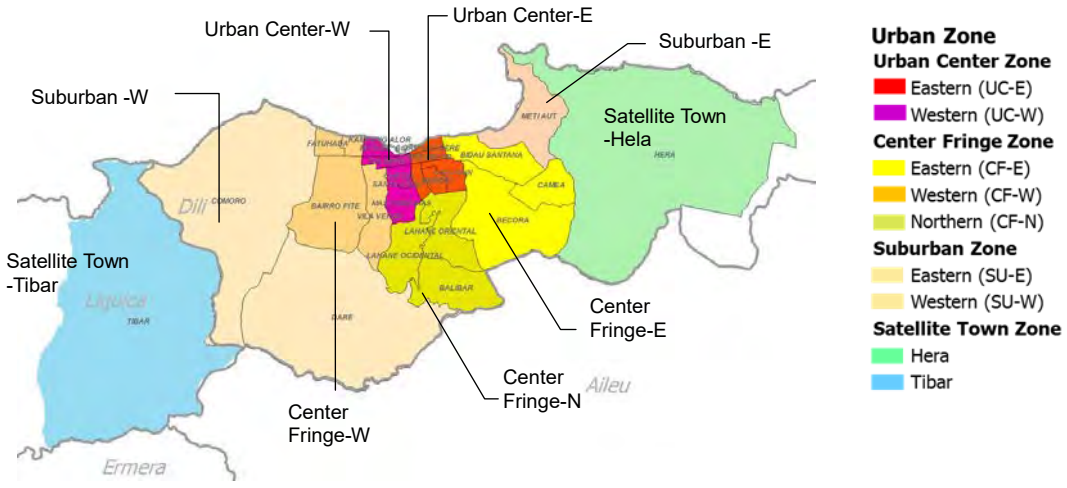
Urban block aims to formulate indicative and aggregated urban character taking account of spatial organization giving clear function and role rather than administrative demarcation by administrative posts (e.g., subdistrict) and sucos. Table 9.3.1 shows the proposed urban block with each spatial distribution principle for target population and employment.

Table 9.3.1 Land Use Distribution Principle by Urban Block in DMA

Urban Block		Suco	Character and Trend	Distribution Principles
1.Urban Center (UC)	UC-East	✓ Acadiru Hun ✓ Bemori ✓ Bidau Lecidere ✓ Culu Hun ✓ Gricenfor ✓ Santa Cruz	• Commercial business district (CBD) center including government facilities and key business facilities • Many Portuguese historical buildings are scattered in this block.	• Future settlement will be modest as Government Center and Historical Center formulation • Formulation of Historical Center of Timor-leste without large development • Commercial business center should be enhanced as one of the CBDs in DMA
	UC-West	✓ Caicoli ✓ Colmera ✓ Macarenhas	• Embassies and other government facilities are located in this block • Colmera is one of the traditional business commercial centers in Dili	
2. Center Fringe (UCF)	UCF-East	✓ Becora ✓ Bidau Santana ✓ Camea	• Mainly residential area with large hospital, education facilities, and other government facilities. • Living environment in this block has comparatively worse conditions in terms of roads, water supply, and other urban services	• High-density settlement without good urban services should be improved through organized infrastructure provision and land consolidation. • Neighborhood commercial area should also be developed
	UCF-West	✓ Bario Pite ✓ Fatuhada ✓ Kampung Alor ✓ Vila Verde	• This urban block was an urban sprawl area, and an active commercial and business activities area through conversion of residential areas. • Seafront area in this block is occupied by embassies, hotel, restaurant • New business commercial areas have existed especially on Banana Street, mainly by wholesaler business.	• Corridor commercial and business activities along major streets should be promoted by dense development and well-managed traffic and transportation system • Existing settlement occupies nearly the whole area to be improved by key urban roads.
	UCF-North	✓ Lahane Oriental ✓ Lahane Ocidental ✓ Balibar	• Residential settlements have encroached in hilly and slope areas. • Mountainous areas occupy the majority of land use in this block.	• Settlements in this block with steep slopes, hillsides and ridgelines should be controlled strictly to avoid natural disaster.
3.Suburban (SU)	SU-East	✓ Meti Aut	• Major tourist area in Dili providing restaurants, hotels and recreational areas for domestic and international	• Without deterioration of seafront landscape, quality of tourism hospitality should be enhanced.

Urban Block		Suco	Character and Trend	Distribution Principles
			visitors. • Cristo Rei (Fatucama) area is one of the well-known destinations of Dili together with the beach front areas.	• Modest settlement development is required in terms of limited habitable land.
	SU-West	✓ Comoro ✓ Dare	• This block is one of the rapid and emerging urbanizing area with new commercial facilities such as Timor Plaza. • Presidente Nicolau Lobato International Airport (PNLIA) plays an important role as Timor-Leste gateway. • The Comoro River, the biggest river in DMA, has become the barrier in connecting with the center of Dili City	• Comoro Suco has potential for new urban development because of low density area with agriculture land and vacant lands. • Taking the advantage of this block's proximity to the PNLIA, new urban cores for business and commercial can be promoted. • Local industry can be formulated in this block taking account of the advantages of external linkage by regional highways and the new ports by air and sea.
4.Satellite Town (ST)	ST-Hera	✓ Hera	• There are three distinct facilities: UNTL, (the engineering faculty), power plant and marine base in Hera. • Paddy fields are predominant land use due to the low land with several rivers, and gravel mining field and factories.	• University city could be formulated with adequate living area and supporting commercial and business to support UNTL in which new campus will be developed. • Small scale industry can also be introduced to encourage local products development.
	ST-Tibar	✓ Tibar	• There are few settlements with traditional local industry of fishing and salt farm. • Dumping site for solid wastes mainly from Dili is a negative element for future urban development.	• The New Tibar Port project, which is under preparation, will have large impact on this block where relevant supporting industrial function and land use should be introduced. • Living and working places are required

Source： JICA Project Team



Source： JICA Project Team

Figure 9.3.1 Urban Block for Land Use and Development Direction

(2) Population Distribution by Urban Block

Population distribution in DMA is set and shown in Table 9.3.2 according to the direction of development of each urban block as follows:

- Urban Center Block: The population in this block aims to inhibit the increase of settlement taking into account the proposed historical center zone and major use as the administrative and political center of the capital city of Dili.
- Center Fringe Block: This block having the second largest population (45% of DMA at present) such as Becora and Bario Pite sucos with vacant lands should be improved for living conditions to also achieve modest population increase through appropriate living density, while inappropriate settlement in fragile lands such as steep slope lands, hillsides, and ridgelines in the Center Fringe North should be controlled with development regulations.
- Suburban Block: The Suburban East in this block as the tourist area aims to inhibit increase of settlement, while the Suburban West aims to promote efficient settlement utilizing remaining agriculture or vacant lands and improving low-density settlement to medium-density development (e.g., collective housing development).
- Satellite Town Block: Hera and Tibar as the satellite town blocks aim to develop new settlement areas with appropriate density in the current low-density rural areas, taking account of the improvement of the population concentration in the urban center of Dili and achievement of living and working place co-existence.

Table 9.3.2 Target Population by Urban Block in DMA

Urban Block		2014*	2020	2025	2030	AAGR	Distribution (%)	
Main	Sub category						2014*	2030
Urban Center	Urban Center-E	25,940	27,990	29,890	31,900	1.3%	10.1%	8.7%
	Urban Center-W	17,810	18,750	19,610	20,500	0.9%	6.9%	5.8%
	Sub-total	*43,750*	*46,740*	*49,500*	*52,400*	*1.1%*	*17.0%*	*14.5%*
Center Fringe	Center Fringe-E	41,210	49,070	56,820	65,800	3.0%	16.0%	15.3%
	Center Fringe-W	57,030	70,850	84,980	102,000	3.7%	22.1%	22.0%
	Center Fringe-N	18,160	18,960	19,680	20,400	0.7%	7.0%	5.9%
	Sub-total	*116,400*	*138,880*	*161,480*	*188,200*	*3.0%*	*45.2%*	*43.2%*
Suburban	Suburban-E	900	1,200	1,550	2,000	5.3%	0.3%	0.4%
	Suburban-W	81,050	105,150	135,450	171,400	4.8%	31.5%	32.7%
	Sub-total	*81,950*	*106,350*	*137,000*	*173,400*	*4.8%*	*31.8%*	*33.1%*
Satellite Town	Satellite-Hera	10,130	16,290	24,250	36,000	8.2%	3.9%	5.1%
	Satellite-Tibar	5,400	13,500	25,000	50,000	14.9%	2.1%	4.2%
	Sub-total	*15,530*	*29,790*	*49,250*	*86,000*	*11.3%*	*6.0%*	*9.3%*
Total		257,630	321,760	397,230	500,000	4.2%	100.0%	100.0%

Note: Population in 2014 is estimated based on Census 2010 (DGS) and existing Land Use Survey conducted by JPT.
Source: JICA Project Team

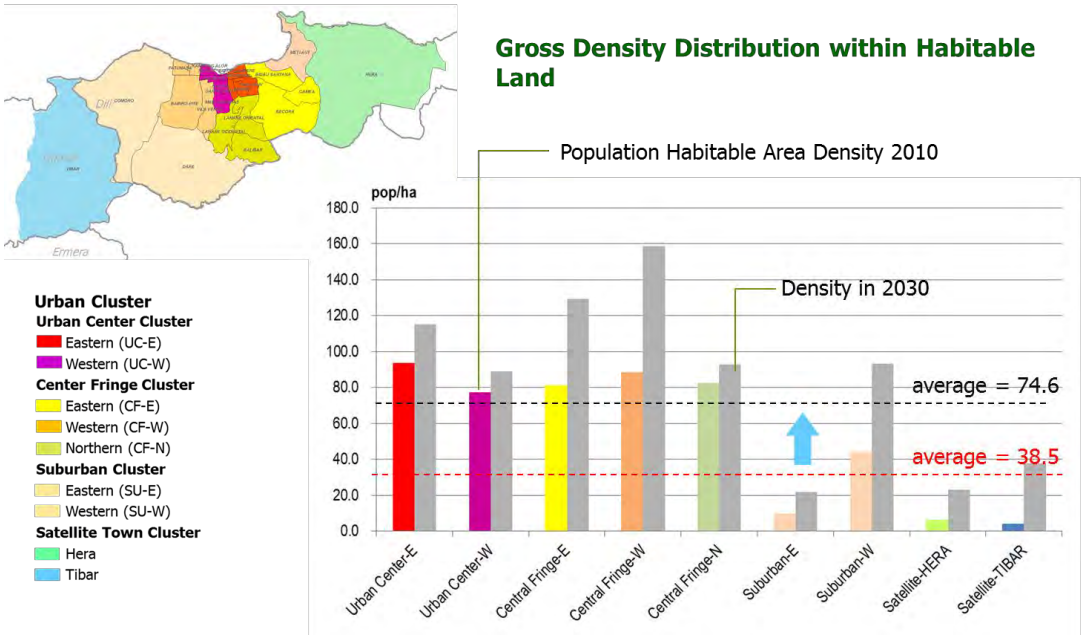
(3) Density Allocation of Settlement in DMA by Urban Block

Density distribution is one of fundamental planning elements in DMA for future urbanization due to significant scarcity of available land to accommodate the future population demand. From this point of

view, higher density allocation is required inevitably to be set appropriately in each urban block except in the fragile areas such as historical areas and slope areas for the population distribution in DMA.

At least medium-density settlement is expected where low density areas are spread dominantly in urbanized areas of DMA except at some sucos such as Acadiru Hun, Santa Cruz, Macarenhas and Kampung Alor with nearly over 100 person/ha (gross density in habitable land).

Figure 9.3.2 illustrates a comparison between the existing gross density (2014) and planned density in 2030. Average population density for DMA should be around 75 person/ha against the existing density of 38.5 person/ha. In order to increase the density, collective housing development and land consolidation should be promoted through the government institutional supports while zoning system would allow medium-density development through regulations.



Note: Population in 2014 is estimated based on the Census 2010 (DGS) and existing Land Use Survey conducted by JPT. Areas are computed by GIS software.
Source: JICA Project Team

Figure 9.3.2 Target Gross Population Density in DMA

(4) Employment Distribution by Urban Block

According to the economic development framework and development direction of urban blocks, target employment of 145,000 is distributed into each urban block of DMA. Table 9.3.3 shows the proposed distribution of employment at working place base.

- Urban Center Block: Modest employment increase is promoted in this block taking into account the proposed historical center zone without large floor increase and consolidation of the administrative and political center of the capital city of Dili.
- Center Fringe Block: This block aims to promote mixed use development and corridor commercial and business areas with increase of commercial business floors.
- Suburban Block: The Suburban East in this block, as the tourist area, aims to promote tourism sector employment, while the Suburban West aims to promote efficient commercial business sub-center development.

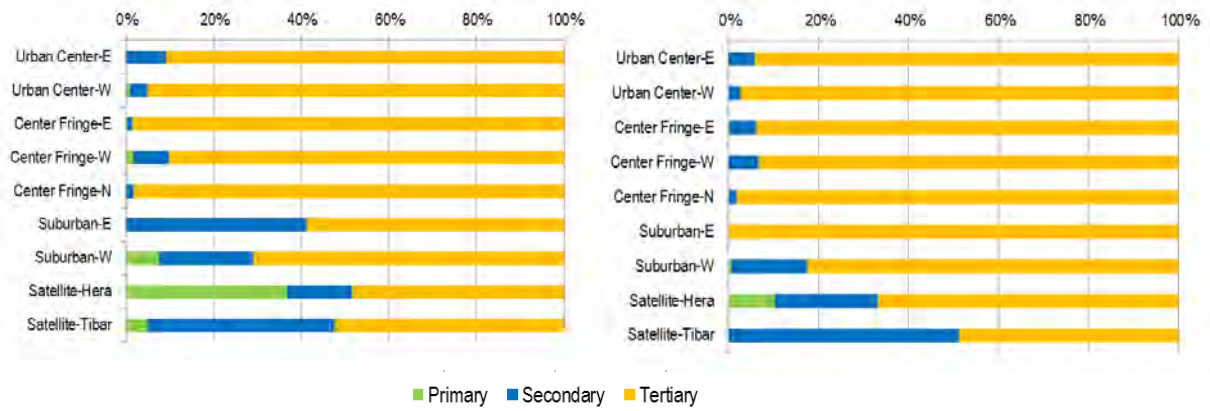
- Satellite Town Block: Hera and Tibar, as the satellite towns, aim to secure considerable employments by developing new commercial and business sub-centers with certain amount of floor spaces to serve not only settlements but also industrial area and the university towns, and tourism development areas in Hera and Tibar.

Table 9.3.3 Target Employment by Urban Block in DMA

Urban Block		2014*	2020	2025	2030	AAGR	Distribution (%)	
Main	Sub category						2014*	2030
URBAN CENTER	Urban Center-E	7,961	10,200	12,735	16,040	4.5%	11.4%	11.1%
	Urban Center-W	5,919	7,485	9,180	11,350	4.2%	8.5%	7.8%
	Sub-total	*13,881*	*17,684*	*21,915*	*27,390*	*4.3%*	*19.8%*	*18.9%*
CENTER FRINGE	Center Fringe-E	10,617	12,780	15,050	18,410	3.5%	15.2%	12.7%
	Center Fringe-W	15,632	18,710	21,850	25,220	3.0%	22.3%	17.4%
	Center Fringe-N	5,262	5,550	5,825	6,150	1.0%	7.5%	4.2%
	Sub-total	*31,511*	*37,040*	*42,725*	*49,780*	*2.9%*	*45.0%*	*34.3%*
SUBURBAN	Suburban-E	281	520	1,330	3,430	16.9%	0.4%	2.4%
	Suburban-W	21,152	26,520	32,970	41,420	4.3%	30.2%	28.6%
	Sub-total	*21,433*	*27,040*	*34,300*	*44,850*	*4.7%*	*30.6%*	*30.9%*
SATELLITE TOWN	Satellite-Hera	2,180	2,530	4,190	7,760	8.3%	3.1%	5.4%
	Satellite-Tibar	1,004	2,690	6,400	15,220	18.5%	1.4%	10.5%
	Sub-total	*3,185*	*5,220*	*10,590*	*22,980*	*13.1%*	*4.5%*	*15.8%*
Total		70,010	86,985	109,530	145,000	4.7%	100.0%	100.0%

Note: Employment in 2014 is estimated based on Census 2010 (DGS) and existing Land Use Survey conducted by JPT.
Source: JICA Project Team

Sector employment distribution (at working place) by urban block is indicated in Figure 9.3.2 through comparison of existing composition (2014) and future composition in 2030. Changes of primary sector shares are mainly by agriculture employment in Hera and Tibar where new urban settlements are expected, while industrial development is also expected in Tibar. Especially, Suburban East urban block at Meti Aut Suco, as seafront recreational area, is proposed to shift some unsuitable industrial use in Met Aut Suco to tourism sector as tertiary sector.



Employment Distribution By Sector By Urban Block 2014* Employment Distribution By Sector By Urban Block 2030

Source: JICA Project Team

Figure 9.3.3 Land Suitability for DMA and Development Suitability

9.3.2 Future Land Requirement by Land Use Category for Dili Metropolitan Area

(1) Residential Area

1) Current Settlement Status Examination

The land requirement for residential area in DMA is proposed to be addressed mainly through land intensification measures including lands in Hera and Tibar by new residential developments. In other words, residential land needs to be provided through "density improvement within limited available lands". This situation can be explained by existing land use conditions shown in Table 9.3.4 where unsuitable lands or mountainous rural areas with steep slope areas have already been encroached by 273 ha of settlements, and where around 8,200 residents are assumed to be in such vulnerable hilly or mountainous lands in DMA.

Table 9.3.4 also indicates the existing net population densities within residential and mixed use lands. Average net density (in residential areas including infrastructure, open space, others) is 117 person per hectare, while the highest density for residential use is 218 person/ha in Urban Center West Block, and 17 person/ha in Suburban East (Meti Aut) is the lowest.

Regarding this existing density condition, it is expected that major areas such as Center Fringe East Block, where low density settlement has spread, would play an important role in absorbing future increase of population except Hera and Tibar.

Table 9.3.4 Existing Conditions of Residential Areas in DMA

		Existing Land Use (ha) for CB Area					Population Distribution				Population Net Density 2014		
Urban Block		2014	Under 15 degree		Over 15 dgree		2014	Under 15 degree		Over 15	Pop/ha	Under 15 degree	
Main	Sub category	Total	R	RMX	R	RMX	Total	R	RMX	R+RMX	Total	R	RMX
URBAN	Urban Center-E	174.93	157.61	17.03	0.29	0.00	25,940	24,602	1,329	9	148	156	78
CENTER	Urban Center-W	103.79	74.16	9.07	20.57	0.00	17,810	16,202	991	617	172	218	109
	Sub-total	**278.72**	**231.76**	**26.10**	**20.86**	**0.00**	**43,750**	**40,804**	**2,320**	**626**	**157**	**176**	**89**
CENTER	Center Fringe-E	387.26	322.06	6.06	59.01	0.14	41,210	39,438	121	1,772	106	122	20
FRINGE	Center Fringe-W	391.75	353.98	15.02	22.62	0.13	57,030	56,350	156	680	146	159	10
	Center Fringe-N	198.97	97.58	0.57	100.61	0.21	18,160	15,139	155	3,021	91	155	270
	Sub-total	**977.99**	**773.62**	**21.65**	**182.23**	**0.48**	**116,400**	**110,926**	**432**	**5,474**	**119**	**143**	**20**
SUBURBAN	Suburban-E	42.60	28.21	0.08	14.27	0.05	900	471	17	429	21	17	215
	Suburban-W	637.11	566.68	23.87	46.56	0.00	81,050	78,010	1,643	1,397	127	138	69
	Sub-total	**679.71**	**594.89**	**23.95**	**60.83**	**0.05**	**81,950**	**78,482**	**1,660**	**1,825**	**121**	**132**	**69**
SATELLITE	Satellite-Hera	156.90	150.12	1.54	5.24	0.00	10,130	9,922	51	157	65	66	33
TOWN	Satellite-Tibar	110.67	104.54	2.61	3.49	0.03	5,400	5,230	65	105	49	50	25
	Sub-total	**267.57**	**254.66**	**4.14**	**8.73**	**0.03**	**15,530**	**15,152**	**116**	**262**	**58**	**59**	**28**
	Total	**2203.98**	**1854.94**	**75.84**	**272.64**	**0.56**	**257,630**	**245,364**	**4,527**	**8,188**	**117**	**132**	**60**

Note: R: Residential, RMX: Mixed use residential, Number of degree indicates slope degree.
Existing settlement distribution by land use and slope degree were assumed by estimation of density based on the satellite imagery 2014 and statistical data by the Census 2010 population in combination with land use density assumption by the mixed use taken by half density of residential density.
Net Density* is calculated by the formula: population / residential area (including roads, infrastructure open spaces, and other areas) divided

Source: JICA Project Team

2) Proposed Settlement Distribution and Additional Requirement

The residential areas are estimated and set as shown in Table 9.3.4 based on the desirable future density target range according to two degrees, medium density and low density, and other settlements by mixed use settlement and rural residential (e.g., mountainous villages). Mixed residential use is considered in the existing land use distribution pattern in DMA, where commercial and business activities have been observed in many residential areas as mixed use (residential with commercial, business and small scale cottage industries) by vertical or horizontal building use. In addition, mixed use will play an important role in absorbing the future population demand through conversion of existing mono-type residential areas with potential for future mixed use.

Total cumulative land requirement for residential areas will be 2,359 ha including an additional requirement of 155 ha in 2030 as shown in Table 9.3.5, while fragile areas in steep slope, hillsides, and rural settlement (rural villages in mountainous areas) will be intensified and consolidated by dense settlement only without expansion of settlement if technically allowable, which are defined by rural and low-density residential area. Residential areas will be required by dense development inevitably not only from future population absorption point of view but also decrease of land areas due to necessary increase of other land use classification such as public facilities, park and commercial, and business uses.

It should also be noted that the rural residential area includes small-scale commercial, business and cottage industries taking remote location from major urban services into account. The following are the distribution principles for residential areas in each urban block:

- Urban Center Block: The land for residential areas in this block aims to inhibit the increase of settlement taking into account the proposed historical center zone and major use as the administrative and political center of the capital city of Dili, while mixed use conversion from residential areas and medium-density residential areas would be promoted.
- Center Fringe Block: The residential areas in this block aims to improve existing residential areas by appropriate living density and infrastructure without large residential area expansion, while mixed use residential areas would be formulated in residential areas and fragile residential areas in steep slope and villages in the mountain would be inhibited and controlled.
- Suburban Block: The Suburban East in this block as the tourist area aims to inhibit an increase of residential areas, while the Suburban West aims to expand residential areas utilizing the remaining agriculture or vacant lands and improving low-density settlement to medium-density development (e.g., collective housing development).
- Satellite Town Block: Hera and Tibar as the satellite towns aim to create new residential areas with appropriate density by compact residential area development taking account of habitable resilient settlement to avoid vulnerable areas especially in flood prone areas.

Table 9.3.5 Land Requirement for Residential Area (ha)

Urban Block		2014	Residential Areas (ha) 2030					Additional (ha)
Main	Sub category	Total	Rural	Low-dense	Medium	Mixed	Total	
Urban Center	Urban Center-E	175	0	0	21	133	154	-21
	Urban Center-W	104	0	27	6	65	99	-5
	Sub-total	**279**	**0**	**27**	**27**	**198**	**253**	-26
Center	Center Fringe-E	387	18	112	214	8	353	-35

Fringe	Center Fringe-W	392	1	41	240	75	358	-33
	Center Fringe-N	199	57	86	52	0	194	-5
	Sub-total	**978**	**76**	**239**	**506**	**83**	**906**	-72
Suburban	Suburban-E	43	7	22	0	48	76	34
	Suburban-W	637	99	67	343	125	634	-3
	Sub-total	**680**	**106**	**89**	**343**	**173**	**711**	31
Satellite Town	Satellite-Hera	157	16	95	115	20	245	88
	Satellite-Tibar	111	13	56	140	36	245	135
	Sub-total	**268**	**28**	**151**	**255**	**56**	**490**	223
Total		**2,204**	**211**	**507**	**1,131**	**511**	**2,359**	155

Note: Target density assumption for residential area

Type of Residential Area	Population/ha	Reference
Rural residential	10-20	Assumption by satellite images
Low-density residential	20-30	Ditto
Medium-density residential	200 – 400	Collective housing to be introduced
Mixed use residential	200 – 400	Multi-story with 2-3 floor residential

Source: JICA Project Team

(2) Commercial and Business Area

The commercial and business areas are estimated and set as shown in Table 9.3.6. This is based on the desirable future density target range by commercial and business type, namely: Urban Center Commercial and Business (UCB), Corridor Commercial Business (CCB), Neighborhood Commercial Business Center (NCB), and mixed use with residential use and commercial, business and small-scale/cottage industries (RMX).

The land requirement for commercial and business land use is examined and set by the required floor space per employee. Total cumulative land for commercial and business areas is estimated to be 925 ha in 2030 through mainly conversions of existing residential use.

And it should be noted that the conversion of use from other land use to commercial and business use is considered to apply to this estimation as an important measure in order to achieve mixed use concept, and as an example, some resident owner can be allowed or promoted by this conversion under regulation or incentive to add his/her retail shop on the residential building by vertical or horizontal expansion.

Regarding the historical area in the urban center area where Historical Center Conservation Zone is proposed as described later in Section 9.3.5, commercial and business activities are proposed to be developed as decent development without high-density or tall building development for commercial and business use, taking account of historical townscape conservation. The following are the distribution principles for commercial and business areas in each urban block:

- Urban Center Block: It is aimed to develop and reorganize the commercial and business area in this block through modest developments taking into account the proposed historical center zone and major use as the administrative and political center of the capital city of Dili.
- Center Fringe Block: This block aims to promote corridor commercial business and mixed use commercial business through the densification of building development and mixed use conversion from residential areas.

- Suburban Block: The Suburban East in this block as the tourist area aims to enhance mainly commercial area in tourism sector, while the Suburban West aims to formulate sub-urban center with convenient major commercial and business floor areas in combination with public transportation nodes.

- Satellite Town Block: Hera and Tibar, as the satellite town block, aim to develop new urban cores with attractive and convenient commercial and business functions to serve not only the new communities but also the industrial activities. Also, both Hera and Tibar would have tourist resorts area with low-density development in consideration of natural environmental protection.

Table 9.3.6 Land Requirement for Commercial and Business Area (ha)

Urban Block		Existing Condition 2014*			Emp (T)	Land Requirement 2030 (ha)						Additional
Main	Sub category	Land (ha)	Emp (T)*	Emp/ha	2030	UCB	NCB	CCB	RMX	TR	Total	/Conversion
URBAN	Urban Center-E	44	7,241	164	15,140	30	0	11	133	0	175	130
CENTER	Urban Center-W	30	5,639	186	11,065	20	0	17	65	0	101	71
	Sub-total	**74**	**12,880**	**173**	**26,205**	**50**	**0**	**28**	**198**	**0**	**276**	202
CENTER	Center Fringe-E	17	10,479	633	17,300	0	0	18	8	0	26	9
FRINGE	Center Fringe-W	53	14,124	266	23,540	0	0	67	75	0	143	90
	Center Fringe-N	14	5,175	382	6,050	0	6	8	0	0	14	0
	Sub-total	**83**	**29,778**	**358**	**46,890**	**0**	**6**	**93**	**83**	**0**	**182**	99
SUBURBAN	Suburban-E	8	166	22	3,430	0	0	0	48	0	48	40
	Suburban-W	134	15,027	112	34,200	33	11	86	125	0	256	121
	Sub-total	**142**	**15,193**	**107**	**37,630**	**33**	**11**	**86**	**173**	**0**	**303**	161
SATELLITE	Satellite-Hera	6	1,055	174	5,200	10	0	17	20	30	75	69
TOWN	Satellite-Tibar	21	527	26	7,420	9	2	29	36	11	88	67
	Sub-total	**27**	**1,582**	**59**	**12,620**	**18**	**2**	**45**	**56**	**41**	**163**	136
	Total	**326**	**59,433**	**182**	**123,345**	**101**	**19**	**253**	**511**	**41**	**925**	598

Note: Target employment density assumption

Type of Commercial and Business Area	Employment/ha by Urban Block			
	UC	CF	SU	SAT
Urban Center Commercial Business (UCB)	200	--	150	150
Neighborhood Commercial Business (NCB)	--	150	150	100
Corridor Commercial Business (CCB)	150	300	180	100
Mixed Use (residential and commercial business) (RMX)	90	200	100	90
Tourism and Recreation (TR)	--	--	--	100

Emp (T) : Tertiary sector employment, UC: Urban Center, CF: Center Fringe, SU: Suburban, SAT: Satellite Town
Conversion: Land use changes from other use (residential, industry) to relevant land use for the tertiary sector.
Source: JICA Project Team

(3) Industrial Area

The industrial areas are estimated and set according to spatial development principles and employment framework for the secondary sector based on the assumption of unit employment by existing land use condition examination (unit employment by land use area). Target land requirements are shown in Table 9.3.7 based on the desirable future density target range by the following industrial types:

- Industrial Zone (IZ): This area is expected to be introduced in order to accommodate industrial investment needs targeting mainly foreign direct investment where institutional arrangements such as special economic zone (SEZ) need to be considered.

- Quasi-industrial Area (QI): This area, which is planned to be concentrated by industries, includes not only industrial use but also other uses such as residential, commercial, business and others. Industrial type is targeting to promote small- to medium-scale industry for local or domestic investment.

According to the industrial type mentioned above, each preferred density of employment is set referring to the existing industrial area density in DMA and cases in other countries. It should be noted that scattered and small-scale/cottage industries (mainly existing) can be involved in the residential, mixed use area, urban center commercial and business, neighborhood commercial and business and corridor commercial business areas, unless pollution to neighboring places is generated. However, it is proposed that some industries in Hera and Tibar can be reorganized to fit to the desirable land use to concentrate them to the proposed "Quasi-industrial Area" or "Industrial Zone" taking account of smaller numbers of industrial area to be integrated by the proposed industrial areas.

Total cumulative land requirement for all industrial areas will be 216 ha including the additional requirement of 135 ha in 2030. The quasi-industrial area requirement (83 ha) is distributed mainly into Comoro Suco due to proximity to the planned regional road along the Comoro River and the proposed bypass along mountain skirts, and the industrial zone (77 ha) is proposed to be introduced into Tibar Suco where the area's proximity to the new Tibar Port, which is under preparation by the government, will take the advantage of logistic and export-import type industries. Additionally, it is reiterated that an industrial area in Meti Aut will be converted to mixed use land use taking account of potential conversion to tourism sector business and the desirable environment formulation.

Table 9.3.7 Land Requirement for Industry Area (ha)

Urban Block		Existing Condition 2014*			Emp (S)	Land Requirement 2030 (ha)				Additional
Main	Sub category	Land (ha)	Emp (S)*	Emp/ha	2030	IZ	QI	In Others	Total	/Conversion
URBAN	Urban Center-E	5	720	141	900	0	0	5	5	0
CENTER	Urban Center-W	2	235	110	285	0	0	2	2	0
	Sub-total	**7**	**955**	**132**	**1,185**	**0**	**0**	**7**	**7**	0
CENTER	Center Fringe-E	3	113	41	1,080	0	8	3	11	8
FRINGE	Center Fringe-W	6	1,250	207	1,680	0	0	6	6	0
	Center Fringe-N	2	87	44	100	0	0	2	2	0
	Sub-total	**11**	**1,451**	**134**	**2,860**	**0**	**8**	**11**	**19**	8
SUBURBAN	Suburban-E	2	116	52	0	0	0	2	2	0
	Suburban-W	37	4,541	123	6,970	0	65	37	102	65
	Sub-total	**39**	**4,657**	**119**	**6,970**	**0**	**65**	**39**	**104**	65
SATELLITE	Satellite-Hera	6	323	53	1,770	0	10	0	10	4
TOWN	Satellite-Tibar	18	429	23	7,800	77	0	0	77	58
	Sub-total	**25**	**753**	**31**	**9,570**	**77**	**10**	**0**	**86**	62
	Total	**81.69**	**7814.89**	**95.66**	**20,585**	**77**	**83**	**57**	**216**	135

Note 1: Existing land includes industry area and mixed use with commercial (e.g., wholesale) and industries.
Note 2: Emp (S) = Secondary sector employment
Note 3: In Others = Small cottage industry's areas scatter in various other uses such as commercial and business center, neighborhood commercial and business center, corridor commercial and business, mixed use, residential
Note 4: Target employment density assumption

Type of industry	Employment/ha	Reference
Industrial Zone	50-80	Newly developed
Quasi-industrial Area	150-200	Including existing area

Conversion: Land use changes from other use (residential, commercial business,) to relevant land use for the secondary sector.
Source: JICA Project Team

(4) Key Public Facilities

The areas for key public facilities are defined as major facilities for public use occupying large lands in general. This category includes facilities for the government and administration, education and institutions, key health facilities, utilities (water plants, sewerage plant), transportation (public transportation and/or logistic terminal), solid waste disposal site, and cemetery.

The land use requirement for key public facilities is estimated on assumption basis referring to each sector plan with available numerical frameworks. Due to insufficient existing data and information in general, the key public facilities of education, health, park and others are necessary to address the demand based on the population increase. Also, the key infrastructure described in relevant chapters is excluded.

1) Education Facilities

Referring to the National Education Strategic Plan 2011-2030 and the population framework, the land requirements for basic school (BS: grade 1-9) and secondary school (SS: grade 1-3) education facilities are estimated as shown in Table 9.3.8 with some assumptions described in the note of the table. Key assumption is the expansion of existing school capacity due to limited land by multi-story building provision in existing sites of schools. This land requirement for basic and secondary schools includes key public facilities as aggregated land requirement.

It is envisaged that the future demands of higher education in universities and colleges could be accommodated by more flexible operation and management of the new campus of UNTL and other universities with larger campus than basic and secondary schools.

Table 9.3.8 Land Requirement for Education Facilities (Basic and Secondary Schools) (ha)

Urban Block		Gross Enrollment 2014*		School		Gross Enrollment 2030		BS		SS		New School
Main	Sub category	Basic	Secondary	BS	SS	Basic	Secondary	Imp	New	Imp	New	Area (ha)
URBAN	Urban Center-E	4,246	2,334	8	2	5,568	2,371	8	1	2	2	6
CENTER	Urban Center-W	2,929	1,613	5	2	3,577	1,501	5	0	2	0	0
	Sub-total	**7,175**	**3,947**	**13**	**4**	**9,145**	**3,871**	**13**	**1**	**4**	**2**	6
CENTER	Center Fringe-E	8,242	4,079	11	8	13,966	5,255	11	3	8	0	6
FRINGE	Center Fringe-W	10,519	5,142	11	1	20,110	7,429	11	4	1	3	14
	Center Fringe-N	3,562	1,744	7	0	4,254	1,580	7	0	0	0	0
	Sub-total	**22,323**	**10,965**	**29**	**9**	**38,330**	**14,264**	**29**	**7**	**9**	**3**	20
SUBURBAN	Suburban-E	153	54	1	0	362	95	1	0	0	0	0
	Suburban-W	14,366	7,366	28	8	32,178	12,575	28	2	8	7	18
	Sub-total	**14,519**	**7,419**	**29**	**8**	**32,540**	**12,671**	**29**	**2**	**8**	**7**	18
SATELLITE	Satellite-Hera	2,312	844	6	0	8,741	2,419	6	6	0	4	20
TOWN	Satellite-Tibar	1,247	484	3	0	12,281	3,614	3	8	0	5	26
	Sub-total	**3,559**	**1,328**	**9**	**0**	**21,022**	**6,033**	**9**	**14**	**0**	**9**	46
	Total	**47,576**	**23,660**	**80**	**21**	**101,037**	**36,839**	**80**	**24**	**21**	**21**	90

Note 1: Target gross enrollment rate (GER) indicators (assumption) referred by the National Education Strategic Plan 2011-2030

Type of School	2014	2020	2025	2030
Basic school	94%	96%	98%	100%
Secondary school	124%	115%	107%	100%

Note 2: Gross Enrollment Rate (GER)

Note 3: School requirement is estimated by the following premise:
- Existing school capacity could be expanded by multi-story facilities (double capacity). (Imp: expansion of capacity)
- New school is estimated by 18 classrooms per school, of which site area covers 2.0 ha
- One classroom accommodates 40 pupils

Source: JICA Project Team

2) Health Facilities

The National Health Sector Strategic Plan 2011-2030 describes the future target of health facilities. According to the plan, facilities of national hospital (1), regional referral hospital in Dili (1), municipal (district) hospital (1) in Dili, community health centers of each suco (25) in DMA, and health posts in each aldeia (hamlet) of sucos in DMA, are listed in the report in order to achieve health access of all the citizens.

The land use plan considers aggregated land requirement for existing and additional health facilities based on the estimated number of health facilities indicated in the National Health Sector Strategic Plan to be reflected to key public facilities. Therefore, the distribution of health facilities for health sector is not considered.

Table 9.3.9 Land Requirement for Health Facilities (ha)

Description	Amount	Unit: ha/site	Area Unit per Facility (ha)	Reference
1, National Hospital	1	2.00	2.00	Provision in the capital Dili
2. Municipal (District) Hospital	1	1.25	1.25	Liquica Municipality not in Tibar
3. Community Health Center	25	0.4	1.0	Provision in each suco
4. Health Post	125*	0.02	2.5	Provision in each aldeia

Reference: The National Health Sector Strategic Plan 2011-2030
Note: Number of aldeia in DMA is obtained by assuming 5 aldeia per suco.
Source: JICA Project Team

3) Other Public Facilities

The land requirement for other key public facilities including government administration, public institutions is considered by assuming that almost all government facilities could be expanded by increasing their floor area within their properties without new land acquisition. Therefore, the new land requirement of other key facilities is not considered through their distribution. However, there are some exceptions for central government agencies, because of the proposed idea for partial redistribution of government facilities. The proposed idea of government facilities relocation into Hera and Tibar is to be reflected into the proposed land use plan.

It should be noted that major plans or projects shown below have been incorporated into the land use plan based on the following premises or conditions. Table 9.3.12 is also referred to in this consideration.

- Tibar Port Project: Option 2A selected by the alternative study[4] for Tibar Port was adopted in the proposed land use plan.
- PNLIA-PPP Project: There is no clear official information for the future expansion plan of the airport facilities at present. Therefore, the proposed land use was illustrated by the the assumption of a desirable alternative plan[5] which needs to be reviewed, without generation of large-scale resettlement by expansion of runway in case of 2,500 m length.

[4] Summary of Environment and Social Scoping Study (IFC, Nov 2013)

[5] Presidente Nicolau Lobato International Airport (Dili International Airport) PPP (IFC, Feb 2015)

4) Cemetery Park

Currently, there is scarcity of land in DMA for provision of cemetery, majority of which is owned and operated by religious organizations. Although there is an idea to provide public cemetery park, it is a sensitive issue and securing the land for the cemetery is challenging. The following describes some possible directions to cope with the cemetery development issue in DMA:

Policies for cemetery development

- Maximization of efficient land use coping with limited capacity of cemetery supply in DMA
- Establishing innovative supply-side development for cemetery to minimize land requirement for cemetery development
- Refraining from utilizing flat land use in principle due to scarcity of living area and other use for urban development
- Challenges for acceptance of social cultural change against traditional custom about cemetery utilization

Preliminary assumption of land demand for cemetery development

An examination can be shown as an assumption. Considering the planning standard for spatial requirement of cemeteries in Japan (e.g., 5 lots/100 household), total requirement for 500,000 population is estimated as 5.5~6.0 ha.

Possible options for cemetery development

- Option 1: Introduction of innovative compact cemetery by common ossuary system
- Option 2: Far place cemetery park system beyond Hera as common public facilities among administrative posts (ex-districts)
- Option 3: Hillside cemetery park development in Dili, Hera and Tibar separately

As candidate location of cemetery would be a sensitive social issue, the options show only those that are not shown in the proposed land use plan.

Table 9.3.10 Land Requirement for Cemeteries (ha)

Option	Candidate Location	Assessment	
		Constraints	Opportunities
Option 1: Compact cemetery	• In the city by building near the park • Or beside existing graveyards	• People's acceptance in terms of social custom • Crematorium facilities construction	• Most efficient land utilization by compact common ossuary facilities • Best accessibility from home • No environmental problem (cemetery)
Option 2: Cemetery park at the outside	• Metinaro Administration Post	• Far distance mainly from Dili residents • Negative environmental impacts to surroundings	• Attractive people's park development with flowers garden • Common park development for multi-administrative posts
Option 3: Cemetery park in the dump area	• Hilly side in every administrative post	• Negative environmental impacts (land erosion, groundwater pollution) • Hinterland landscape deterioration	• Desirable accessibility for every residents in every administrative post

Source: JICA Project Team

(3) Green and Open Spaces

1) Park, Sports and Open Spaces

The park, sports and open space are defined as public park, field sports facilities and public open spaces for citizens and tourists except the private green facilities such as golf course and sports club which are privately owned and operated. Currently, the Ministry of Tourism, Culture and Art (MoTCA) is the responsible agency for the maintenance and improvement of the park, where five parks and three playgrounds are listed by MoTCA. On the other hand, other sports fields for citizen are managed by other ministries such as the Dili Stadium, football fields, and basketball courts, which are managed by the Secretary of State of Youth and Sports, and cemeteries, which are are managed by the Ministry of Social and Solidarity (MSS).

According to the existing land use status, the total area of existing parks and open spaces is estimated to be 23.4 ha, in which the park and recreational space per capita is 0.9 sq.m. Referring to similar cities' level of achievement for park and open spaces in other countries, the target indicator in DMA is proposed as 7 sq.m green space per capita, which is seven times the existing spaces.

It is proposed that the hierarchical park system by administrative jurisdiction area be introduced to each level of municipality, administration post, and suco, in principle, although there are no more spaces for park development in some sucos. Land use requirement for park, sports, and open spaces in 2030 is estimated by unit requirement for standard open space.

Table 9.3.11 Land Requirement for Park, Sports and Open Spaces

Urban Block		2014*		2030	
Main	Sub category	Park & Recreation (ha)	m^2 /pop	Target Park (ha)	Additional (ha)
Urban Center	Urban Center-E	5.4	2.1	9	3
	Urban Center-W	7.0	3.9	11	4
	Sub-total	**12.4**	**2.8**	**19**	**7**
Center Fringe	Center Fringe-E	0.0	0.0	30	30
	Center Fringe-W	1.4	0.3	29	28
	Center Fringe-N	0.1	0.0	8	8
	Sub-total	**1.5**	**0.1**	**67**	**65**
Suburban	Suburban-E	1.9	20.8	2	0
	Suburban-W	7.6	0.9	137	130
	Sub-total	**9.5**	**1.2**	**140**	**130**
Satellite Town	Satellite-Hera	0.0	0.0	71	71
	Satellite-Tibar	0.0	0.0	74	74
	Sub-total	0.0	0.0	**145**	**145**
Total		**23.4**	**0.9**	**371**	**348**

Source: JICA Project Team

2) Other Open Spaces and Nature Areas

Other open spaces and nature areas include all other green areas to secure appropriate urban environment for DMA including riverside green where citizen can enjoy. Public authority should maintain and manage these areas in terms of people's safety and security.

In order to secure or acquire lands for park, recreation, or green and open spaces, the following policies and measures need to be applied:

- Buffer green to be secured by natural hazard protection areas for which hazard management fund can be established and utilized in case of private property subject to compulsory land acquisition, or voluntary free of charge land lending to public
- Agriculture area can be preserved as a part of the green spaces through farmer's incentive like tax exemption especially in Hera where some paddy fields would remain in the proposed UNTL campus plan and neighboring paddy fields.
- Development control may include obligation of developer to retain open space in the property development with incentive mechanism such as tax exemption
- Tasitolu Project: The project report does not show clear information for the future protection area and the regulatory contents for the Tasitolu Protection Area. Therefore, the proposed land use was drawn tentatively. Further adjustment will be required for the protection area and contents of development controls.

9.3.3 Land Use Allocation in Dili Metropolitan Area

The future residential, commercial and business, industry, public facility and green and open spaces land use allocations in 2030 are set in Table 9.3.12. The total area is equivalent to the study area of DMA. Table 9.3.13 shows also the distribution of land use areas by the proposed classification in administrative unit at Suco level.

Table 9.3.12 Proposed Land Use Allocation by Classification of Use in 2030 in DMA

Urban Block	Land Use Class	I Rural		II: Residential			III: Commercial & Business				IV:Industry		V: Public		VI: Green & Open Space				RD	Total
	Sub-block	AG	RR	RL	RM	RMX	UCB	NCB	CCB	TR	IZ	QI	PU	HE	PSO	NF	ONA	W		
URBAN	Urban Center-E	0	0	0	21	133	30	0	11	0	0	0	36	0	9	0	0	1	38	280
CENTER	Urban Center-W	0	0	27	6	65	20	0	17	0	0	0	62	4	11	33	17	0	39	299
	Sub-total	**0**	**0**	**27**	**27**	**198**	**50**	**0**	**28**	**0**	**0**	**0**	**98**	**4**	**19**	**33**	**17**	**2**	**76**	**579**
CENTER	Center Fringe-E	0	18	112	214	8	0	0	18	0	0	8	32	16	30	775	109	18	68	1,426
FRINGE	Center Fringe-W	0	1	41	240	75	0	0	67	0	0	0	81	0	29	174	259	11	86	1,067
	Center Fringe-N	0	57	86	52	0	0	6	8	0	0	0	23	1	8	551	204	7	41	1,042
	Sub-total	**0**	**76**	**239**	**506**	**83**	**0**	**6**	**93**	**0**	**0**	**8**	**136**	**16**	**67**	**1,500**	**572**	**36**	**196**	**3,535**
SUBURBAN	Suburban-E	0	7	22	0	48	0	0	0	0	0	0	1	0	2	110	287	1	14	491
	Suburban-W	22	99	67	343	125	33	11	86	0	0	65	210	14	137	1,897	1,369	196	233	4,909
	Sub-total	**22**	**106**	**89**	**343**	**173**	**33**	**11**	**86**	**0**	**0**	**65**	**211**	**14**	**140**	**2,007**	**1,656**	**197**	**248**	**5,401**
SATELLITE	Satellite-Hera	89	16	95	115	20	10	0	17	30	0	10	93	128	71	2,447	765	98	120	4,121
TOWN	Satellite-Tibar	0	13	56	140	36	9	2	29	11	77	0	77	0	74	2,561	959	60	119	4,224
	Sub-total	**89**	**28**	**151**	**255**	**56**	**18**	**2**	**45**	**41**	**77**	**10**	**170**	**128**	**145**	**5,008**	**1,723**	**159**	**240**	**8,345**
	Total	**112**	**211**	**507**	**1,131**	**511**	**101**	**19**	**253**	**41**	**77**	**83**	**614**	**162**	**371**	**8,548**	**3,968**	**393**	**759**	**17,860**

Note: AG=Agriculture, RR=Rural Residence, RL=Low-dense Residential, MR=Medium-density Residential, RMX=Mixed Use (R+CB), UCB=Urban Commercial Business Center, NCB=Neighborhood Business Commercial Center, CCB=Corridor Commercial and Business, TR=Tourism and Recreation Area, IZ= Industrial Zone, QI=Quai-industrial Area, PU=Key Public Facilities, HE=Higher Education, PSO=Park, Sports and Open Spaces, NF=Natural and Forest Area, ONA = Other Nature Area, W=Water Body

Note 2: Industrial areas for small-scale factories and cottage industries are included by several Land Use Classes of Residential, Commercial and Business where those industry areas are scattered and dispersed.

Source: JICA Project Team

Table 9.3.13 Proposed Land Use Distribution by Use Classification 2030 in Suco (DMA)

District	Administrative Post (AP)	Suco	Urban Block	I Rural		Sub-	II: Residential			Sub-	III: Commercial&Business				Sub-
				AG	RR	total	RL	RM	RMX	total	UCB	NCB	CCB	TR	total
DILI	CRISTO REI	Balibar	CF-N		35.3	*35.3*				*0.0*					*0.0*
		Becora	CF-E	0.4	12.2	*12.6*	56.7	125.6		*182.3*			16.4		*16.4*
		Bidau Santana	CF-E		1.4	*1.4*	35.2	51.9	8.0	*95.1*					*0.0*
		Camea	CF-E		4.7	*4.7*	20.2	36.7		*56.9*			1.3		*1.3*
		Culu Hun	UC-E			*0.0*		20.7	36.9	*57.6*	7.3		7.1		*14.3*
		Meti Aut	SU-E		6.6	*6.6*	22.3		47.5	*69.8*					*0.0*
		Hera	SA-E	89.2	15.7	*104.9*	95.0	114.7	19.5	*229.2*	9.7		16.5	29.7	*55.9*
		Sub-total		**89.6**	**75.9**	*165.4*	**229.4**	**349.6**	**111.9**	*690.9*	**16.9**	**0.0**	**41.2**	**29.7**	*87.9*
	NAIN FETO	Acadiru Hun	UC-E			*0.0*			17.0	*17.0*			1.9		*1.9*
		Bemori	UC-E			*0.0*			46.1	*46.1*			1.3		*1.3*
		Bidau Lecidere	UC-E			*0.0*			12.8	*12.8*	4.5				*4.5*
		Gricenfor	UC-E			*0.0*				*0.0*	12.9				*12.9*
		Lahane Oriental	CF-N		5.5	*5.5*	45.7	45.1		*90.8*		5.8	7.8		*13.6*
		Santa Cruz	UC-E			*0.0*			20.7	*20.7*	5.2		1.0		*6.2*
		Sub-total		**0.0**	**5.5**	*5.5*	**45.7**	**45.1**	**96.6**	*187.4*	**22.7**	**5.8**	**11.9**	**0.0**	*40.4*
	VERA CRUZ	Caicoli	UC-W			*0.0*			15.6	*15.6*	8.8		0.8		*9.6*
		Colmera	UC-W			*0.0*			13.6	*13.6*	10.8		5.2		*16.0*
		Dare	SU-W	13.9	42.5	*56.4*	2.7	12.5		*15.2*					*0.0*
		Lahane Ocidental	CF-N		15.8	*15.8*	40.4	6.7		*47.1*			0.1		*0.1*
		Mascarenhas	UC-W		0.1	*0.1*	27.3	6.1	17.5	*50.9*			5.3		*5.3*
		Motael	UC-W			*0.0*			18.4	*18.4*			5.5		*5.5*
		Vila Verde	CF-W		1.2	*1.2*	11.0	53.1	4.2	*68.2*			12.8		*12.8*
		Sub-total		**13.9**	**59.5**	*73.5*	**81.3**	**78.4**	**69.2**	*229.0*	**19.7**	**0.0**	**29.7**	**0.0**	*49.4*
	DOM ALEIXO	Bairro Pite	CF-W		0.2	*0.2*	30.2	163.0	29.6	*222.8*			38.4		*38.4*
		Comoro	SU-W	8.3	56.8	*65.1*	64.4	330.1	125.2	*519.8*	33.3	10.9	86.3		*130.5*
		Fatuhada	CF-W			*0.0*		19.8	23.7	*43.5*			12.4		*12.4*
		Kampung Alor	CF-W			*0.0*		4.5	18.0	*22.5*			3.9		*3.9*
		Sub-total		**8.3**	**57.0**	*65.3*	**94.7**	**517.5**	**196.5**	*808.6*	**33.3**	**10.9**	**141.0**	**0.0**	*185.2*
		Total		**111.8**	**198.0**	*309.8*	**451.1**	**990.6**	**474.2**	*1,915.9*	**92.6**	**16.7**	**223.9**	**29.7**	*362.8*
LIQUIÇA	BAZARTETE	Tibar	SA-W	**0.2**	**12.7**	*12.8*	**56.3**	**140.0**	**36.4**	*232.7*	**8.8**	**2.4**	**28.9**	**11.3**	*51.3*
		Grand Total		**112.0**	**210.6**	*322.6*	**507.4**	**1,130.6**	**510.6**	*2,148.6*	**101.4**	**19.1**	**252.7**	**41.0**	*414.1*

District	Administrative Post (AP)	Suco	Urban Block	IV: Industry		Sub-	V: Public Use			Sub-	VI: Green&Open Space			Sub-		
				IZ	QI	total	PU	HE	PSO	total	NF	ONA	W	total	RD	Total
DILI	CRISTO REI	Balibar	CF-N			*0.0*	1.9			*1.9*	270.1	77.0	1.0	*348.0*	11.2	**396.4**
		Becora	CF-E			*0.0*	15.3	15.5	11.7	*42.6*	546.7	33.1	10.2	*590.0*	28.2	**872.0**
		Bidau Santana	CF-E		7.7	*7.7*	7.0		14.1	*21.0*	98.4	75.9	4.8	*179.1*	19.0	**323.4**
		Camea	CF-E			*0.0*	9.9		3.8	*13.7*	129.8	0.3	2.9	*133.0*	21.1	**230.7**
		Culu Hun	UC-E			*0.0*	8.0		2.1	*10.1*			0.7	*0.7*	11.9	**94.6**
		Meti Aut	SU-E			*0.0*	0.8		2.2	*3.0*	110.2	286.8	0.8	*397.8*	14.2	**491.4**
		Hera	SA-E		9.7	*9.7*	92.7	128.3	71.1	*292.1*	2,446.6	764.5	98.2	*3,309.3*	120.2	**4,121.4**
		Sub-total		**0.0**	**17.5**	*17.5*	**135.6**	**143.8**	**105.0**	*384.4*	**3,601.7**	**1,237.5**	**118.6**	*4,957.8*	**225.8**	**6,529.8**
	NAIN FETO	Acadiru Hun	UC-E			*0.0*	0.4			*0.4*				*0.0*	2.9	**22.2**
		Bemori	UC-E			*0.0*	3.8		0.6	*4.4*			0.7	*0.7*	6.2	**58.6**
		Bidau Lecidere	UC-E			*0.0*	4.9		5.0	*9.9*		0.5		*0.5*	5.5	**33.1**
		Gricenfor	UC-E			*0.0*	6.0			*6.0*				*0.0*	4.3	**23.3**
		Lahane Oriental	CF-N			*0.0*	17.2		2.8	*20.0*	108.9	71.7	3.7	*184.3*	15.2	**329.4**
		Santa Cruz	UC-E			*0.0*	13.0		1.1	*14.2*				*0.0*	7.1	**48.1**
		Sub-total		**0.0**	**0.0**	*0.0*	**45.4**	**0.0**	**9.5**	*54.8*	**108.9**	**72.2**	**4.4**	*185.4*	**41.2**	**514.7**
	VERA CRUZ	Caicoli	UC-W			*0.0*	30.1			*30.1*				*0.0*	6.3	**61.6**
		Colmera	UC-W			*0.0*	12.2	3.4	1.1	*16.8*				*0.0*	11.1	**57.5**
		Dare	SU-W			*0.0*	2.9		2.4	*5.2*	1,516.3	741.5	37.3	*2,295.1*	18.5	**2,390.4**
		Lahane Ocidental	CF-N			*0.0*	3.4	0.7	5.3	*9.4*	172.1	55.2	1.9	*229.3*	14.5	**316.0**
		Mascarenhas	UC-W			*0.0*	9.9	0.9	3.0	*13.8*	32.8	16.3		*49.0*	6.5	**125.7**
		Motael	UC-W			*0.0*	9.4		6.4	*15.8*		0.5	0.1	*0.5*	14.6	**54.7**
		Vila Verde	CF-W			*0.0*	12.9		5.6	*18.4*	125.9	26.2	4.0	*156.2*	15.4	**272.2**
		Sub-total		**0.0**	**0.0**	*0.0*	**80.7**	**5.0**	**23.7**	*109.4*	**1,847.0**	**839.7**	**43.4**	*2,730.1*	**86.9**	**3,278.1**
	DOM ALEIXO	Bairro Pite	CF-W			*0.0*	51.4		20.1	*71.5*	48.4	229.8	5.6	*283.8*	47.8	**664.5**
		Comoro	SU-W		65.3	*65.3*	207.5	13.6	135.1	*356.1*	380.7	627.6	159.0	*1,167.2*	214.9	**2,518.8**
		Fatuhada	CF-W			*0.0*	9.0		1.4	*10.4*		1.3	0.2	*1.6*	13.4	**81.2**
		Kampung Alor	CF-W			*0.0*	7.6		2.2	*9.8*		1.5	1.2	*2.7*	9.9	**48.8**
		Sub-total		**0.0**	**65.3**	*65.3*	**275.5**	**13.6**	**158.8**	*447.8*	**429.1**	**860.2**	**166.0**	*1,455.2*	**286.0**	**3,313.3**
		Total		**0.0**	**82.7**	*82.7*	**537.1**	**162.4**	**297.0**	*996.4*	**5,986.7**	**3,009.6**	**332.3**	*9,328.6*	**639.9**	**13,636.0**
LIQUIÇA	BAZARTETE	Tibar	SA-W	**76.6**		*76.6*	**76.8**		**74.3**	*151.1*	**2,561.3**	**958.6**	**60.4**	*3,580.2*	**119.3**	**4,224.0**
		Grand Total		**76.6**	**82.7**	*159.3*	**613.9**	**162.4**	**371.3**	*1,147.5*	**8,548.0**	**3,968.1**	**392.6**	*12,908.7*	**759.2**	**17,860.0**

Note: AG=Agriculture, RR=Rural Residence, RL=Low-dense Residential, MR=Medium-density Residential, RMX=Mixed Use (R+CB), UCB=Urban Commercial Business Center, NCB=Neighborhood Business Commercial Center, CCB=Corridor Commercial and Business, TR=Tourism and Recreation Area, IZ= Industrial Zone, QI=Quai-industrial Aea, PU=Key Public Facilities, HE=Higher Education, PSO=Park, Sports and Open Spaces, NF=Natural and Forest Area, ONA = Other Nature Area, W=Water Body

Source: JICA Project Team

9.3.4 Further Considerations for Land Use Coordination with Relevant Projects

In the final stage of the project for the Dili Master Plan, several new projects were identified in which sector government agencies have ideas of facilities development to utilize certain areas for the development in DMA, although these projects are in various stages, such as preliminary idea, planning stage, and preparation stage.

Some projects have been incorporated into the land use plan, although other projects cannot be considered because of uncertain or unavailable information on whether they would be able to be committed and implemented by the government or not. These projects should be coordinated and adjusted by relevant authorities and decision makers toward appropriate formulation of land use as listed in Table 9.3.14.

Table 9.3.14 List of Current Project Information to be Coordinated and Adjusted in DMA

Project	Location (Suco)	Current Status			Considerations / Consistency with Land Use Plan (LUP)
		Area (ha)	Responsible Authority	Stage	
1. Runway Expansion of PNLIA	Comoro (Eastern Part)	31.0	MOPWTC, AACTL/ ANATL / PNLIA (including IFC technical assistance)	Planning	Proposed LUP by a possible option, but necessary to coordinate with further technical study of the airport expansion project
2. Airport Frontage Development (PNLIA)	Comoro (Western Part)	18.0			Proposed LUP follows preliminary scheme of commercial and business use for PNLIA PPP project
3. Tibar Port Project	Tibar	40.6	MOPWTC, APORTIL	Implement ation	Necessary to coordinate with proposed LUP for access and land use of adjacent areas, especially coastal area with mangrove forests
4. Sports Training Center	Comoro	1.9	Secretary States of Youth and Sports	Planning	Incorporated to proposed LUP
	Becora	3.6			Necessary to coordinate with proposed LUP for bus terminal plan
5.Indoor Sports Facilities	Hera as one of Candidates	12.0			As there is an idea to be in Metinaro, it is not considered in the proposed LUP
6.Crocodile Care Center	Hera	2.0	Ministry of Industry, Commerce and Environment	Planning	Incorporated to proposed LUP
7.Waste Incineration Plan Facilities	Tibar	12.0		Implement ation	Necessary to coordinate with proposed LUP for scale of capacity and location
8. Master Plan & Detail Planning for Ecological Protection and Improvement of Tasitolu	Tibar	600.0 ~650.0 (approximately)		Planning	Necessary to coordinate with proposed LUP for the boundary of Tasitolu Protection Area and contents of development regulations
9. Pasific Tourists Resort	Hera	100.0	And Ministry of Tourism, Culture & Art	Planning	Necessary to coordinate with Cristo Rei Protected Area
10. University City Plan for UNTL	Hera	367.0	Ministry of Education/ University of Timor Lorosa'e	Planning	Necessary to coordinate with proposed LUP for future land use in the plan for UNTL campus especially in reserved land by paddy field.

Note: LUP: Land use plan for the Dili Urban Master Plan, MOPWTC: Ministry of Public Work, Transport and Communications, PNLIA: Presidente Nicolau Lobato International Airport, AACTL: Civil Aviation Authority of Timor-Leste, ANATL: Air Navigation of Timor-Leste E.P., APORTIL: Port Authority of Timor-Leste

Source: JICA Project Team

9.3.5 Land Use Plan 2030

(1) Proposed Land Use and its Classification for Dili Metropolitan Area

The use classification for land use plan which may also be intended for zoning category for the development control mentioned in the succeeding Section 12.2.1 is proposed based on certain considerations in line with the land use policy aforementioned in the previous section.

On the other hand, the use classification is proposed to be composed of six main classes in association with 17 sub-classes. These classes are aimed to be applied mainly to DMA in consideration of use complexity as the largest city. Therefore, the proposed sub-classes can be modified to fit other cities' land use conditions while the six main use classes shall be kept as the land use framework.

Rationale of use class to be applied to DMA

The following are key considerations to formulate the proposed land use class:

- Introducing the land use class to achieve the land use policies as interpretation of the development vision which aims to encourage various urban activities (living, economic, administration, and infrastructure services) and to secure and sustain urban environment in the DMA.
- Considering suitable use classes to enable to formulate the urban structure focusing on competitive and effective urban core development by hierarchical commercial and business function in the DMA.
- Introducing appropriate use classes to guide the development density especially for the living areas taking account of efficient land utilization in limited land of DMA and mitigation of hazard risk through different use classes.
- Considering promotive use classes to encourage existing and/or potential urban activities in the DMA such as commercial and business activities on the major roads, and land use for small-medium scale industries.
- Introducing hierarchical use class system through the main use class in which every city needs to consider standard class groups and sub-class with flexible application to each city taking account of each spatial condition. DMA is considered to have one of the most intricate spatial activities in Timor-Leste.

Rationale of use class to be applied to DMA

The following main use classes and sub-classes are proposed based on the considerations above. Table 9.3.15 illustrates the hierarchical system with color codes.

1) CLASS I: Rural

DMA covers wide range of land uses not only for urban area to be developed in the future but also for rural areas including agriculture land with rural villages. Class I of rural consists of agriculture (AG) to be retained and improved as agricultural area and rural residential (RR) mainly as rural village in the mountain, where scattered small-scale commercial, business and cottage industries can be involved in case of remote settlement.

2) CLASS II: Residential

Class II consists of low-density residential (LR) to achieve low-density population settlement, where this land use will be applied mainly to the existing settlement area in the vulnerable lands in order to prevent further settlement. Medium-density residential (MR) meanwhile will be applied in principle to almost all other settlement areas.

Mixed-use (RMX) category is also categorized as Class II, which is residential area in combination with commercial and business land use, simultaneously developed horizontally or vertically with medium-high density settlement. Class II also involves scattered and limited small-scale and commercial, business (e.g., kiosk, tobacco shops, small grocery shop.), and cottage industries.

3) CLASS III: Commercial and Business

Class III consists of Urban Center Commercial and Business (UCB) to be developed and improved as a dominant area for high to medium density development of CBD.

The Corridor Commercial and Business (CCB) for areas along major primary urban roads allows medium to high density development within certain width in both sides from the road center (e.g., 50-30 m). The Neighborhood Commercial and Business (NCB) for areas such as the center of local community (e.g., Suco Center) shall be through medium development for commercial and business activities including local market and small-scale cottage industries. The Tourism and Recreation Area (TR) is also in this Class III as part of commercial and business activities, although this category is suitable to be applied to suburban areas or Hera or Tibar with rich natural environment.

4) CLASS IV: Industrial

Class IV consists of Industrial Zone (IZ) to be developed and improved for industrial purposes only (heavy or light industry), with adequate infrastructure and suitable competitive location. The SEZ is expected to apply to this land use area. The Quasi-Industrial (QI) is another type of use for Class V allowing mixed use with other land use such as commercial and business or other types of industry, i.e., logistics, transportation use, research and development facilities for industry. This area to be developed as planned areas also aims to promote local small to medium-scale industries concentration.

5) CLASS V: Public Use

“Key Public Facilities” known as Class V show the existing and future areas by annotation of facility coding to identify the types of government, institutions, higher education, key transportation terminal, airport, key utilities, and cemetery. “Higher Education” is also classified as a large land occupation area with large impact to its surrounding areas and traffic condition.

6) CLASS VI: Green and Open Spaces

The Tourism and Recreation Area (TR) of Class VI aims to encourage and promote attractive tourism area where facilities and infrastructure should be treated with careful measures to avoid deterioration of natural environment through sustainable tourism and recreation development.

The Park, Sports, and Open Space (PSO) is to be developed and improved as citizen's park or for sports recreation use. On the other hand, the open spaces also serves as buffer areas for demarcation between the living environment (residential or commercial and business use) and for other uses taking into account landscape and environmental control (e.g., riverside green, seafront green, buffer green for factories).

Table 9.3.15 Proposed Land Use Classification with Coding System for DMA

Plan Use Class		Sub-class	Code	Color	Reference
Class I: Rural (100)		Agriculture Land	110: AG		
		Rural Residential	120: RR		Low density in slope areas
Class II: Residential (200)		Low-density Residential	210: RL		Mainly in slope areas in DMA
		Medium-high density Residential	220: RM		
		Mixed Use	230: RMX		Residential + Commercial & Business
Class II: Commercial and Business (300)		Urban Center Commercial-Business	310: UCB		
		Corridor Commercial-Business	320: CCB		
		Neighborhood Commercial-Business	330: NCB		
		Tourism and Recreation Area	340: TR		
Class IV: Industry (400)		Industrial Zone	410: IZ		Applicable to SEZ
		Quasi-Industrial Area	420: QI		Light industry + others
Class V: Public Use (500)		Key Public Facilities	510: code		See code list in below
		Higher Education	520: HE		
Class VI: Green and Open Space (600)		Park, Sports, and Open Space	610: PSO		
		Nature and Forest Area	620: NF		
		Other Nature Areas	630: ONA		Bush, grass land, coastal area
		Water Surface	640: W		
Class/Sub-clas	Code	Description			
Key Public Facilities (510)	GO	Key Government / Institutions / Administration / Security by large site			
	RH	Key health care facilities with large site (hospital, health care center, welfare facilities)			
	PU	Key utilities (large site for plant facilities for water supply, sewerage treatment, disposal)			
	CE	Key cemetery			
	TF	Key transportation facilities (terminal, large depot, other transport facilities)			
	AP	Airport facilities			

Note: Each code is shown in each parcel of land use sub-class on the map by scale of 1/25,000
Source: JICA Project Team

(2) Integrated Approach for Urban Growth Management

Urban growth management, addressing the land use policies aforementioned on i) compact urban form, ii) protection of fragile areas, iii) green network and recreational open spaces, and iv) historical urban center in urban planning and its implementation, requires two key measures in order to serve as guidance for appropriate and sustainable development as shown below and in Table 9.3.16.

- Regulation and control measures for urban activities and desirable urban form to achieve the proposed land use plan taking into account the protection of distinctive natural environment and urban characteristics and values in DMA
- Promotion measures for effective and efficient urban activities and services through appropriate provision of urban infrastructure (e.g., road and transport) and public services (e.g., education and health services) based on the land use plan.

Table 9.3.16 Effective Management for Spatial Planning and Urban Development

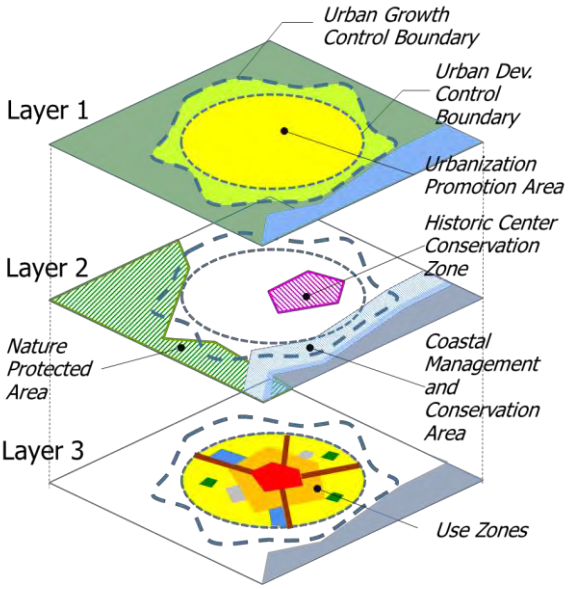
Key Issues for Effective Urban Planning and Development Management		Regulative Control Measure			Promotive Measure	
		Urban Growth Control	Land use Activities Control	Special & Building Control	Priority Area and Public Support	Key Urban Services Provision
Sustainable Land Use and Effective Management	Management of hazard prone area and unsafe usage of land	●	●	●	◎	--
	Natural environmental (water & green) protection and adequate open space creation	●	●	●	◎	●
	Coastal management for conservation and utilization of the coast areas	●	●	●	--	--
	Attractive living environment with adequate density	--	●	●	◎	--
	Maximizing land value and its potential activities	◎	●	●	●	◎
	Effective transportation system in combination with adequate land use formulation	◎	●	●	●	●
	Balanced development between rural (agriculture, mountain) and urban areas	●	●	●	◎	●
	Safe and sufficient public services (health, education, social welfare)	◎	●	◎	●	●
Effective Urban Growth Management	Controlling Urban Sprawl	●	◎	●	--	●
	Strategic Provision of Public Facilities for time framework (2030)	◎	●	●	--	●
	Encouraging competitive urban economic development	◎	●	◎	●	●
	Existing urban areas revitalization and improvement	◎	◎	◎	●	●
Adequate Spatial Structure and Landscape Management	Conservation of Cultural Historical Environment	◎	●	●	●	◎
	Harmonized Urban Landscape Formulation with adequate spatial structure and building design	◎	●	●	◎	--
Effective Urban Planning	Strategic long-term socio-economic target framework	●	●	--	--	◎
	Effective publicity and involvement for urban planning process	●	●	--	●	◎
	Local community participation and cooperation for urban management	◎	●	--	◎	●

Legend ● = Compulsory, ◎ = desirable, -- = not applicable
Source: JICA Project Team

(3) Regulative Control Measures

There are several development control measures as mentioned previously in Table 9.3.16 in order to manage and control appropriate and sustainable urban development and growth for DMA. The development control measure in DMA is proposed to introduce three control system layers, which are the Urban Growth Control Boundary, Special Control Areas, and Land Use Zoning. Each layer for the development control can carry out complementary control and guide functions for the planning entity of DMA as inevitable and integrated control measures. Table 9.3.17 shows the conceptual development control system by three layers.

Table 9.3.17 Effective Urban Management and Control by Three Layer System

Development Control Layer	Purpose and Measures	Conceptual Diagram	Cross-cutting Control Measure
Layer1: Urban Growth Control	To indicate an urbanization edge beyond which urban development is severely limited or restricted. • Designating boundary • Promoting urban services within boundary to guide desirable settlement areas		Building Code: to regulate all building construction for structure, form, materials in order to secure safety, hygiene, and fire-protection .
Layer 2: Specific Control Area	To enhance development control by specific control measures to be applied to specific environment. • Designating special control area overlaying on other control layers • Example: historical protection area, coastal management area, landscape control area		
Layer 3: Land Use Zone	To control all urban activities by defining and regulating appropriate use and activities in association with building form regulations. • Designating zone by use • Defining regulations of building form and land use of activities		

Source: JICA Project Team

1) Urban Growth Boundaries (Layer 1)

It is proposed to apply urban growth boundary system to DMA, although physical conditions such as slopes and skirts of hillsides and mountains may obviously give impression of visible boundary. However, many settlements have encroached on fragile lands such as natural hazard prone areas including steep slope areas in the mountain and dry riverbed areas. Therefore, possible measures for these settlements are required through careful development control with minimum urban service as outside areas of the Urban Growth Boundary (UGB) where residents in these areas should consider moving to normal flat areas within the growth boundary.

- Urban Growth Boundary (UGB)

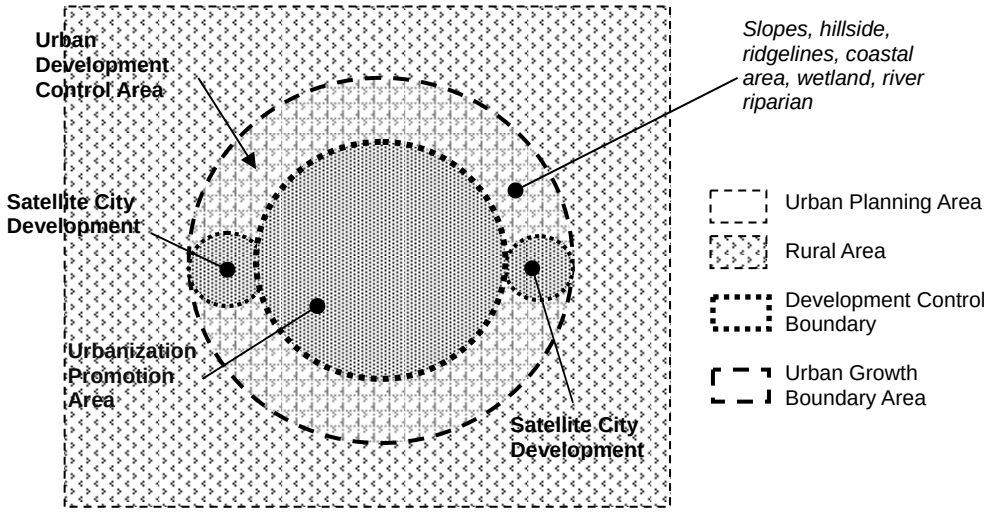
  This boundary delineates the areas that will be urbanized within 10 to 15 years. The area within the UGBs is defined as urbanization development promotion area.

- Urban Development Control Area

  Areas such as steep slope area in the mountain or dry riverbed area within the UGB are defined as urban development control areas, where more controlled and guided activities need to be done by strict or discouraging measures including less infrastructure opportunities or no services if necessary taking account of dangerous conditions under pressures of natural hazards.

  As the preliminary draft of the Spatial Planning Law stipulates the planning area by municipal administration boundary including mountain and rural cultivated areas,

where DMA includes too mountainous rural settlements, it is envisaged that planning areas need to consider both urban and rural entities, especially taking account of outside urban areas of DMA. Although, it is proposed to have: 1) urban planning area where urbanization is expected with appropriate infrastructure and urban services; and 2) rural area where forest and agricultural area with villages are predominant, discussions and coordination with the Spatial Planning Law are required.



Source: JICA Project Team

Figure 9.3.4 Conceptual Diagram of Urban Growth Management Areas and Boundary for DMA

3) Coastal Management and Protection (Layer 2)

Coastal management is one of the important development issues in terms of protection of the natural features and utilization including contemporary land management issues due to increase of natural hazards in coastal areas such as tidal wave, coastal erosion, and tsunami. The DMA, having attractive beaches and beautiful coasts and important socioeconomic activities including existing and planned ports, and existing and planned tourism areas, should be managed by well-organized operation of use activities and protection measures. The following are policies for coastal area protection and utilization in DMA:

- Tourism promotion and enhancement utilizing coastal resources as one of the key economic development sectors in DMA.
- Coastal area protection to succeed natural assets in DMA in terms of valuable natural resources and landscape protection.
- Coastal area management for natural hazard mitigation (e.g., tsunami, tidal wave)

In order to realize the policies for coastal management aforementioned, the following measures are proposed to be introduced to DMA taking into account two aspects of institutional and physical enhancement. Table 9.3.18 indicates the desirable key measures to be applied to DMA.

- Institutional measures for coastal management
  - Regulative measures (land use control, national law setting)

- Enlightening measures (campaign, capacity development)
- Enforcement measures (resettlement, monitoring)
- Promotion measures (incentive for tourism enterprise, guideline)
- Sea activities management (marine recreation, transport)

- Physical measures for coastal management

  - Coastal protection treatment (embankment, breakwater block)
  - Coastal park development (walkway, plaza, observatory points)
  - Marine leisure development (marina, swimming beach)
  - Waterfront urban development (fisherman's wharf)

Table 9.3.18 Key Measures to be Applied to Dili Urban Master Plan Area

Type of Land	Location	Protection Measures for Coastal Area		Utilization Measures for Coastal Area	
		Institutional	Physical	Institutional	Physical
Urban Area	Nain Feto Vera Cruz	• Marine activities management • APORTIL operation coordination • Enhancement existing regulation (50 m setback) for natural hazard	• Coastal embankment or break water block (BWB) for tidal wave	• Organizing waterfront development organization with APORTIL • Marine sports recreational activities guideline formation • Enhancement of commercial activities for waterfront areas	• Waterfront park improvement • Marina (pier) development • Fisherman's wharf development
	Dom Aleixo	• Coastal embankment for tidal wave • Land use regulation by setback or building regulations	• Coastal embankment or BWB for tidal wave	• Commercial facilities water front development guideline formulation • Development control area proximity to airport	• Waterfront park development
Rural Area	Cristo Rei	• Land use regulation by setback or building regulations • Institutional enhancement of Cristo Rei Protected Area	• No physical measures	• Coastal nature conservation campaign • Institutional enhancement of Cristo Rei Protected Area	• Sewerage treatment plant without discharge • Beach walkway development
	Tibar Suco	• Coastal protection by mangrove plantation • Monitoring and management between Tibar Port and Tibar bay environment	• No physical measures	• Tasitolu recreational area promotion and campaign • Mangrove ecotourism promotion or educational campaign	• Sewerage treatment plant for minimum discharge

Source: JICA Project Team

As this theme of coastal management in Timor-Leste is addressed by APORTIL, as one of the management authorities for the port and surroundings, and the coastal management project funded by UNDP/LDCF for building shoreline resilience of Timor-Leste to protect the local communities and their livelihoods, well-organized coordination, and institutional arrangement are required in an integrated manner.

3) Introduction of Historical Landscape Control (Layer 2)

As mentioned in the previous section for the integrated approach for urban growth management, the protection of historical and cultural assets of Dili is required inevitably to be secured by certain institutional measures. In order to succeed the historical assets and their environment to the next generation, it should be established by not only historical building protection but also historical townscape conservation of the city center where distinctive historical buildings are remaining and utilized.

Overlay regulation system by special zoning such as Historical Center Conservation Zone adding on the land use zoning should be applied to desirable area. It is necessary for this zone

to promote improvement of urban environment with comfortable walkway network, traffic control, parking system, and to stimulate activities for attractive cultural events and relevant commercial business. The draft boundary of the Historical Center Conservation Zone in Figure 9.3.5 is proposed tentatively for further discussion.

Legend: ● Historical buildings identified by SEAC.

Source: JICA Project Team based on the State Secretariat of Arts and Culture (SEAC)/ Ministry of Tourism, Arts and Culture (MOTAC)

Figure 9.3.5 Tentative Proposal for Historical Center Conservation Zone

4) Introduction of Land Use Control by Zoning System (Layer3)

Zoning system aims at controlling and regulating urban activities and building forms which are allowed and not allowed according to each zoning category referring to the land use classification. Table 9.3.19 proposes tentative use control which should be elaborated and discussed among relevant stakeholders in order to build consensus. And zoning area also should be designated through elaboration in detailed scale of map and stakeholder's consensus.

On the other hand, building form control and regulation such as building area coverage ratio to the site (BCR), floor area ratio to the site (FAR), building height control, setback control, sky-exposure line control and space requirements for car parking should be elaborated and determined also in the detail plan which is expected to be prepared after the Master Plan is completed. Section 12.2 "Urban Development Management" also describes relevant aspects in details in conjunction with land use management.

Table 9.3.19 Use Activity Control (tentative) by Proposed Land Use Classification interpreted as Zoning Area

Plan Use Class	Sub-class	Code	color	Use Activity to be Allowed by Sub-class interpreted as Zoning Area
Class I: Rural (100)	Agriculture Land	110: AG		Activity related to agriculture: small scale warehouse, houses for farmers
	Rural Residential	120: RR		Activity related to daily lives of the residents: houses, small shops, small scale social facilities, religious buildings
Class II: Residential (200)	Low-density Residential	210: RL		Activity related to daily lives of the residents: houses, small shops, small scale social facilities, religious buildings
	Medium-high density Residential	220: RM		Residents and small scale commercial activities: houses (medium to high rise), hospitals, shops, offices, hotels, religious buildings
Class III: Commercial and Business (300)	Mixed Use	230: RMX		Residents and small-scale commercial & business activities: houses (medium to high rise), clinic, school, small-scale universities, religious buildings, shops, offices, hotels, warehouses, theater, cottage industries.
	Urban Center Commercial-Business	310: UCB		Residents and commercial activities: houses (medium to high rise), religious buildings, clinic, small-scale hospital and universities, shops, offices, hotels, warehouses, theater, small scale cottage industry
	Corridor Commercial-Business	320: CCB		Residents and commercial activities: houses (medium to high rise), religious buildings, hospitals, universities, shops, offices, hotels, warehouses, theater, small scale cottage industry
	Neighborhood Commercial-Business	330: NCB		Residents and commercial activities: houses (medium to high rise), religious buildings, hospitals, universities, shops, offices, hotels, warehouses, theater, small scale cottage industry
	Tourism and Recreation Area	340: TR		Tourism and recreation related activities which do not disturb natural environment: hotels, shops, restaurants, condominium
Class IV: Industry (400)	Industrial Zone	410: IZ		Activities related to SEZ: industry, logistics, transport, office, shops and clinic and other services for workers,
	Quasi-Industrial Area	420: QI		Activities related to light industry: light industry, houses, shops, office, and clinic and other services for workers,
Class V: Public Use (500)	Key Public Facilities	510: code		See code list in below
	Higher Education	520: HE		Activities related to high education: universities, dormitory, small-scale shops and service facilities for students, teachers and staffs
Class VI: Green and Open Space (600)	Park, Sports and Open Space	610: PSO		Parks, recreational facilities: houses, business, commercial, industry activities are not permitted.
	Nature and Forest Area	620: NF		Small scale facilities related to nature and conservation activities
	Other Nature Areas	630: ONA		No buildings permitted.
	Water Surface	640: W		No buildings permitted.

Class/	Code	Description
Key Public Facilities (510)	GO	Key Government / Institutions / Administration / Security by large site
	RH	Key health care facilities with large site (hospital, health care center, welfare facilities)
	PU	Key utilities (large site for plant facilities for water supply, sewerage treatment, disposal)
	CE	Key cemetery
	TF	Key transportation facilities (terminal, large depot, other transport facilities)
	AP	Airport facilities

Note: Each code is shown in each parcel of land use sub-class on the map by scale of 1/25,000
Source: JICA Project Team

(4) Promotion Measure for Urban Development

This section focuses on one of the essential supporting measures for effective and efficient urban development promotion in DMA, although there are various promotion measures in terms of land use management, construction management, private sector participation, and other aspects. The resettlement measure is one of the most important arrangements to reorganize the urban structure with necessary public investment in association with expropriation and regulations to secure public space and/or lands in order to achieve safe urban settlement without hazards and efficient and effective public services such as road and transportation and other infrastructure.

1) Necessary Public Space/Land to be Secured in Association with Involuntary Resettlement

- Hazard management area: river side buffer, coastal buffer, buffer for hilly area as landslide/erosion prone land
- Large infrastructure development area: Airport buffer, trunk road buffer, large public utilities plant (waste disposal site, sewerage plant, logistic/transportation center)
- Large economic development area initiated by the government: Industrial zone, commercial and business complex, and tourist resort.

2) Policies on Involuntary Resettlement for Public Space/Land Securement

- Providing public housing (collective housing, four to five storey) to absorb future needs of resettlements generated by public land development taking account of land scarcity
- Establishing resettlement institutional arrangement (law, regulation, guideline) for appropriate program implementation (e.g., financing, compensation, housing)
- Developing mechanism for public land development utilizing cross-subsidy system in terms of resource generation or land acquisition for resettlement

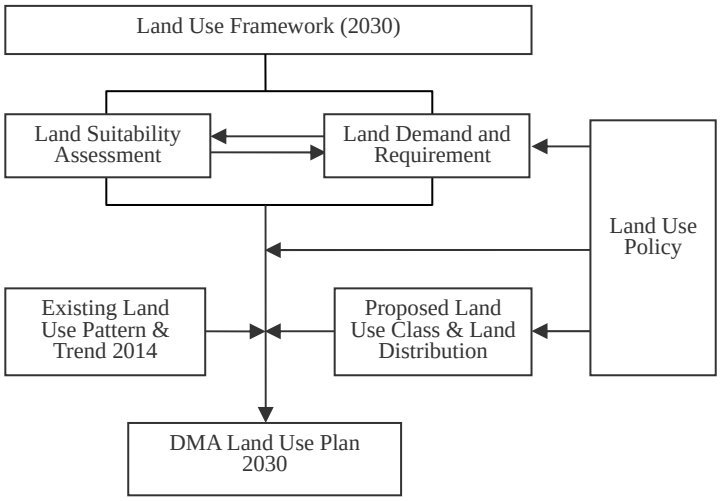
3) Formulation of Urban Redevelopment Mechanism for Urban Structure Consolidation

- Formulating urban cores in the DMA to establish competitive and effective urban centers through revitalization of key urban areas in line with the land use plan (this DMA Master Plan proposes “Focused Area Development” schemes at concept level planning described in the Section 9.3.6)
- Establishing urban redevelopment mechanism including law, regulation, guideline for appropriate program implementation (e.g., financing, compensation, housing, private sector participation, infrastructure development method) with special focus on land development mechanism (transfer of land right, leasing)
- Developing public sector role and function focusing on public transportation nodes development in the focused urban cores (terminal or station for proposed bus rail transit (BRT) system) in cooperation with private sector involvement utilizing several incentive arrangements.

(5) Proposed Land Use Plan for 2030

According to the land use policies and spatial distribution frameworks on population and employment mentioned in the previous section, the spatial scheme as land use plan for Dili Metropolitan Area can

be set through the following steps: 1) land demand examination according to the land use framework, 2) examination of supply side capacity through "Land Suitability Assessment", 3) adjustment of land balance between demand and supply, 4) land use class setting and applicability, and 5) consideration of existing land use pattern and trend. Figure 9.3.6 shows the land use plan formulation process and method.

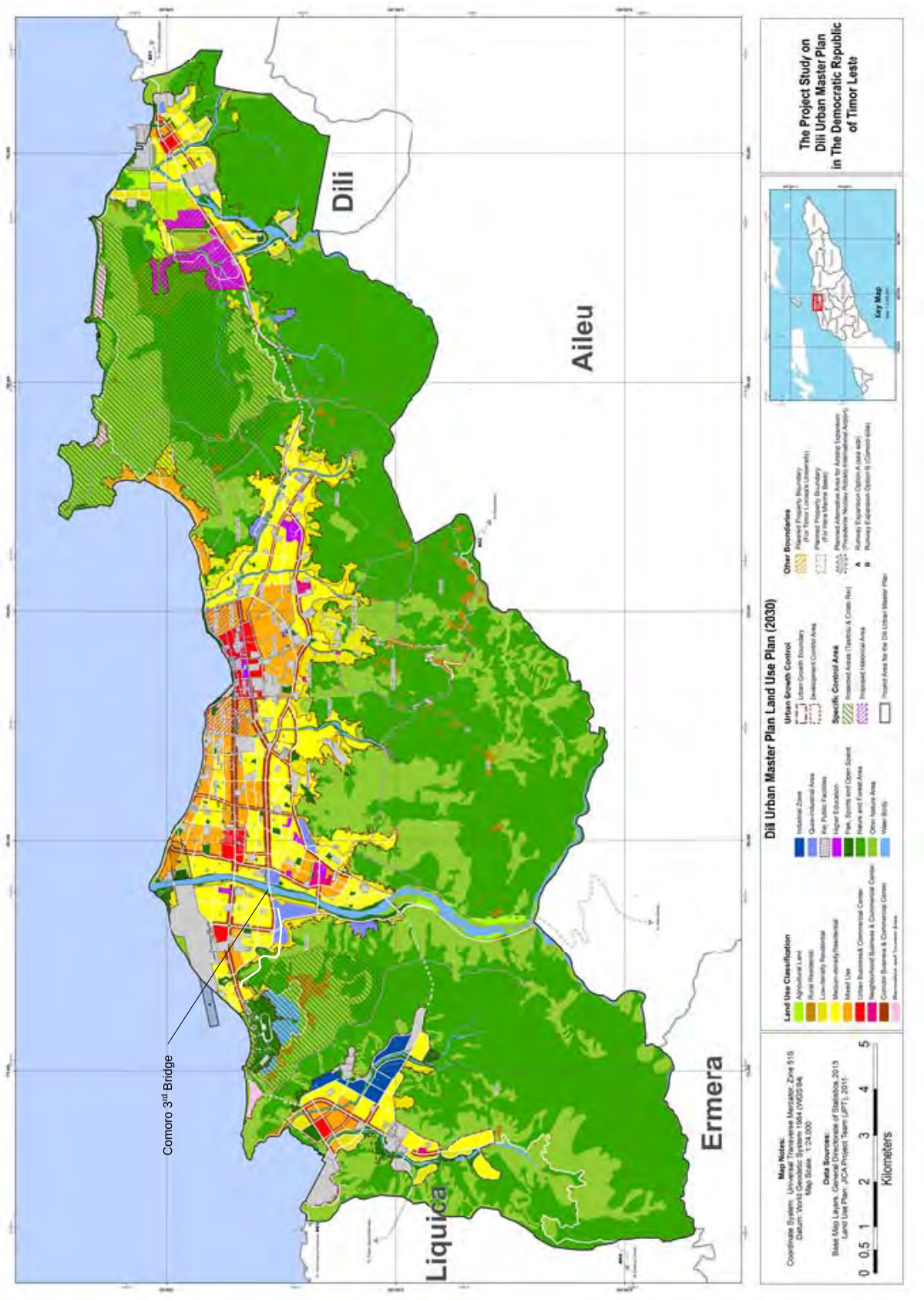


Source: JICA Project Team

Figure 9.3.6 Land Use Plan Formulation Process and Method

Based on the above process, the land use plan for the Dili Urban Master Plan is proposed as shown in Figure 9.3.6.

It should be noted that the road network illustrated in Figure 9.3.6 is one of the possible and considerable road networks in line with the proposed scheme for transportation policies and road framework in Chapter 10. Further studies would be required to formulate and make the plan of detailed road and transportation network in DMA.



Source: JICA Project Team.

Figure 9.3.7 Proposed 2030 Land Use Plan for Dili Metropolitan Area

9.3.6 Concept Note for Focused Area Development

(1) Objectives

This concept note (preliminary study) aims at illustrating focused urban developments toward the implementation of the Master Plan in the selected areas, and they are expected to play essential roles in formulating desirable urban structure and function for DMA in the future. The Focused Development Areas give basis for further urban planning toward implementation with effective land use in association with specific development policies and contents in the future. The following are the objectives of this concept note which are also applied as selection criteria of focused development:

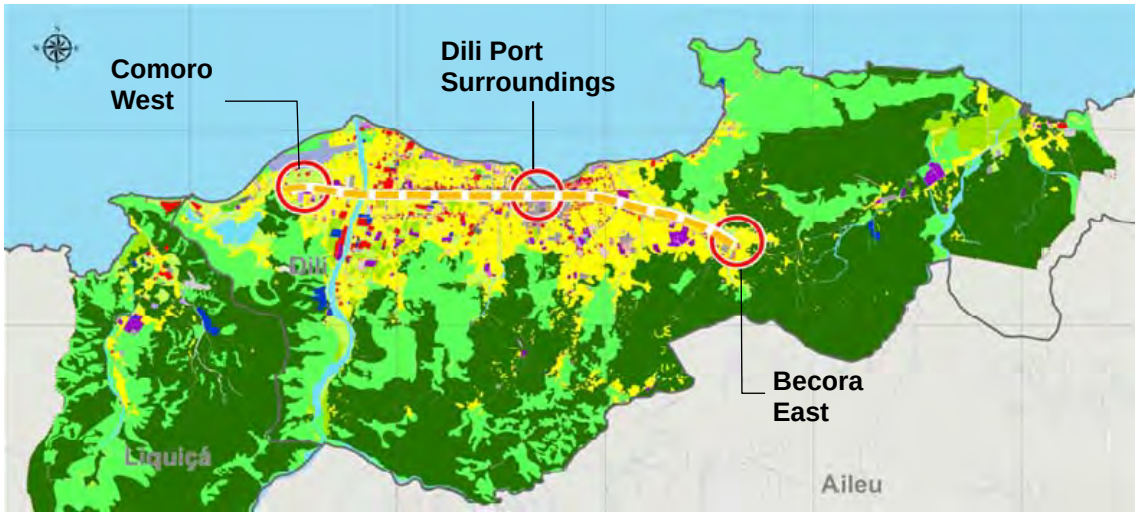
- To be a model development of urban core area in consideration of the "Development Vision" realization
- To be a model for sustainable urban development through the transit-oriented development (TOD) concept in association with public transportation system
- To be a model for innovative urban development mechanism

(2) Selection of Focus Development Area

Based on the proposed transportation plan in the Master Plan, the proposed public transportation system will be one of the essential elements toward the formulation of sustainable urban development of DMA. In order to encourage and enhance the public transportation system, urban development should be integrated and incorporated into it especially in the station or terminal area as important nodes where major urban activities would be generated.

The three focused areas of Comoro West, Dili Port Surroundings, and Becora East are selected as core developments dedicated to the formulation of the proposed urban structure of DMA in conjunction with the expected trunk line of the public transportation system. The following are the expected function and roles for the three focused development areas:

- Comoro West: aiming to be an urban core in the western part of Dili District in combination with commercial and business center development and public transportation node development for expected BRT system and inter-city bus terminal function.
- Dili Port Surrounding: aiming to be a transportation node of the city center of Dili in combination with the historical conservation center with administrative and political center function and public transportation node development for expected passenger port development and intra-city public transportation station development.
- Becora East: aiming to be an urban core in the eastern part of the Dili urban area in combination with neighborhood commercial and business center development and public transportation node development for expected BRT system and inter-city bus terminal function.



Source: JICA Project Team.

Figure 9.3.8 Location of Focused Development Areas

(3) Comoro West Focused Area Development Concept

1) Spatial context and development issues

This focused area is proposed to be one of the future urban commercial and business centers in DMA according to the proposed land use plan, taking high advantage of urban development proximity to PNLIA, where the airport upgrading project is expected to enhance the national gateway capacity.

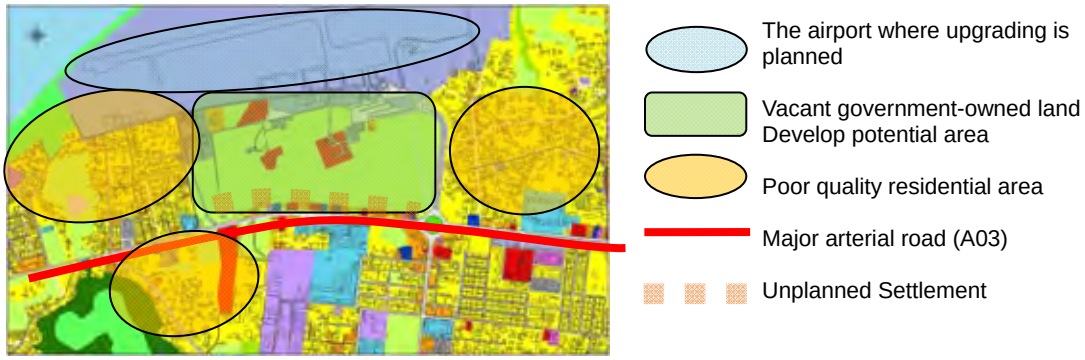
A large vacant government-owned land (around 26 ha), managed by the Civil Aviation Authority, is one candidate area for the focused development areas. The following issues are observed in this focused area to be considered for integrated development:

- Airport upgrading plan and issues: The International Finance Corporation (IFC) has drawn up the plan to carry out the rehabilitation of PNLIA to upgrade its safety and capacity. However, this plan especially for the expansion of airstrip is pending at present in terms of further study and implementation. The IFC plan has also proposed the vacant land development in front of PNLIA where improvement of parking and access and business commercial land development are proposed. It is necessary for this development to be integrated with urban development and airport upgrading.

- National Highway (A03) with considerable public transportation: The results of traffic survey conducted by the JICA Project Team (JPT) shows that the number of trips between this area to other areas becomes more than the other areas as a result of high number of traffic. This result implies that this area seems to be a commuter town to other working areas. In consideration of the traffic condition, new commercial and business facilities would be possible and desirable for new urban core to facilitate surrounding residential areas with less mobility to contribute to sustainable environment formulation.

- One road project on the National Highway (A03) is underway under the Road Network Upgrading Sector Project. This Tasitolu to Tibar New Port Road project, supported by the Asian Development Bank (ADB), is from the roundabout of the highway to the intersection of Tibar, and four-lane roads are designed. Therefore, capacity and accessibility from Dili to the western area would be enhanced.

- Unplanned settlement in surroundings: Within the vacant area, several residents with mini-market occupy the front areas along the main street (A03) without land ownership, where residents live there and lived previously in mountainous areas. This focused area development could involve residential development including people to be required by the resettlement program.



Source: JICA Project Team.

Figure 9.3.9 Current Conditions in Comoro West Area

2) Development concept

The concept for the development considering the current situation can be formulated by the following points:

- To develop "Transportation Hub": The transportation hub would play important role in serving as terminal station of expected public transportation system taking account of seamless linkage with multi-modal transfer such as microlet, taxi, and bus services in combination with commercial and business facilities. The terminal would be located in an area with access to trunk roads and certain area to accommodate public transportation demand.

- To develop "New Commercial Business Center": This area is expected to become one of the new urban poles in DMA taking advantage of its proximity to the international airport where new business center will provide sufficient office floors to support expected industrial business in Tibar and Comoro South in association with attractive commercial services including a Tourism Information Center.

- To formulate "Mixed Use Urban Core Development": Mixed use concept can also be applied to this focused area, with residential development by mid-rise housing as a part of commercial complex. Some parts of residential areas are for social housing area where residents affected by involuntary resettlement would be candidates to be accommodated. Also, transportation facilities at ground level could also be combined into multi-storey building development as shown in Figure 9.3.10.

A) Airport Area
B) Bus Terminal Complex Candidates with Mixed use development (Commercial and Residence)
C) Residential Use (Maintenance plan)
D) Mixed Use (Commercial – Business & Residential
E) Corridor Commercial

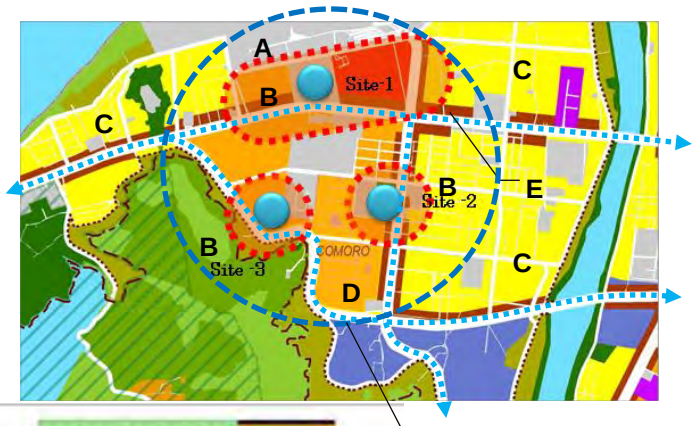


Image of Mixed Use Development with Transportation Hub

Source: JICA Project Team.

Figure 9.3.10 Conceptual Development Scheme and Section for Comoro West Area Development

3) Development measure and program

Although further studies with vigorous coordination with the international airport improvement project are required to clarify feasibility of this focused area development, basic measure for this urban development is to introduce public private partnership (PPP) development. However, the government has to have strong initiative to guide this development because of large public benefits such as the airport, public transportation system, and public housing development

Table 9.3.20 Development Program in Comoro West Focused Area

Development Component	Development Program Scheme			Implementation Body
	Short Term	Mid Term	Long Term	
Public transportation terminal development	• Transportation MP • F/S study	• Terminal / Station Construction • Transit operation plan	• Park & Ride system study to be introduced • Transit operation and management	Public
Commercial and business complex development	• Integrated Development Plan • Institutional arrangement for Investors contract	• Tenant involvement • Complex building construction	• Expansion of business floors • Tenant investment monitoring	Public & Private
Provision of pedestrian network	• Traffic management study • Walkway design	• Construction of walkway • F/S study	• Walkway extension • Parking system development	Public

Housing development	• Housing plan • Social survey • Market and F/S study	• Resettlement plan & social housing program • F/S study for housing complex	• Construction of Housing complex including social housing	Public & Private

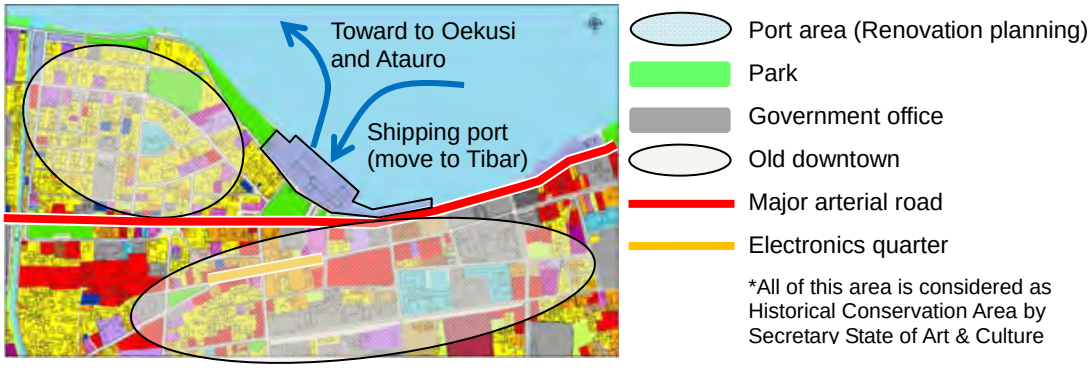
Source: JICA Project Team

(4) Dili Port Surroundings Focused Area Development Concept

1) Spatial context and development issues

This focused development area covers the Dili Port and its surroundings as part of the Dili City Center (capital CBD), where central government facilities and political centers are located. This area is also expected to be designated as the "Historical Center Conservation Zone" embracing many historical buildings of Portuguese colonial era mainly. The following describe the current status of the area and development issues:

- Existing Dili Port upgrading and issues: Dili Port is currently a cargo and domestic passenger ferry port, where small port area and its limited hinterland have become constraints for not enabling to address the increasing trade demand. Consequently, the new sea cargo port development is under the preparation stage to move the cargo port function to the new place in Tibar. Therefore, existing Dili Port is expected to perform as key passenger port including domestic ferry and international cruise port. This change would give high opportunities to enhance waterfront development in combination with marine recreation development. The detailed port improvement proposal is described in Section 10.2.3 (Port Development Plan).
- National Highway (A03) with considerable public transportation: The future traffic assessment of road traffic by JPT in this area shows possible traffic congestion. Also, the port area will require efficient transfer area from sea transport to land transport with convenient transportation terminal. Proposed public transportation system is expected to link with this port transportation node to promote efficient modal shift.
- Waterfront with historical center formulation: Waterfront of Dili is one of the most important urban amenities for visitors. It is expected that attractive waterfront development in association with hinterland historical center of Dili can be enhanced and developed.



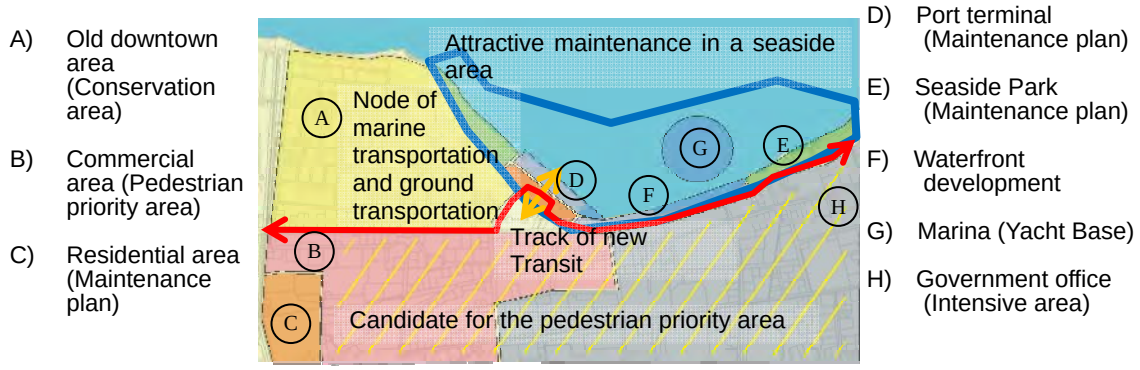
Source: JICA Project Team.

Figure 9.3.11 Current Conditions in Dili Port and Surrounding Area

2) Development concept

The concept for development taking account of the current situation can be formulated by the following points:

- To develop "Transportation Hub": Another transportation hub would also play important role not only in serving as domestic and international gateway of the seaport but also in serving as terminal station of expected public transportation system taking account of seamless linkage with the seaport, public transportation terminal, and the CBD of Timor-Leste.
- To encourage "Capital Commercial Business Center": This area is expected to become one of the most significant urban poles in DMA as the capital center of Timor-Leste in association with attractive historical center with Portuguese historical buildings charming tourist and visitors supported by Tourism Information Center.
- To formulate "Waterfront Amenity": The waterfront in this area is/will be an essential element of the city center of Dili. In order to enhance and promote attractive waterfront area, attractive commercial amenity with comfortable walkway system and convenient parking should be introduced.



Source: JICA Project Team.

Figure 9.3.12 Conceptual Development Scheme in Dili Port and Surrounding Area

3) Development measure and program

Although further studies are also required to clarify the feasibility of this focused area development, basic measure for this urban development is to introduce public private partnership (PPP) development in conjunction with potential private commercial business activities. However, the government has to have strong initiative to guide this development because of large public benefits such as the seaport, public transportation system, and historical center revitalization.

Table 9.3.21 Development Measure in Dili Port and Surrounding Focused Area

Development Component	Development Program Scheme			Implementation Body
	Short Term	Medium Term	Long Term	
Public transportation terminal development	• Transportation MP • F/S study	• Terminal / station construction • Transit operation plan	• Transit operation and management	Public
Waterfront Amenity Development	• Integrated Waterfront Plan • Institutional arrangement for waterfront area	• Private investor formulation • Waterfront park construction	• Operation of commercial facilities • Tenant investment monitoring	Public and Private
Provision of pedestrian network	• Traffic management study • Walkway design	• Construction of walkway • Traffic control design	• Traffic control operation • Parking system development	Public
Historical Center Revitalization Program	• Identification of historical building • Building renovation plan • Tourist Information Center (TIC) Plan	• Renovation of selected buildings • Construction of TIC • Tenant operation program	• TIC operation • Commercial or cultural organization tenant operation	Public & Private

Source: JICA Project Team

(5) Becora East Focused Area Development Concept

1) Spatial context and development issues

This focused area is proposed as one of the future neighborhood commercial and business centers in DMA according to the proposed land use plan, taking account of large population without major commercial and business area, and poor living conditions in the area. It is necessary to improve the living environment of this area by having certain urban services.

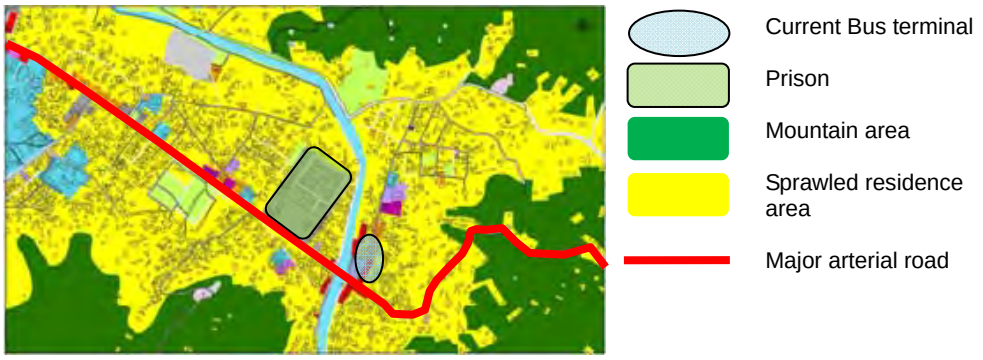
There are two large vacant lands as candidate areas for this focused development area, namely: one large vacant land (around 3.7 ha) at the southern side of the National Highway (A01) and the area (around 1.9 ha) in front of the Becora Prison at the opposite side of the highway. The following issues are observed in this focused area to be considered for integrated development:

- Living environment upgrading and issues: Becora Suco is one of the unplanned settlements without well-organized development of road and other utilities. Insufficient access road and insufficient water supply service (6-18 hours/day) are observed in this area. It is necessary for this area to improve its living environment through sufficient access road and utilities.

- National Highway (A01) with considerable public transportation: Becora is a well-known place as eastern terminal for Dili microlet bus and inter-city bus services from/to eastern side cities (e.g., Manatuto, Baucau) in Timor-Leste. However, the terminal itself faces capacity issues which are not being able to address the future traffic increase due to its small area. Adequate terminal development will be required with sufficient land area to accommodate the future demand of traffic.

- Neighborhood commercial and business: In spite of large settlement in Becora, there are few commercial and business activities. In order to formulate convenient and effective urban structure and services in each major settlement, neighborhood

commercial and business center formulation could support the improvement of appropriate urban services and community life.



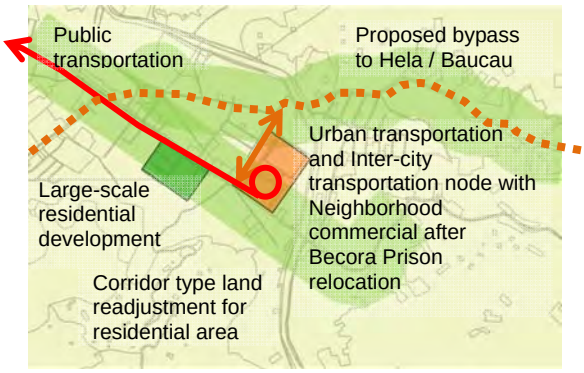
Source: JICA Project Team

Figure 9.3.13 Current Conditions in Becora East Area

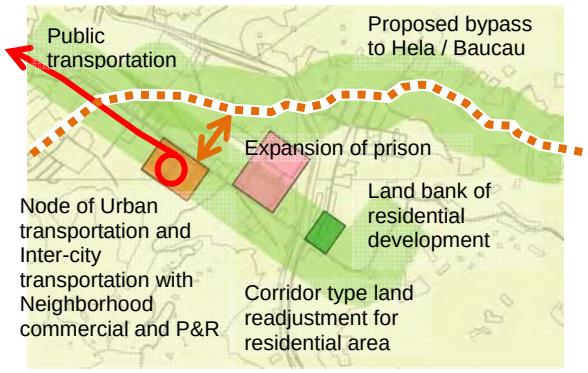
2) Development concept

The concept for development taking account of the current situation can be formulated by the following three points:

- To develop "Transportation Hub": The transportation hub would play important role in serving passengers and traveler for inter-city and intra-city trips in DMA. Location of the transportation hub is proposed to shift to new area to be able to accommodate the future demand of bus terminal. There are two options in terms of potential land for development as shown in Figure 9.3.12. Plan A shows the case of development in the Becora Prison which has a possibility to relocate to other place such as Hera. Other case, i.e., Plan B, aims to utilize the large vacant land along the A01 highway. Transportation hub requires a good link to the proposed bypass to Hera.
- It should be noted that Plan B requires sufficient discussion and coordination with the Secretary State for Youth and Sports in which Directorate of Sports has proposed a football training center.
- To develop "New Neighborhood Commercial Business Center": This area is expected to have commercial and business service taking account of convenient access from neighboring communities without long travel for shopping and business.
- To improve "Living Environment": Taking opportunity of proposed bypass road construction as effective link from Dili to Hera, the surrounding residential area can be improved by land consolidation or land readjustment. Access road with good drainage system and water supply improvement can be incorporated into land consolidation for Becora residence. Also, in this focused area, residential development will be by mid-rise housing as a part of commercial complex. Some parts of the residential areas are for social housing area where residents affected by involuntary resettlement could be accommodated.
- This area is also concerned with the proposed concept of the long-term future bypass road development with tunnel system described in Chapter 10 where the mountain pass to Hera has become an obstacle to the efficient link between Dili and Hera areas.



Plan A for Becora East Focused Area Development



Plan B for Becora East Focused Area Development

Source: JICA Project Team

Figure 9.3.14 Conceptual Development Scheme in Becora East Area

3) Development measure and program

The PPP development measures could also be applied to this focused area. The government has to have strong initiative to guide this development because of large public benefits such as public transportation system and residential area improvement through land consolidation. Especially, the proposed relocation of the Becora Prison for desirable urban formulation also requires strong government intervention.

Table 9.3.22 Development Measure in Comoro West Focused Area

Development Component	Development Program Scheme			Implementation Body
	Short Term	Medium Term	Long Term	
Public transportation terminal development	• Transportation MP • F/S study	• Terminal / Station Construction • Transit operation plan	• Park & Ride system study to be introduced • Transit operation and management	Public
Neighborhood commercial and business complex development	• Integrated Development Plan • Institutional arrangement for Investors contract	• Tenant involvement • Temporal housing provision for living environment program • Complex building construction	• Expansion of business floors • Tenant investment monitoring	Public & Private
Living environment improvement program	• Institutional arrangement • Land consolidation study	• Establishment of implementation body • Land tenure arrangement program • F/S study	• Construction of infrastructure • Resident resettlement program	Public
Access road development to link with Bypass road	• Social and property survey • F/S study	• Resettlement plan & social housing program • F/S study for access road	• Resettlement operation • Construction of access road	Public

Source: JICA Project Team

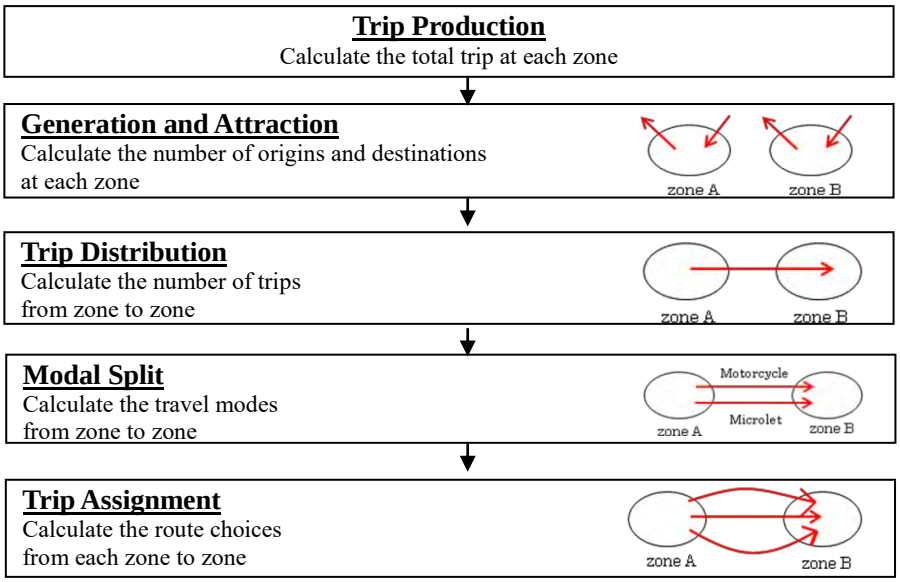
CHAPTER 10 : TRANSPORT DEVELOPMENT PLAN

10.1 Road and Public Transportation Plan

10.1.1 Demand and Gap Analysis

(1) Method of Analysis

Future traffic demand is forecasted based on the traffic survey analysis in order to specify the problems in Dili traffic network. Four-step-method, which is the most basic analysis method is applied. Four-step-method is composed of i) trip generation and attraction, ii) trip distribution, iii) modal split, and iv) trip assignment as shown in Figure10.1.1.



Source: JICA Project Team

Figure 10.1.1 Outline and Flow of Four-Step-Method

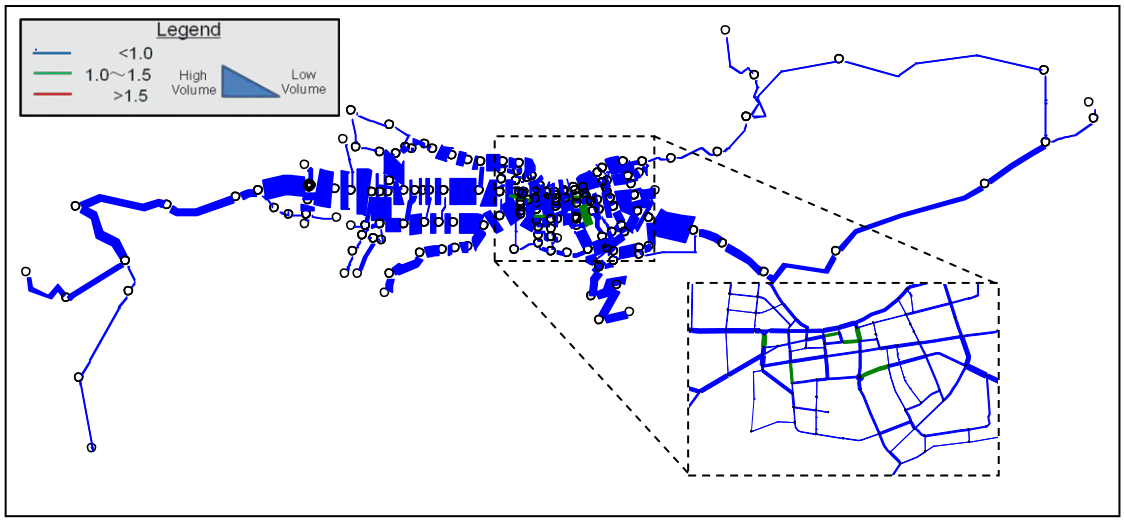
Formulation of future transport demand is described in Appendix 8 in detail. By applying this method, the future transport demands for both existing case and do-nothing case are forecasted. Visible problems at present are on-street parking and Microlet boarding and alighting. These behaviors lessen the capacity of roads. Therefore, the existing case means that on-street parking and Microlet boarding and alighting problems still remain. Do-nothing case in 2030 is also forecasted under the same road network and condition in 2014.

(2) Result of Analysis Without Any Countermeasures

Existing case in 2014 and do-nothing case in 2030 are forecasted as shown in Figures 10.1.2 and 10.1.3, respectively.

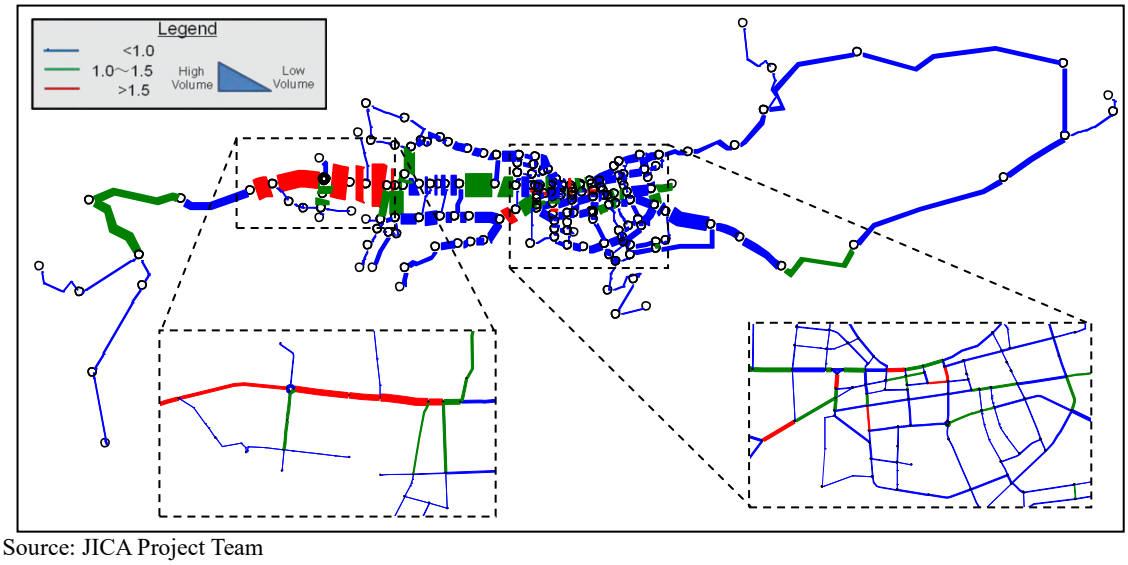
Blue color shows that congestion rate is less than 1.0. It means that traffic congestion does not happen because road capacity is larger than traffic volume. Green color shows that road congestion can be seen in the morning and evening peak time. Red color shows the chronically heavy traffic jam at present. Furthermore, heavy line means high volume and thick line means low volume in spite of its capacity.

As for the existing case, it happens during the peak time of congestion in the urban area. It seems to be affected by on-street parking and Microlet boarding and alighting. On the other hand, if any countermeasures are not taken, it is clear that Comoro area and urban area do not have enough capacity to deal with the future demand volume.



Source: JICA Project Team

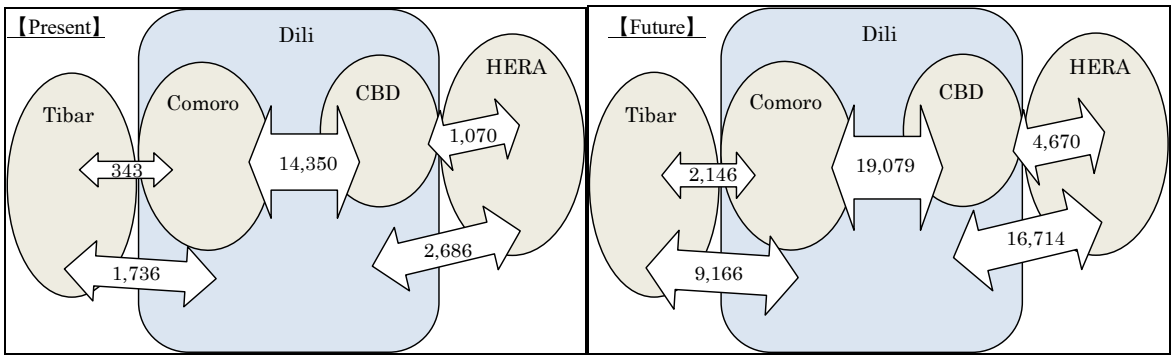
Figure 10.1.2 Result of Forecasting of Existing Case in 2014



Source: JICA Project Team

Figure 10.1.3 Result of Forecasting of Do-Nothing Case in 2030

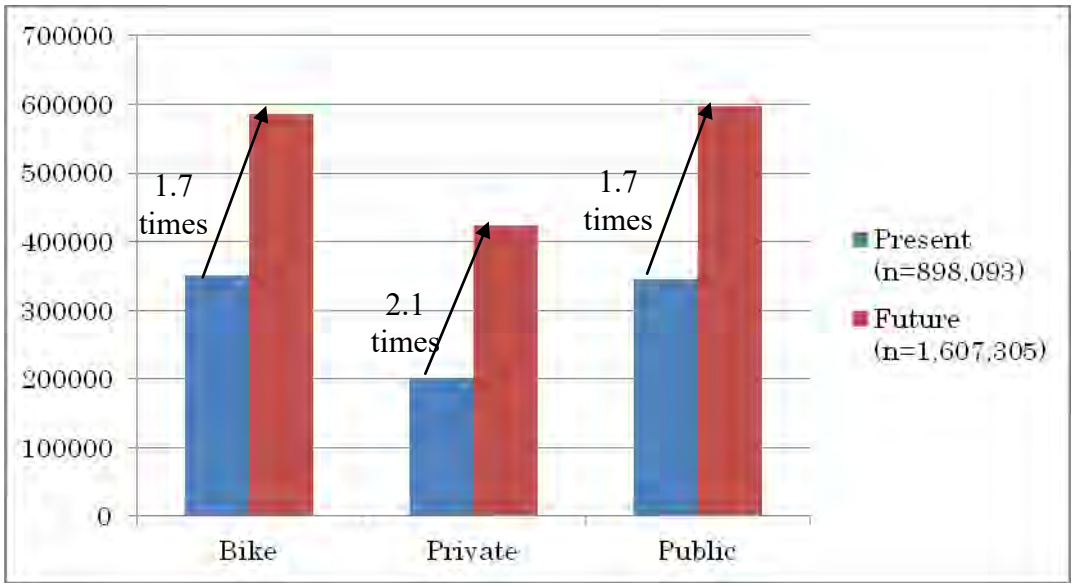
Furthermore, movement volumes between main urban area zones are shown in Figure 10.1.4. Traffic volume between Tibar and Comoro is about six times and between Hera and central business district (CBD) is about four times from present to future. Road improvement between Tibar and Comoro is high priority because there is only one road connecting to Tibar and Comoro at present.



Note: Unit is passenger car unit (PCU)
Source: JICA Project Team

Figure 10.1.4 Traffic Movement Volume Between Main Urban Area at Present (2014) and in the Future (2030)

As shown in Figure 10.1.5 bike and public volume is 1.7 times growth but private is 2.1 times in contrast with 1.8 times growth in total, through focusing attention on process of each modal volume. Therefore, it is nessecary to promote the use of the public transport to restrain private car demand, before rapid increase of private car starts.



Source: JICA Project Team

Figure 10.1.5 Process of Traffic Volume of Each Mode

Taking these results, five cases are forecasted. All forecasted cases are summarized in Table 10.1.1.

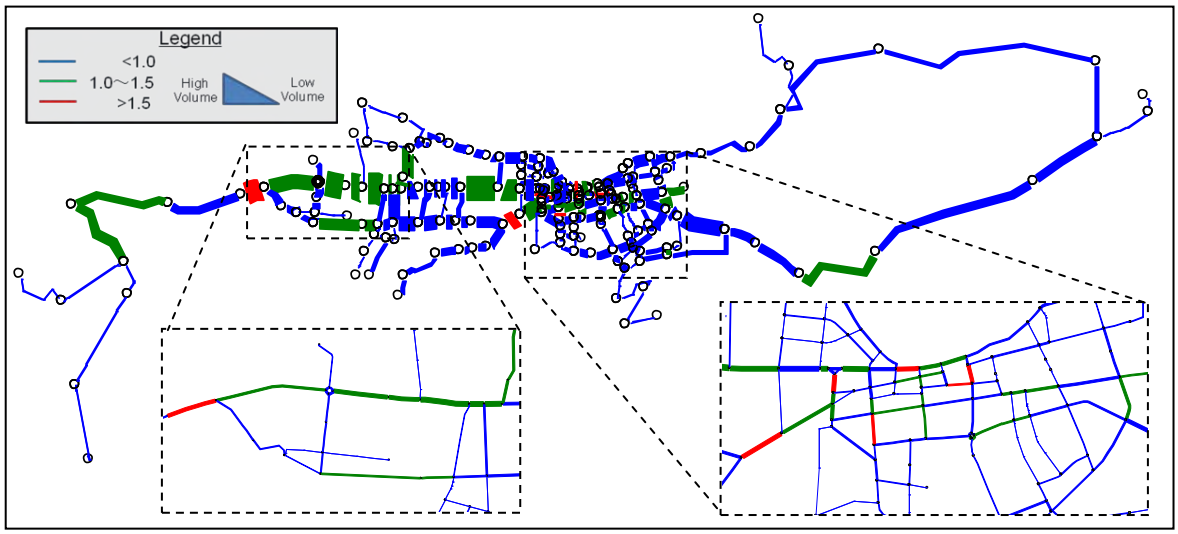
Table 10.1.1 Summary of Forecasted Case

No.	Year	Forecasted Case	Project	Effect of Project Introduction
Case 1	2030	Ongoing project	・Comoro No. 3 is opened ・Maintenance of National Road No.1 ・Maintenance of road between Comoro and Tibar ・Maintenance of road along the Comoro River	・Relief the congestion among urban area, Comoro, and Tibar
Case 2	2030	Do-minimum	・Comoro No.3 is opened. ・The problems of parking and Microlet boarding and alighting are removed. ・Road widening is conducted around near the urban area.	・Relief the congestion among urban area, Comoro and Tibar. ・Relief the congestion at urban area.
Case 3	2030	Bypass project	・Projects of do-minimum case are completed. ・New bypass road is constructed to connect the Tibar to ring road of the city center.	・Remove the through traffic from Tibar to Hera and other cities. ・Relief the congestion at urban area
Case 4	2030	Mass transit project	・Projects of do-minimum case are completed. ・Bus rapid transit (BRT) is introduced through main road.	・To cope with the limitation of road traffic capacity, introduction of public transportation such as BRT that enables transfer of more passengers in fewer number of vehicles, and it supports the urban planning of transit oriented development (TOD). ・Relief the increasing number of private cars
Case 5	2030	Do-maximum	・All projects above are completed.	・Total effect of above four cases.

Source: JICA Project Teams (JPT)

(3) Result of Analysis in Case 1, On-going Project

The result of the analysis in Case 1 is shown in Figure 10.1.6. Congestion of Comoro area is still remaining, nevertheless, partially relieved compared with do-nothing case. Congestion in urban area is still occurring because there is no countermeasure.

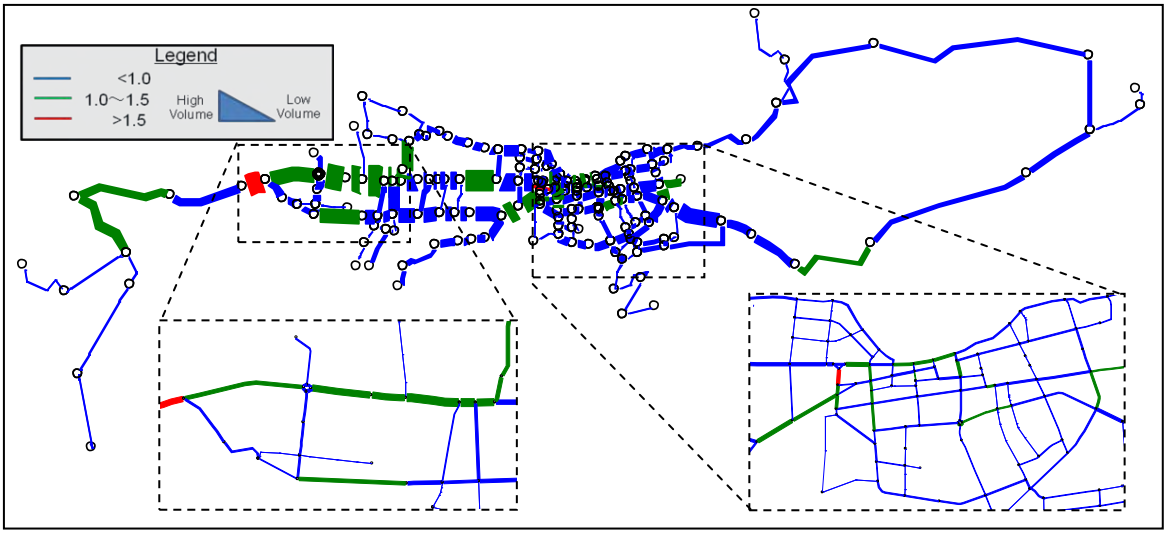


Source: JICA Project Team

Figure 10.1.6 Result of Demand Forecast of Case 1 in 2030

(4) Result of Analysis in Case 2, Do-minimum

The result of the analysis in Case 2 is shown in Figure 10.1.7. Congestion is somewhat relived inside the city center; however, congestion problems still remain along the ring road and around the city center. Serious traffic problems might happen in the near future if the projects considered in this case would not be conducted.

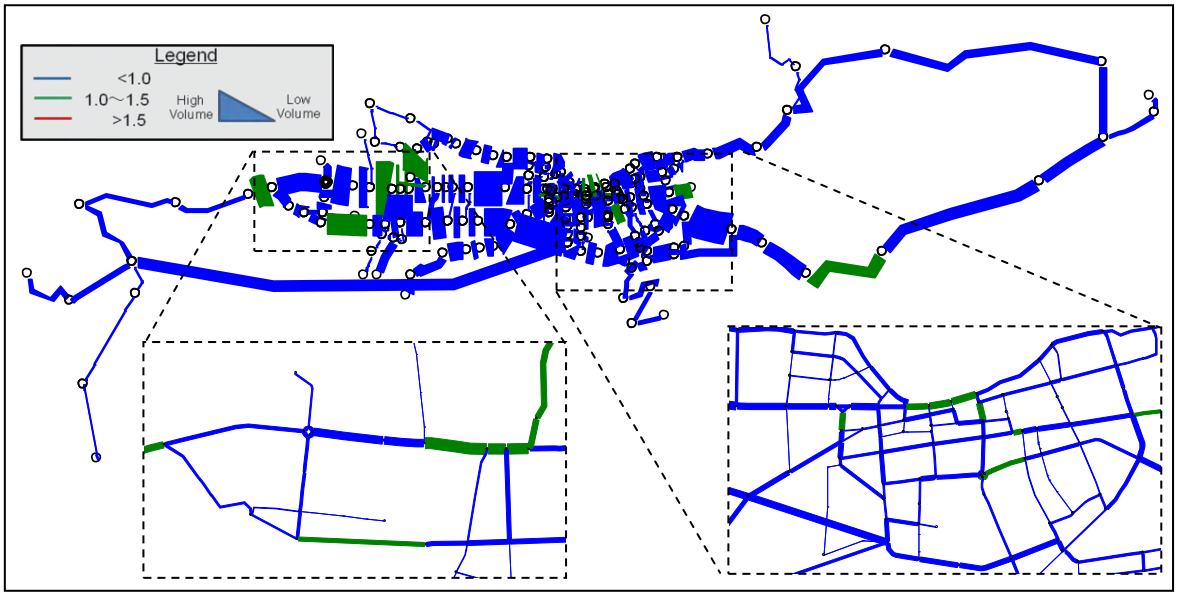


Source: JICA Project Team

Figure 10.1.7 Result of Demand Forecast of Case 2 in 2030

(5) Result of Analysis in Case 3, By-pass Project

The result of the analysis in Case 3 is shown in Figure 10.1.8. Bypass road alignment is settled tentatively from Tibar junction to the ring road. It is consisted of a 10 km two-lane road. In addition, another new road is established from the eastern edge of Banana Road to ring road. In this case, the new bypass roads have big effect on the alleviation of traffic congestion.



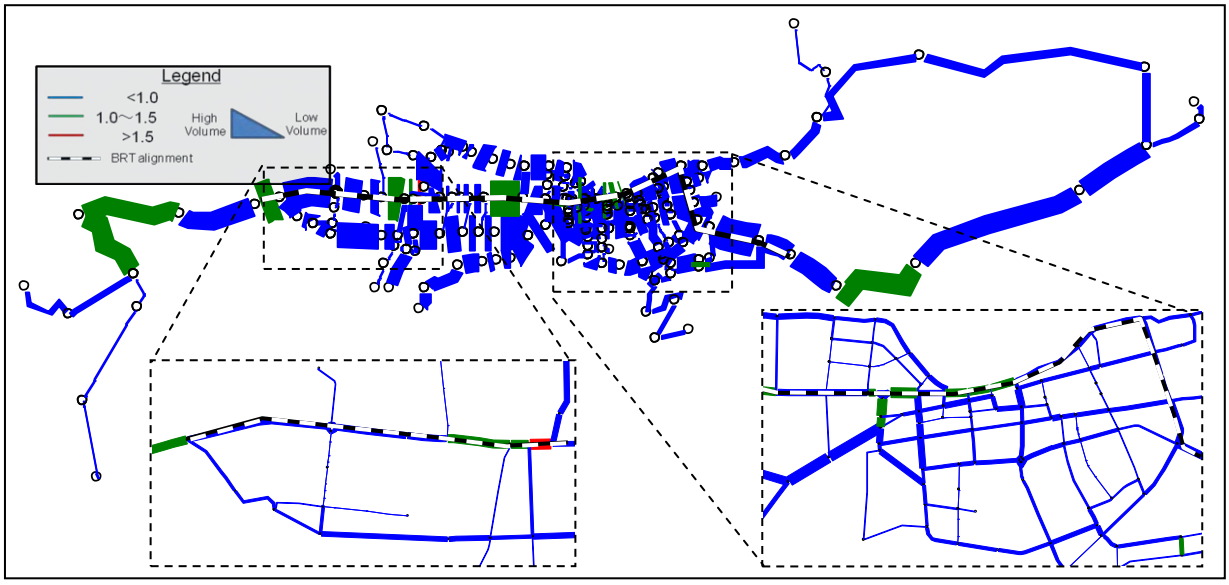
Source: JICA Project Team

Figure 10.1.8 Result of Demand Forecast of Case 3 in 2030

(6) Result of Analysis in Case 4, Mass Transit Project

The result of the analysis in Case 3 is shown in Figure 10.1.9. BRT alignment is settled tentatively for forecasting. Conversion ratio to BRT from motorcycle and private car is 83% and from Microlet is 86% within the area of 500 m from BRT alignment. It indicates a total conversion ratio of 42% from other traffic mode. The result of stated preference survey is utilized to estimate the conversion ratio. Basically, road network capacity decreased due to the occupation of priority lane for BRT.

Considering the above condition, the area around the BRT alignment will contribute to the alleviation of traffic congestion. However, the road of BRT alignment is still congested due to the insufficient road capacity.



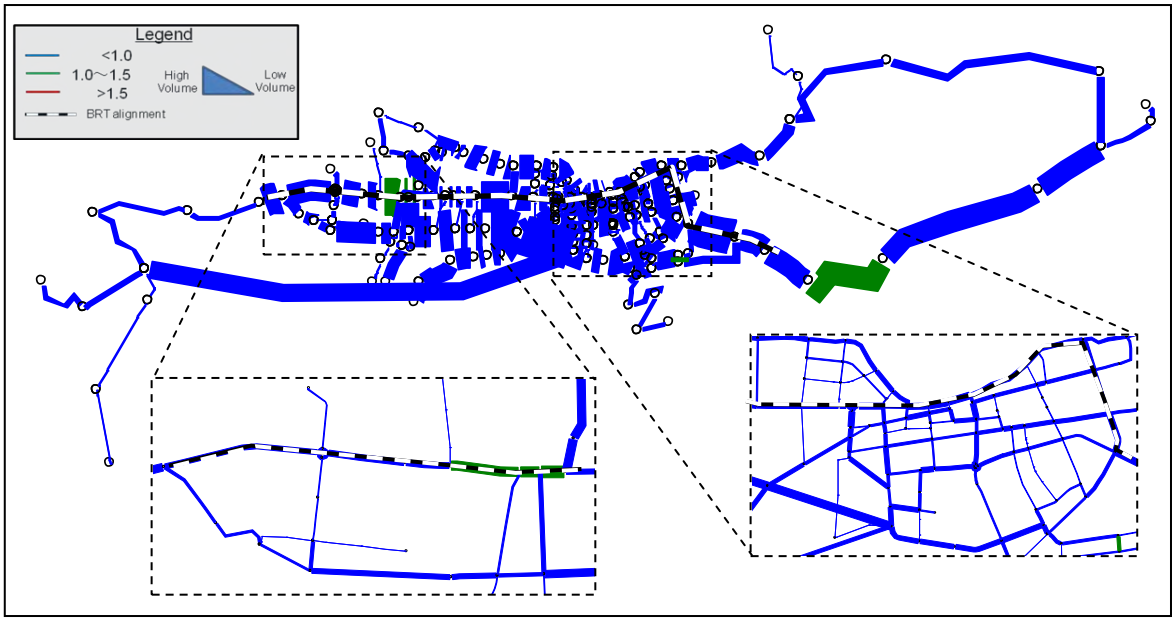
Source: JICA Project Team

Figure 10.1.9 Result of Demand Forecast of Case 4 in 2030

(7) Result of Analysis in Case 5 (Do-maximum)

The result of the analysis in Case 5 is shown in Figure 10.1.10. This case is oriented to realize the strength of connectivity among urban areas, which is proposed by the development concept mentioned after. This case contains all countermeasures such as off-street parking, Microlet boarding and alighting, Comoro No. 3 construction, bypass road, and BRT.

The problems of traffic congestion are obviously solved in this case. Its cost effectiveness should be considered further.



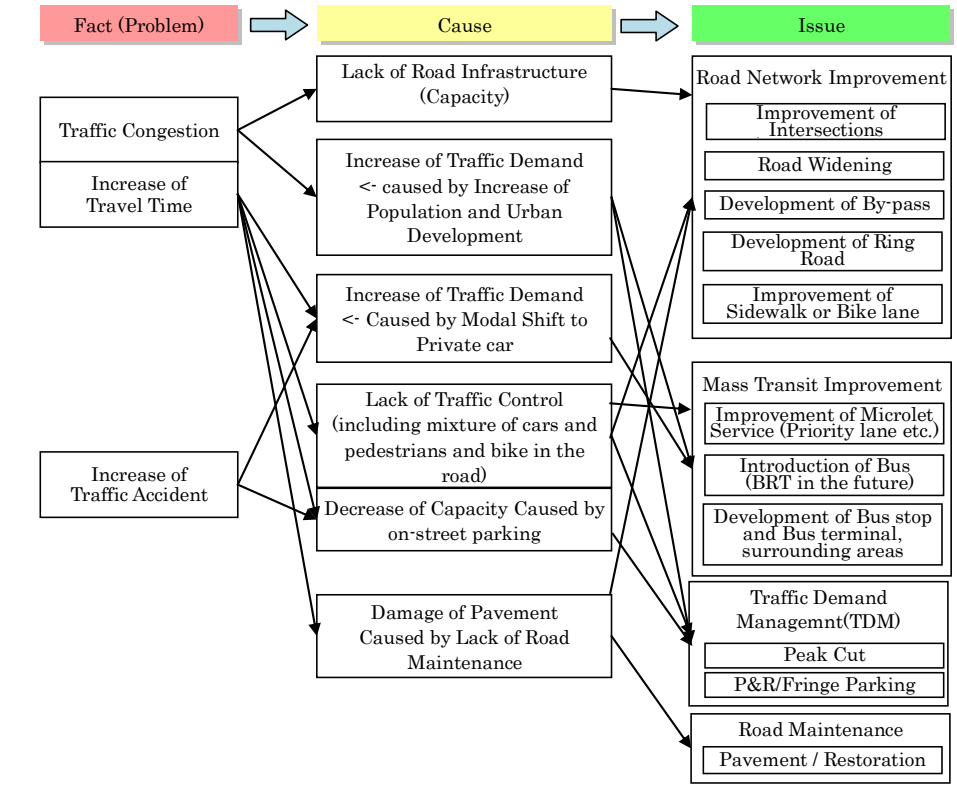
Source: JICA Project Team

Figure 10.1.10 Result of Demand Forecast of Case 5 in 2030

10.1.2 Transport Policy

(1) Problems and Issues

Future problems and issues of transportation sector in DMA are shown in Figure 10.1.11

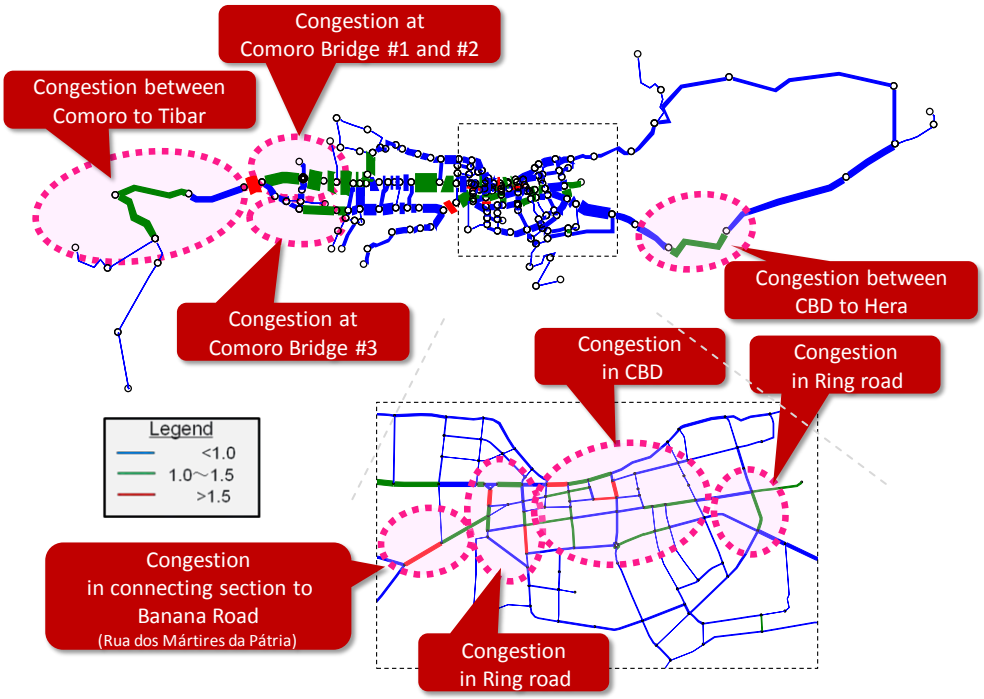


Source: JICA Project Team

Figure 10.1.11 Problems and Issues

The detailed sections of the future traffic congestion are shown in Figure 10.1.12.

As shown in Figure 10.1.12, traffic congestion will be a serious problem not only for CBD but also for outside of it. Typical congestion happens at a connecting section to CBD from Banana Road and a section on national road between Comoro and Tibar areas.



Source: JICA Project Team

Figure 10.1.12 Detail Sections of the Future Traffic Congestion (Based on the Result of Demand Forecast of Case 1 in 2030)

(2) Development Policy

Development policy of the transportation sector in DMA to cope with the future problems and issues of transportation sector are as follows:

- Improvement of the road network and improvement of traffic regulation (such as one-way) to cope with increasing future traffic demand;
- Promotion of usage of mass transit to reduce the traffic volume of private cars and motorcycles (including introduction of BRT development);
- Improvement of mass transit in cooperation with urban development such as the transit oriented development (TOD);
- Securing of smooth traffic and enhancement of safety by developing parking lots; and
- Enhancement of safety by providing smooth traffic and reduction of traffic volume.

Furthermore, Table 10.1.2 shows the target effect indicators in the road and public transportation sectors. The target effect indicators show the capacity and service level of road network and public transportation network of DMA.

Below target is oriented to support the pillars of "robust economic hub" and "high-quality of life" in DMA Vision 2030 by providing smooth and comfortable traffic services.

Table 10.1.2 Effect Indicators of Road and Public Transportation Sector

Sector	Target Effect Indicator (Narrative)	Target Effect Indicator (Quantitative)		Description
		2010 (Base)	2030 (Target)	
Road and Public Transportation	Average travel speed in major road in DMA	More than 20 km/h	More than 20 km/h (maintain the status quo, even in increase of traffic demand)	The travel speed of public transportation (Microlet or bus) will be corresponding to travel speed on major roads in DMA
	Average congestion rate in major road in DMA	Less than 1.0	Less than 1.0 (maintain the status quo, even in increase of traffic demand)	

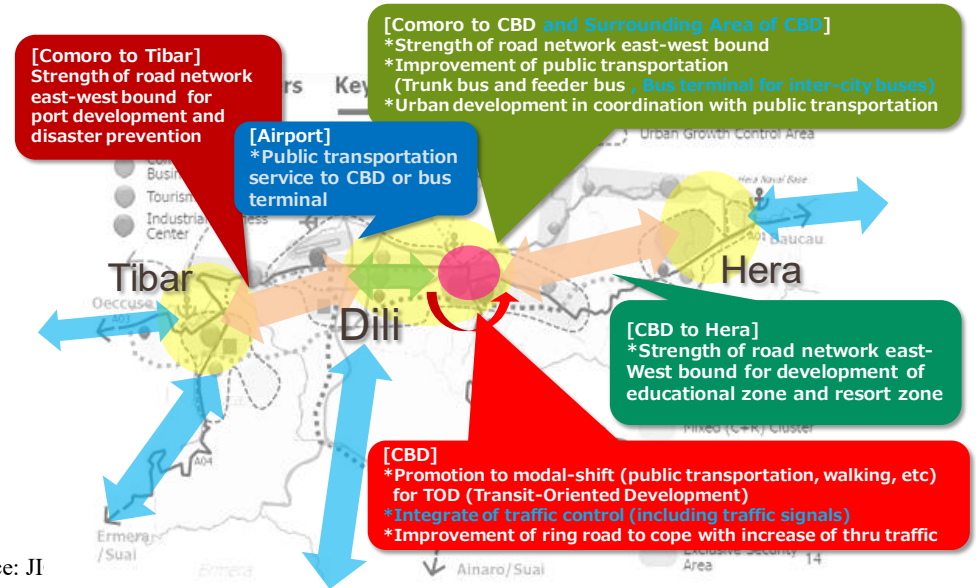
Source: JICA Project Team / Ministry of Public Works, Transport and Communications (MPWTC)

10.1.3 Transport Plan

(1) Conceptual Development Image

The conceptual development image in DMA is shown in Figure 10.1.13.

The development plan shows the relief congestion and support on urban development around public TOD, which maintains the road network corresponding to future traffic demand and connectivity among urban areas, improvement of traffic regulation, and maintenance of public transport.



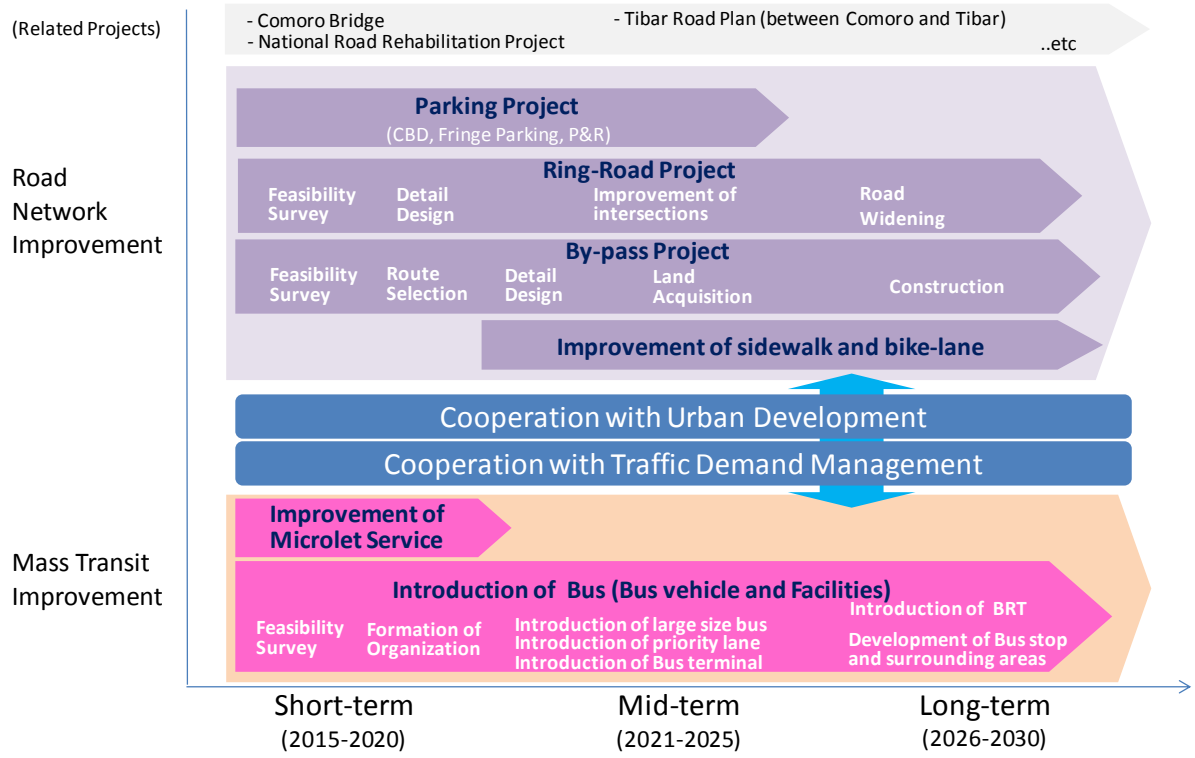
Source: JI

Figure 10.1.13 Conceptual Development Image in DMA

(2) Development Plan and Schedule

The development plan and schedule of the transportation sector in DMA is shown in Figure 10.1.14.

Transportation demand management (TDM) projects, e.g., park and ride, are considered to be introduced to enhance the usage of public transportation and to relieve traffic congestion, corresponding to improvement of road network and parking lots for park and ride (fringe parking), and public transportation network and public transportation facilities such as bus stations and bus terminals.



Source: JICA Project Team

Figure 10.1.14 Development Plan and Schedule

(3) Possible Projects

The possible projects of transportation sector in DMA are shown in Table 10.1.3 and Table 10.1.4, which are based on the development plan and schedule. Proposed project in Table 10.1.3 is based on the analysis cases of Table10.1.1.

Table 10.1.3 Project Long List in Transportation Sector About Road Network Projects

No.	Project	Term			Project Cost (USD)	Possible Fund Source	New Project Proposed by JPT	Assumed Implementation Organization
		Short	Mid	Long				
1	**[Priority Project]** Development of Off-street Parking and Fringe Parking	●	●		USD 13.0 million (in case of 1,000 lots multistory parking)(*1)	PPP or Private	●	DNTT-MPWTC
2	**[Priority Project]** Improvement of Ring Road and Traffic Management in CBD	●	●		USD 19.8 million (in case of improvement of six intersections) (*2)	Public	●	DRBFC-MPWTC
3	**[Priority Project]** Road Widening of Current Road Network Between Comoro and CBD	●	●		USD 15.5 million per km(USD 155 million in case of by-pass length of 10 km)	Public	●	DRBFC-MPWTC
4	New Bypass Development		●	●		Public or PPP	●	DRBFC-MPWTC

Note: Land acquisition cost is not included
Source: JICA Project Team/ Nagano City Department of Construction (*1)/ Osaka Prefecture Department of Urban Developing (*2)

1) Development of Off-street Parking and Fringe Parking

Increase the traffic capacity of streets in CBD by removing vehicles parking alongside the streets, increasing the actual number of street lane, developing off-street parking in CBD, and fringe parking (developing parking in suburban areas or inter-city bus terminal or nearby BRT station in the future and promote to use public transportation those who travel to CBD).

Enhancement in safety of pedestrians and bikes are also expected by decreasing on-street parking. It is desirable to develop sidewalk around parking lots to improve access to destination of the road user.

It is oriented to support the viewpoint of "Sustainability" in DMA Vision 2030, by relieving congestion and enhancing public transportation.

2) Improvement of Ring Road

This project aims the development of CBD and other Dili urban centers such as Tibar and Hera by reducing traffic in CBD, relieving traffic congestion, and providing smooth service. This project includes the improvement of intersection along ring road and road widening of the current narrow section (including improvement of sidewalk or introduction of bike lane corresponding to road widening), and reconsidering of one-way regulation in CBD.

Introduction of traffic control system to the optimization of traffic signal control. Development at suburban area and near BRT station is considered. This Project is oriented to support the viewpoint of "Linkage" in DMA Vision 2030 because of the support of wide movement among DMA and other cities.
The improvement of intersection components includes improving the intersection shape (such as introduction of right-turn lane to avoid vehicles waiting to turn right which interrupts the following vehicle) or improving traffic control (such as introduction of traffic signal and integration to Advanced Traffic Management System in the future).
The objective is that sections reconsidering one-way regulation should be examined by conducting network simulation and coordination with roadside landowners and police.

3) Road Widening of Current Road Network Between Comoro and CBD

This project is aimed at strength of development of CBD and other Dili urban centers such as Tibar and Hera by increasing capacity, relieving traffic congestion and providing smooth service. This Project includes road widening of "Rua dos Martires da Patria" (connecting Banana Road and ring road) and improvement of sidewalk or introduction of bike lanes corresponding to road widening.

This project also includes improving existing intersection shape (such as introduction of right-turn lane to avoid vehicles waiting to turn right which interrupts following vehicle) or improving traffic control (such as improvement of optimal traffic signal to traffic condition and integration to Advanced Traffic Management System in the future).

This project is oriented to support the viewpoint of "Linkage" in DMA Vision 2030 because of the support of wide movement among DMA and other cities.

4) New Bypass Development

This project aims to strengthen the development of CBD and other Dili urban centers such as Tibar and Hera by developing new route. One of the possible routes is the utilization of existing Banana Road (development of shortcut route between Banana Road and ring road (Estrada De Balide) in cooperation with land readjustment and urban development), and another possible route is developing the new bypass between Tibar junction to ring road that will pass through the mountainous areas and may include tunneling work.

This project is oriented to support the viewpoint of "Linkage" in DMA Vision 2030 because of support of wide movement among DMA and other cities.

5) Improvement of Tibar Road Between Tibar and Comoro

Heavy traffic is eliminated through a new road from Tibar Junction to ring road in order to relieve congestion at CBD, Nicorau Lobaute Road and Comoro No.3 Bridge. This project is oriented to support the viewpoint of "Linkage" in DMA Vision 2030 because of the support of wide movement among DMA and other cities. In addition, this project is also oriented to support "Resilience" in DMA vision. This project will increase accessibility of inter-city bus (from bus terminal) and inter-city cargo vehicles from DMA to other major cities.

Table 10.1.4 Project Long List in Transportation Sector About Public Transportation Projects

No.	Project	Term			Project Cost (USD)	Possible Fund Source	New Project Proposed by JPT	Assumed Implementation Organization
		Short	Mid	Long				
5	**[Priority Project]** Improvement of Mass Transit (including development of mass transit facilities)	●	●	●	20,000 USD per vehicle (in case of introduction of large size bus) (*1) 24.0 USD million (in case of introduction of length of 10 km BRT)	Public or PPP	●	MPWTC DRBFC

Note: Land acquisition cost is not included
Source: JICA Project Team/ Yokohama City Road and Highway Bureau(*1)

6) Improvement of Mass Transit

To promote usage of public transportation (currently, its service is provided by Microlet) and mitigate modal-shift to private car, improving of mass transit is essential. It is oriented to support the viewpoint of "Sustainability" in DMA Vision 2030 by relieving congestion and enhancing public transportation.

The cooperation with urban development around mass transit corridor and around mass transit terminals should be considered as TOD corresponding to the improvement of mass transit.

The components of this project are as follows:

- Improvement of Microlet Service Including the Development of Related Facilities

To promote usage of Microlet and mitigate modal-shift to private car, improving the Microlet bus service such as improvement of bus stops (improvement of waiting space and introduction of roofs and benches in bus stops) and information provision for passengers such as bus route map.

- Formation of Public Transportation Organization

Forming new organization to control and operate public transportation such as Transportation Bureau or bus operator company should considered participation of existing Microlet operators or owners.

- Introduction of Bus Terminal (or improvement of existing bus terminal)

To provide better service to inter-city passengers and to cope with the increase in inter-city bus demand, introduction of new bus terminals or improving existing bus terminals should be done. To correspond with the introduction/improvement of bus terminal, new access transportation mode to CBD such as Microlet, large size bus, BRT is considered to be introduced. Additionally, introduction of functions for passengers such as waiting area, ticket booth, shops and restaurants, and parking areas are considered to be introduced inside the bus terminal or the surrounding areas of the bus terminal to correspond with redevelopment.

- Introduction of Priority Lane for Public Transportation

To assist smooth operation of public transportation (for Microlet and for large-sized bus in the future), priority lane for public transportation in existing street such as Avenida Presidente Nicolau Lobato will be assigned. In addition, priority signal is considered to be introduced in order to pass public transport as priority.

- Introduction of Large-sized Bus

To mitigate congestion in Microlet vehicle and to increase capacity, introducing large sized bus vehicle (approximately three times the capacity per one vehicle in comparison with the existing Microlet vehicle). The introduction of large size bus will contribute in enhancing comfortableness of passengers and mitigate traffic congestion by reducing traffic volume.

- Introduction of BRT

BRT facilities will be developed after forming public transportation organization and introduction of large-sized bus and priority lane. This project includes development of BRT stations, including station traffic square to assist transfer to feeder traffic mode such as feeder Microlet service, and pedestrian bridges across BRT street to enhance safety of BRT passengers and crossing pedestrians, and improvement of exclusive lane for BRT bus vehicle from priority lane and bus priority signals.

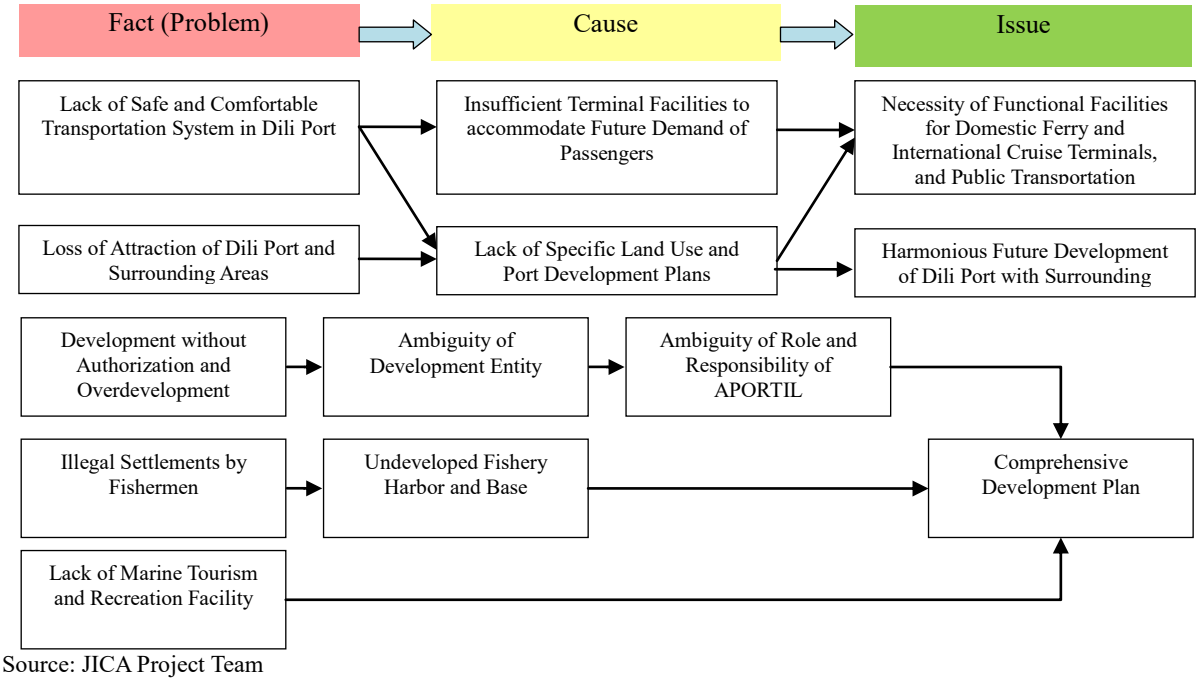
10.2 Seaport

10.2.1 Demand and Gap Analysis

This seaport sector plan is prepared based on the premise that the Tibar New Port will be constructed in line with the proposed construction schedule by PPP scheme and all cargoes will be transferred to the Tibar New Port gradually from 2018 and will be completed by 2020 except the passengers who are accommodated in the existing Dili Port. It is recommended that Dili Port be converted to a dedicated "Passenger Terminal" with international cruise and domestic ferry terminals.

"Fact-Cause-Issue" table in Figure 10.2.1 shows the flow of the problem-solving process for the seaport sector has been prepared. The current terminal facilities of Dili Port cannot accommodate the future demand of passengers. Accordingly, a domestic ferry terminal, international cruise terminal, and public transportation terminal need to be constructed.

In addition, specific land use plan and development plan for Dili Port and the surrounding areas are not yet prepared. Harmonious future development of Dili Port with surrounding areas is necessary.



Source: JICA Project Team

Figure 10.2.1 Problems, Causes, and Issues

10.2.2 Port Policy

Efficient land use is required at Dili Port and the coastal area near the port after main logistic functions are transferred to Tibar Port. The following policies are recommended. The related target effective indicators are shown in Table 10.2.1.

(1) Future Development of Dili Port

Ferry Terminal will connect Dili Port with enclave Oecusse and Atauro Island, the cruise terminal with neighboring countries, and the comprehensive bus terminal with the whole area of Timor-Leste. These projects will greatly contribute to the development of the national economy. Accordingly, this development plan is oriented to support the pillar of "Robust Economic Hub" in DMA Vision 2030.

(2) Waterfront Redevelopment of Coastal Area

The development of the waterfront will be closely linked to the urban development structures. Therefore, the new redevelopment plan will be evaluated highly from the view-point of national welfare and health as it is consistent with DMA Vision 2030, which stresses "High Quality of Life" and "Healthy and Eco-friendly Society".

Table 10.2.1 Effect Indicators of Seaport Sector

Sector	Target Effect Indicator (Narrative)	Target Effect Indicator		Description
		2010 (Base)	2030 (Target)	
Seaport	Development of ferry berth at Dili Port	0 berth	3 berths	
	Development of cruise berth	0 berth	1 berth	
	Development of comprehensive bus terminal and car parking area	none	developed	
	Waterfront redevelopment of coastal area near Dili Port	none	developed	

Source: JICA Project Team

10.2.3 Port Development Plan

(1) Development Plan of Dili Port

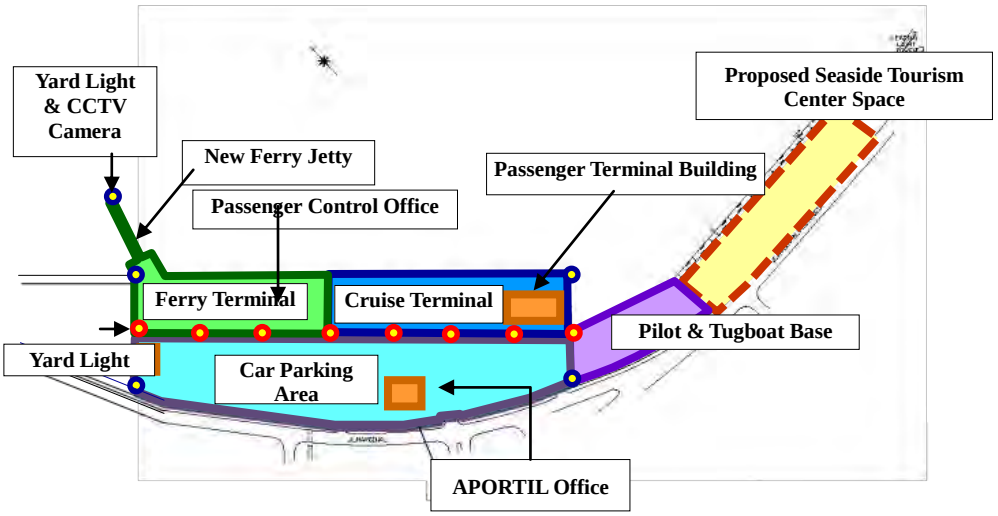
1) Long List of the Projects

Project list of seaport sector and image of seaport sector development project are shown in Table 10.2.2 and Figure 10.2.2, respectively.

Table 10.2.2 Project List of Seaport Sector (1)

No.	Project	Term			Project Cost (USD million)	Possible Fund Source	New Project Proposed by JPT	Possible Execution Agency
		Short	Mid	Long				
1	**[Priority Project]** Domestic Ferry Terminal and Other Related Facilities Project	●	-	-	10.50*	Public	-*	MPWTC (APORTIL)
2	**[Priority Project]** International Cruise Terminal and Other Related Facilities Project	●	-	-	3.00	Public	●	MPWTC (APORTIL)
3	**[Priority Project]** Comprehensive Bus Terminal and Other Related Facilities Project	●	●	-	3.90	Public	●	MPWTC (APORTIL)
4	Development of Security Facilities and System Project	●	-	-	2.23	Public	●	MPWTC (APORTIL)
5	Pilot and Tugboat Base Development Project	●	-	-	-	Public	●	MPWTC (APORTIL)
6	Seaside Tourism Center Construction Project	●	●	●	-	PPP	●	MPWTC (APORTIL)

*) A part of this project will be funded by JICA grant (USD 8.5 million).
Source: JICA Project Team



Source: JICA Project Team

Figure 10.2.2 Image of Seaport Sector Development Project

2) Outline of Each Priority Project

i) Domestic Ferry Terminal and Other Related Facilities Project

This project, which is designed to meet the needs of a new ferry operation, includes the rehabilitation of No. 5 and No. 6 berths, conversion of the existing transshipment shed to a new passenger control office, and construction of a new jetty.

Through this project, a robust domestic ferry network will be established in Timor-Leste which complements the concept of "Linkage", which is one of the pillars of DMA Vision 2030. Furthermore, 3-ferry operation system needs an efficient and effective management. Accordingly, it will be important to develop "Human Resources", which is another key concept of the vision.

ii) International Cruise Terminal and Other Related Facilities Project

This project is consisted of international cruise terminal and passenger terminal building.
International cruise terminal will be created together with the rehabilitation of No.1 to No.4 berths while the existing passenger terminal building will be refurbished. New government offices such as customs, immigration, and quarantine will be located in the newly refurbished passenger terminal building.

Through this project, Timor-Leste will be linked with foreign countries by the international cruise vessels which again support the concept "Linkage" contained in the Vision.

iii) Comprehensive Bus Terminal and Other Related Facilities Project

This project is consisted of a comprehensive bus terminal, taxi and vehicle parking area, and Administração dos Portos de Timor-LesteAPORTIL) Office.
Comprehensive bus terminal will be a land-sea node to connect the whole area of Timor-Leste in the future. Remodeling of the existing stacking place of 40' containers and demolishing of existing warehouses, leveling of land, new paving and traffic marking, are necessary.
The existing APORTIL Office will be refurbished and modernized.

Through this project, Dili Port will become a land-sea node which connects whole areas of the nation and foreign countries, which again coincides with the viewpoint of "Linkage" mentioned above. Furthermore, this project involves the development of a new long-distance bus system which requires the development of "Human Resources".

iv) Development of Security Facilities and Systems Project

This project is consisted of installation of yard lights, and closed-circuit television (CCTV) cameras for the new ferry and cruise terminals, and construction of a new security station which will be used to control security at the port.
A security system which complies with the International Maritime Organization (IMO)/ International Ship and Port Security (ISPS) Code is essential for an international port.

As this project is vital to the success of the projects mentioned above, i) and ii), it is consistent with the goals of the Vision.

v) Pilot and Tugboat Base Development Project

Tugboat service is compulsory to ensure the safety of cruise vessels' arrival and departure. Therefore, this project is to develop the pilot and tugboat base to the east of the international cruise terminal. This project is also consistent with the goals of the Vision.

vi) Seaside Tourism Center Construction Project

This Seaside Tourism Center will be constructed in the vacant lot of 20-container stacking yard. It is necessary for Dili Port to become a tourism center in the future. There is a possibility that this project can be conducted under a PPP scheme. Tourism center will contribute to the promotion of the tourism industry including eco-tourism and thus incorporates "Sustainability", one of the key concepts of the Vision.

(2) Waterfront Redevelopment Plan of Coastal Area

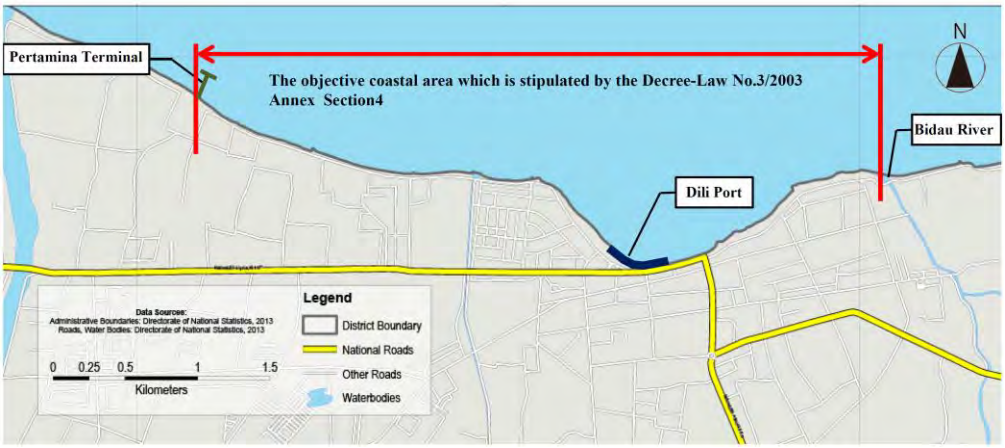
1) Long List of Projects

The objective coastal area of the waterfront redevelopment plan is shown in Figure 10.2.3. The target area under the jurisdiction of APORTIL is stipulated in the Decree-Law No.3/2003 Annex Section 4 (Area of Jurisdiction). Table 10.2.3 shows another list of projects of the seaport sector.

Table 10.2.3 Project List of Seaport Sector (2)

No.	Project	Term			Project Cost (USD million)	Possible Fund Source	Possible Execution Agency
		Short	Mid	Long			
1	Formulation of Waterfront Redevelopment Plan of Coastal Area	●	-	-	-	Public	MPWTC (APORTIL)

Source: JICA Project Team



Source: JICA Project Team

Figure 10.2.3 Objective Coastal Area for Waterfront Redevelopment

2) Outline of Each Priority Project

i) Formulation of Waterfront Redevelopment Plan of Coastal Area

This project is consisted of formulating a comprehensive development plan of the coastal area. The long-term national policy shall be reflected in the plan. This project will contribute to the enhancement of the health of citizens and visitors, thus, supports the concept of "Sustainability".

10.3 Airport

10.3.1 Demand and Gap Analysis

(1) Historical Air Traffic

The Presidente Nicolau Lobato International Airport (PNLIA) accounts for the 187,282 passengers and 5,208 times aircraft movement in 2013 and its past five years statistics are shown in Table 10.3.1.

Table 10.3.1 Air Traffic Statistics (2008 to 2013)

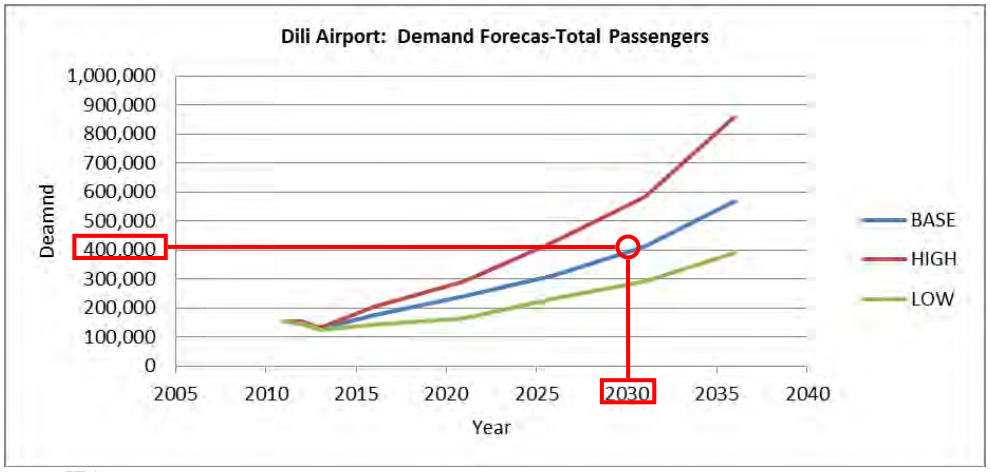
	2008	2009	2010	2011	2012	2013	2013 - 2008
Passenger Volume	97,807	125,722	149,962	151,488	179,493	187,282	+ 89,475
Aircraft Movement	3,328	4,056	4,980	4,150	4,474	5,208	+ 1,880

Source: MPWTC

The increased passenger volume was recorded at 89,475 during the five years from 2008 to 2013 and its index is almost doubled (1.9 times).

(2) Air Traffic Demand Forecast

Air traffic demand forecast have been prepared under the International Finance Corporation (IFC) project as shown in Figure 10.3.1 based on the historical data and economic growth rate. IFC estimated the passenger traffic to reach over 400,000 in 2030 and to reach around 500,000 in 2036, which means more than double of 2013 volume.



Source: IFC

Figure 10.3.1 Traffic Demand Forecast (Passengers)

The study team of Timor-Leste Transport Sector Master Plan of the Asian Development Bank (ADB) (hereinafter referred to as "ADB Team") reviewed the aviation sector forecast based on the IFC forecast. The passenger volume in 2030 is forecasted 500,000 based on the evaluation of 4.0% and 5.7% of compound average growth rate (CAGR) as shown in Table 10.3.2.

Table 10.3.2 Comparison of Passenger Forecast between IFC and ADB Team

Year	Forecasted 2012 (IFC)	Reviewed in 2014 (ADB Team)
2015	150,000	200,000
2020	230,000	250,000
2025	300,000	350,000
2030	400,000	500,000

Source: IFC, ADB Team

The JPT conducted the simulation based on population and gross domestic product (GDP) of their demand forecasts which is viable because IFC carried out the forecast based on economic growth, tourism growth, and other factors.

The passenger volume in 2030 will reach more than double of the current number in Timor-Leste. Presently, the capacity of existing airport facility has been already exceeded and has suffered inadequate operations in arrival of aircraft at the terminal building due to the narrow space which was described in Clause 4.3.

However, the airport facilities of PNLIA are necessary to improve/develop related land side facilities such as passenger terminal building, land side road, and car parking.

Also, PNLIA is necessary to the staging development to take into account the future demand forecast and view point of the international regulation. The existing location of the terminal area should be shifted around 50 m to south. Air side facilities such as runway, taxiway, and parking apron need improvement due to the inadequate physical characteristics regarding safety requirement to meet the international standards and considering future aircraft movements in 2030 together with the normal operations of large aircraft to reach key destinations.

The JPT recommended relocation of land side facilities such as terminal area and access roads and to add the parallel taxiway for flexibility for future expansion.

10.3.2 Airport Policy

(1) Development Policy

The Government of Timor-Leste established the Strategic Development Plan (SDP) 2011-2030 and prepared the policy at "Overview and Challenges" and "Strategy and Actions" for airports sector and main features of PNLIA listed below.

- Runway expansion to 2,500 m long and 45 m width to host large aircraft such as the Airbus 330; and
- Construction of the modern new terminal facility.

Also, the government prepared short-term, medium-term, and long-term plan for airport sector as shown in Table 10.3.3.

Table 10.3.3 Airport Sector of Strategic Development Plan

Policy	2015 Short-term	2016 to 2020 Medium-term	2021 to 2030 Long-term
To meet the future demand for all traffic and boost key industry sectors, the study team will expand international airport and build a network of district airports	The PNLIA Master Plan will have been completed, including new terminal facilities and a longer runway A commercially-oriented airport authority will be managing PNLIA	PNLIA will be a modern international standard airport with a capacity to handle over one million passengers per year	N/A

Source: Timor-Lest Strategic Development Plan

The development of PNLIA is not only the resolution of current issues and problems but also the contribution to related Pillars of Vision such as "Robust Economic Hub." Particularly, the development of PNLIA where it is located in the capital city and gateway of the overseas countries is considered "Linkage" to realize DMA Vision 2030.

The JPT particularly established the policy for PNLIA development as "Safe and Comfortable Airport" in accordance with the International Civil Aviation Organization (ICAO) standards and secure the appropriate service level under the International Air Transport Association (IATA) manual.

According to IATA Airport Development Reference Manual (ADRM), the level of service is considered as a range of level of service measures from A to F as shown in Table 10.3.4.

Table 10.3.4 Passenger Terminal Facilities Level of Service Framework

Service Level	Description
A	An excellent level of service, conditions of free flow, no delays, and excellent levels of comfort.
B	High level of service, conditions of stable flow, very few delays, and high levels of comfort.
C	Good level of service, conditions of stable flow, acceptable delays, and good levels of comfort.
D	Adequate level of service, conditions of unstable flow, acceptable delays for short periods of time, and adequate levels of comfort.
E	Inadequate level of service, conditions of unstable flow, unacceptable delays, and inadequate levels of comfort.
F	Unacceptable level of service, conditions of cross-flows, system breakdowns, and unacceptable delays; an unacceptable level of comfort.

Source: IATA ADRM

(2) Target Effect Indicators

The target effect indicators of PNLIA development is set in Table 10.3.5.

Table 10.3.5 Target Effect Indicator of Airport Sector

Sector	Target Effect Indicator (Narrative)	Target Effect Indicator (Quantitative)		Description
		2010 (Base)	2030 (Target)	
Airport	Passenger volume	150,000	500,000	ADB Team forecast
	Runway strip (m) (Runway length)	1,970 x 150 (1,850 x 30)	2,620 x 300 (2,100 x 45)	ICAO Annex 14
	Terminal service level	E	C	IATA ADRM

Source: JICA Project Team

Currently, ADB Team is conducting transport master plan including airport sector. ADB Team prepared the master plan of which 2,050 m long runway expansion for urgent development plan coordinated with Timor-Leste government officials.

10.3.3 Airport Development Plan

The Stage 1 project which was prepared by IFC is runway extension to 2,100 m in Figure 4.3.6. This is a reasonable plan considering optimized land area and less land acquisition and resettlement. However, it is not enough to normal operation for designated aircraft such as A320 and B737-800. Therefore, IFC proposed further runway extension to 2,500 m as Stage 2 in Figure 4.3.7 and Figure 4.3.8. Also, Table 10.3.6 shows the periodical term plan such as short-term, mid-term, and long-term. Development plan and list of projects of airport sector are summarized in Table 10.3.6 and Table 10.3.7, respectively.

Table 10.3.6 Development Plan of Airport Sector

Period	Short-Term	Mid-Term	Long-Term
	to 2020	2021 to 2025	2026 to 2030
Project	PNLIA Development Project 1 - Runway extension 1 (2,100 m) - Passenger terminal development 1 (Passenger terminal, security equipment, CIQ equipment)	N.A	PNLIA Development Project 2 - Runway extension 2 (2,500 m) - Passenger terminal development 2 (Passenger terminal, cargo terminal, commercial facilities)

Source: JICA Project Team

Table 10.3.7 Long List of Projects of Airport Sector

No.	Project	Term			Project Cost (USD million)	Possible Fund Source	New Project Proposed by JPT	Possible Execution Agency
		Short	Mid	Long				
1	**[Priority Project]** PNLIA Development Project 1	●			100*	Public	-	AACL (MPWTC)
2	PNLIA Development Project 2			●	100*	Public	-	AACL (MPWTC)

*) Estimated by JPT based on the IFC project
Source: JICA Project Team

(1) PNLIA Development Project 1

Currently, PNLIA has several plans by IFC and ADB. Therefore, it is necessary to update those plans including feasibility study for PPP scheme and evaluation of prioritization study for projects 1 and 2.

The scope of the works of the study is as follows:

- Demand forecast
- Preliminary design of airport facilities
    - Air side: Airport civil facilities including runway extension (2,050 m/2,500 m) and related taxiway and aircraft apron stand and their pavement improvement.
    - Land side: Airport building facilities including passenger terminal building with security and CIQ equipment, land side roads, and car parking
    - Air navigation system especially airport lighting system and facilities
- Control tower and operation building
- Public utilities such as water supply, sewerage disposal supply, power supply, and solid waste disposal system

Based on the prioritization of PNLIA above, PNLIA Development Project 1 will be conducted. The major scope of works is the 250 m extension runway for the 2,100 m total and terminal area improvement works.

(2) PNLIA Development Project 2

Based on the prioritization of PNLIA actual plan, PNLIA Development Project 2 will be conducted. However, the extension runway length will meet the normal international flight operation such as no weight limitation. Also the scope of works consist of airport civil facilities, expansion passenger terminal building, cargo terminal, airport administration building facilities, air navigation system, and public utilities.

CHAPTER 11 : URBAN INFRASTRUCTURE DEVELOPMENT PLAN

11.1 Disaster Management

11.1.1 Demand and Gap Analysis

Timor-Leste is highly vulnerable to natural disasters such as floods, strong winds, landslides, droughts, cyclones, earthquakes, and tsunamis. Based on the disaster records of DesInventar* in Dili the frequent natural disasters are floods, strong winds, and landslides and the disaster management is indispensable to cope with them. But earthquake and tsunami are also to be considered as possible natural disasters that require preparedness.

Disaster management is aiming to establish a disaster risk management system for the Dili Metropolitan Area (DMA) in order to reduce natural disaster risks and to build the basis for the four viewpoints (linkage, human resources, sustainability, and resilience) of the development vision of DMA.

Note: Disaster Inventory System of the effects of disasters supported by UNISDR, UNDP and others.*

(1) Disaster Risk Management

Timor-Leste developed the National Disaster Risk Management Policy (NDRMP) in 2008 in accordance with the Hyogo Framework for Action 2005-2015. The policy takes a multi-hazard approach, which is designed to deal with the Disaster Risk Management (DRM) of all hazards and protects the security and safety of lives and assets from the natural and human-induced disasters. The NDRMP also includes the Climate Risk Management (CRM) as well as DRM.

According to the NDRMP, DMA, which is composed of a part of Dili Municipality and Tibar Suco of Liquicia Municipality, should establish the Disaster Management Committee (DMC) at each level of municipality, administrative posts, and suco. The Dili Municipality has established DMC at Dili Municipality, six administrative posts and at 31 sucos. Liquicia Municipality has established DMC at Liquicia Municipality itself, Bazartete Administrative Post, and at Tibar Suco.

(2) Disaster Preparedness

DMA is the nation's capital and center of politics, economics, and culture in the country; and due to the NDRMP, DMA should have a disaster preparedness plan which includes early warnings and emergency response plans against natural disasters. However, the confirmation study on hydro-meteorological and geological hazards, risks, and vulnerabilities has not been conducted yet. The hazards, risks, and vulnerabilities assessment should be conducted at the suco level for DRM.

The area is prone to natural disasters. In the current situation of NDRM, emergency responses have been conducted both at national level and municipal level, but the preparedness plans have not been prepared yet. Some hazard maps (e.g., earthquake, tsunami, and landslide) have been prepared at national level, but an early warning system, which is one of the most effective disaster risk reduction measures, has not been established yet because there are not enough hydro-meteorological/geological observation facilities as well as not enough technical staff for the analysis of hydro-meteorological/geological data. Also, no proper dissemination system has been established not only at Dili Municipality but also at the sub districts and sucos levels.

(3) Structural Measures

The urban areas of Dili, Hera, and Tibar are located in the coastal plains where several rivers are passing through and causing floods. The river channels in Dili urban area have already been improved and provided with flood control works such as levees, concrete walls, and check dams; and assessed to have discharge capacities larger than discharges of the 25-year return period flood by the drainage master plan (DMP), but the river channels seem to have problems needed to be solved.

The other rivers in Hera and Tibar are not improved. There are no flood control works except protection works for roads so floods occur almost every year.

The river basins are small scale with areas from 6.0 to 31.2 km^2. The catchment areas are mostly composed of steep mountains with poor forest cover, so the river basins need to be assessed from the river basin management aspects and needs flood and sediment control measures.

Most of the houses and buildings in the urban area are assumed to be vulnerable to strong winds and earthquakes and require reinforcements.

11.1.2 Disaster Risk Management Policy

(1) National Policy for DRM

In the NDRMP, the following specific policies are stated as strategic activities for DRM.

1) Specific Policy 1: Hazard and Vulnerability Monitoring and Analysis

2) Specific Policy 2: Regional Early Warning Monitoring and Analysis

3) Specific Policy 3: Emergency Disaster Reporting and Communication to the Public

4) Specific Policy 4: Principles and Responsibilities for Effective Early Warning

The specific policies should be followed by DRM as basic policies.

Based on the specific policy, “Effective Indicators” for penetration of the NDRMP are considered as follows:

- Public awareness on hazards, risks, and vulnerability to natural disasters is an indicator for national and local risk assessment. As the basis of the regional disaster risk management, relevant information on disasters should be known at all levels.

- Regional early warning systems are effective indicators for disaster risk reduction (DRR) and for safety. Effective warning systems require proper monitoring systems of hydro-meteorological and geological events and data analysis.

- Functions and responsibilities of each ministries and agencies should be clearly determined, which are effective indicators of activities in disaster preparedness and emergency response plans.

Table 11.1.1 shows the target effect indicator for disaster management. These indicators are related with the pillar of "High Quality of Life" in DMA Vision 2030.

Table 11.1.1 Effect Indicators of Disaster Management

Sector	Target Effect Indicator (Narrative)	Target Effect Indicator		Description
		2010(Base)	2030(Target)	
Disaster Management	Public awareness of hazards, risks, and vulnerability to natural disasters	Almost no awareness about hazards, risks and vulnerability to natural disasters because of no accurate information through public education.	Most people have raised awareness about hazards, risks, and vulnerability to natural disasters and are able to protect themselves from natural disasters.	Identification and public educations of hazards, risks, and vulnerability are effective to raise public awareness about natural disasters and to promote DRM at the community level.
	Regional early warning systems	No early warning system for natural disasters has been established yet	Regional early warning systems for natural disasters are to be established.	By establishment of early warning systems, losses of human lives and assets are possible to be reduced.
	Functions and responsibilities of each ministries and agencies	Functions and responsibilities are not clearly stated in the policy and any action plan for DRM has not been prepared yet.	All ministries and public sectors have prepared action plans for DRM and executed them to protect infrastructure, lifelines, and people from natural disasters.	By attaining a main streaming of DRM, the public facilities and public sectors will be prepared against natural disasters.

Source: JICA Project Team

(2) Development Policy for DRM in DMA

There is a need to develop and strengthen national capacities to manage natural disasters as well as disasters and emergencies caused by human beings.

In this regard, institutional development and capacity development of technical staff members are priority demands that require special attention. Improving disaster risk management as well as training and building the capacity of technical staff at national level is required.

The following improvements are development policy for disaster management and should be required for Disaster Risk Management (DRM).

1) To promote main streaming of DRM for every sectors;

2) To prepare clear functions and responsibilities of line ministries and agencies and each line ministry and agency should develop its action plan;

3) To strengthen the institutional and technical capacities at the national level in order to carry out the DRM responsibilities;

4) To establish monitoring systems for hydro-meteorological and geological hazards, and there may be required to install real time observation facilities for early flood warning; and

5) To develop the capacities of technical staff of the Ministry of Public Works to cope with hydro-meteorological for weather forecasting and early warning for tropical storms and floods.

11.1.3 Disaster Risk Management Plan

(1) Points to be addressed for DRM in DMA for

The points to be considered for DRM in DMA are the following:

(National Level)

1) To support Dili Municipality and Liquicia District for preparation of their preparedness for DRM;

2) To introduce river management systems to control the sand/gravel mining activities and housing in the river area;

3) To introduce technical standards for river structures to increase the stability of river structures;

4) To introduce building code to ensure human safety and welfare, including resistance to collapse and damage caused by anticipated strong winds and earthquakes;

(Municipality Area)

5) To develop preparedness for a multi-hazard early warning system, public education, and planning for response and recovery;

6) To conduct hazards, risks, and vulnerabilities assessment at suco level for DMA and utilize the results for disaster risk management plan of DMA;

7) To establish monitoring system and capacity development of technical staff in order to establish a multi-hazard early warning system for hydro-meteorological and

geological events;

8) To review the DMP for the rivers in Dili from the river basin management aspects and implement priority measures; and

9) To formulate flood and sediment control master plan for the rivers in Hera and Tibar and implement priority measures.

(2) Proposed Projects

Table 11.1.2 shows the proposed projects for disaster management.

Table 11.1.2 Proposed Project List for Disaster Management

No	Project	Term			Project Cost (USD in million)	Possible Fund Source	New Project Proposed	Possible Implementation Agency
		Short	Mid	Long				
1	**[Priority Project]** Implementation of hazards, risks, and vulnerability assessment on DMA	●			1.6	Public	●	MSS/ MoPWTC
2	Installation of monitoring equipment for hydro-meteorological and geological hazards	●	●		2.0	Public	●	MoPWTC/ IPG-IP
3	Capacity development of hydro-meteorological and geological staff for weather forecasting and early warning systems	●	●	●	0.3	Public	●	MoPWTC
4	Review of the DMP from watershed management aspects and implementation of flood control measures for the five rivers in Dili	●	●	●	8.0	Public	-	MoPWTC
5	Formulation of flood and sediment control master plan for the rivers in Hera and Tibar and implementation of priority measures	●	●	●	7.0	Public	●	MoPWTC

Source: JICA Project Team

1) Implementation of hazards, risks and vulnerability assessment on DMA

This Project aims the formation of urban areas with resilience so the viewpoint of "Resilience" in DMA Vision 2030 is considered in the Project.

i) Project Component

Short Term (2015-2020): To identify hazards, risks, and vulnerabilities to natural disasters in DMA as basic information for DRM;

ii) Responsible Agencies: Dili Municipality, Liquicia Municipality, and NDMD

2) Installation of monitoring equipment for hydro-meteorological and geological hazards

This Project aims the formation of urban areas with resilience, so the viewpoint of "Resilience" in DMA Vision 2030 is considered in the Project.

A. Meteorology

i) Project Component

Short Term (2015-2020):	Study on monitoring networks for weather forecasting and early warning of tropical storms in Timor-Leste
Mid Term (2021-2025):	Installation of monitoring facilities and monitoring activities
Long Term (2026-2030):	Monitoring activities

ii) Responsible Agencies:

National Directorate Meteorology and Geophysics (NDMG),

Ministry of Public Works, Transport, and Communication (MoPWTC)

B. Hydrology

i) Project Component

Short Term (2015-2020):	Study on monitoring networks of early flood warnings for the rivers in DMA
Mid Term (2021-2025):	Installation of monitoring facilities for the rivers in DMA
Long Term (2026-2030):	Monitoring activities

ii) Responsible Agencies:

National Directorate Water Quality Control (NDWQ),

MoPWTC

C. Geology

iii) Project Component

Short Term (2015-2020):	Study on monitoring networks for landslides in DMA and earthquakes in Timor-Leste
Mid Term (2021-2025):	Installation of monitoring facilities
Long Term (2026-2030):	Monitoring activities

iv) Responsible Agencies:

Institute of Petroleum and Geology Public Institute (IPG-IP), Ministry of Petroleum and Mineral Resources

3) Capacity development of hydro-meteorological and geological staff for weather forecasting and early warning systems for floods and landslide

This Project aims the formation of urban areas with resilience, so the viewpoint of "Resilience" in DMA Vision 2030 is considered in the Project. Plus, the Project includes capacity development so the viewpoint of "Human Resources" of the vision is also

considered.

A. Meteorology

i) Project Component

Short Term (2015-2020):	Capacity development of technical staff for weather forecasting and early warning for tropical storms
Mid Term (2021-2025):	Weather forecasting and early warning of tropical storms
Long Term (2026-2030):	Weather forecasting and early warning of tropical storm

ii) Responsible Agencies:

National Directorate Meteorology and Geophysics (NDMG)

B. Hydrology

i) Project Component

Short Term (2015-2020):	Capacity development of technical staff for hydrological data analysis and early flood warning
Mid Term (2021-2025):	Establishment of early flood warning systems for the rivers in Dili
Long Term (2026-2030):	Establishment of flood warning systems for DMA

ii) Responsible Agencies:

Hydrology: National Directorate Water Quality Control (NDWQ)

C. Geology

i) Project Component

Short Term (2015-2020):	Capacity development of technical staff for geological data analysis and early warning for landslides
Mid Term (2021-2025):	Establishment of early warning systems for landslides
Long Term (2026-2030):	Establishment of landslide warning systems for DMA

ii) Responsible Agencies:

Institute of Petroleum and Geology Public Institute (IPG-IP), Ministry of Petroleum and Mineral Resources

4) Review of the DMP from watershed management aspects and implement flood control measures for the Maloa, Kuluhum, Santana (Bemori and Becora) rivers:

This Project aims formation of urban areas with resilience in Dili Municipality, so the viewpoint of “Resilience” in DMA Vision 2030 is considered in the Project.

i) Project Component

Short Term (2015-2020):	Review the DMP and study on priority measures for the rivers in Dili
Mid Term (2021-2025):	Implementation of priority measures for the rivers in Dili from river improvement aspects
Long Term (2026-2030):	Implementation of slope protection and reforestation for the river basins in Dili

ii) Responsible Agency:

National Directorate of Basic Sanitation, Ministry of Public Works, Transport, and Communication (MoPWTC)

5) Formulation of flood and sediment control master plan for the rivers in Hera and Tibar and implementation of priority measures:

This Project aims formation of urban areas with resilience in Hera and Tibar, so the viewpoint of "Resilience" in DMA Vision 2030 is considered in the Project.

i) Project Component

Short Term (2015-2020):	Formulation of flood and sediment control master plan for the rivers in Hera and Tibar and study on priority measures
Mid Term (2021-2025):	Study on river improvement and priority measures from river basin management aspects
Long Term (2026-2030):	Implementation of priority measures for the rivers in Hera and Tibar

ii) Responsible Agency:

National Directorate of Basic Sanitation, Ministry of Public Works, Transport, and Communication (MPWTC)

11.2 Water Supply

11.2.1 Demand and Gap Analysis

(1) Water Demand in 2030

The water demand in 2030 is estimated based on the projection of the population and the unit rates of the water consumption. The basis of the projection composes parameters mentioned in the Dili Sanitation and Drainage Master Plan (DSDMP) and assumptions by JPT.

1) Population

The projection of population for the water demand projection is presented in Table 11.2.1. The areas mentioned in the table follow are the categories presented in Clause 11.3.1.

Table 11.2.1 Projection of Population for the Water Demand Projection

Year	2010[1*)]	2020	2025	2030	Remark
Area1[*2)]	156,516	220,840	267,980	323,800	Vila Verde, Motael, Macarenhas, Colmera, Caicoli, Santa Cruz, Gricenfor, Bidau Lecidera, Bemori, Acadiru Hun, Kampung Alor, Fatuhada, Comoro BirroPite, Culu Hun
Area2[*2)]	56,805	71,130	80,000	90,200	Balibar, Becora, Bidau Santana, Camea, Meti Aut, Lanhane Oriental, Lahane Ocidental, Dare
Area3	7,376	16,290	24,250	36,000	Hera
Area4	3,096	13,500	25,000	50,000	Tibar
Total	223,793	321,760	397,230	500,000	

Note *1) Population of 2010 based on the National Census 2010
*2) Area1 is the area of DSDMP and Area2 is the sucos of Dili Urban Area not included in the area of DSDMP.

Source: National Census 2010 and JICA Project Team

2) Unit Consumption

Two different cases are considered for water demand projection. The difference depends on unit water consumption per capita to be applied. Unit consumption for the first case is 0.125 (m^3/day/capita), which is used in DSDMP. Unit consumption for the last case is 0.15 (m^3/day/capita), which is used in the National Directorate of Water Supply (DNSAS) for Dili Urban Area and 0.07 (m^3/day/capita) is assumed by JPT for Hera and Tibar. JPT assumed 0.07 (m^3/day/capita) as the minimum requirement to be supplied for a person living in the area.

Commercial consumption rate is 40% of the unit water consumption per capita as utilized in DSDMP. In addition to the method of the DSDMP, the case of the commercial consumption rate covering the industrial consumption is estimated by JPT. As JPT assumed that the transportation of staffs and customers for commercial activity are limited within the project area, the consumption amount per capita covers the water consumption of the commercial works. JPT assumed that the method of estimation covers the consumption of the industrial works such as manufacturing foods or assembling goods. On the point, the detailed study for the master plan of water supply needs to be carried out to gather accurate figures.

Industrial consumption rate is not utilized in the DSDMP due to lack of information. JPT adds another case that the commercial consumption includes the industrial consumption.

The ratio of water loss is 40% same as the DSDMP. The ration needs to be studied in detail in the master plan of water supply.

3) Water Demand Projection

From the conditions described above, the water demand projections in 2030 (0.125 m^3/day/capita) based on the DSDMP and (0.150 and 0.07 m^3/day/capita) based on consideration of the water supply sector are presented in Tables 11.2.2 and 11.2.3, respectively.

Table 11.2.2 Water Demand Projection in 2030 (0.125 m^3/day/capita)

Item	Domestic (m^3/day)	Commercial (m^3/day)	Water Loss (m^3/day)	Total (m^3/day)	Remark
Unit Rate	0.125 m^3/day/capita	40% of Domestic	40% is the loss before supplying		
Area1	40,500	16,200	37,800	94,500	Urban Dili Area covered by DSDMP
Area2	11,300	4,600	10,600	26,500	Urban Dili Area without covering by DSDMP
Area3	4,500	1,800	4,200	10,500	Hera
Area4	6,300	2,500	5,900	14,700	Tibar
Total	62,600	25,100	58,500	146,200	

Source: JICA Project Team

Table 11.2.3 Water Demand Projection in 2030 (0.15 and 0.07 m^3/day/capita)

Item	Domestic (m^3/day)	Commercial (m^3/day)	Water Loss (m^3/day)	Total (m^3/day)	Remark
Unit Rate	0.15 for area 1and 2 0.07 for area 3and 4 m^3/day/capita	40% of Domestic	40% is the loss before supplying		
Area1	48,600	19,500	45,400	113,500	Urban Dili Area covered by DSDMP
Area2	13,600	5,500	12,800	31,900	Urban Dili Area without covering by DSDMP
Area3	2,600	1,100	2,500	6,200	Hera
Area4	3,500	1,400	3,300	8,200	Tibar
Total	68,300	27,500	64,000	159,800	

Source: JICA Project Team

4) Capacity of Water Supply

As the capacity of the existing facilities for water supply is 38,090 (m^3/day) during dry season and 49,090 (m^3/day) during rainy season as of August 2014, the development of the water supply system is necessary to meet the estimated demand of approximately 150,000 (m^3/day).

11.2.2 Water Supply Policy

Although the existing water supply system has partially covered the project area, neither the evaluation of the capacity on the water resource nor the master plan of the water supply has been available yet. The development of the water supply system is only for each case and the management system for the existing system has not been appropriately operated, especially on the period of the water supply. Under the situation, the following development policy on water supply is necessary for the comprehensive urban development plan in the project area.

(1) Evaluating the Capacity of Groundwater

Evaluating the capacity of the groundwater as water resource has the high priority for the urban development. The potential of developing the water resource is the same as the possibility of urban development. Especially, the capacity is indispensable to invite private development of commercial or industrial development, as the capacity is one of the elements for their feasibility study (F/S) of the development. Based on the urban development plans utilizing the capacity, the master plan of water supply needs to be formulated for the development of the water supply system.

Studying the capacity is one of the initial steps on developing the water supply system in the peripheral area of urban areas such as Tibar and Hera. In the peripheral area, a master plan on water supply is indispensable for the comprehensive development of water supply system. The study of the master plan requires the direction of the urban development. The capacity is a helpful information to implement the direction of the urban development.

(2) Improvement of the Existing Water Supply Systems

The improvement of the existing water supply system to meet the period of water supply for 24 hours is other aspect of the development policy. In the project area, the existing system only supplies water for 0 - 18 hours only. Due to little time of the water supply service, certain people in the area have complaints to the water supply system. Improving the existing system such as distribution pipelines system including valves and reservoirs recovered the people's confidence on the system. It then changed the situation on tariff system and water conservation. As such, the improvement needs to be continuously progressing in parallel with the development of the capacity and formulation of the master plan.

The following actions have priority for the improvement of the existing water supply system:

1) Repairing leakage in the distribution network including detecting of the locations of leakage; and

2) Improving the gap between the existing and the planned water supply zones by installing stop valves and reservoirs.

In the water supply sector, the targets of the development policy are set through the development of the capacity of the water resource, formulation of the master plan of water supply, and the improvement of the existing water supply system. The period of the water supply is applied for the effect indicator in water supply sector as presented in Table 11.2.4. It is 0 - 18 hours in the project area as of 2010 and will be improved to 24 hours in the project area by 2030. This is conducive to the pillar of “High Quality of Life” in DMA Vision 2030.

Table 11.2.4 Effect Indicator of Water Supply Sector

Sector	Effect Indicator	Base 2010	Target 2030	Description
Water Supply	Period of Water Supply	0 - 18 hours per day	24 hours per day	The target in 2030 is to be achieved through the existing and newly developed water supply system.

Source: JICA Project Team

11.2.3 Water Supply Development Plan

The development plan consists of the projects. The development plan for water supply mainly covers the survey on the capacity of the groundwater for water supply, formulation of the master plan for water supply, reconstruction of the existing distribution network, preparation of the standard about the structural aspect of the facilities, and the cooperative management of the water supply system among the governmental organizations and the communities. JPT set the three categories of the short-term plan by 2020, midterm plan by 2025, and long-term plan by 2030 in order to present the schedule of the Project and its priority. The long list of the projects is presented in Table 11.2.5.

(1) Short Term

1) Survey on the Capacity of the Groundwater for Water Supply

To elaborate the urban development plans in DMA, the evaluation of the capacity for the water supply is indispensable. Especially, its importance is high in Dili because groundwater covers certain amount of the water demand in Dili. The development of the water resource has not been controlled yet in Dili and assessing the capacity of water resources is necessary to discuss the water distribution. Controlling the water resource based on the result of survey meets the requirement of "Sustainability" mentioned in the four viewpoints to realize DMA Vision 2030.

The survey includes investigating the existing wells, planning the grid to set the survey points, and to carry out the numerical analysis, stress test through pumping up the water at the test wells, numerical analysis on the recovery of the groundwater level and the degree of the salinity after pumping up the water, and studying the capacity of the groundwater as water resource.

2) Master Plan of Water Supply

Based on the capacity of the water resource, the master plan of water supply needs to be formulated to set the direction of the development for the water supply system and the order of the priority to each project of water supply.

The master plan basically covers to survey about the urban development plans such as residential area, commercial area, and industrial area for fixing the project area; to evaluate the existing facilities for water supply; to estimate the water consumption in the project area; to plan the sequential construction/re-construction of the facilities in preliminary; and to study the required organization structure.

In the Dili Urban Area, the expansion of the existing water supply system need to be diligently studied on the point of the existing water supply zones, its performance and its utilization in the development plan under the master plan of water supply system.

In the peripheral area such as Tibar and Hera, the area of developing water supply mainly needs to be studied in accordance with the comprehensive urban development plan approved by the government.

The Project meets the requirement of "Sustainability" and "Resilience" mentioned in the four viewpoints to realize DMA Vision 2030.

3) Reconstruction of the Distribution Network

As mentioned in the development policy, the improvement and reconstruction of the existing distribution network is also necessary in parallel with the establishment of the master plan for water supply.

The improvement and reconstruction of the existing distribution network includes surveying the existing pipelines through the as-built drawings, interview with the people in the community and trial pits, to carry out pressure test, to repair the leakage and to instruct community the acceptable management/usage of the water supply system.

In Dili, the Japan International Cooperation Agency (JICA) has already carried out a project to the issue and has achieved the water supply for 24 hours in the Benamauk Ward, although the water supply in the area was only for 0-18 hours before the Project. Presentation of the achievement in public is also necessary for understanding the necessity of the appropriate management and maintenance for the water supply system to improve the period of water supply.

The Asian Development Bank (ADB) has launched the Project in 2015 to improve the existing water supply system in Dili Urban Area. The Project has targeted to evaluate the existing water supply system; to study a plan of the improvement; and to investigate the capacity of water resource in the Comoro basin based on the existing information. The achievement of the Project needs to be shared and reviewed among the organizations relating with the water sector such as DNSA and DNWQC.

The reconstruction of the distribution network is effective to realize the high quality of life, as it improves the performance of the water supply system. On the point, the Project meets the requirement of "Sustainability" and "Resilience" mentioned in the four viewpoints to realize DMA Vision 2030.

(2) Mid Term

In middle term, it continuously needs to take action for the improvement and reconstruction of the existing distribution network. In addition, the following projects need to be carried out.

1) Strengthening the Responsible Organization of the Water Supply

Strengthening the responsible organization of the water supply in accordance with the master plan is necessary. Division in charge of planning, management, maintenance, and tariff need to be strengthened to meet the requirement of the master plan. The Project meets the requirement of "Human Resources" mentioned in the four viewpoints to realize DMA Vision 2030.

2) Establishing the Standard for the Structural Aspect of the Facilities

For appropriate operation, management, and maintenance, the standard of the structures is indispensable.

In public, many kinds of infrastructures exist such as lines of wastewater/drainage, electrical power supply, telecommunication, and transportation. To meet the requirement of the facilities without preventing the function of other infrastructures, stipulating the material of the facilities, suitable alignment, and depth of facilities and minimum requirement of structural stability. The standard should be shared among the relating organizations such as sanitation, electrical power supply, telecommunication, and transportation.

Unified standard and sharing a common understanding among the related organizations is effective for operation and maintenance (O&M) to improve the performance of the facilities. It is under "Sustainability" and "Resilience" mentioned in the four viewpoints to realize DMA Vision 2030 on the high quality of the life.

3) The Modification of the Master Plan for Water Supply

In middle term, modification of the master plan for water supply is necessary to meet the requirement of the newly planned projects by private or governmental funds.

Establishing the capacity of the groundwater is one of the elements to encourage urban development, as the private or governmental funds require the amount of water supply for their project to evaluate the feasibility of their project. This is the reason for the necessity of the modification to realize the high quality of the life same as the establishment of the master plan.

(3) Long Term

In long term, JPT still expects that the improvement and reconstruction of the existing distribution network is necessary, as the center of Dili has more complicated situation compared with the peripheral area of Dili and it cause to the delay of the improvement and reconstruction. In addition, the following projects need to be carried out.

1) Development of the Water Supply Facilities

After the study of the capacity of water resources, approval of comprehensive urban development plan and modification of the master plan for water supply, the development of facilities for enlarging the capacity of the water supply is necessary to meet the requirement of the urban development plan.

The development of the water supply facilities is effective to realize the high quality of life, as it improves the performance of the water supply system. On the point, the Project meets the requirement of "Sustainability" and "Resilience" mentioned in the four viewpoints to realize DMA Vision 2030.

Survey on the capacity of the groundwater for water supply is the recommended project. To prepare the capacity of the water resource for the water supply is indispensable conditions for studying other development plans such as residential, commercial, and industrial areas. Reflecting the development plans in other sectors to the master plan of water supply make the master plan practical. From the situation, the survey is the first step for the development in the water supply sector.

Table 11.2.5 Long List of the Projects for Water Supply Sector

No.	Project	Term			Project Cost (USD in million)	Possible Fund Source	New Project Proposed by JPT	Possible Implementation Agency
		Short	Middle	Long				
1	**[Priority Project]** Survey on the Capacity of the Ground Water for Water Supply	●			2.0	Public	-	DEGUS
2	Master Plan of Water Supply	●			2.0	Public	-	DEGUS
3	Reconstruction of the Distribution Network	●	●	●	1.0	Public	-	DEGUS
4	Strengthening the Responsible Organization of the Water Supply		●		0.5	Public	-	DEGUS
5	Establishing the Standard for the Structural Aspect of the Facilities		●		1.0	Public	-	DNSA
6	The Modification of the Master Plan for Water Supply		●		1.0	Public	●	DNSA
7	Development of the Water Supply Facilities			●	100.0	Public	●	DNSA

Source: JICA Project Team

11.3 Sewerage/Drainage

11.3.1 Demand and Gap Analysis

(1) Sewerage

1) Population

Comparing with the projection of the population by DSDMP and this master plan, the projection by this master plan is higher than that of DSDMP. As the area of the project is different between DSDMP and this master plan, areas 1, 2, and 3 are set for comparison. The names of sucos covered by the areas are presented in Table 11.3.1. The comparison on the projection of the population by DSDMP and this master plan is presented in Table 11.3.2.

Table 11.3.1 Name of Suco Covered by the Areas

Area	Municipality	Suco	Area (ha)	Urbanized Area (ha)	Remark
1	Dili	Vila Verde, Motael, Macarenhas, Colmera, Caicoli, Santa Cruz, Gricenfor, Bidau Lecidera, Bemori, Acadiru Hun, Kampung Alor, Fatuhada, Comoro BirroPite, Culu Hun	4,155	2,416	Project Area of DSDMP
2	Dili	Balibar, Becora, Bidau Santana, Camea, Meti Aut, Lanhane Oriental, Lahane Ocidental, Dare	5,337	656	
3	Dili	Hera	4,157	650	
4	Liquicia	Tibar	4,212	525	
Total			17,861	4,247	

Source: National Census 2010 and JICA Project Team

Table 11.3.2 Comparison on the Projection of Population by DSDMP and This Master Plan

Year		2010[1*)]	2012	2017	2020	2022	2025	2030
Area 1	DMDMP	156,516	158,922	185,402	-	214,464	235,136	-
	This Master Plan	156,516	169,381[2*)]	201,542[2*)]	220,840	239,696[2*)]	267,980	323,800
Area 2	This Master Plan	56,805	-	-	71,130	-	80,000	90,200
Area 3	This Master Plan	7,376	-	-	16,290	-	24,250	36,000
Area 4	This Master Plan	3,096	-	-	13,500	-	25,000	50,000
Total of this Master Plan		223,793	-	-	321,760	-	397,230	500,000

Note *1) Population of 2010 based on the National Census 2010
*2) Linier approximation for comparison

Source: DSDMP and JICA Project Team

2) Amount of Wastewater Need to be Treated

Procedure of the projection on the amount of the waste water follows that of DSDMP.

The domestic wastewater is 80% of the daily consumption. The daily consumption utilized in DSDMP is 0.125 m^3/day/capita, on the other hand, the daily consumption utilized by the water supply sector (DNSAS) is 0.150 m^3/day/capita and minimum requirement of water for one person assumed by JPT is 0.07 m^3/day/capita. From the situation, the two cases are presented same as DSDMP and the figure utilizing DNSA with the minimum requirement.

The commercial wastewater is 40% of the daily consumption including 40% of water loss in accordance with DSDMP. Thus, the commercial wastewater of each domestic wastewater is 40% of 0.208 m^3/day/capita (0.125/0.6), 0.250 m^3/day/capita (0.150/0.6), and 0.117 m^3/day/capita (0.070/0.6).

The industrial water is excluded from the projection in DSDMP, because DSDMP considered that using estimated figures based on the limited information was not appropriate for their projection. In this study, the projection follows the DSDMP consideration.

The infiltration contribution is estimated the same as the DSDMP with 9.0 m^3/day/ha of the DSDMP's sewerage area. For the estimation of this master plan, the urbanized area of each suco (ha) utilized for the calculation of filtration.

Based on the unit rate described above, the projections of wastewater in 2025 and 2030 utilizing the unit rate of water consumption with 0.125 m^3/day/capita and that of 0.150 and 0.07 m^3/day/capita are presented in Tables 11.3.3and 11.3.4, respectively

Table 11.3.3 Projection of Wastewater in 2025 (0.125 m^3/day/capita)

Item		Domestic	Commercial	Filtration	Total (m^3/day)
Unit Rate		80% of 0.125 m^3/day/capita	40% of 0.208 m^3/day/capita	9.0 m^3/day/ha	
Area 1	DMDMP	23,600	17,900	19,000	60,500
	This Master Plan	32,400	27,000	21,800	81,200
Area 2	This Master Plan	9,100	7,600	6,000	22,700
Area 3	This Master Plan	3,600	3,000	5,900	12,500
Area 4	This Master Plan	5,000	4,200	4,800	14,000
Total of this Master Plan		50,100	41,800	38,500	130,400

Source: DSDMP and JPT

Table 11.3.4 Projection of Wastewater in 2030 (0.15 and 0.07 m^3/day/capita)

Item		Domestic*1) (m^3/day)	Commercial*1) (m^3/day)	Filtration (m^3/day)	Total (m^3/day)
Unit Rate		80% of 0.15 for Area 1 and 2 0.07 for Area 3 and 4 m^3/day/capita	40% of 0.25 for Area 1 and 2 0.117 for Area 3and 4 m^3/day/capita	9.0 m^3/day/ha	
Area1	This Master Plan	38,900	32,400	21,800	93,100
Area2	This Master Plan	10,900	9,100	6,000	26,000
Area3	This Master Plan	2,100	1,700	5,900	9,700
Area4	This Master Plan	2,800	2,400	4,800	10,000
Total of this Master Plan		54,700	45,600	38,500	138,800

Note *1) 0.07 m^3/day/capita is utilized to Hera of Area 2 and Tibar of Area 3
*2) Linier approximation for comparison

Source: DSDMP and JICA Project Team

As of February 2015, while the project for the four locations of the Community Sewerage Treatment System (CSTS) is under operation, the capacity of the public sewerage system has not been built yet. Although the development of the sewerage system is an urgent issue on the aspect, the sewerage system needs to be developed even in slow and steady pace for the necessary period of training the staff members in charge of the management of the construction project, operation of the sewerage system and communication with the related organizations such as the department of urban development, private development fund, water supply, and communities in collecting information.

(2) Drainage

1) Dili Urban Area

In Dili Urban Area, the existing drainage facilities are available, because the plan and the development of the drainage system have been continuously implemented since 1994.

Its performance, however, is not sufficient for discharging the rainwater to public water. The Government of Timor-Leste (GoTL) has stated that the issue is one of the high priorities to be resolved as of February 2015. For resolving the issue, DSDMP pointed out the following problems:

a) Insufficient capacity of the facilities compared with the requirement of the design;

b) Increase of sedimentation in the facilities due to the lack of the maintenance;

c) Obstruction in the facilities such as agricultural facilities and structures over the path; and

d) No drainage facilities in some urbanized areas.

These problems are the gap between the requirement and the existing facilities.

DSDMP carried out a simulation with model of the existing facilities considering the problems described above. As a result, the rainwater with return period of two years causes inundation of over 20 cm in 10% of the Dili Urban Area.

2) Hera and Tibar

The drainage system as complementary facilities of roads is only available in the area.

Thus, in preparing urban development plans, it is necessary to review the plans and avoid the problems observed in the Dili Urban Area.

The dumpsite for solid wastes exists in Tibar and receives the wastes collected in Dili. Outlet of rainwater from the dumpsite needs to be separated from the drainage system. Cooperative discussion between responsible organization on drainage and environment is necessary on the development of drainage system for the existing dumpsite.

11.3.2 Sewerage/Drainage Policy

For the urban development of Dili, DSDMP, in accordance with the Timor-Leste Strategic Development Plan 2011-2030 (SDP) has been available already. The development policy of Dili Urban Master Planfor the sewerage/drainage sector basically follows the DSDMP's policy. The outline of the development policy is presented as below.

(1) Sewerage

Based on the DSDMP, the sanitation policy composes of three statements.

1) Sanitation improvement shall be guided by a framework built on increased demand for sanitation goods and services, strengthened supply of sanitation goods and services, and improved conditions to achieve sanitation for all.

2) The minimum level of service of every household, institution, and public place shall have an improved sanitation including a hygienic toilet, hand-washing facility, and safe solid and liquid waste management.

3) Public financing shall ensure public sanitation facilities, promotion, and urban services and infrastructure while all households are responsible for their own sanitation facilities.

For the development policy, the DSDMP recommended the on-site treatment system through the CSTS and the decentralized wastewater treatment system. Developing the sewerage system in the small community and expanding it to another area is an enable procedure under the current situation, where the urban development plan in many sectors such as transportation, residential area, commercial area, and industrial area is prepared. The procedure may flexibly adjust the plan in accordance with the development plan of other sectors. On the other hand, on-site systems will occupy the many locations due to its small coverage of the area. As mentioned in the DSDMP, the plan needs to be adjusted in accordance with the concrete urban development plan.

To implement the measures in the development policy, the National Directrate Sanitation Services, Ministry of Public Works (DNSB) needs to be strengthened as the responsible organization. The range of the DNSB's works widely covers the sewerage such as planning, construction, and management of the sewerage system. While DNSB covers huge area of works, the number of staff members is not sufficient to manage the development of the sewerage system.

In the sewerage sector, the target effect indicator of the development policy is the amount of the treated water by wastewater treatment plant as presented in Table 11.3.5. This is conducive to the pillar of “Healthy and Eco-friendly Society” in DMA Vision 2030.

(2) Drainage

Based on the DSDMP, the drainage policy is summarized below.

1) Public announcement for people to understand the drainage system and their duty to keep the performance of the drainage system;

2) Strengthening the governmental organization for planning, and O&M of the drainage system; and

3) Strengthening the existing drainage system through improving the existing facilities and constructing new facilities proposed in the DSDMP.

In the current situation, urban development plans for residential, commercial, and industrial areas is still under study. Since the development plan of the drainage system should be adjusted in accordance with the development plans for the residential, commercial, and industrial areas, the drastic improvement of the drainage system in hard aspect may cause to double the cost for one measure. Thus, higher priority is given to the improvement in soft aspect.

DSDMP recommended the utilization of the non-governmental organizations (NGOs) and communities for the effective development of the drainage system in soft aspect. For the recommendation, the responsible organization needs to manage and control the NGO's or community's activities.

In implementing development plans in accordance with the policy, DNSB needs to be the responsible organization for the implementation of the development, while communities of the area and NGOs involve some measurements. It is indispensable that the organization comprehensively control and understand the situation surrounding the drainage system.

Currently, the number of the DNSB's staff members is insufficient to manage the activities because there are only 25 staff members in total. The number of staff members needs to be gradually increased in parallel with strengthening the technical performance of the staffs.

In the hard aspect of improvement, DSDMP recommended some measures to improve the drainage facilities such as removing sediment in channels, widening the channels, and reshaping the section of channels. The measures need to be carried out after the strengthening the responsible organization.

In the drainage sector, the target indicator of the development policy is if the capacity of the drainage facilities is enough to flow the rainwater with five years return period. The effect indicator of the sewerage/drainage sector is presented in the Table 11.3.5. This is conducive to the pillar of "High Quality of Life" in DMA vision 2030.

Table 11.3.5 Effect Indicator of Sewerage/Drainage Sector

Sector	Indicator	Base 2010	Target 2030
Sewerage	Amount of Treated Wastewater	0	138,800 (m^3/day)
Drainage	Capacity of Drainage Facilities	Below the capacity with two years return period	To meet the capacity with five years return period

Source: JICA Project Team

11.3.3 Sewerage/Drainage Development Plan

In the sewerage/drainage sector, DSDMP has already shown the direction and proposed development plans for Dili. The proposed plans need to be implemented. For Hera and Tibar, the experience of the development in Dili is to be utilized to construct the suitable sewerage/drainage system considering the new urban development of other sectors. The long list of the projects is presented in Table 11.3.6.

(1) Sewerage

1) Short Term

Development of the CSTS was already launched as of March 2015 and needs to be stepwise developed in accordance with the DSDMP.

After the completion of the CSTS in some areas, the decentralized wastewater treatment plant needs to be constructed to connect each area of CSTSs.

Strengthening the organization of DNSB is the highest priority to implement the projects. Since the urban development plan is under preparation and the development of sewerage system should be studied based on the urban development plan, the development of the sewerage system should be implemented after the completion of the urban development

plan such as development of the residential, commercial, and industrial areas. By the completion of the urban development plan, reviewing the existing study such as the master plan for Dili in 2003 studied by GHD Pty Ltd and DSDMP in 2012 and field study on the existing sanitation facilities by the staffs of the DNSB will be a good experience in implementing the development of sanitation system and clarifying necessary competency for engineers to be newly hired. The Project meets the requirement of "Human Resources" mentioned in the four viewpoints to realize DMA Vision 2030.

Establishing the standard of the sewerage system of the building is necessary. Currently, many kinds of sewerage system for building exist in Dili without law or regulation controlling it. The situation will affect the public sewerage system on the point of the connection level between the private and public sewerage system and unexpected wastewater quality flowing into the public sewerage system. To avoid such situation, establishing the standard in terms of the quality and structure and instructing the people constructing the sewerage system in their building to work in accordance with the standards is necessary.

Unified standard and sharing a common understanding among the related organizations is effective to improve the performance of the sewerage facilities. It is under "Sustainability" and "Resilience" mentioned in the four viewpoints to realize DMA Vision 2030 on the high quality of the life.

2) Mid Term and Long Term

Development of CSTS and connecting each CSTS by decentralized wastewater treatment plants has been continuously expanding its covered area.

Reviewing and revising the master plan of sewerage system need to be carried out based on the newly established urban development plan, as urban development plans studied in other sectors may be established and approved.

Reviewing and revising the master plan is effective to realize the high quality of life, as it improves the performance of the sewerage system. On the point, the Project meets the requirement of "Sustainability" and "Resilience" mentioned in the four viewpoints to realize DMA Vision 2030.

Strengthening the organization structure of DNSB needs to be continued in parallel with expanding the sewerage system. The Project meets the requirement of "Human Resources" mentioned in the four viewpoints to realize DMA Vision 2030.

The communication with the communities is necessary to reflect the actual situation in the site of the development. The main issues of the communication are the interview for the performance of the developed sanitation system, the instruction on the function and the necessity of the sewerage system and the request for the communities' cooperation on the maintenance of the sewerage system. The Project aims to meet the requirement on the high quality of life and to improve the performance of the organization for resilience and human resources.

Establishing the standard of the sewerage system for buildings is the recommended project in the sewerage sector. Almost all of the sewerage systems of the building need to be connected to the public sewerage system. The connection between the sewerage system in the building and the public sewerage is one of the important elements, since the sewerage system utilizes gravity-flow system and its elevation is not flexible for the connection. The quality of wastewater flowing into the public sewerage from the building is the other issue of the elements. The extraordinary quality of wastewater flowing from building damages

the performance of the public wastewater treatment system. Thus, the acceptable quality of wastewater flowing into the public sewerage and independent sewerage system to meet the acceptable quality needs to be discussed and established. The Project studies the subject described above and prepares a draft of the standard based on the study.

(2) Drainage

1) Short Term

Removing dust and sediment from the drainage channel is one of the important problems to be resolved. Utilizing the drainage channels with full capacity through the removal of dust and sediment from the channel is the effective measurement to mitigate the inundation with lower cost than new construction of the drainage system.

Improving the inclination of the channel is the second step of the improvement. The inclination of certain channels is bumpy according to the survey result of DSDMP. The location with changing inclination from steep to gentle without increasing the cross-section of the channel causes the inundation. The improvement makes the flow smooth and mitigates the inundation.

Third step of the improvement is reshaping the section of the channel. The increase in the section of channel has a direct effect to the increment of the flow capacity.

The Project is effective to realize the high quality of life as it improves the performance of the drainage system. On the point, the Project meets the requirement of “Sustainability” and “Resilience” mentioned in the four viewpoints to realize DMA Vision 2030.

Cooperative works with the organization responsible for the road is necessary. Complementary facilities of road such as curbs, rainwater collection pits, and connection pipelines to drainage channels have a role to quickly flow rainwater to the drainage system. Discussion on the requirement of the facilities in terms of its structural standard and necessary number per unit length of the road is needed. The Project aims to meet the requirement on the high quality of life and the performance of the organization for “Resilience” and “Human Resources”.

Instructing the communities to keep the performance of the drainage system is indispensable such as no throwing of wastes to the drainage channel and rainwater collection pits.

The survey of rainfall is necessary. As of February 2015, rainfall has been observed only near the international airport in Dili. The record, however, is not enough to be utilized for the analysis of the drainage system due to daily basis of data, while the requirement of the analysis is hourly data. It is necessary to survey the rainfall in Dili for the analysis of the drainage system in order to prepare for future climate change.

Strengthening the DSNB in terms of project management, planning, design, and maintenance is indispensable. It needs to be carried out through the implementation of projects.

Instructing the communities, the survey of rainfall, and strengthening DNSB mainly aims to meet the viewpoint of “Human Resources” in DMA Vision 2030.

2) Mid Term and Long Term

The instruction to the communities and the survey of rainfall needs to be continued in the middle and long term.

Construction of retention ponds needs to be studied after the completion of the improvement of the existing facilities. As the construction of the ponds requires certain area in the urban area, JPT recommended studying the necessity of the ponds based on the collected rainfall data and the review of the effect on the improvement of the existing drainage system.

Revision of the DSDMP is necessary based on the new urban development plan of the residential, commercial, and industrial areas.

Revising the master plan is effective to realize the high quality of life, as it improves the performance of the drainage system. On the point, the Project meets the requirement of "Sustainability" and "Resilience" mentioned in the four viewpoints to realize DMA Vision 2030.

In the projects mentioned above, establishing the standard for curbs, rainwater collection pits, and connection pipelines to drainage system is recommended to be the priority project. The main objectives of the Project are to make consensus and to devise a system of cooperation between the responsible organizations such as DNSB; National Directorate of Road, Bridge, and Flood Protection; and National Directorate of Transportation through studying the standard. Details of the projects for sewerage and drainage sector are presented in Table 11.3.6.

Table 11.3.6 Long List of the Projects for Sewerage/Drainage Sector

No.	Project	Term			Project Cost (USD in million)	Possible Fund Source	New Project proposed by JPT	Possible Implementation Agency
		Short	Middle	Long				
Sewerage								
1	Construction of CSTS	●	●		114.9	Public	-	DNSB
2	Construction of the Decentralized Waste Water Treatment Plant	●	●		248.8	Public	-	DNSB
3	Strengthening DNSB	●	●	●	103.0	Public	●	DNSB
4	**[Priority Project]** Establishing the Standard of the Sewerage System for Buildings	●			1.0	Public	●	DNSB
5	Review and Revision of DSDMP		●		1.5	Public	-	DNSB
6	Communicating with Communities on Sewerage System and Instruction to the Communities' Cooperative Maintenance of the Sewerage System		●	●	15.5	Public	-	DNSB
Drainage								
1	Removal of Wastes from Drainage Channels Improvement of Inclination of Drainage Channels Reshape of Section of Drainage Channels	●	●		50.3	Public	-	DNSB
2	**[Priority Project]** Establishment of Standard on Curbs, Rainwater Collection Pits, and Connection Pipelines to Drainage System Between the Organizations Responsible on Roads and	●			0.5	Public	-	DNSB

	Drainage System							
3	Instructing Communities for Cooperative Maintenance of the Drainage System	●	●	●	3.3	Public	-	DNSB
4	Survey of Rainfall	●	●	●	1.5	Public	●	DNSB
5	Strengthening DNSB	●	●	●	22.6	Public	-	DNSB
6	Study and Construction of Retention Ponds		●	●	17.6	Public	-	DNSB
7	Review and Revision of DSDMP		●		1,500,000	Public	●	DNSB

Source: DSDMP and JICA Project Team

11.4 Solid Waste Management

11.4.1 Demand and Gap Analysis

Solid waste management in Dili is driven by the amount of waste generated by its population and corresponding establishments. Population of DMA is projected to grow from 257,630 in 2014 to 500,000 by 2030. Based on the recent ADB Waste Analysis and Characterization Survey (WACS), the per capita waste generation as of 2014 corresponds to about 0.4 kg per day. This is assumed to nominally grow by 1% per year during the planning period. Waste generation in Dili is projected to increase from 103 tons per day (tpd) in 2014 to 137 tpd in 2020 and 235 tpd by 2030 (Table 11.4.1).

Table 11.4.1 Projected Population and Waste Generation of Dili

Year	2014	2020	2025	2030
Projected Population	257,630	321,760	397,230	500,000
Per capita Waste Generation (kg)	0.400	0.425	0.446	0.469
Daily Waste Generation (tons)	103	137	177	235

Source: JICA Project Team

The generated waste will require corresponding efficient collection and proper disposal in order to mitigate potential negative impacts on the environment as well as on the health and safety of workers and nearby communities.

Collection of waste is undertaken by a combined fleet of government owned, contracted, and privately owned vehicles. Table 11.4.2 shows the number of trucks and average collection trips made in 2014 and in January 2015.

Table 11.4.2 Number of Collection Trucks/Vehicles and Trips

Institution	Trucks/Vehicles		Actual Truck/ Vehicle Trips/Day		Required Truck/ Vehicle Trips/Day	
	2014[1]	2015[2]	2014	2015	2014	2015
Government	15	12	12	11	15	12
Contract	30	40	80	108	90	120
Private[3]	15	15	14	15	NA[4]	NA
Total	45	52	106	134		

Note: Each truck has an average load capacity of 6 m^3
Source: JICA Project Team

[1] Number of trucks and trips averaged from January to July 2014

[2] Based on January 2015 records

[3] Estimated number of vehicles

[4] Not applicable, trips made based on demand

In 2014, the average number of truck trips per day is 106, which translated to an estimated daily collection of 73 tons. This amount represents 71% of the waste generation. In January 2015, the number of contacted trucks was increased from 0 m^3 to 40 m^3. This led to an increase in daily trips and collection to 134 trips and 93 tons, respectively. The daily collection rate in January 2015 corresponds to 86% of the waste generation. The table also shows that larger amount of waste can be collected if the trips required of the contracted trucks are undertaken.

Table 11.4.3 shows the gap between the demand or waste generation and the estimated actual collection for the period 2014 to 2030. It was assumed that the 85% waste collection in 2015 will at least be maintained for the duration of the planning period.

Table 11.4.3 Demand and Gap in Waste Collection for Dili for 2014, 2020, 2025, and 2030

Year	Actual Collection (Tons per Day)	Demand/Waste Generation (Tons per Day)	Collection Gap(tons per day)	% Waste Collection/Waste Generation
2014	73	103	24	77%
2015	93	108	16	85%
2020	117	137	20	85%
2025	151	177	27	85%
2030	199	235	35	85%

Source: JICA Project Team

Current waste disposal in Dili corresponds to open dumping in Tibar, which is located approximately 13 road km southwest of the center of Dili. Currently, the site can be divided into three cells which are referred to in this report as lower, central, and upper reckoned from the west (Figure 11.4.1). The areas of these sectors are approximately 10.7 ha. The active dumpsite occupies about 1.5 ha of the upper sector. The potential air space for the three cells assuming an average waste pile height of 10 m is approximately 1 million m^3.

Source: JICA Project Team

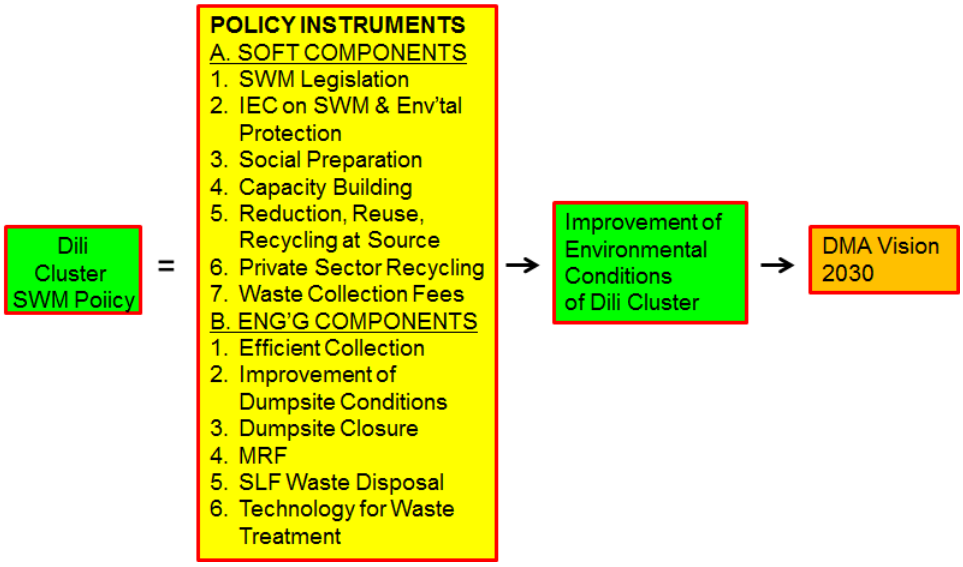
Figure 11.4.1 Satellite Image of the Tibar Dumpsite Showing the Three Sectors

Based on the current and projected collection rates, waste arriving at the Tibar Dumpsite will increase from 93 tpd in 2015, 118 tpd by 2020, and 202 tpd by 2030. The waste brought to Tibar

Dumpsite is subjected to waste picking and burning and if these practices are allowed to persist, the net waste that will be left is estimated at 20% of what was delivered by the collection trucks. The estimated net waste over the period from 2015 to 2030 is about 168,000 tons or 420,000 m^3 assuming a conservative final waste density of 0.4 ton/m^3. Compared to the potential airspace, the dumpsite can accommodate burned waste for the next 30 years. Even if Tibar has a large potential capacity, a sanitary landfill is needed for the proper disposal of the solid waste of the Dili cluster.

11.4.2 Solid Waste Management Policy

The government shall have the following policy on solid waste management: ***The government shall implement an efficient, comprehensive, and integrated solid waste management program which will ensure the protection of public health and environment within the next ten years.*** Unlike the current collect and dump system, it will include soft and engineering policy instruments which will apply to the urban cluster of Dili-Hera-Tibar. This policy is conducive to "Healthy and Eco-friendly Society". Figure 11.4.2 shows the connection between the solid waste management policy and DMA Vision 2030.



Source: JICA Project Team

Figure 11.4.2 Linkage between SWM Policy and DMA Vision 2030

(1) Soft Components

1) Solid Waste Management (SWM) Legislation

Passage of a comprehensive law on solid waste management will provide the legal basis for the programs and projects needed to improve the current system.

2) Information, Education, and Communication (IEC) Campaign on SWM and Environmental Protection

Information, education, and communication campaign will augment knowledge on proper solid waste management and increase awareness on the need to protect the environment. It

will support the program of the three Rs (reduce, reuse, and recycle at source), which in turn will translate to lesser amount of waste for collection.

3) Social Preparation

Social preparation via consultation and coordination will increase support and promote ownership for SWM projects and programs by stakeholders.

4) Reduction, Reuse, Recycling at Source

5) Private Sector Recycling

The government should support the current private sector initiatives on recycling and provide guidelines for the sanitary operation of its facilities.

6) Waste Collection Fees

The polluter pays principle will initially be applied to the business sector through appropriate legislation and after extensive consultation. Thereafter, waste collection fees shall also be imposed on the residential sector.

Capacity building on SWM operation and monitoring shall be implemented to support implementation of engineering projects.

(2) Engineering Component

1) Efficient Collection

The required trips for the contracted trucks shall be strictly implemented. The current fleet of open trucks shall then be replaced by compactor trucks which will allow the collection of more waste with less number of trips.

2) Improvement of Dumpsite Conditions

The Tibar Dumpsite shall be improved to mitigate negative environmental conditions therein until such time that it is replaced by a sanitary landfill (SLF).

3) Dumpsite Closure

The Tibar Dumpsite shall be properly closed and rehabilitated once the SLF becomes operational.

4) MRF

A materials recovery facility (MRF) shall be established at Tibar to improve its recycling and provide work for waste pickers.

5) SLF Waste Disposal

A sanitary landfill shall be constructed within the rehabilitated Tibar Dumpsite. This facility will facilitate waste disposal in accordance with the environmental standards.

6) Technology for Waste Treatment

Over the long term, the urban cluster shall consider employing appropriate new technologies for waste processing and treatment subject to the results of feasibility studies.

Table 11.4.4 presents the target effect indicators for the implementation of the proposed SWM policy. These cover the various aspects and practices which needs improvement to meet the requirements of the SWM program.

Collection will increase from 73% in 2014 to 90% by 2020. Recycling will increase from 10% in 2014 to 15% by 2020. This will be bolstered by the operation of the MRF sometime in 2018. Burning of waste will cease by 2018 when MRF becomes operational. Dumpsite operations will improve by 2018 when additional equipment becomes available and training of disposal staff gets completed. Preparatory works on SLF such as F/S, financing, design, and bidding shall progressively commence in 2018 and culminate with its operation in 2022.

Table 11.4.4 Target Effect Indicators of Solid Waste Management Sector

Sector	Target Effect Indicator	Target Effect Indicator (Quantitative)				Description
		2014(Base)	2020 (Intermediate Target)	2025 (Intermediate Target)	2030 (Target)	
Solid Waste Management Sector	Collected Waste	73	123	161	211	Increase from 73% in 2014 to 90% in 2020
	Recycled Waste	8.8	19.1	25.1	32.8	Increase from 10% in 2014 to 15% in 2020
	Burning of Waste	Yes	None	None	None	Total stoppage of burning at Tibar by end of 2017
	Unsanitary Waste Picking	Yes	None	None	None	Stoppage of unsanitary waste picking by end of 2017
	MRF Operation	Not yet operational	12	16	21	Will operate in 2018 to facilitate sanitary recovery of recyclables and stop burning of waste
	Open Dumping	73	None	None	None	Improvement of dumpsite by 2016
	Disposal at SLF	Not yet operational	Not yet operational	137	190	SLF operation by 2022

Source: JICA Project Team

Institutionally, the program will be implemented under the Ministry of State Administration specifically through the Sanitation Department of the Dili Municipality.

11.4.3 Solid Waste Management Plan

(1) Overview

The development plan for the solid waste sector includes interrelated projects which will be implemented over the short term (2015 to 2020), medium term (2021 to 2025), and long term (beyond 2025). The projects are consistent with the four viewpoints needed to realize the DMA

Vision of 2030 particularly the attainment of high quality of life and a healthy and eco-friendly society.

Table 11.4.5 presents the long list of the proposed projects within the planning period, the corresponding indicative cost, and potential sources of funding.

Table 11.4.5 Long List of Proposed SWM Projects

No.	Project	Term			Project Cost (USD in million)	Possible Fund Source	New Project proposed by JPT	Possible Implementation Agency
		Short	Medium	Long				
1	**[Priority Project]** Improvement of Tibar Dumpsite Conditions and Operations	●			2.4	Public	●	Ministry of State/Sanitation Department
2	Improvement of Waste Collection	●			0.3	Public		Ministry of State/Sanitation Department
3	Regulatory Strengthening	●			1.35	Public	●	Ministry of Justice
4	IEC Campaign and Social Preparation	●			1.2	Public	●	Ministry of Education and Ministry of State/ Sanitation Department
5	Capacity Building on SWM	●			0.2	Public	●	Ministry of Education
6	Development of New Sanitary Landfill		●		7.0	Public		Ministry of State/Sanitation Department
7	Closure of Tibar Dumpsite		●		1.5	Public		Ministry of State/Sanitation Department
8	Acquisition of Compactor Trucks		●		0.8	Public		Ministry of State/Sanitation Department
9	Imposition of Fees for Waste Collection		●	●	0.6	Public	●	Ministry of Planning and Finance/ Ministry of State/Sanitation Department
10	New Technology for Waste Treatment			●	10	PPP		Ministry of Planning and Finance/ Ministry of State/Sanitation Department
TOTAL COST					25.35			

Source: JICA Project Team

Improvement of the Dili cluster SWM system would require an investment of about USD 25 million over the planning period based on current prices. The proposed projects could be implemented using funds from grants, loans, local resources, and private sectors or their combination.

(2) Short-term Projects

Table 11.4.6 lists the implementation schedule of the short-term projects. Among the five short-term projects, improvement of Tibar Dumpsite conditions and operations is given the top priority for immediate implementation due to the urgency of mitigating the negative environmental conditions.

Table 11.4.6 Short-term Projects and Their Implementation Schedules

No.	Project	2017	2018	2019	2020	2021
1	**[Priority Project]** Improvement of Tibar Dumpsite Condition and Operations	●	●	●	●	●
2	Improvement of Waste Collection	●				
3	Regulatory Strengthening	●	●	●	●	●
4	IEC Campaign and Social Preparation	●	●	●		
5	Capacity Building on SWM	●	●			

Source: JICA Project Team

1) Improvement of Tibar Dumpsite Conditions and Operations

This Project will include set of activities such as environmental assessment, site clearing and grading, compaction of waste, application of intermediate soil cover, construction of peripheral drainage canal, improvement of internal access road, and training of site personnel on proper disposal operations. Safety, sanitation, and security measures shall be implemented. This will include provision of wash area for disposal staff and waste pickers, provision of proper protective equipment for disposal personnel, access limitation to authorized personnel only, registration of waste pickers, and installation of signages

The Project will also include the acquisition of a weigh bridge and at least two additional bulldozers and the construction of a MRF for the waste pickers. The weigh bridge will facilitate accurate measurement and recording of incoming waste and can be used as basis for payment of collection services. The bulldozers will be used for grading, compaction of waste and application of soil cover. MRF will provide sanitary waste picking conditions in the recovery of recyclable materials and will result in the stoppage of burning.

This Project contributes to environmental improvement of inside and surrounding areas of Tibar Dumpsite, and the viewpoint of “Sustainability” in DMA Vision 2030 is considered.

Table 11.4.7 presents the various components of the Tibar Dumpsite improvement and their schedule of implementation.

Table 11.4.7 Components and Implementation Schedule of the Tibar Dumpsite Improvement

Activity	2017	2018	2019	2020	2021
Environmental assessment					
Acquisition of additional disposal equipment	●				
Acquisition and installation of weigh bridge	●				
Establishment of materials recovery facility		●			
Site clearing	●				
Site grading, waste compaction, and soil cover application		●	●	●	●
Construction of drainage canal	●				
Improvement of internal access road	●				
Training on disposal operation	●	●			
Safety, security, and sanitation measures	●	●	●	●	●

Source: JICA Project Team

2) Improvement of Waste Collection

The acquisition of the high density polyethylene (HDPE) bins will enhance the establishment of common accessible collection points and fill in the spatial gap between the established concrete waste storage areas. The bins will facilitate the easy loading of the waste into the collection trucks. The collection contract should not focus on number of trips as basis for payment but on the amount of waste collected and the cleanliness of the collection areas.

This Project contributes environmental improvement at surroundings of collection points, and the viewpoint of "Sustainability" in DMA Vision 2030 is considered.

3) Regulatory Strengthening

Enforcement of Decree Law 33/2011 will require regular and sustained monitoring by the government. Studies, consultation, formulation, and passage of the comprehensive law on integrated solid waste management will be initiated in the short term but will likely extend into the medium term.

This Project addresses the viewpoint of "Sustainability" in DMA Vision 2030, and it contributes to environmental improvement through the improvement of solid waste management by enforcing the regulations.

4) IEC Campaign and Social Preparation

IEC campaign will cover the basic components of solid waste management from generation through diversion, collection, and disposal. It will highlight the three Rs (reduce, reuse, and recycle) and present income opportunities related to the recovery and sale of recyclables. It will also give emphasis on timely placement of waste for collection and care and maintenance of HDPE bins. All proposed projects will need social preparation to generate acceptance and ownership among stakeholders. This will entail information dissemination, coordination, and consultation.

This Project addresses the viewpoint of "Sustainability" in DMA Vision 2030, and it contributes environmental improvement through improvement of manners in waste generation by conducting IEC campaign.

5) Capacity Building on SWM

Capacity building on SWM will be comprehensive and will cover the technical, financial, and management aspects. It should include study tours on operating the SWM systems in the countries with conditions generally similar to Dili.

This Project addresses the viewpoint of "Sustainability" and "Human Resources" in DMA Vision 2030 and contributes to environmental improvement through the improvement of solid waste management by capacity development of the concerned officials.

(3) Mid-Long Term Projects

1) Development of New Sanitary Landfill

The major engineering project in the medium term would be the construction of a sanitary landfill to replace the Tibar Dumpsite. The physical features of the Tibar Dumpsite provides options for its development into a sanitary landfill with due consideration for the waste that has been deposited therein and the negative environmental conditions it has generated. With proper design and usage, it could serve as a long term disposal facility for the Dili cluster.

In preparation for SLF development, an F/S needs to be conducted for comprehensive site and SWM system assessment; environmental licensing; social preparation; and determination of the optimum design, required mitigating measures for in-situ waste, equipment and manpower, and project cost. The study will also determine the phasing of the construction with the on-going operation of the dumpsite. It will also include the study of alternative sites outside of Tibar.

Although targeted for the medium term, preparatory works could be undertaken earlier subject to the resolution of site jurisdiction and acceptability issues of the host community.

This Project addresses the viewpoint of "Sustainability" in DMA Vision 2030, and it contributes to environmental improvement through the improvement of sanitation by developing SLF.

2) Closure of Tibar Dumpsite

The phased development of the SLF in Tibar needs to be integrated with the closure and rehabilitation of selected sectors of the present dumpsite. The sectors which will be closed will require the preparation of a closure plan which will include grading, compaction of waste, application of soil cover, installation of drainage system, gas venting, and placement of vegetation buffer and signage.

This Project addresses the viewpoint of "Sustainability" in DMA Vision 2030, and it contributes to environmental improvement through the improvement of solid waste management by closure of Tibar Dumpsite.

3) Acquisition of Compactor Trucks

During the medium term, the government can shift to the use of compactor trucks for waste collection either through contract or by administration. Currently, there are enough government and contracted trucks to handle the waste being generated if the efficiency and system of collection will be improved.

This Project addresses the viewpoint of "Sustainability" in DMA Vision 2030. It contributes reduction of expenditure through efficient transport of solid waste by introducing compactor trucks.

4) Imposition of Fees for Waste Collection

The imposition of collection fees on the waste generators in the Dili cluster will be needed to generate funds to cover part if not all of the expenditures for the O&M of the improved SWM system. This will be included in the proposed SWM legislation. The initial target will be the business sector in the medium term followed by the residential sector in the long term. This Project addresses the viewpoint of "Sustainability" in DMA Vision 2030, and it contributes to sustainable O&M of solid waste management system.

5) New Technology for Waste Treatment

Options for the use of technologies involving mechanized waste treatment and processing and even generation of power from waste may be considered in the long term. These options would require large investments, entail expensive O&M costs and require highly trained personnel. These types of projects would likely be initiated and operated by the private sector under a public-private partnership (PPP) arrangement with the government providing the site for development and waste that will be fed into the facility.

Aside from the large investment and technical requirements, the feasibility and sustainability of projects involving new technologies particularly on power generation will depend on the composition and sustained amount of collected waste.

11.5 Power Supply

11.5.1 Demand and Gap Analysis

ADB has been preparing the Power Sector Development Plan (PSDP) for Timor-Leste as the power sector plan for 20 years (from 2002 to 2020).

(1) Existing Demand Forecast

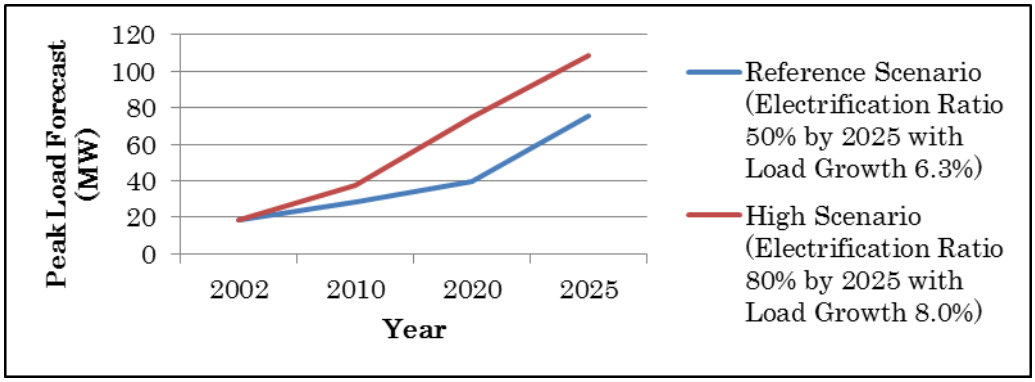
PSDP describes the demand forecast from 2002 to 2020, as shown in Table 11.5.1 and Figure 11.5.1. The two scenarios depend on some factors. These are calculated by sector investment packages (SIP) as the scenarios proposing that 50% and 80% of households have access to electricity by 2025.

Among the two scenarios, most of the assumptions adopted for the reference case and the reference scenario demand were used for analysis of the future plan in PSDP. In the case of the 80% scenario, high scenario, the peak demand of 2025 is about 5.8 times that of 2002.

Table 11.5.1 Forecasts of Load Growth in Timor-Leste in PSDP by ADB

Scenario	Electrification Ratio (%)		Peak Load Forecast (MW)				Average Load Growth (%)
	2002	2025	2002	2010	2020	2025	2002-2025
Reference Scenario	21	50	18.6	28.0	39.5	75.2	6.3
High Scenario	21	80	18.6	37.5	75.0	108.6	8.0

Source: Power Sector Development Plan for Timor-Leste by ADB



Source: Power Sector Development Plan for Timor-Leste by ADB

Figure 11.5.1 Forecasts of Load Growth in Timor-Leste in PSDP by ADB

(2) Power Demand Forecast

1) Power Demand Forecast for Timor-Leste

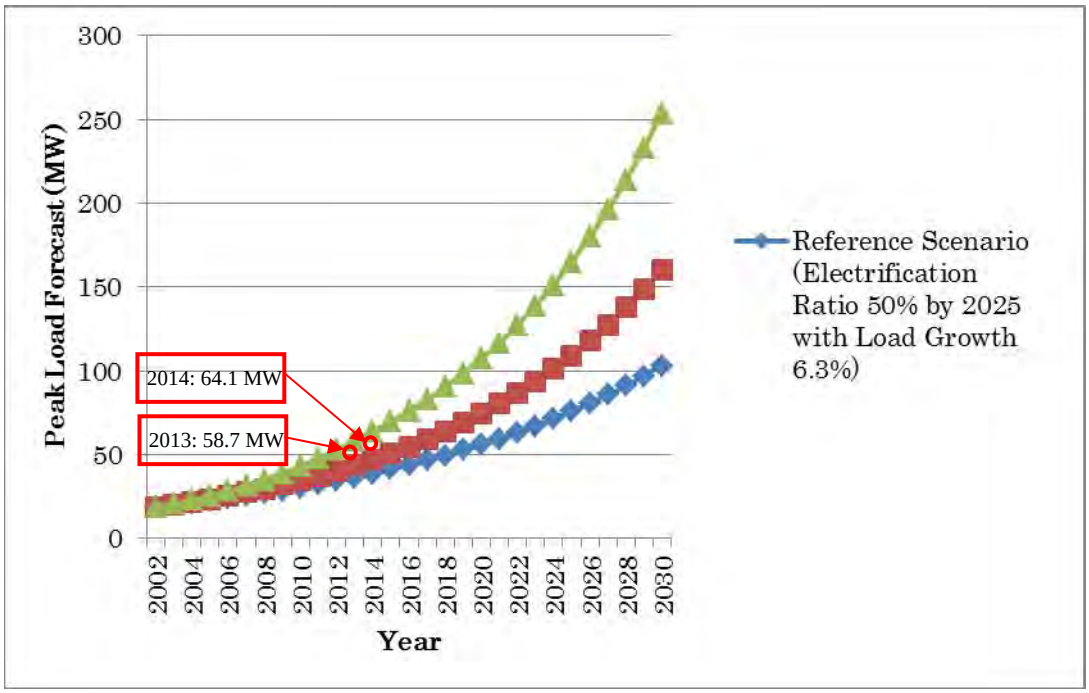
The existing power demand forecast above is based on the PSDP study period: 2002-2025. The Load Growth of Power Sector Development Plan LCPDP has two scenarios, namely, high scenario and reference scenario. The difference of the two scenarios is due to the difference of the electrification ratio. For example, the load growth ratio in high scenario is 8.0% as the electrification ratio 80% in 2025 and 6.3% as electrification ratio 50% in 2025, respectively, based on the reference scenario. On the other hand, SDP 2011-2030 sets the electrification ratio to 100% in 2030.

Table 11.5.2 and Figure 11.5.2 show the power demand forecast by 2030 using the electrification ratio growth rate and load growth assumed by JPT. The table also shows the actual peak load of 2013 and 2014 approximately equal the power demand forecast by JPT.

Table 11.5.2 Power Demand Forecast of Timor-Leste by 2030

Year	Project Demand Forecast (MW) (Electrification Ratio 100% by 2030 with Load Growth 11% from 2002 to 2012, and 9% from 2013 to 2030)	Reference Scenario (Electrification Ratio 50% by 2025 with Load Growth 6.3%) (MW)	High Scenario (Electrification Ratio 80% by 2025 with Load Growth 8.0%) (MW)	Note
2002	18.6	18.6	18.6	
2010	42.9	28.0	37.5	
2013	58.6	36.4	43.4	Actual Peak Power Demand: 58.7 MW (Measured in 20 kV Substations)
2014	63.9	38.7	46.8	Actual Peak Power Demand: 64.1 MW (Measured in 20 kV Substations)
2020	107.2	39.5	75.0	
2025	164.9	75.2	108.6	
2030	253.7	102.9	160.5	

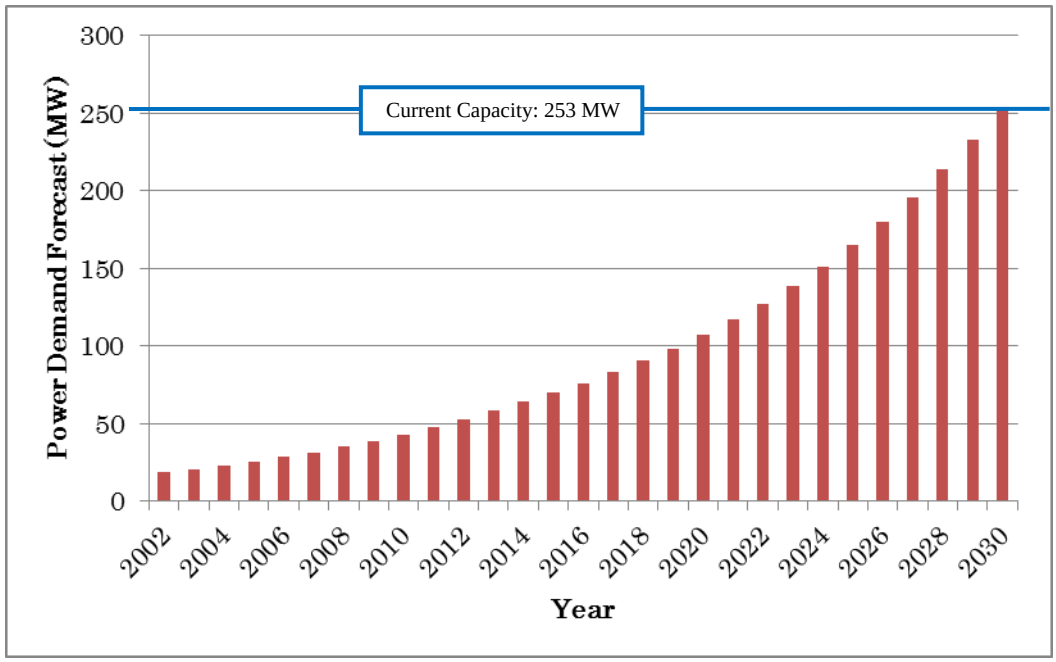
Source: JICA Project Team



Source: JICA Project Team

Figure 11.5.2 Power Demand Forecast of Timor-Leste by 2030

As mentioned in the Review of Current Condition of Power Supply, Timor-Leste has two power plants, which are the Hera Power Plant with capacity of 120 MW and Betano Power Plant with capacity of 136 MW. The total capacity of two power plants is 256 MW. JPT assumes that the power loss in 150 kV transmissions from the power plant to 150/20 kV substation is 1%. Hence, the current capacity of power supply is 253 MW. This forecast shows that the future power demand will not exceed the current capacity of power supply by 2030 (Figure 11.5.3).



Source: JICA Project Team

Figure 11.5.3 Power Demand Forecast of Timor-Leste by 2030

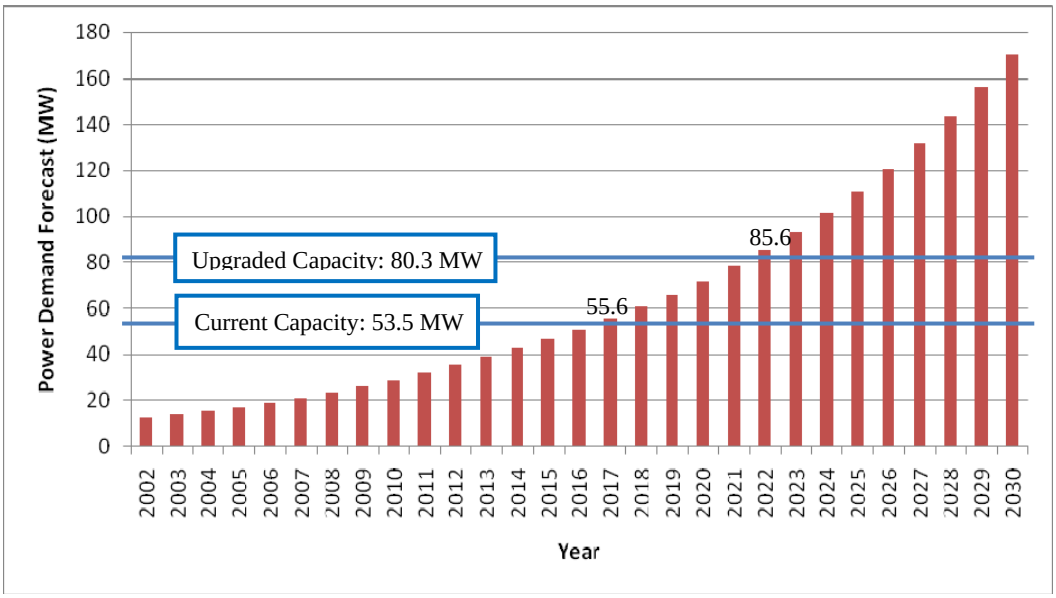
2) Demand Forecast of DMA

As already discussed, the power demand forecast of Timor-Leste has been assumed. Therefore, it is possible to calculate the power demand of DMA by utilizing the power demand forecast of Timor-Leste and the ratio of DMA demand to Timor-Leste demand. As a result of calculation, the power demand forecast of DMA is shown in Table 11.5.3 and Figure 11.5.4. The table also shows that the actual peak load of 2013 and 2014 are approximately equal to the power demand forecasted by JPT.

Table 11.5.3 Power Demand Forecast of DMA by 2030

Year	Project Demand Forecast (MW) (Electrification Ratio 100% by 2030 with Load Growth 11% from 2002 to 2012 and 9% from 2013 to 2030)	Note
2002	12.5	
2010	28.8	
2013	39.4	Actual Peak Power Demand: 40.1 MW
2014	42.9	Actual Peak Power Demand: 42.1 MW
2017	55.6	Exceed the current capacity of two transformers in Dili Substation with total capacity is 63 MVA (equal to 53.5 MW)
2020	72.0	
2022	85.6	Exceed the upgraded capacity of Dili Substation with total capacity is 94.5 MVA (equal to 80.3 MW)
2025	110.8	
2030	170.5	

Source: JICA Project Team



Source: JICA Project Team

Figure 11.5.4 Power Demand Forecast of DMA by 2030

As mentioned in the Review of Current Condition of Power Supply in the interim report, DMA has one 20 kV substation, namely Dili Substation. It has two transformers with capacity of 2x31.5 MVA (total capacity is 63 MVA, equivalent to 53.5 MW) and one spare space for one 31.5 MVA substation. This forecast shows that the future power demand of DMA by 2017 will be 55.6 MW. It will exceed the current capacity of Dili Substation. Dili Substation should be installed with one 31.5 MVA transformer in spare space to meet the load demand before 2017.

However, after upgrading the Dili Substation with a total capacity of 94.5 MVA (equivalent to 80.3 MW), the future power demand of DMA will exceed this capacity by 2022. (Figure 11.5.4)

11.5.2 Power Supply Policy

From the demand and gap analysis and the study of the current conditions previously, four points set for the development policy of the power sector to achieve the vision and urban structure are as follows:

- Reliable and sufficient power source to all Dili and surrounding areas;
- Affordable and lowest possible cost in distribution network;
- Improved management and operation in power system; and
- Renewable energy sources.

This policy caters for the pillars of "Robust Economic Hub" and "High Quality of Life".

1) Reliable and Sufficient Power Source to Dili and All Surrounding Areas

Power source should be reliable and sufficient for DMA and Timor-Leste. It will meet the needs of power demand, to support economic productivity and quality of life. This is the basic right and the foundation of the future economy. Table 11.5.4 shows the target effect indicators of power source in the power supply sector.

Table 11.5.4 Target Effect Indicators of Power Source (Power Supply Sector)

Sector	Target Effect Indicator (Narrative)	Target Effect Indicator (Quantitative)				Description
		2014	2020	2025	2030	
Power Supply	Power Plant	256 MW	256 MW	256 MW	346 MW	Total capacity of power plants for Timor-Leste will be enhanced from 256 MW (2014) to 346 MW (2030).
	150/20 kV substations for DMA	63 MVA	94.5 MVA	153 MVA	258 MVA	Total capacity of 150/20 kV substations for DMA will be enhanced from 63 MVA (2014) to 258 MVA (2030).

Source: JICA Project Team

2) Affordable and Lowest Possible Cost in Distribution Network

Beside sufficient power source, the distribution system is also very important. Increase of transformers and distribution lines to improve the quality of electricity. Generally, the voltage fluctuations in low voltage networks far exceed the levels of electrical appliances. This represents an additional burden for customers who thus bear the costs associated with electrical failure caused by voltage loss and poor performance of electrical appliances. Table 11.5.5 shows the target effect indicators of distribution network in the power supply sector.

Table 11.5.5 Target Effect Indicators of Distribution Network (Power Supply Sector)

Sector	Target Effect Indicator (Narrative)	Target Effect Indicator (Quantitative)				Description
		2014	2020	2025	2030	
Power Supply	Capacity of distribution substations	50.6 MVA	103.9 MVA	175.1 MVA	295.0 MVA	Total capacity of distribution substations for DMA will be enhanced from 50.6 MVA (2014) to 295 MVA (2030).
	20 kV transmission lines	204.9 km	274.6 km	350.5 km	447.3 km	Total length of 20 kV transmission line for DMA will be enhanced from 204.9 km (2014) to 447.3 km (2030).

Source: JICA Project Team

3) Improve Management and Operation in Power System

Power system of DMA will be increasing in scale and becoming more complex. The development of management and operation in power system by information technology, telecommunications, strengthened monitoring system, and automatic control systems is indispensable. It will improve the reliability and power supply contributing to the management of power demand and encourage the use of energy-saving and efficiency.

4) Renewable Energy Sources

As in the SDP 2011-2030, the development of renewable energies will help drive the economic growth and allow Timor-Leste to embrace new technologies and be a model of sustainable development.

Currently, the Hera Power Plant and Betano Power Plant are operated using fuel oil. Renewable energy will give significant recognition as a power supply. DMA should promote the generation of electricity using renewable energy resources and improve the rating of renewable energy sector as an attractive destination for substantial private sector investment. Accordingly, generation from hydro, solar, wind, biomass, and solid waste are among them and screened as candidates for the future generation sources.

These sources will also contribute to climate change adaptation and climate change mitigation efforts and help Timor-Leste meet the obligations under international climate change conventions.

11.5.3 Power Supply Development Plan

(1) Projects Necessary to Achieve the Development Policy

Currently, the power generation to national transmission network in Timor-Leste is from Hera Power Plant and Betano Power Plant with a total capacity of 256 MW. Current peak power demand of Timor-Leste is 64.1 MW by 2014. Due to the excess capacity of power generation, Hera Power Plant is the only one operating, while the Betano Power Plant is used as a backup power plant. According to the power demand forecast by JPT, the power demand of Timor-Leste will exceed the capacity of Hera and Betano power plants by 2028. However, beside the power generation from the two power plants, in the report, "Access to Energy in Timor-Leste" by the Electricity of Timor-Leste (EDTL) in 2013. The EDTL has targeted reduction of fossil fuel targets through exploitation of:

- Wind power: 81 MW
- Solar power: 7 MW
- Hydro power: 351 MW

Therefore, the power generation capacity at Timor-Leste will be enough in the future.

Regarding DMA, power supply is received from the national grid through 115/20 kV substations. When the power demand of DMA increases, the existing 115/22 kV Dili Substation should be upgraded to increase the capacity or install the new 115/22 kV substation.

With the reason above, the JPT proposes five projects to be carried out by 2030 to achieve the development policy set for the power sector, which are shown in Table 11.5.6.

Table 11.5.6 List of Projects of Power Supply Sector

No.	Project	Term			Project Cost (USD in million)	Possible Fund Source	New Project proposed by JPT	Possible Implementation Agency
		Short	Middle	Long				
1	**[Priority Project]** Upgrade Dili Substation	●			1.0	ODA	●	EDTL (MOPW)
2	**[Priority Project]** Extension Distribution Network	●			6.2	ODA	●	EDTL (MOPW)
3	Development of 150/20 kV 3x63 MVA substation		●		10	ODA	●	EDTL (MOPW)
4	Development of SCADA System for Distribution Network		●		5.0	ODA	●	EDTL (MOPW)
5	Development of Renewable Energy			●	1.0	Public	●	EDTL (MOPW)

Source: JICA Project Team

These projects are divided into three categories. Priority projects are to be carried out for power supply development and to be completed by 2020. Meanwhile, other projects are the ones to be implemented after 2020.

The main objectives of each project are as follows:

1) Upgrade Dili Substation

Currently, Dili Substation has two transformers with each capacity of 31.5 MVA (total capacity is 63 MVA, equivalent to 56.7 MW) and one spare space for one 31.5 MVA substation. In the power demand forecast, it shows that the future power demand of DMA by 2017 will be 59.8 MW. It will exceed the current capacity of Dili Substation. Dili Substation should be installed one 31.3 MVA transformer in spare space to meet the load demand before 2017. This Project aims to upgrade power supply and to support industry and citizens' lives. In this sense, the Project is related with the viewpoint of "Sustainability" of DMA Vision 2030.

2) Extension Distribution Network

Power distribution network of DMA has 217 substations with a total capacity of 50.55 MVA and 20 KV transmission line with the length of 204.92 km. As power demand forecast, the power distribution network needs to add about 53.3 MVA (equivalent to approximately 130 substations including low voltage distribution line) and 69.7 km of 20 kV transmission lines with overhead line and underground cable (underground cable is applied in historic area and center area only). The purpose of extension distribution network is to cope with the increase of power demand in the future and increase the sufficient power supply to all areas of DMA. This Project aims to upgrade the power supply and to support industry and citizens' lives. In this sense, the Project is related with the viewpoint of "Sustainability" of DMA Vision 2030.

3) Development of 150/20 kV 3x63 MVA Substation

Although after upgrading Dili Substation to full design capacity of 94.5 MVA (equivalent to 85 MW), the power demand of DMA will still exceed the capacity of Dili Substation in 2021. In addition, the power demand of DMA will increase up to 232.2 MW (equivalent to 258 MVA) by 2030; therefore, DMA needs to install a new 150/20 kV substation with a total capacity of 189 MVA (including three transformers with capacity of 63 MVA). This Project aims to upgrade the power supply and to support industry and citizens' lives. In this sense, the Project is related with the viewpoint of "Sustainability" of DMA Vision 2030.

4) Development of SCADA System for Distribution Network

SCADA stands for Supervisory Control and Data Acquisition. It is not only a complete control system but also a monitoring system. SCADA system is an automated system with management and supervision of the entire power system. SCADA system will improve the efficiency of work, modernization, and saving power consumption. SCADA conducts power system monitoring with the technical parameters such as kW and kVA. These parameters should be monitored closely for the power management works. SCADA systems should be installed after the extension of power distribution network in DMA. This Project aims efficient use of electricity and supports industry and citizens' lives. In this sense, the Project is related with the viewpoint of "Sustainability" of DMA Vision 2030.

5) Development of Renewable Energy

Renewable energy is the energy from the natural resources which are continuous and cannot be exhausted such as solar, hydro, wind, geothermal, ocean, and biology. They are clean energy, environment-friendly product, and do not contribute to the warming of the global climate. However, a limitation of all renewable energy sources is it is very difficult

to be produced in large capacity and the initial investment cost is high. Some renewable energy station will be installed in DMA for the solar energy stations and wind energy stations will be installed for small area which has a low power demand. This Project aims to upgrade power supply and supports industry and citizens' lives. In this sense, the Project is related with the viewpoint of "Sustainability" of DMA Vision 2030.

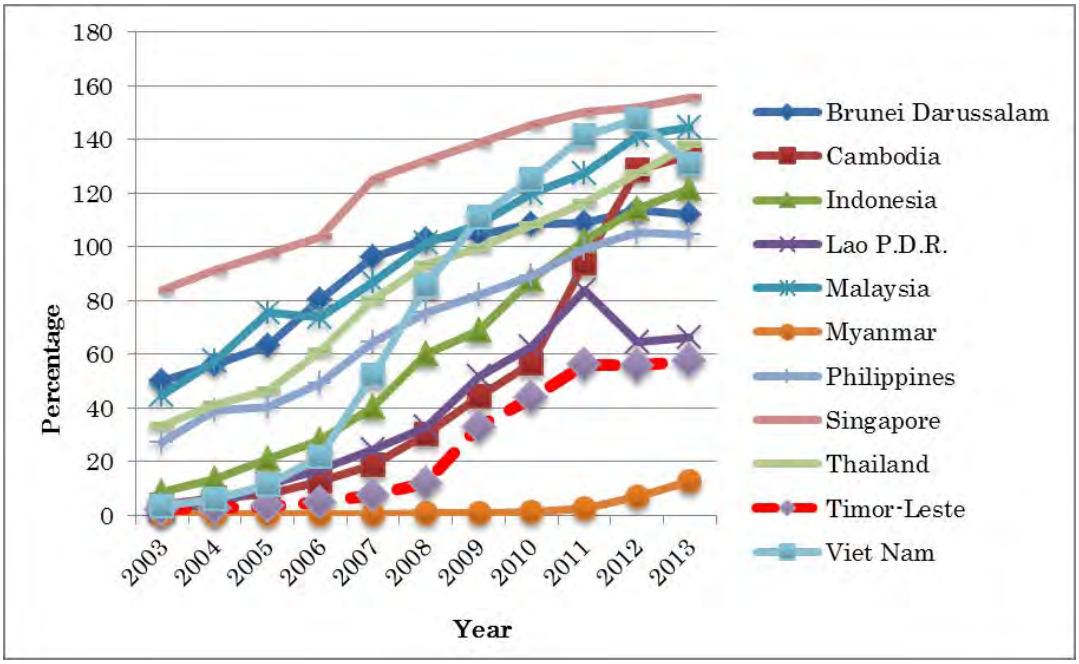
11.6 Telecommunication

11.6.1 Demand and Gap Analysis

In this section, JPT calculates the demands for telecommunications, such as mobile telephone, internet use, internet broadband use, and international bandwidth capacity. Demand for telecommunications is calculated in consideration of the future population studied in this report and the world trends of the telecommunications sector.

(1) Mobile Telephone

Based on the International Telecommunications Union (ITU) statistics, mobile penetration ratio of countries in the Association of Southeast Asian Nations (ASEAN) is shown in Figure 11.6.1. In this statistics, the mobile penetration ratio of Timor-Leste was 57.38% in 2013. The development of mobile penetration ratio in Southeast Asia is divided into three main groups. The first group starts its early stages from 2005 to 2006, including Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam. The second group starts from the period of 2008, including Cambodia, Laos, and Timor-Leste. The last group is Myanmar. Since Myanmar opened its free market in 2010, the development of mobile penetration ratio begun in 2011. The growth rate of mobile penetration ratio in each country was nearly constant after the mobile penetration started to rise.



Source: JICA Project Team based on ITU statistics

Figure 11.6.1 Mobile Phone Penetration Ratio of ASEAN Countries

In addition, the mobile penetration of G7 countries moved up at 41.24% points per decade on average as shown in Table 11.6.1. Applying this growth rate to calculate the mobile penetration ratio demand in DMA, mobile demand is expected to grow as shown in Table 11.6.2.

Table 11.6.1 Penetration Ratio of Developed Countries between 2003 and 2013

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Growth Rate (2003-2013)
Canada	42.07	47.06	52.76	57.49	61.47	66.20	70.55	75.68	79.41	80.05	78.40	36.33
France	68.90	73.02	78.26	83.53	88.98	92.68	92.10	91.39	94.08	97.38	98.50	29.60
Germany	77.34	85.06	94.55	102.28	115.14	126.56	126.23	106.48	109.66	111.59	119.03	41.69
Italy	98.10	107.69	121.86	136.12	150.96	150.89	149.51	154.80	158.15	159.69	158.88	60.78
Japan	68.49	72.16	75.98	78.52	84.35	86.71	91.32	96.81	102.00	108.73	115.19	46.70
United Kingdom	90.88	99.51	108.59	115.60	121.10	122.19	123.95	123.63	123.60	124.76	123.77	32.89
United States	54.85	62.55	68.32	76.29	82.06	85.21	88.62	91.31	94.40	96.02	95.53	40.68
											Average Growth Rate of the Decade	41.24

Source: JICA Project Team based on ITU statistics

Table 11.6.2 Mobile Telephone Demand of DMA

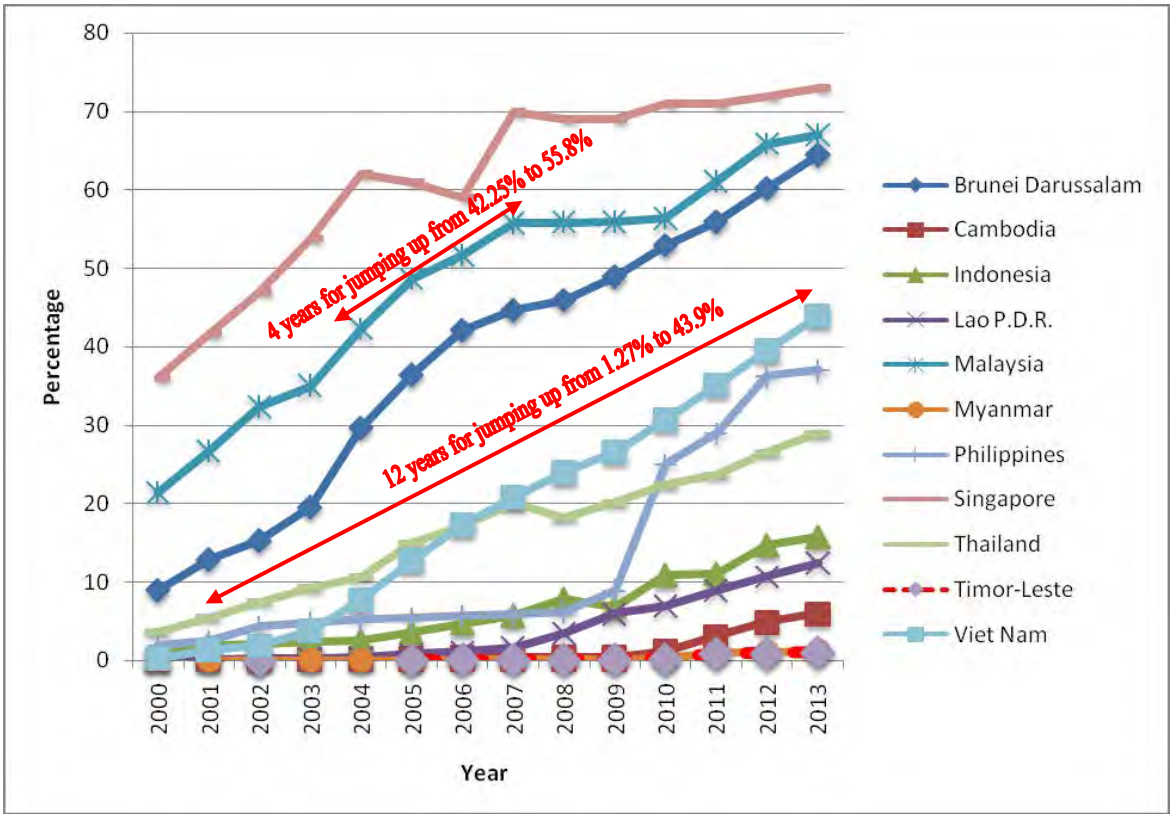
Year	2014	2020	2025	2030
Population	257,630	321,760	397,230	500,000
Mobile Penetration (%)	61.13	83.63	102.38	121.13
Estimated Mobile Subscriptions	157,489	269,087	406,684	605,650

Source: JICA Project Team based on ITU statistics

(2) Internet Use

Internet use penetration ratio in Timor-Leste is very low. According to the ITU, in 2005 the proportion of internet users in Timor-Leste is 0.1%, and by 2013 it reached 1.1%. The main reason is due to international connectivity, which is provided only through satellite links or microwave. There is no submarine fiber links that is connected to Timor-Leste. It leads to a higher price compared with the citizens' income. In the future, terrestrial local cable links can be connected with Kupang (Indonesia) or Darwin (Australia). Moreover, the internet cost will be a lot cheaper, while the internet users' penetration will increase rapidly like its neighboring countries.

As shown in Figure 11.6.2, it took 12 years for the internet use penetration ratio to reach up to 43.9% from 1.27% in Vietnam. In Malaysia, where a much higher penetration ratio is seen, it took approximately four years for the ratio to rise from 42.25% to 55.8%. Applying this growth rate to calculate the internet use penetration in Timor-Leste, the demand is assumed as shown in Table 11.6.3. Following the trend of ASEAN countries, the internet penetration ratio demand will reach 25.95% by 2020, 43.7% by 2025, and 60.65% by 2030.



Source: JICA Project Team based on ITU statistics

Figure 11.6.2 Internet Use Penetration Ratio of ASEAN Countries

As seen in Table 11.6.3, it is expected that the majority of Dili's population will use the internet by 2030. With reference to the increasing internet penetration ratio, the expansion of the international communication bandwidth capacity to be connected outward through the undersea cable and satellite will be necessary.

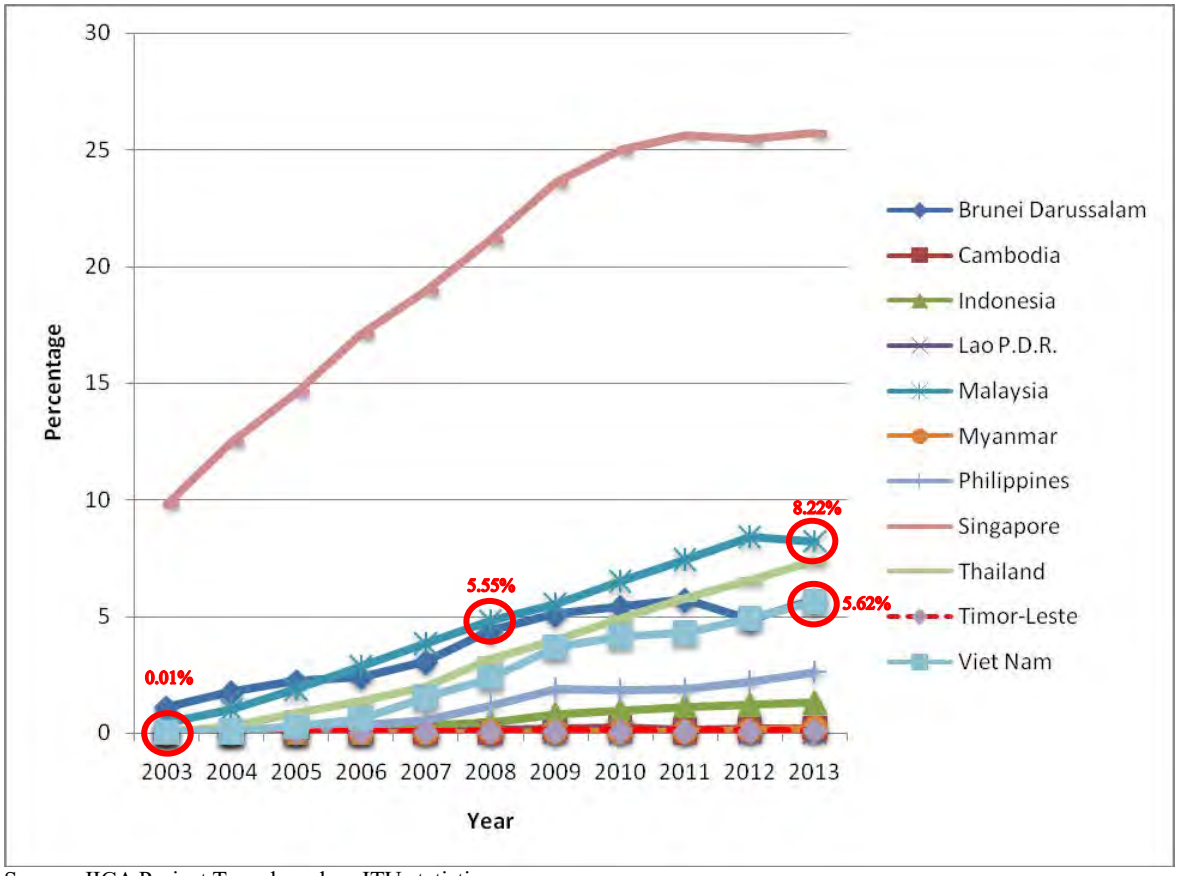
Table 11.6.3 Internet Use Demand of Dili

Year	2014	2020	2025	2030
Population	257,630	321,760	397,230	500,000
Internet Penetration (%)	4.65	25.95	43.7	60.65
Estimated Internet User	11,980	83,496	173,589	303,250

Source: JICA Project Team based on ITU statistics

(3) Internet Broadband Use

Internet broadband use penetration ratio is similarly with the internet use penetration ratio. According to the ITU statistics, the internet broadband use penetration ratio of Timor-Leste by 2013 is only 0.06%. As shown in Figure 11.6.3, from 0.01%, it took ten years for the internet broadband use penetration ratio of Vietnam to reach up to 5.62%. Furthermore, in Malaysia, where a much higher penetration ratio is seen, it took approximately five years for the ratio to rise from 5.55% to 8.22%. Applying this growth rate to calculate the internet broadband use penetration, the demand is assumed as shown in Table 11.6.4.



Source: JICA Project Team based on ITU statistics

Figure 11.6.3 Internet Broadband Use Penetration Ratio of ASEAN Countries

Table 11.6.4 Internet Broadband Use Demand of Dili

Year	2014	2020	2025	2030
Population	257,630	321,760	397,230	500,000
Internet Broadband Penetration (%)	0.62	3.98	6.78	9.43
Estimated Internet Broadband User	1,597	12,806	26,932	47,150

Source: JICA Project Team based on ITU statistics

(4) International Communication Bandwidth Capacity

The international communications of Timor-Leste is provided through satellite and microwave. As interview of three internet suppliers, the current international bandwidths are as follows:

- Telcomcel: 750 Mbps by microwave which is installed in the border between Timor-Leste and Indonesia,
- Timor Telecom: 800 Mbps by satellite, and
- Telemor: 400 Mbs by satellite.

Total international communication bandwidth capacity of Timor-Leste by 2014 is 1,950 Mbps. In particular, Dili traffic accounted for 70% of the entire of Timor-Leste (equivalent to 1,365 Mbps).

With the increase in the number of internet users, there is a need for the international communication bandwidth capacity to expand in order to provide smooth internet connection for the users. Demand for international communication bandwidth capacity is studied based on the following assumptions listed in Table 11.6.5, which shows the result of demand forecast for international communication bandwidth capacity.

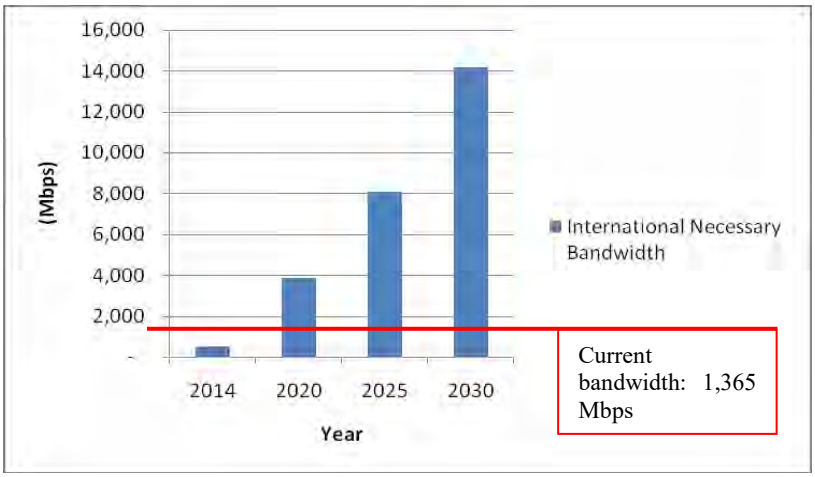
Table 11.6.5 International Communication Bandwidth Capacity Demand

No.	Items	Unit	2014	2020	2025	2030	Calculation
(1)	Population		257,630	321,760	397,230	500,000	
(2)	Internet user		11,980	83,497	173,590	303,250	
(3)	Internet user ratio	%	4.65	25.95	43.70	60.65	
(4)	Broadband user ratio	%	0.62	3.98	6.78	9.43	
(5)	Broadband user		1,597	12,806	26,932	47,150	(1)*(4)/100
(6)	Individual data use per day	MByte	3,000	3,000	3,000	3,000	
(7)	Individual data use per day	Mbit	24,000	24,000	24,000	24,000	
(8)	Total data per day	Mbit	38,335,344	307,345,152	646,372,656	1,131,600,000	(5)*(7)
(9)	**Necessary bandwidth (broadband user)**	**Mbps**	**444**	**3,557**	**7,481**	**13,097**	**(8)/24/60/60**
(10)	Narrowband user		10,382	70,691	146,657	256,100	(2)-(5)
(11)	Individual data use per day	MByte	300	300	300	300	
(12)	Individual data use per day	Mbit	2,400	2,400	2,400	2,400	
(13)	Total traffic per day	Mbit	24,917,974	169,657,613	351,977,558	614,640,000	(10)*(12)
(14)	**Necessary bandwidth (narrowband user)**	**Mbps**	**288**	**1,964**	**4,074**	**7,114**	**(13)/24/60/60**
(15)	**Necessary bandwidth (internal)**	**Mbps**	**732**	**5,521**	**11,555**	**20,211**	**(9)+(14)**
(16)	Internal connection ratio		0.7	0.7	0.7	0.7	
(17)	**International necessary bandwidth**	**Mbps**	**512**	**3,865**	**8,088**	**14,148**	**(15)*(16)**

Assumption:
Broadband subscription : Linear increase
Individual data usage per day : 3,000 MByte (for broadband user) and 300 MByte (for narrowband user)
International connection ratio : 0.7

Source: JICA Project Team based on ITU statistics

As shown in Table 11.6.5, although the current available international communication bandwidth capacity for Dili is 1,365 Mbps, the estimated international capacity will be 3,865 Mbps by 2020. This forecast shows that the international communication bandwidth capacity will exceed the current capacity before 2020 (Figure 11.6.4).



Source: JICA Project Team based on ITU statistics

Figure 11.6.4 International Communication Bandwidth Capacity Demand

11.6.2 Telecommunication Policy

Based on the study of the current conditions previously, JPT set up policies for the development of telecommunications in Dili to achieve Vision and Urban Structure. The policies are as follows:

- Reliable and affordable mobile phone coverage provided to all Dili and surrounding areas,
- High speed and reliable communications network and its connectivity,
- E-government,
- Policy, regulation, and institution development.

These policies are conducive to the pillars of "Robust Economic Hub" and "High Quality of Life" in DMA Vision 2030.

1) Reliable and Affordable Mobile Phone Coverage Provided to All Dili and Surrounding Areas

Telecommunications network is a public infrastructure. Therefore, Dili shall administer the construction, installation, and maintenance works conducted by the telecommunications contractors/operators, because telecommunications infrastructure partially occupying municipal roads or lands and antenna towers built operator-by-operator impair the urban landscape. Thus, the PPP should be improved to optimize telecommunications infrastructure development for providing sufficient mobile phone demand in Dili. Table 11.6.6 shows the target effect indicators of mobile phones on the telecommunication sector.

Table 11.6.6 Target Effect Indicators of Mobile Phone (Telecommunication Sector)

Sector	Target Effect Indicator (Narrative)	Target Effect Indicator (Quantitative)				Description
		2014	2020	2025	2030	
Telecommunication	Mobile Phone Penetration ratio	61.13%	83.63%	102.38%	121.13%	Mobile phone penetration ratio will be enhanced from 61.13% (2014) to 121.13% (2030).
	Mobile Phone Subscriptions	157,489	269,087	406,684	605,650	Mobile phone subscriptions will be enhanced from 157,489 (2014) to 605,650 (2030).

Source: JICA Project Team based on ITU statistics

2) High Speed and Reliable Communications Network and its Connectivity

Building reliable information and communications infrastructure is essential to realize robust economy and to improve the quality of life in DMA. Furthermore, it contributes to operating and maintaining other sector infrastructures effectively and reasonably. To realize this, all communication infrastructure layers including the national backbone communication network, the metro trunk communication network, and the access network, which are an interface with the users, need to be improved. Similarly, the bottleneck of the international connection should be solved by building a submarine fiber link that can process the increasing international bandwidth that goes together with the expansion of internet users. Table 11.6.7 shows the target effect indicators of internet use and international communication bandwidth on the telecommunication sector.

Table 11.6.7 Target Effect Indicators of Internet Use and International Communication Bandwidth (Telecommunication Sector)

Sector	Target Effect Indicator (Narrative)	Target Effect Indicator (Quantitative)				Description
		2014	2020	2025	2030	
Internet	Internet user	11,980	83,496	173,589	303,250	Internet user will be enhanced from 11,980 (2014) to 303,250 (2030).
	International communication bandwidth (Mbps)	512	3,865	8,088	14,148	International communication bandwidth will be enhanced from 512 Mbps (2014) to 14,148 Mbps (2030).

Source: JICA Project Team based on ITU statistics

3) E-government

E-government delivers a next generation of administrative services that enables to share and utilize information and data among the national and local governments through computer network instead of the current administrative services conducted face-to-face through documents; and to promote e-government, through raising the level of information and communications technology (ICT) literacy education and developing an exclusive government network that is not affected by data stream of the private sector, are recommended to be introduced.

4) Policy, Regulation, and Institution Development

Timor-Leste is supposed to have the authority to consider and approve all development applications and grant all development permissions. Moreover, it is expected to control the use and development of land and buildings in the city area, and to have jurisdiction over the control of the use and development of land and infrastructure for the interest of proper and orderly development. For this reason, Timor-Leste is required to formulate and enforce the policy, regulations, and institutions when developing the telecommunications infrastructure.

In the future, the government should not intervene in pricing, except in reviewing prices in the event of market failures. The new telecommunications legislation also addresses the interconnection, and may require operators to publish reference interconnection offers. The telecommunications should upgrade to the universal service goals such as to provide voice-service access to all citizens, and to provide broadband internet access to all district capitals in the near term. To achieve this, the government has to establish the telecom fund, which will be financed from levies, donor funding, and government grants. Successful implementation of these progressive policies will reach strengthened technical capabilities within the relevant governmental bodies.

11.6.3 Telecommunication Development Plan

(1) Projects Necessary to Achieve the Development Policy

The JPT proposes six projects to be carried out by 2030 to achieve the development policy set for the telecommunications sector which are shown in Table 11.6.8.

Table 11.6.8 List of Projects of Telecommunication Sector

No.	Project	Term			Project Cost (USD million)	Possible Fund Source	New Project proposed by JPT	Possible Implement-ation Agency
		Short	Mid	Long				
1	**[Priority Project]** Development of Submarine Fiber Links	●			16.5	Public	-	NDIT (MOTC)
2	**[Priority Project]** Development of Optic Trunk Communication Network	●			1.0	PPP	-	NDIT (MOTC)
3	**[Priority Project]** Development of National ICT Center	●			6.0	Public	-	NDIT (MOTC)
4	Development of E-Government		●		0.75	Public	-	NDIT (MOTC)
5	Development of Domain Management System		●		1.0	Public	●	NDIT (MOTC)
6	Establishment of Government Data Center with Cyber sSecurity			●	4.0	Public	●	NDIT (MOTC)

Source: JICA Project Team

These projects are divided into three categories. Priority projects are to be carried out for telecommunications infrastructure development and to be completed by 2020. Meanwhile, other projects are to be implemented after 2020.

The main objective of each project as follows:

1) Development of Submarine Fiber Link

Currently, the international connectivity of Timor-Leste is provided only through satellite links and microwave links and no submarine fiber links, which is connected to Timor-Leste. Therefore, internet speed is slow with higher costs. To avoid such bottleneck, three international connectivity options are possible. The most cost effective option is to connect to nearby Kupang-Indonesia (about 300 km). Kupang is already connected by the Mataram-Kupang cable system maintained by PT-Telkom, Indonesia. Capital expenditures of connectivity are estimated to be USD 16.5 million to Kupang. The other options are to connect Darwin, Australia via Suai (about 750 km) at a cost of USD 68 million or Singapore (about 3750 km) for USD 133 million.

This Project aims to strengthen international connectivity with other countries, and to address the viewpoint of “Linkage” of DMA Vision 2030.

2) Development of Optic Trunk Communication Network

Upgrading the optic fiber trunk network for the metro trunk communications and local access network is essential to solve the telecommunications infrastructure issues. Enhancement of communications network contributes not only to the improvement of internet user convenience but also to the introduction of the intelligent transport systems (ITS) which provide innovative services to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks.

This Project aims to strengthen the communication network between the urban areas and other regions in the country, and it addresses the viewpoint of “Linkage” of DMA Vision 2030.

3) Development of National ICT Center

The main purpose of this Project is to improve the ICT training centers to develop the potential and ability of all government employees to facilitate the process of introducing ICT to be implemented in their respective workplaces. Additionally, it will be the main office of the National Division of IT for the implementation and development of ICT systems and it establish Democratize the Research and Development for more development and investment in Dili and Timor-Leste as well.

This Project aims capacity development of concerned officials in charge of ICT, and it addresses the viewpoint of "Human Resources" of DMA Vision 2030.

4) Development of E-Government

The purpose of e-government is to increase transparency, accountability, integrity, and leadership of the modern government. Timor-Leste government attaches great importance to e-government initiative. The necessity of e-government is outlined in the Government's Strategic Development Plan (SDP). It is envisaged in the SDP that e-government should provide citizens easy access to information and government services. This Project aims to strengthen the connection between the government and its citizens, so it addresses the viewpoint of "Linkage" of DMA Vision 2030.

5) Establishment of Government Data Center with Cyber Security

The data center is a centralized repository, either physical or virtual, for the storage, management, and dissemination of data and information. On the national government level, the Timor-Leste should build a government data center for processing and storage of government applications and data.

In addition, cyber-attacks of fraudulent access and distributed denial of service (DDoS) have hit and damaged the intranet system of companies and government offices and concurrently might have caused a leak of confidential information or an organization's defamation. Cyber-attack protection does not only serve to block an attack from the outside of intranet, but also includes countermeasures which are premised on intrusion into the intranet.

This Project will sustain the ICT functions of the government through strengthening the security, and it addressed the viewpoint of "Sustainability" of DMA Vision 2030.

CHAPTER 12 : URBAN DEVELOPMENT MANAGEMENT

12.1 Outline of Urban Development Management

For efficient implementation of the Dili Urban Master Plan (DUMP) including realizing the structure plan, land use plan, and infrastructure development plan, urban development management has to be strengthened. The population of the Dili Metropolitan Area (DMA) is expected to increase from 223,793 in 2010 to around 500,000 in 2030. In the case of Hera, the population is expected to increase more than three times from 7,376 to 27,000, and for Tibar, it is expected to be more than 15 times (from 3,096 to 48,000). A strong policy and direction is necessary to realize the structural plan and to accommodate population increase which includes strengthening of "institutional arrangement for urban development management" which shall be supported by human resources development and database management.

- Institutional arrangement for urban development management is composed of (i) development control measures and (ii) development promotion measures. Development control measures cover land development permit and building permit which are being regulated through guidance on control of the "development zone" and "conservation zone". Development promotion measures cover urban development project, policy on housing development, land management, and infrastructure development to guide the development in Hera and Tibar.

- Human resources development is proposed to accommodate tasks required for establishing urban management and targeting concerned organizations including central government organization, local government organization, and coordination agency (to be established).

- Database management plan is utilized for land use control and infrastructure development.

12.2 Institutional Arrangement for Urban Development Management

Institutional arrangement for urban development management is proposed through development control measures and development promotion measures which are important in promoting sound development in Dili and directing development in Hera and Tibar.

12.2.1 Development Control Measures

Since the Dili Metropolitan Area is surrounded by ocean and mountain, and land is limited, land use efficiency has to be improved through land use control. Proper development control mechanism has to be developed, which includes the establishment of land development permit mechanism, strengthening of building permit mechanism, establishment of development standard, and other mechanisms which aim to promote sound urban development.

(1) Establishment of land development permit mechanism

Development permit mechanism is applied on large-scale development which is expected to have impact on land use and also in neighboring areas. Development conditions for applying development permit are proposed as shown below.

- Commercial development of area with more than 5,000 m^2
- Residential development of area with more than 1,000 m^2
- Factory depending on size and types of activities
- Other development which is expected to have impact on urban environment including traffic congestion, security, noise, solid waste

Evaluation of permit will be conducted based on development standard shown in (5).

(2) Strengthening of building permit mechanism

Building permit is composed of building safety and zoning regulation, but building permit system does not exist in Timor-Leste. For implementation of the Master Plan, zoning regulation should be strengthened. Since the capacity of staff in terms of number and skills is limited, the types of buildings requiring building permits have to be selected. Housing for individual use can be excluded from mandating building permit. Buildings, which many people are expected to use so the impact to neighboring area is large and also can be used for "evacuation place" when disaster happens, require permit as shown below.

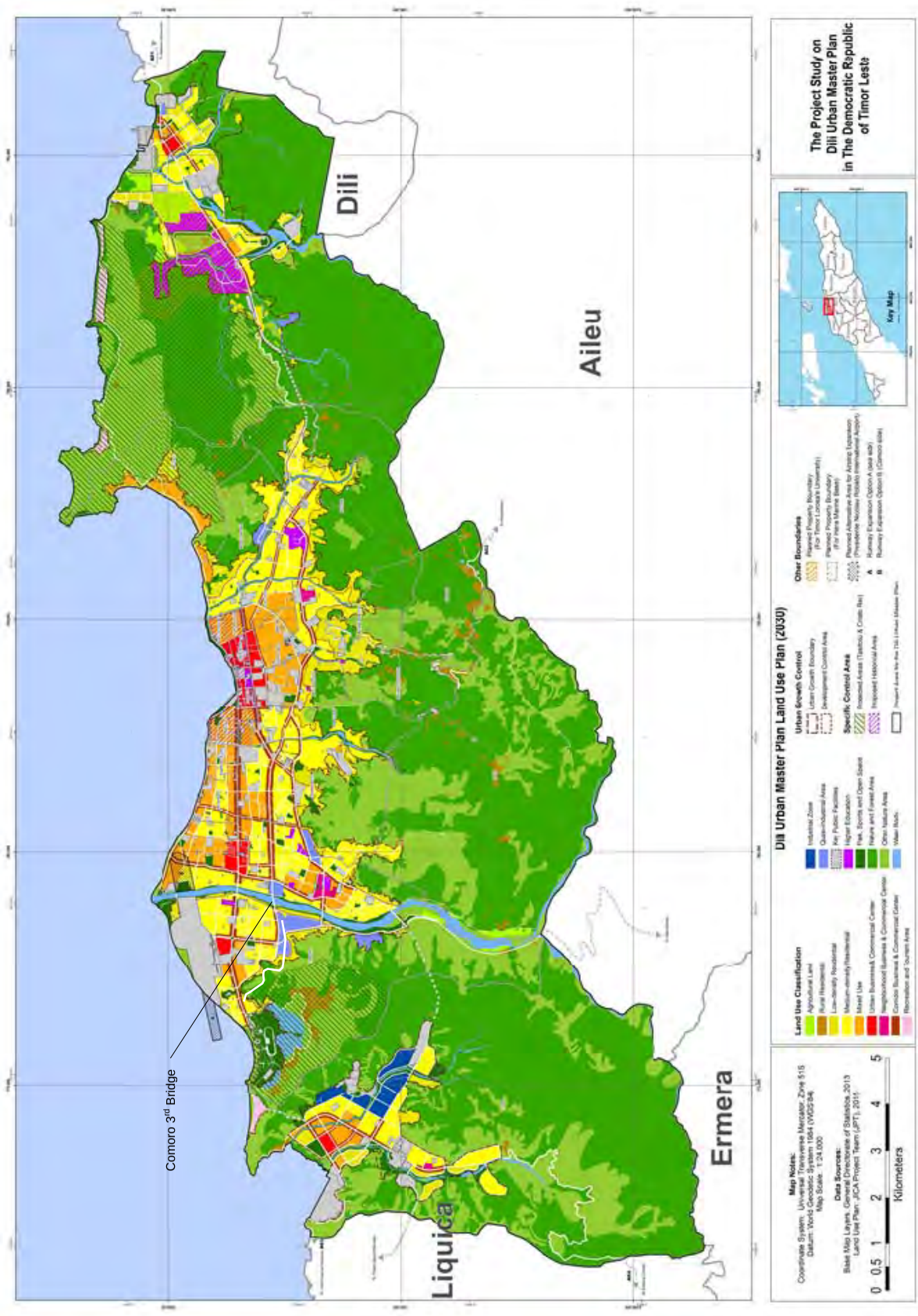
- Building used for public purpose: government building, schools, hospitals, shops, hotels
- Apartment (more than six rooms, more than three floor levels)

(3) Control of Development Zone

Development zone is designated in the area where urbanization or development is promoted which should be controlled by setting guidance on building use, building size, and bulk control.

1) Building use

Building use is one of the important items to realize in the land use plan since the plan shows the major function of each zone by eliminating disturbing factors. Building use shows the building use permitted and not permitted in each zone. For example, residential zone does not mean only "housing" is allowed, any building or development directly related to residential activity including small shops, elementary schools, religious building, and clinic should be allowed, but shopping mall, which has negative impact on residential activity by causing traffic congestion, noise, and security, should not be allowed. The following table shows ideas of the building use that are allowed and not allowed for each zone proposed for urban areas.



Source: JICA Project Team.

Figure 12.2.1 Proposed Land Use Plan in 2030 for Dili Metropolitan Area

Table 12.2.1 Proposed Zoning and Building Use for Urban Area

Zone	Low Residential	Medium Residential	Neighborhood Commercial	Commercial	Industry	Public Use
Houses	○	○	○	○	×	○
Schools	○	○	○	○	×	○
Religious building	○	○	○	○	○	○
Hospital, University	×	○	○	○	×	○
Shop (150 m^2 max)	○	○	○	○	○	○
Shop (500 m^2 max)	×	×	○	○	×	○
Office	○	○	○	○	×	○
Hotel	×	○	○	○	×	○
Green open space	○	○	○	○	○	○
Garage (workshop)	×	○	○	○	○	○
Warehouse	×	×	○	○	○	×
Theater	×	×	○	○	×	○
Sports facilities	×	×	○	○	×	○
Factory with SOME possibility of Danger or Environmental Degradation	×	×	×	○	○	○
Factory with STRONG possibility of Danger or Environmental Degradation	×	×	×	×	○	×

Note: ○: allowed, ×: not allowed, with *: conditional
Source: JICA Project Team

2) Nuisance/hazardous facilities in residential area

Nuisance/hazardous facilities are specified as follows:

- Hazardous facilities: facilities treating explosive equipment/material (flammable substance, oxidizer, source of ignition)
- Odorous facilities: chemical factory, leather processing, sewer plant
- Noisy facilities: event/music hall, processing factory with noisy equipment,
- Large vehicle traffic facilities: fuel station, wholesale, storage,

Proposed measures for nuisance/hazardous facilities treatment in residential area are as follows:

- Enhance guidance and control for planning certification, construction permit to guide appropriate location based on the appropriate land use/zoning
- Appropriate facilities and site standards and regulation, enforcement for nuisance/hazardous facilities are required, taking account of forced situation due to limited land and effective use of lands in the Dili Urban Master Plan area
- Mixed land use regulation for co-living conditions needs careful regulations for nuisance and hazardous facilities taking into account local community sensitization
  - Desirable use: industry zone, quasi-industrial area, corridor business and commercial

- Allowable use: urban business and commercial, neighborhood business and commercial, other nature area
- Allowable use with strict conditions: low density residential

3) Building size

Building size is characterized as building coverage ratio (BCR), floor area ratio (FAR), and building height. For setting building size control, capacity of administrative officers and capacity of architect/construction companies have to be considered. In order to realize the proposed land use plan, building volume (BCR) and building height are considered important and have to be applied as a land development control tool.

4) Bulk control

Bulk control is characterized by the location of building in relation with the road (setback), distance between buildings, and location of building in relation with land boundary. Bulk control is applied to the area where new development is expected or the area where land re-development is expected. Bulk control can be set in the detailed plan to be prepared after the master plan is approved.

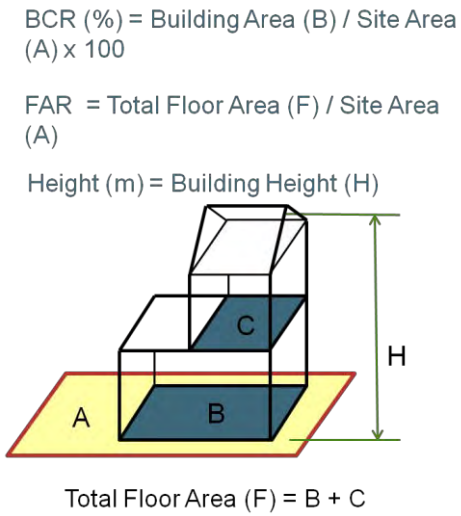


Figure 12.2.2 Illustration of Building Size

Setback is the measurement from the edge of the road (if pedestrian way is available, distance from edge of pedestrian way) to the wall or façade of the building. Setback contributes to creation of cityscape, improve urban environment by avoiding building congestion which also contribute to disaster mitigation. Some distances between buildings are needed to be kept for disaster mitigation purpose and for environmental purpose.

(4) Control of Conservation Zone

Conservation zone is identified for forest area and coastal area, both of which have potential for economic activity. Forest area can be used for cultivation activity while the coastal area has potential for tourism development. Control of conservation zone can be executed by dividing the zone into “protected zone” and “utilization zone”. Delineation of protected zone and utilization area shall be determined in the detailed plan or sector plan to be prepared after the master plan is approved.

1) Protection zone

Protected zone is designated in the area where any development is prohibited for the purpose of protecting the natural condition and minimizing disaster management.

2) Utilization zone

Utilization zone is designated in the area where development is allowed if the condition met such conditions such as size of development, purpose of development, and conservation measures. Utilization zone is designated in a part of the coastal area for tourism purpose and a part of the forest area for cultivation (agriculture, forestry, tourism) purpose.

(5) Establishment of development standard

Currently, development application is reviewed without a clear standard. Development application is reviewed one by one or case by case. In order to promote realization of land use plan and promote fair evaluation of development application, development standard, which will be used for development application, has to be developed. The contents to be included in development standard are summarized in Table 12.2.2 below.

Table 12.2.2 Ideas for Development Standard

Objective: Development standard is used for proper evaluation of development application, providing guidance for applicants to provide necessary condition for development for securing sound development, which contributes in the improvement of urban condition.	
Contents	**Ideas of Criteria**
Proper location of public facilities	• Education facility (per population): kindergarten, elementary school, junior high school. • Health care (per population): community health care, drug stores • Public and government facilities: administration, meeting halls
Road	• Connecting to road outside the development area • Road in development site: local road (width: 11 m with sidewalk), neighborhood road (width: 3 m)
Safety design: flood control, fire prevention	• Water hydrant: Commercial area: 1 hydrant within every 80 radius, Residential area: 1 hydrant within every 100 radius. • Building setback of road.
Environmentally sound development	• Green buffer zone for size of development area ➢ 1~1.5 ha: 4 m ➢ 1.5~5 ha: 5 m ➢ 5~15 ha: 10 m
Proper design of water supply and sewerage system, including water resources	• Satisfy demand for residential use and commercial use
Parks: require minimum park area	• Parks: ➢ Neighborhood park: 1 for every 250 population, 250 m^2, ➢ District park: 1 for every 2,500 population, 1,250 m^2
Car parking:	• Mandating development of car parking space, particularly in new development area and commercial area where large volume of traffic is expected. ➢ 1 car space for every 60 m^2 shopping center, 1 car parking for every 100 m^2 of office space.

Source: JICA Project Team prepared based on guidelines in Indonesia

12.2.2 Development Promotion Measures

Together with development control measures, development promotion measures have to be implemented. Development promotion measures aim to accelerate urban development and also to guide development to realize structure plan and land use plan.

(1) Establishment of Urban Development Project Scheme

Urban development project scheme, which aims to promote spatial development in a selected area, includes both infrastructure development and land development. Urban development can be applied to such areas as priority areas as shown below.

- Junction of BRT route and main road;
- Comoro area with junction of Comoro bridge to be constructed; and
- Any area where land use efficiency has to be improved.

Components have to be clearly defined; some critical points that have to be considered for urban development project are listed below.

- Implementing organizations: The responsibility among stakeholders in project implementation has to be clearly defined including role of public, private sector, and other stakeholders. One of the important functions is coordination among stakeholders since project implementation involves many sectors and stakeholders.
- Delineating project boundary: Project boundary has to be clearly defined to avoid confusion of the covered area and to have smooth implementation such as land acquisition.
- Zoning plan: Zoning plan should be considered based on the target and needs of the project. Depending on the needs, zoning plan should be considered including types of residential function and commercial function. Zoning plan also affects the financial plan. More space for public facility and infrastructure, which does not generate income, affects the financial condition. Balance of land use which generates income and which does not have to be carefully examined.
- Infrastructure plan: road network, water supply/sewerage, drainage, and power have to be planned. Road network is one of the important infrastructures which has effects on traffic flow and safety of users.
- Financial plan: Revenue and cost of the project have to be planned. Cost includes construction cost and operation cost. Revenue includes rent and/or sales of facilities. In addition, funding has to be considered depending on the implementing organization. Public and private sectors may have to share the cost.

(2) Executing housing policy to diversify population to Hera and Tibar

Development of the possible area is limited in Hera and Tibar. Development should not be promoted in the areas such as hilly and mountain area. In order to accommodate an increased population in Hera and Tibar, housing policy has to be implemented to increase density. As a first step, public housing for university students and professors in Hera and industry workers in Tibar has to be provided which is expected to trigger housing development by the private sector. Multi-floor buildings should also be constructed.

(3) Strengthening of land policy

Land-related laws are still under preparation but many development projects are ongoing and development has to continue. One of the comments raised during the public meeting was the treatment of land for development, that is, the relocation and compensation to people who occupy the land regardless of land condition (illegal occupancy, occupancy with land title, occupancy with lease, and occupancy in communal land). Land acquisition and compensation for the projects listed in the master plan have to be clearly defined to promote urban development.

(4) Promotion of infrastructure development in Hera and Tibar

In order to realize the direction shown in the development vision and structure plan, resources have to be allocated for infrastructure development in Hera and Tibar. Incentive, such as supporting land acquisition and prioritizing infrastructure development in development area, needs to be provided to accelerate development in Hera and Tibar. In addition, public fund should be allocated for development of Hera and Tibar as listed in the priority projects.

12.3 Organizational Development Plan

12.3.1 Main Players of Urban Development Management (Overall)

Even though Timor-Leste government is preparing to establish a municipal government, the responsibility and role of the central government and municipal government are still not determined. Policy and guidance of spatial management have to be established and strengthened.

The main organizations for spatial management can be classified into three groups, namely:

- Ministry of Planning and Strategic Investment (MPSI): the overall regulator of spatial management including management of the national spatial plan and management of large-scale development.
- Ministry of State Administration: coordination between MPSI and municipalities, management of municipality, capacity development of local authorities, coordinating inter-regional matters including infrastructure, land development, and urban services
- Municipality (Dili, Liquica): management of municipality spatial plan, management of urban service, implementation of urban facility, land use management (development and building permit)

12.3.2 Strengthening of the National Directorate of Housing and Urban Planning in the Ministry of Planning and Strategic Investment

The main duties of the National Directorate of Housing and Urban Planning (DNHPU) are to prepare the national spatial plan, local spatial plan, urban plan and housing plan, and to implement and manage the approved projects and programs in the plans. There is no document showing the detailed contents of the duties. The most detailed one is the Ministerial Decree of the Ministry of Public Works, No. 25 / December 11, 2013.

After the DUMP is approved, it will enter the implementation stage including plan dissemination, land use management, and urban development. The following shows the job description which is considered necessary for DNHPU to perform alone and to be performed through coordination and collaboration with other relevant organizations.

(1) Duties related to plan dissemination

1) Disclosure of spatial management information: provision of information on the contents of the spatial management and land use plan, spatial demarcation, zoning, other zoning district designation to the public, certificate for the citizen.

(2) Duties related to land use management

1) Development permission regulations: permission of development application such as subdivision and large-scale land development, and related works such as coordination with the Ministry of Agriculture (MoA), Ministry of Tourism (MoT,) and other related ministries.

2) Building control regulations: permission of building application in urbanization promotion zone, technical guidance for building construction, and related works such as close coordination with the Department of Building in the Ministry of Public Works, Transportation and Communication (MoPWTC). For this, based on the consultation with the Department of Building of MoPWTC in the future, the Department of Housing and Urban Planning will have a responsibility to carry out the work to verify the consistency with the proposed land use plan in the building construction permit procedures.

3) Land transaction regulation: public notice of land price, land buying and selling, cadastral survey data, etc., required close coordination work with the Department of Land, Property, and Cadastre in the Ministry of Justice (MoJ), and the municipal government.

4) Data management: updating data on land use and buildings required for spatial management, transportation; basic surveys such as infrastructure; data collection; monitoring; information update

(3) Duties related to promotion of urban development

1) Urban facilities development: parks, schools, hospitals, markets, bus terminals,

government offices, etc., coordination with the relevant departments in the newly reorganized MoPWTC, MoT, Ministry of Education, Ministry of Health (MoH), Ministry of State Administration (MoSA), etc.

2) Infrastructure development: road, drainage, water supply, sewage, electricity, solid waste management, telecommunications, etc., coordination mainly with the other relevant departments of the MoPWTC. Coordination for solid waste management with MoSA

3) Urban development projects: examples in Japan; planning and implementation of the land readjustment project, urban redevelopment project, new residential built-up area, etc., coordination with relevant departments of the MoPWTC, etc.

(4) Other duties

1) Duties regarding transportation: planning and project implementation and operation of public buses, measures for parking facilities and bicycle parking, etc.

2) Duties regarding townscape: landscape planning and regulation, urban greening, outdoor advertising, etc.

3) Other duties: regulation of on-site retarding pond, regulations on natural disaster management, etc.

12.3.3 Strengthening of Local Governments (Dili and Liquica)

The urban development in Dili and Liquica municipalities is composed of the implementation of project approved at the national level, although it is not yet managed based on the overall plan because decentralization and establishment of the municipality are progressing currently in the local government. Only waste disposal and park cleaning services are being carried out in Dili Municipality. The other urban infrastructure services such as water supply, electricity, and road maintenance are being done by the national government. The following items are duties that can be transferred to the local government. For the time being, the General Directorate of Urban Management in MoSA supports municipalities in the execution of the following duties:

- Implementation and management of urban development and planning to be proposed in accordance with the Spatial Planning Law (urban master plan and land use planning)
- Administration of urban infrastructure services such as cleaning, garbage, water supply, and road maintenance
- Building permission

12.3.4 Establishment of Coordination Board

Currently, spatial management coordination mechanism for inter-regional (municipal) does not exist. The Ministry of State Administration is responsible for the local government and Ministry of

Planning and Strategic Investment is responsible for spatial management. The coordination body is composed of the concerned central government and the local government has to be established to improve spatial management coordination. DNHPU of MPSI should play a leading role in the secretariat of the coordination board. The secretariat, which consists of four organizations, plays a role in leading the operation of the board at the working level so these organizations should have frequent discussion for the smooth implementation of DUMP.

The outline of the coordination board is shown below.

- Objective:
  - ➢ To coordinate implementation and management of Master Plan of Dili Metropolitan Area
- Tasks:
  1) To formulate and update the master plan
  2) To monitor and control the development of the Dili Metropolitan Area
  3) To carry out inter-regional development coordination, integration, and synchronization
     - ✧ Transport development (road, public transport), water supply and sanitation, disaster management, solid waste management, large-scale development
  4) To coordinate and collaborate with project management units
- Members:
  1) Chairman: Minister of Planning and Strategic Investment
  2) Vice Chairman: Minister of Public Works, Transport and Communications, Minister for State Administration
  3) Secretariat: National Directorate of Housing and Urban Planning, MPSI; General Directorate of Urban Management (DNOU), MOSA; Dili Municipality; Liquica Municipality
  4) Board Members: Ministry of Justice; Ministry of Tourism, Arts and Culture; Ministry of Agriculture and Fisheries; Ministry of Commerce, Industry and Environment; Aileu Municipality; Ermera Municipality; Manatuto Municipality; and others if necessary

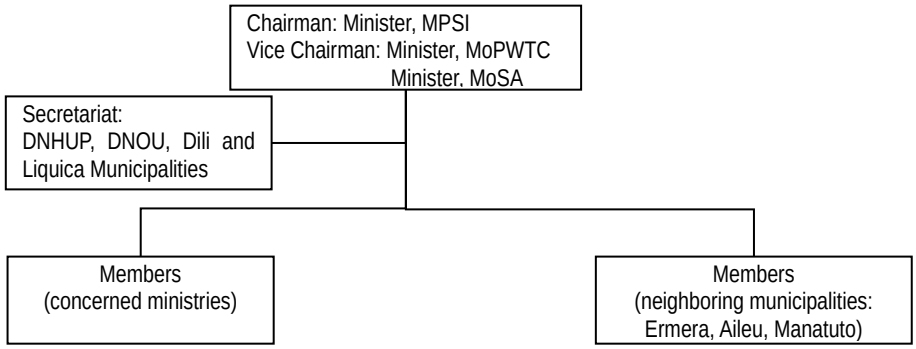


Figure 12.3.1 Proposed Structure of Coordination Board

12.4 Human Resources Development Plan

The purpose of human resource development for this project period is to acquire basic knowhow at the stage of plan formulation. Human resource development is conducted through on-job-training, working group (WG), and training in Japan for the selected counterparts (C/P). These trainings have raised the motivation of C/P for the work and increased the basic knowledge on spatial management. Based on the results and experiences, a human resource development plan, which will be necessary after the completion of this project, is proposed. The following points of view are required for human resources capacity development:

- ➢ Acquisition of knowhow regarding spatial management in general;
- ➢ Acquisition of knowhow regarding planning skills;

- Acquisition of knowhow regarding the management of land use control;
- Acquisition of knowhow regarding the implementation of projects such as urban facilities and infrastructure facilities and urbanization development.

12.4.1 Goal Setting for Capacity Development

The MPSI is responsible for the implementation and operation of spatial management. In accordance with the progress of decentralization, which is currently underway, the duties and powers regarding spatial management will be gradually transferred from the central government to the local government (municipality). Along with the assumed scenario of decentralization, the step-by-step goals for the human resource development program are set as follows:

Table 12.4.1 Goal Setting of the Human Resources Capacity Development Plan

	Short Term (2015 - 2020)	Medium Term (2021 - 2025)	Long Term (2026 - 2030)
Scenario of Decentralization	• The DNHPU has the responsibility and power to ensure that spatial management is executed according to the existing law. • The coordination board will be established and have the ability to coordinate between Central and Dili and Liquica municipalities through DGMU	• Parts of the responsibility and powers are transferred from the central to the municipalities.	• Most of the responsibility and powers are transferred from the central to the municipalities.
Goal of Capacity Building Program	• DNHPU will be able to carry out duties on spatial management. • DNHPU will be able to provide training of municipality staff.	• The spatial management staff of Dili and Liquica municipalities will be able to carry out basic duties on spatial management.	• The spatial management staff of Dili and Liquica municipalities will be able to carry out basic duties on spatial management.
Required Skills	• Formulation of necessary plans • Land use management • Project management • Database management • Coordination with related organizations • Training skills	• Formulation of necessary plans • Land use management • Project management • Database management • Coordination with related organizations	• Formulation of necessary plans • Land use management • Project management • Database management • Coordination with related organizations
Type of Support Program	Technical cooperation in combination with TOT (training of teachers)	Technical cooperation (or dispatch of expert) in combination with dispatch of central teaching staff.	Dispatch of expert

Source: JICA Project Team

12.4.2 Training Program

To achieve the above goals, the training program is proposed to develop capacity of personnel in-charge of the implementation of the urban master plan in DMA. There are five training courses proposed for the training of the staff of DNHPU in the short term, and to the municipality's staffs in the medium term.

Table 12.4.2 Proposed Training Program for Human Resource Development

Training Course	Theme	Contents of Training
Training course-1	General understanding of spatial management	• Laws and regulation of spatial management • Composition of spatial management • National spatial plan
Training course-2	Acquisition of know-how regarding planning	• Master plan: objective, contents, procedure • Detail plan: objective, contents, procedure
Training course-3	Acquisition of knowhow regarding the management of land use control	• Development permit and building control: administrative drawings, regulatory content, permit application procedures, evaluation criteria, duty sharing among the related organizations, etc. • Technical standard: contents, utilization for development permit • Building standards (especially building use, size, bulk, etc.) contents, utilization for building control
Training course-4	Acquisition of knowhow regarding the implementation of projects such as urban facilities and infrastructure facilities and urbanization development	• Urban facility and infrastructure management: project scope, planning, implementation, responsible body, government support program, duty sharing among the related organizations, etc. • Urban development projects: concept, implementation
Training course-5	Acquisition of knowhow regarding the database management	• GIS operation procedure • Database management

Source: JICA Project Team

12.4.3 Method of Training

(1) On-the-Job Training (OJT)

Since most staff in the government does not have experience in spatial management, applying OJT for capacity development should be encouraged to acquire practical skills rather than academic knowledge. OJT provides learning opportunities through practice in the real world of urban development and management. In addition, internal trainings should be more encouraged because the menu of internal trainings can flexibly meet the needs of the target officials.

(2) Participatory methods of training

To entail successful capacity development and achieve the goal, active involvement by the target officials should be encouraged. A lecture, in which the trainer delivers ideas to the trainees in one way, is a conventional method of trainings. However, the lectures have limitations to encourage active participation by the trainees. To overcome difficulties, participatory methods, including workshops and group discussions, are worth considering for active involvement.

12.5 Database Management and Geographic Information System (GIS)

12.5.1 Role and Objectives of GIS Database Management

(1) Urban Planning and Spatial Database Management

Spatial database management, especially geographic information system (GIS), has become an inevitable tool for effective and efficient urban planning and management in the current decade. Urban planning involves many functions, scales, sectors, and stages. In general, the functions of urban planning can be classified into general administration, development control, plan making, and strategic planning. General administration and development control are relatively routine planning activities, whereas plan making and non-routine strategic planning are undertaken much less frequently.

The scale of planning area coverage can range from the levels of national, regional, municipal to an administrative region, some urban block, or some subdivisions. The most frequently involved sectors in urban planning are land use, transport, housing, land development, and environment. In each scale of planning, there are different stages such as determination of planning objectives, analysis of existing situations, modeling and projection, development of planning options, selection of planning options, plan implementation, and plan evaluation, monitoring, and feedback.

Different functions, scales, sectors, and stages of urban planning make different uses of GIS database. The use of the data management, visualization, spatial analysis, and modeling components of GIS varies according to different functions of urban planning.

(2) Objectives of GIS Database Management for Urban Master Planning

The GIS database management for the Project aims at formulating the spatial database platform for the urban master planning through the Project of the Dili Urban Master Plan development taking into account the practical application of GIS to various planning stages of the master plan.

- To be an initial model of GIS database system for urban planning to be replicated by the local government;
- To be the foundation of the initial GIS platform within the DNHPU in promoting step-wise development, from initiation to full implementation, and from desktop to multi-user and web-based platforms of GIS database systems in the country;
- To be an instrument for capacity development for GIS management toward establishment of certain central information functions;
- To be a tool for data dissemination/sharing to be enhanced in the future for more effective urban management.

Table 12.5.1 GIS Database Formulation for Urban Master Planning

Urban Master Planning Element and Stage		GIS Application and Utilization		
		Database Integration	Spatial Analysis	Mapping Work
Planning Stage	Planning of tasks or works			
Data Collection and Management	Documentation	●	--	○
	Mapping and imageries data	●	--	◎
	Statistical data	●	--	○
Analysis and Evaluation	Spatial analysis and issue identification	●	●	●
	Quantitative analysis and issue identification	◎	◎	●
	Policy and institutional issue identification	--	--	○
Identification of Issues	Spatial planning issue	--	○	○
	Sector planning issues	--	○	○
	Institutional issues	--	--	--
Vision and Strategy	Formulation of vision	--	--	--
	Development framework formulation	--	--	○
	Spatial structure formulation	○	◎	◎
	Development strategies formulation	--	--	○
Land Use Planning	Land use framework formulation	◎	●	●
	Land use plan/zoning plan	◎	●	●
Sector Planning	Framework for each sector plan	○	○	◎
	Spatial sector plan	○	◎	◎
Implementation	Implementation program	--	--	○
	Action plan	○	○	○
	Institutional arrangement	--	--	--

Legend: ●= Essential Element, ◎ = Supportive, ○ = Supplemental
Source: JICA Project Team

12.5.2 Spatial Database Platform Development through the Project

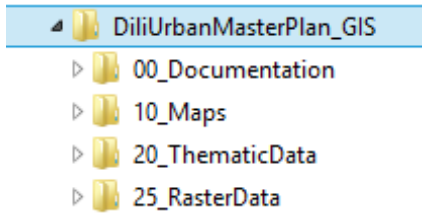
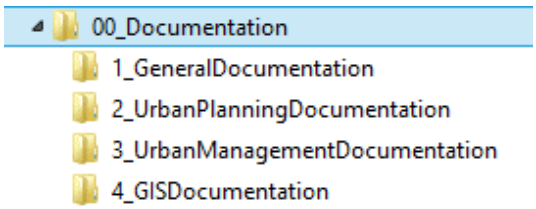
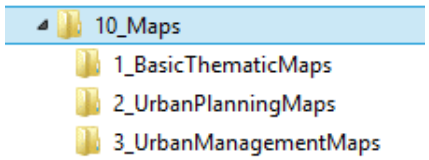
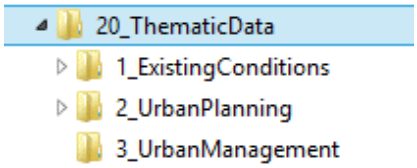
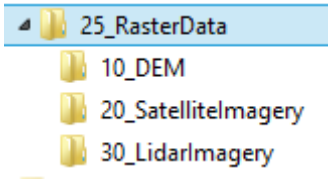
(1) Formulation of GIS Database for the Dili Urban Master Plan

The GIS database for the Dili Urban Master Plan has now been set up in the project server computer, with the following components already in place:

1) Database Structure

The folder system for the GIS database has now been setu p by four groups based on the data category of “00 Documentation”, “10 Maps”, “ 20 Thematic Data” and “25 Raster Data”, as shown in Figure 12.5.4, in which the folder structure is composed of hierarchical structure with sub-folder system through breakdown or relative data and information.

Table 12.5.2 GIS Database Structure for the Dili Urban Master Planning

Main Folders

Output Folders and Sub-Folders
 
Geo-database Folders and Sub-Folders
 

Source: JICA Project Team (JPT)

2) Mapping Outputs for the Dili Master Plan

Base maps and thematic maps through base mapping, analysis, and planning works by GIS, in association with the field surveys for the master plan were produced as part of the GIS database package and handed over and installed into the database server of the DNHPU as follows:

Topographic Base Map

The topographic base map including the following features was produced to be utilized as a simplified base map with the scale of 1/25,000 for the master planning:

- Building footprints, road edges, and river areas digitized based on the 2014 LiDAR Project [1]imagery for Central Dili area and on 2013 Pleiades satellite imagery for the rest of the study area.
- Contours from JICA 2000 topographic map for the central area of the study area excluding sucos of Tibar and Hera, and contours generated from 2010 ALOS DEM for the entire study area.

[1] Light Detection and Ranging (LiDAR) Survey and Mapping for Timor-Leste Territory by Ministry of Public Works, Transportation and Communications

Source: JICA Project Team

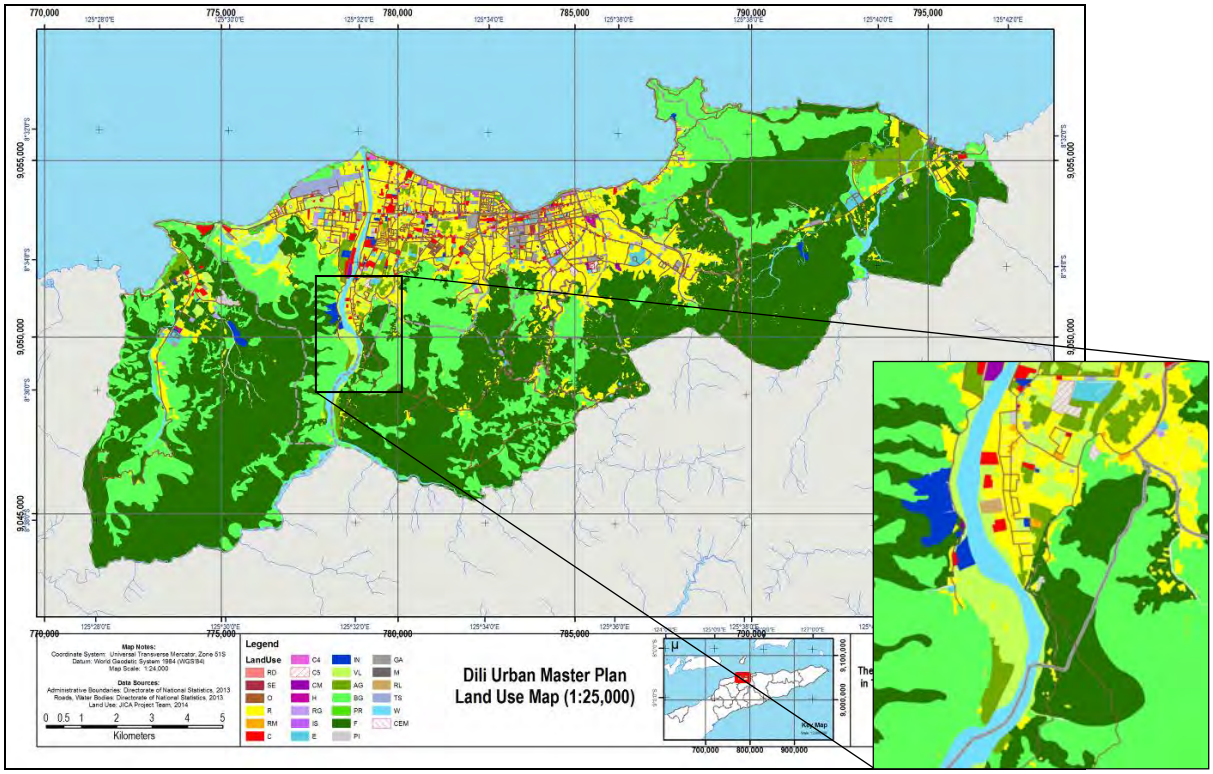
Figure 12.5.1 Topographic Base Map 2014

Existing Land Use Map

The existing land use map was produced with the scale of 1/25,000 for the master planning, using a combination of two methods, namely, field work and satellite imagery interpretation.

- Land Use Field Survey: Four teams were organized to conduct field survey in September 2014. They were equipped with handheld GPS receivers, hardcopy maps, and logbooks. After fieldworks, the field data were processed in the project office. GPS data were downloaded, logbook entries were encoded, and land use polygons were digitized based on the notes on the hardcopy maps.

- Satellite Imagery Interpretation: For areas not covered during the land use field survey, land use classification was done by visual interpretation using the 2013 Pleiades satellite imagery and the 2014 LiDAR Project imagery.



Source: JICA Project Team

Figure 12.5.2 Existing Land Use Map 2014

Future Land Use Plan

The future land use plan was produced as a geographic representation of the outputs of land use planning work and as one of the integrated spatial works by GIS function. Please refer to Chapter 9 showing the outputs (i.e., development suitability analysis and the land use plan 2030).

Other Thematic Maps

Other thematic maps were also produced using the geographic data collected and processed during the course of the study. The thematic maps include public facilities maps, satellite image map, and analysis maps. The complete list of thematic maps is listed in the following Table 12.5.3.

Table 12.5.3 Mapping Lists Produced in the Dili Master Planning Process including Intermediate Outputs

Category/Sub	Map Name	Description
Administrative	Administrative Boundary Map	Administrative boundaries
Topography	Topographic Map	20-meter contours derived from ALOS DEM, and other planimetric features such as roads, buildings, and waterbodies
	Elevation Map	Digital Elevation Model (DEM)
	Slope Map	Slope (degrees) derived from ALOS DEM
Hydrography	River Network Map	River networks in the study area
	River Catchment Map	River catchments for the study area
Infrastructure	Road Network Map	Road network in the study area
Transportation	Transportation Facilities Map	Transportation facilities in the study area, including roads, airport, and seaport
Public Facilities	Educational Facilities Map	Educational facilities in the study area
	Health Facilities Map	Hospitals and health centers in the study area
	Government Offices Map	Government offices in the study area
Utilities	Power Utilities Map	Power utilities data from Electrecidade De Timor Leste (EDTL)
	Street Lights Map	Street lights data from Electrecidade De Timor Leste (EDTL)
	Garbage Facilities Map	Tibar dumpsite areas
Land Condition	Existing Land Use Map (1:5,000 Scale, East)	Existing land use map at 1:5,000 scale, eastern side
	Existing Land Use Map (1:5,000 Scale, West)	Existing land use map at 1:5,000 scale, western side
	Existing Land Use Map (1:25,000)	Existing land use map at 1:25,000 scale, covering the study area
	Land Cover Map	Land cover data from ALGIS
	Forest Cover Map	Forest area from existing land use data
Environment	Protected Areas Map	Protected areas in the study area
	Important Bird Areas Map	Important bird areas in the study area
Socio-economic	Population Density Map	Population density for 2010
	Population Growth Map	Population growth from 2010-2014
Others	National Heritage Sites Map	Some national heritage sites according to the Ministry of Tourism, Art, and Culture (MoTCA)
Coverage Maps	Study Area Map	The study area
	Satellite Image Map	Satellite imagery from SPOT Pleiades (2013) covering the study area
Environment Vulnerability Maps	Slope Instability Map	Ratings based on slope instability
	Flood Susceptibility Map	Ratings based on flood susceptibility
	Protected Areas Map	Ratings based on classification as protected area
	Important Bird Areas Map	Ratings based on classification as an important bird area
	Environment Vulnerability Map	Rating based on environmental vulnerability factors
Accessibility Analysis Maps	Health Facility Accessibility Map	Ratings based on proximity to health facilities
	School Accessibility Map	Ratings based on proximity to educational facilities
	Trunk Roads Accessibility Map	Ratings based on proximity to trunk roads
	Airport Accessibility Map	Ratings based on proximity to the airport
	Future Development Sites Accessibility Map	Ratings based on proximity to future development sites
Accessibility Analysis Maps	Microlet Route Accessibility Map	Ratings based on proximity to microlet routes
	Total Accessibility Analysis	Total rating based on accessibility analysis factors
Development Suitability Maps	Population Density Rating	Ratings based on population density
	Exclusion Areas	Exclusion areas (water areas)
	Land Suitability	Land suitability rating results
	Development Suitability in Habitable Areas	Land development suitability rated for habitable areas
Land Use Plan Map	Land Use Plan 2030 (1:25,000)	Map showing planned land use 2030

Source: JICA Project Team

- *User Interface Development*

The final user interface for the GIS database was also developed to ensure convenient browsing of the project outputs. The following figure shows the screenshots for the user interface:

Source: JICA Project Team

Figure 12.5.3 Dili Urban Master Plan GIS Database Explorer

3) Spatial Data Management and Integration

One of the tasks for the urban master planning is data integration on the base map including existing conditions, plans and projects for natural environment, agriculture and forest, and infrastructure. Various thematic data have been collected throughout the course of the project from relevant authorities and agencies listed in Table 12.5.4. The complete list of thematic data that have been incorporated into the GIS database is shown in Table 12.5.5.

Table 12.5.4 Key Data Sources Collected for GIS Database to be Integrated

Date Source	Data Collected
JICA	1:2,000 Scale Topographic Map (2000)
ILO/Roads for Development (R4D)	Roads and Road Projects
General Directorate of Statistics (GDS)	Administrative Boundaries, Waterbodies, Public Facilities and Population Data
National Directorate of Basic Sanitation (DNSB)	LiDAR Data for the central area for the study area
Ministry of Agriculture and Fishery, ALGIS	Various Geographic Data
Ministry of Education (MOE)	Statistical Data for Schools
Ministry of Tourism, Art and Culture (MOTCA)	National Heritage Sites Listing
Electricidade De Timor Leste (EDTL)	Electrical and Telecommunication Drawings
Birdlife International	Important Bird Areas
United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC)	Protected Areas

Source: JICA Project Team

Table 12.5.5 List of Spatial Database for the Dili Master Plan

CATEGORY / SUB-CATEGORY	LAYER NAME	DESCRIPTION	FILENAME	SOURCE	YEAR
Existing Condition					
Administrative Boundaries	National	National Boundaries, Timor-Leste	A_NatlBnd_TL_JPT_2014_UTMWGS84.shp	JPT	2014
	Municipality	Municipal Boundaries, Timor-Leste	A_MunBnd_TL_GDS_2013_UTMWGS84.shp	GDS	2013
	Administrative Post	Administrative Post Boundaries, Timor-Leste	A_AdminPstBnd_TL_GDS_2013_UTMWGS84.shp	GDS	2013
	Suco	Suco Boundaries, Timor Leste	A_SucoBnd_TL_GDS_2013_UTMWGS84.shp	GDS	2013
		Suco Boundaries, Study Area	A_SucoBnd_SA_GDS_2013_UTMWGS84.shp	GDS	2013
Topography	Contours	Contour Lines, Timor Leste	TO_Contour_TL_GDS_2005_UTMWGS84.shp	GDS	2005
		Contour Lines, 20m interval in the Study Area	TO_Contour20m_SA_ALOS_2010_UTMWGS84.shp	ALOS	2010
		Contour Lines, 10m interval in the Study Area	TO_Contour10m_SA_ALOS_2010_UTMWGS84.shp	ALOS	2010
		Contour Lines, 2m interval in the Study Area	TO_Contour2m_SA_JPT_2000_UTMWGS84.shp	JPT	2000
	Elevations	Elevation Areas in Timor Leste	TO_ElevArea_TL_GDS_2012_UTMWGS84.shp	GDS	2012
	Slope	Slope Areas in Timor Leste	TO_Slope_TL_GDS_2005_UTMWGS84.shp	GDS	2005
		Slope Areas in the Study Area	TO_Slope_SA_JPT_2014_UTMWGS84.shp	JPT	2014
Hydrography	Ocean	Ocean Area Adjacent to Timor Leste	HY_Ocean_TL_GDS_2005_UTMWGS84.shp	GDS	2005
	Lake/Pond	Lakes and Ponds in Timor Leste	HY_LakePond_TL_GDS_2005_UTMWGS84.shp	GDS	2005
	Rivers	River Areas in Timor Leste	HY_RiverArea_TL_GDS_2005_UTMWGS84.shp	GDS	2005
		River Lines in Timor Leste	HY_RiverLine_TL_GDS_2005_UTMWGS84.shp	GDS	2005
	Waterbodies	Waterbodies in the Study Area	HY_Waterbodies_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Watershed/Catchment	River Catchment Areas in the Study Area	HY_RiverCatchment_SA_JPT_2014_UTMWGS84.shp	JPT	2014
		Watersheds in Timor Leste	HY_Watershed_TL_GDS_2005_UTMWGS84.shp	GDS	2005
Infrastructure	Road Network	Road Centerlines in Timor Leste	I_RoadCenterline_TL_GDS_2013_UTMWGS84.shp	GDS	2013
		Road Centerlines in the Study Area	I_RoadCenterline_SA_GDS_2013_UTMWGS84.shp	GDS	2013
		Trunk Road Centerlines in the Study Area	I_TrunkRoad_SA_JPT_2014_UTMWGS84.shp	JPT	2014
		Road Edges in the Focus Area, 2000	I_RoadEdge_FA_JPT_2000_UTMWGS84.shp	JPT	2000
		Road Edges in the Study Area, 2000	I_RoadEdge_SA_JPT_2000_UTMWGS84.shp	JPT	2000
		Road Edges in the Study Area, 2015	I_RoadEdge_SA_JPT_2015_UTMWGS84.shp	JPT	2015
		Road Polygons in the Study Area, 2015	I_RoadPolygon_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Bridges	Bridge Points in Dili Area	I_Bridge_DL_R4D_2014_UTMWGS84.shp	R4D	2014
Transportation	Seaport	Seaport Point Location	T_SeaPort_SA_JPT_2000_UTMWGS84.shp	JPT	2000
	Airport	Airport Point Location	T_AirportTerminal_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Microlet Route	Microlet Route	T_MicroletRoute_SA_JPT_2014_UTMWGS84.shp	JPT	2014
Buildings	Buildings	Building Footprints	B_Buildings_SA_JPT_2015_UTMWGS84.shp	JPT	2015
Public Facilities	Schools	Basic and Secondary Schools in the Study Area	P_Schools_SA_GDS_2012_UTMWGS84.shp	GDS	2012
		Basic and Secondary Schools in Timor Leste	P_Schools_TL_GDS_2012_UTMWGS84.shp	GDS	2012
	Universities and Colleges	Universities and Colleges in the Study Area	P_Universities_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Hospitals	Hostpitals in the Study Area	P_Hospitals_SA_GDS_2014_UTMWGS84.shp	GDS	2014
	Health Centers	Health Centers in the Study Area	P_HealthCenters_SA_GDS_2014_UTMWGS84.shp	GDS	2014
	Government Offices	Government Offices in the Focus Area	P_GovernmentOffices_FA_JPT_2000_UTMWGS84.shp	JPT	2000
		Government Offices in the Study Area	P_GovernmentOffices_SA_JPT_2014_UTMWGS84.shp	JPT	2014
Utilities	Power Utilities	Power Utilities in the Study Area	U_ElectricalFacilities_FA_EDTL_2010_UTMWGS84.dwg	EDTL	2010
	Street Lights	Street Lights in the Study Area	U_Streetlights_FA_EDTL_2010_UTMWGS84.dwg	EDTL	2010
	Garbage Facilities	Garbage Facilities in the Study Area	U_GarbageFacilities_SA_JPT_2015_UTMWGS84.shp	JPT	2015
Land Condition	Existing Land Use	Existing Land Use in the Study Area, with 1:5,000 classes for the Focus Area and 1:25,000 classifications for the Study Area	L_LandUse_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Land Cover	Land Cover Classes in Dili Area	L_LandCover_DL_ALGIS_2010_UTMWGS84.shp	ALGIS	2010
		Land Cover Classes in Tibar Area	L_LandCover_TB_ALGIS_2010_UTMWGS84.shp	ALGIS	2010
Hazard	Flood	Flood Prone Areas in the Study Area	H_FloodProneArea_SA_JPT_2014_UTMWGS84.shp	JPT	2014
Environment	Protected Areas	Protected Areas in the Study Area by JPT	E_ProtectedArea_SA_JPT_2015_UTM51SWGS84.shp	JPT	2015
		Protected Areas in the Study Area by UNEPWCMC	E_ProtectedArea_SA_UNEPWCMC_2012_UTM51SWGS84.shp	UNEPWCMC	2012
	Important Bird Areas	Important Bird Areas in the Study Area	E_ImportantBirdArea_SA_Birdlife_2007_UTM51SWGS84.shp	Birdlife	2007
SocioEconomic	Population	Population Data for 2004 and 2010 per Suco	S_Population_SA_GDS_2014_UTMWGS84.shp	GDS	2014
Others	Heritage Sites	Heritage Sites Point Locations	O_HeritageSites_DL_MOT_2015_UTMWGS84.Shp	MOT	2015
Urban Planning					
Coverage	Study Area	Study Area Boundary	C_StudyArea_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Focus Area	Focus Area Boundary	C_FocusArea_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Analysis Grid	Analysis Grids	C_AnalysisGrid_SA_JPT_2014_UTMWGS84.shp	JPT	2014
Environment Vulnerability Analysis	Slope Instability	Slope Instability Ratings in the Study Area	V_SlopeInstability_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Flood Susceptibility	Flood Susceptibility Ratings in the Study Area	V_FloodProneArea_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Protected Areas	Protected Area Ratings in the Study Area	V_ProtectedArea_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Important Bird Areas	Bird Area Ratings in the Study Area	V_BirdArea_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Environment Vulnerability	Total Environment Vulnerability Ratings in the Study Area	V_TotalVulnerabilityRating_SA_JPT_2014_UTMWGS84.shp	JPT	2014
Accessibility Analysis	School Accessibility	Ratings for Accessibility to Schools	AA_SchoolAccessibilityRating_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Health Service Accessibility	Ratings for Accessibility to Hospitals and Health Centers	AA_HealthServiceAccessibilityRating_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Trunk Road Accessibility	Ratings for Accessibility to Trunk Roads	AA_TrunkRoadAccessibilityRating_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Airport Accessibility	Ratings for Accessibility to the International Airport	AA_AirportAccessibilityRating_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Microlet Route Accessibility	Ratings for Accessibility to Microlet Routes	AA_MicroletAccessibilityRating_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Future Development Sites Accessibility	Ratings for Accessibility to the Future Development Sites	AA_EconSitesAccessibilityRating_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Total Accessibility Rating	Total Accessibility Analysis Ratings in the Study Area	AA_TotalAccessibilityRating_SA_JPT_2014_UTMWGS84.shp	JPT	2014

CATEGORY / SUB-CATEGORY	LAYER NAME	DESCRIPTION	FILENAME	SOURCE	YEAR
Development Suitability Analysis	Population Density 2014	Ratings for Population Density 2014	DS_PopDen2010_SA_JPT_2014_UTMWGS84.shp	JPT	2014
	Exclusion Areas	Ratings for Exclusion Areas	DS_ExclusionArea_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Development Suitability	Total Development Suitability Analysis Ratings within the Study Area	DS_DevtSuitability_SA_JPT_2015_UTMWGS84.shp	JPT	2015
Urban Management					
Land Use Plan	Land Use Plan	Land Use Plan 2030 for the Study Area	LP_LandUsePlan_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Development Control Area	Line to demarcate development control areas	LP_DevelopmentControlArea_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Hatch	Areas	LP_Hatch_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Other Road Access	Other planned road access	LP_OtherRoadAccess_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Road Access	Planned roads	LP_RoadAccess_SA_JPT_2015_UTMWGS84.shp	JPT	2015
	Urban Growth Control Area	Line to demarcate urban growth control areas	LP_UrbanGrowthControlArea_SA_JPT_2015_UTMWGS84.shp	JPT	2015

Source: JICA Project Team

12.5.3 Roadmap toward Effective GIS Database Management for Urban Planning and Management

(1) Goals and Roadmap for GIS Database Formulation

The GIS database platform established during this project is envisioned to serve as baseline data in the roadmap of GIS database formulation for effective urban development planning and management. The goals of GIS development for the future are recommended to be set as follows (see also Figure 12.5.4 , Figure 12.5.5, and Figure 12.5.6):

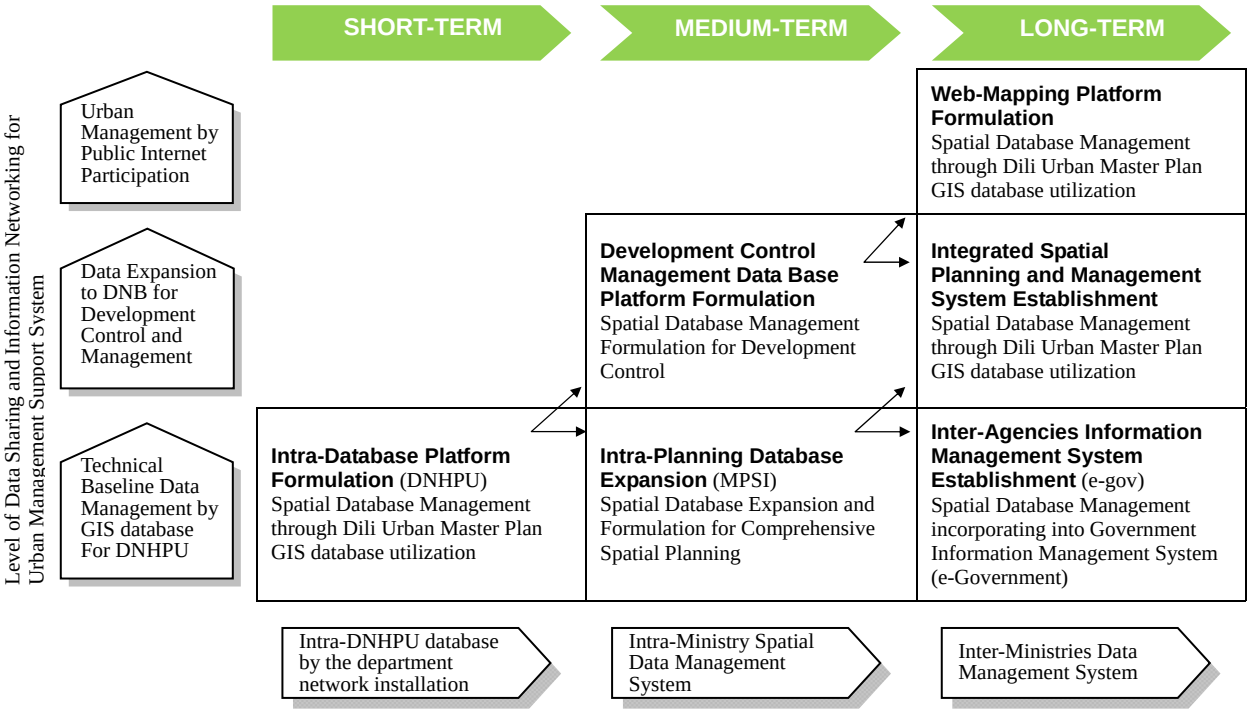
- **Short Term:** Establishment of an Intra-DNHPU Spatial Data Management System. The Dili Urban Master Plan GIS database may be utilized as baseline data for this intra-DNHPU system. This development is characterized by shift from a desktop platform to a multi-user platform GIS, considering the need to cater to the mapping needs of the entire DNHPU with a GIS unit composed of 3-5 technical personnel.

- **Medium Term:** Establishment of an Intra-Ministry Spatial Data Management System. The DNHPU database management system may be integrated with an intra-MPSI system to support more comprehensive spatial planning functions. This is characterized by shift from a multi-user platform to a federated system wherein collaboration will be required among GIS departments of directorates under MPSI with the number of technical users ranging from 10-20.

- **Long Term:** Establishment of an Inter-Ministry Spatial Data Management System. The MPSI database management system may eventually be shared, linked, or integrated with an inter-ministry spatial data management system as part of a national effort to move to internet-based information systems. This federated system will require collaboration of different ministries with shared responsibilities for the different data layers that will be included in the system. The number of technical users may range from 50-100 or more.

At each stage of development, the same steps shall be necessary to ensure success of GIS implementation (see Figure 12.5.4). The implementation steps are as follows: planning, requirements analysis, design, acquisition and development, and operation and maintenance. In the course of the implementation, the organizational structure may have to undergo some changes as a result of these processes.

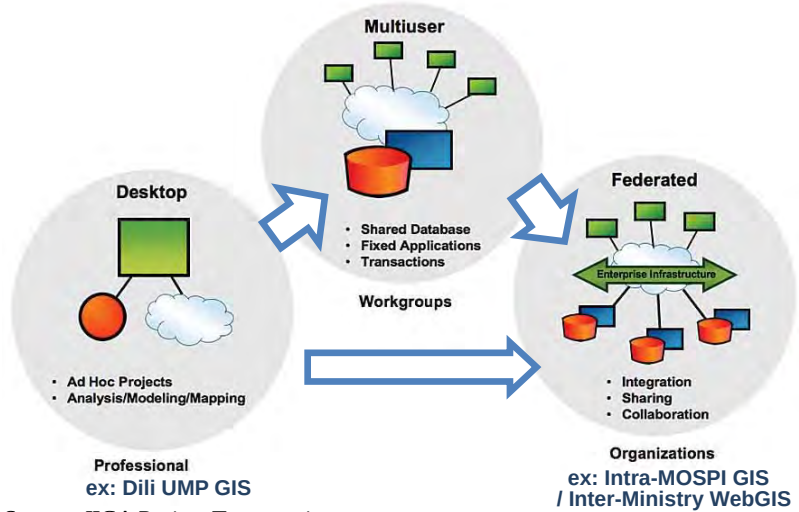
As each GIS development goal is achieved with a successfully operational system in place, planning for the next goal will involve changes in organizational plans as more sophisticated human and hardware and software requirements may be necessary to implement the next GIS development goal.



Note: DNHPU: National Directorate of Housing and Urban Planning, DNB: National Directorate of Buildings, MPSI: Ministry of Planning and Strategic Investments

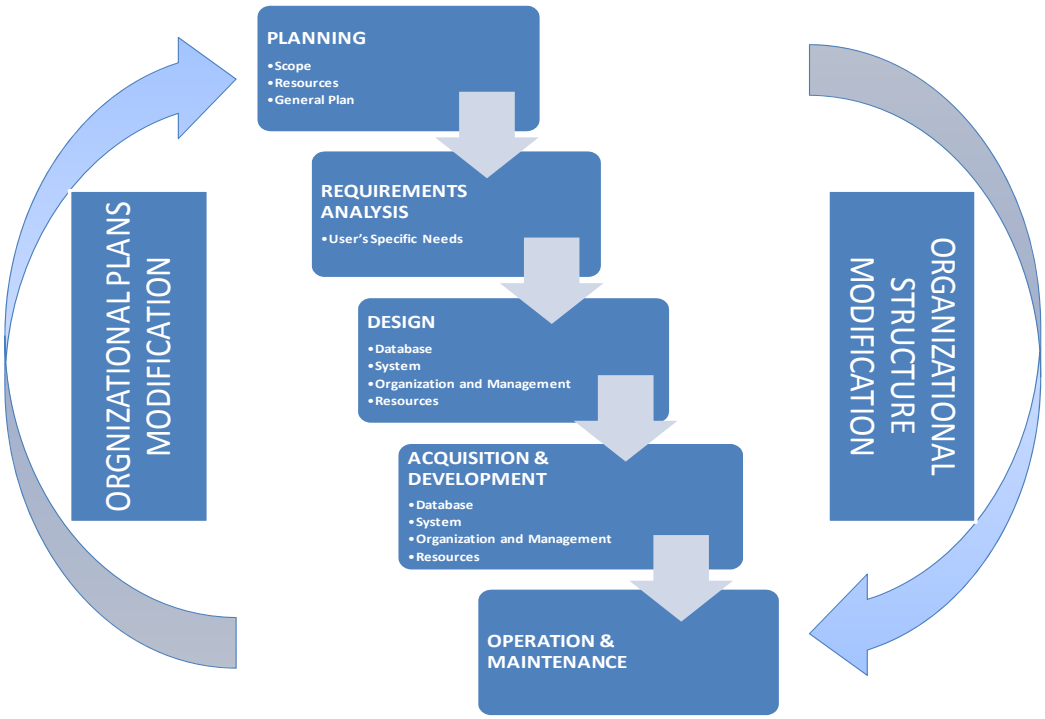
Source: JICA Project Team

Figure 12.5.4 Roadmap for GIS Database Development for Effective Urban Planning and Management



Source: JICA Project Team, esri.com

Figure 12.5.5 GIS Database Platform and Its Expansion



Source: JICA Project Team, esri.com

Figure 12.5.6 GIS Implementation Steps and Development Cycle

(2) Further Issues toward Effective and Sustainable GIS Database Establishment

To ensure effectiveness and sustainability of the GIS database established for the Dili Urban Master Plan, the following issues identified during this study need to be addressed:

Technical issues:

- Data collection in different government agencies proved to be quite difficult at times due to either lack of availability of digital geographic data or lack of cooperation of the target source agencies. This requires promotion of GIS establishment in other agencies as well, and improvement of data-sharing protocols within and among government offices.
- Collected data were found to be of varying formats, quality, and coordinate system setting. This situation requires skills for handling different kinds of data sources. The study team has already done processing of the collected data into project-standard format, but in the future, the end users need to do quality checks, processing, and conversion of new/updated data by themselves to come up with similarly standardized geographic datasets.

Future utilization, operation, and management issues:

- Since the future operation and management of this database will be transferred to the counterpart agency at the end of the project, certain protocols need to be set up by the counterparts.
- Data storage is now in the project server computer which they can continue to use for the same purpose or later upgrade to a higher hardware and software specifications as needed.

- Data updating issues such as responsibility and timing of updates need to be addressed. The contents of the GIS database must be reviewed to check the data sources. If the data came from other agencies, these agencies must be contacted for future updates, while data generated during the study will have to be updated by the counterparts.

- Data analysis done during the study must also be replicated and improved by the counterparts to update the analysis outputs of the study and to serve the planning purposes as will be determined by the future users of the GIS database.

- Data sharing protocols must also be set. Personnel access and security controls need to be established and policies for data sharing or distribution within and outside of the organization need to be set and properly enforced.

Capacity issues of organization and staff:

- The DNHPU is currently undergoing reorganization, with a GIS section being setup as one of the new sections under the information management department, and with five counterparts being trained for certain positions requiring GIS capabilities. These staff will require continuing periodic training to improve their GIS capabilities as this study will be limited to coaching and mentoring as a means of technology transfer.

Effective GIS Database Utilization for Urban Planning and Management

- In order to implement the master plan, monitoring and update/revision will be one of the essential activities for effective urban planning. On the other hand, urban management will be another significant activity through development control and construction permission. Both tasks of urban planning and management need great support through effective and efficient spatial data management tool by GIS database.

- Organization which needs to establish GIS database should be coordinated with GIS database for urban planning by DNHPU (MPSI) and urban management by DNB (MoPWTC) through efficient data sharing system and communications.

CHAPTER 13 : ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

13.1 Outline of Environmental and Social Considerations

Environmental and social considerations for the Project are composed of two studies: a strategic environmental assessment (SEA) for the Dili Urban Master Plan and an initial environmental evaluation (IEE) for the road and transportation plan proposed in the master plan.

13.1.1 Strategic Environmental Assessment (SEA)

In this master plan study, a strategic environmental assessment (SEA) was adopted according to the JICA Guidelines for Environmental and Social Consideration, 2010. The guideline describes that SEA is a kind of assessment that is implemented at the policy, planning, and program levels but not on a project-level environmental impact assessment (EIA) and JICA applies SEA when conducting master plan studies. In Timor-Leste, the Basic Law on Environment also states that SEA should be carried out before the adoption of any policy, legislation, program, plan, or project that is likely to produce significant effects on the environment to avoid, minimize, or to compensate for the effects of the decision-making procedure. SEA can contribute to the early warning on the environmental and social damages as well as in the optimization of the urban master plan in a broad and long-term strategic perspective.

Based on the abovementioned definition of SEA, the JICA Project Team (JPT) adopted the following basic policies for SEA in the Project:

- Assessment of environmental impacts at an earlier study stage, namely in the master plan level, with:
  - Comparison and evaluation of alternatives, and
  - Public involvement at the earlier study stages.

Specifically, JPT took the following steps:

(i) Study of the current social and environmental conditions;

(ii) Involvement of stakeholders in the working group meetings and public consultation meetings;

(iii) Consideration of alternatives; and

(iv) Comparison and evaluation of the alternatives of the urban structure plans.

13.1.2 Initial Environmental Evaluation (IEE)

The JPT proposed a road transportation development plan and five potential projects were proposed as mentioned in Chapter 10. Neither a pre-feasibility nor a feasibility study is included in the scope of the Project, as a result, the project alignments and scales are still not clear. Thus, JPT

studied IEE for the five potential projects at the early level of planning. The detailed evaluations of environmental and social impacts should be conducted at the feasibility study phase.

13.2 Outlines of the Project Sites

The present conditions of the Dili Metropolitan Area (DMA) on natural environment, social environment, and pollution are described in Chapter 2.

13.3 Legal and Institutional Frameworks of Environmental and Social Considerations

13.3.1 Legal Framework

(1) Environmental Legislations

The main legal system on environmental social considerations in Timor-Leste follows three laws, namely: Constitution of the Republic of East Timor, Basic Law on Environment, and Law on Environmental License. The Constitution of the Republic of East Timor includes duties and basic principles of the State on environmental conservation and states that one of the objectives of the State is to protect the environment and conserve natural resources in section f) of Article 6.

Moreover, Article 2 of the Basic Law on Environment states that this law defines the bases of environmental policy, the guiding principles for the conservation and protection of the environment and conservation and sustainable use of natural resources to promote quality of life of citizens. In Chapter 3 of the law, basic policies on strategic environmental assessment, environmental standards, environmental assessment and licensing, environmental monitoring are defined with sectoral policies. Chapter 4 defines basic policies on protection, conservation, and sustainable use of environmental elements, air, surface and groundwater, marine coast, soil and subsoil, biodiversity, species and ecosystems, environmental heritage, and extractive industry. Thus, Chapter 5 is for basic policies on pollution control on air, water, noise and vibration, landscape, hazard chemicals, waste management, and climate change.

Meanwhile, the Law on Environmental License stipulates the environmental assessment procedures. This law creates a system of environmental licensing for public and private projects likely to produce environmental and social impacts. The law regulates a proponent who plans to implement public and/or private projects likely to produce environmental impacts and is required to have environmental license before the start of the projects.

(i) Constitution of the Republic of East Timor

(ii) Decree-Law No. 26/2012 of 4th of July on Basic Law on Environment

(iii) Decree-Law No. 5/2011 of 9th of February on Environmental License

The Ministry of Commerce, Industry, and Environment amended the above two laws of (ii) and (iii) in 2014. A draft decree law amendments to Decree Law 5/2011 states that the title should be published in the Official Gazette and should be renamed as "Approves the Amendments to Decree Law 5/2011 Environmental Licensing Law." This draft amendment states that supplementary regulations are determined by statute for the following matters:

a. Terms of Reference (TOR), Environmental Impact Statement (EIS), and Environmental Management Plan (EMP);

b. Public Consultation Procedure;

c. Impacts and Benefits Agreement;

d. Status of the Evaluation Committee;

e. Fees and other costs related to environmental licensing procedure;

f. Proper forms for environmental licensing procedure;

g. Scheme for rehabilitation and decommissioning of projects;

h. Technical parameters on environmental issues for various components of the environment; and

i. Such other regulations are necessary to implement this law."

As of April 2014, the following four regulations are drafted corresponding to the items from a. to d. as mentioned above:

- Regulation on the detailed requirements for screening, scoping and the terms of reference, environmental impact statements, and environmental management plans for environmental assessment;
- Regulation on the public consultation procedures and requirements during the environmental assessment process;
- Regulation on impacts and benefits agreements; and
- Regulation on the status and rules of procedures for the evaluation committee for managing the environmental assessment procedure for Category A.

(2) Land Related Laws

The main legal system on land in Timor-Leste consists of the following laws: the law for resettlement is Decree Law No. 6/2011: Compensation for Resettlement from State Land. The law was established to relocate and compensate informal occupants who were identified in the state-owned land. However, the law was transitionally established and does not regulate detailed compensation procedures, eligibility of compensation, and calculation method of the amount of compensation although criteria of compensation is described which includes composition of the household, duration of occupancy, type of occupancy, type of construction, and depreciations and improvements. Therefore, the Ministry of Justice is preparing drafts of the land law to clarify and promote the first registration of parcels of land and of the expropriation law to regulate detailed procedures on land acquisition.

(i) Constitution of the Republic of East Timor (Article 54, 141)

(ii) The Civil Code 2011

(iii) Law 01/2003 Juridical Regime for Immovable Property

(iv) Decree Law 19/2004 Regulating Leases of State Land

(v) Law 12/2005 On Leasing Between Private Individuals

(vi) Decree Law 27/2011 Regime to Regulate Ownership of Immovable Property in Undisputed Cases

(vii) Decree Law No. 6/2011: Compensation for Resettlement from State Land

(viii) Draft Land Law: Draft Special Regime for Determining Ownership of Immovable Property

(ix) Draft Expropriation Law

(3) Environmental License (EL)

The Law on Environmental License which stipulates environmental assessment procedures states that a proponent who plans to implement public and/or private projects likely to produce environmental impacts is required to have environmental license before the start of the projects. First, the proponent submits to the National Directorate of Environment (DNMA), a project document (PD). DNMA conducts screening of PD to classify a project as Category A, B, or C. A proponent of Category A project is required to submit EIS and EMP. A proponent of Category B project is required to submit an IEE report and EMP. A Category C project where environmental impacts are negligible or nonexistent is not subject to any procedures for environmental assessment. The DNMA is involved in the reviews of submitted documents and recommends issuance of EL.

(4) Screening

The screening criteria of environmental categories, Category A and B, are defined in Annex I and II of the Law on Environmental License, which cover 11 sectors, namely: mining, oil industry, energy industry, transport, civil construction, sanitation, water, agricultural/livestock/forestry, tourism, defense, and security. In addition, Annex I defines that Category A should be adopted for projects in the following areas:

(i) Sensitive or valuable ecosystems (beaches, mangroves, coral reefs, protected areas, marine areas): All

(ii) Unique and valuable landscape: All

(iii) Archaeological and/or historic site: All

(iv) Densely populated areas: Resettlement $\geq$ 300 persons

(v) Occupied by cultural communities or tribes: All

(vi) Geographically sensitive area: All

(5) Procedures of Environmental License

The procedures to obtain environmental license (EL) are summarized as follows. The following step (iii) later describes the procedures for a Category A project. Meanwhile, since the evaluation committee has not been established, DNMA reviews EIS and EMP, and decides on the issuances of EL for the projects.

On the other hand, a proponent of Category B submits to DNMA and IEE and EMP but not EIS as shown in step (v) below. The proponent conducts public consultations in accordance with a requirement of DNMA. DNMA reviews the reports within 30 days after receiving the report and provides opinions to the proponent. The proponent revises the reports based on the opinions and submits those reports again. DNMA recommends whether the documents are approved or not within ten days, and the superior environmental authority issues EL within ten days.

(i) The proponent submits the PD to DNMA.

(ii) DNMA decides the classification of projects, Category A, B, or C in accordance with Annex I and II (Screening).

(iii) The proponent of Category A optionally submits to DNMA an environmental scoping document including the terms of reference for the environmental impact assessment.

(iv) The DNMA issues opinions on the environmental scoping within 15 days after receipt of the document.

(v) The proponent studies the environmental impact assessment, prepares EIS and EMP, and submits to DNMA.

(vi) The DNMA establishes an evaluation committee within ten days after the submission of the documents

(vii) The proponent begins public consultation within ten days after the establishment of the evaluation committee up to 24 days.

(viii) The evaluation committee technically reviews the documents within 50 days after its establishment. The committee may, whenever necessary, contact the proponent's representatives, the community of the area potentially affected by the project, as well as the ministries related to the project, to obtain additional information, and request reviews of the study and/or plans.

(ix) The proponent re-submits the documents after the reviews in accordance with the request of the evaluation committee.

(x) The evaluation committee technically reviews the documents and recommends the superior environmental authority whether the documents are approved or not within ten days with contributions from public consultations as well as conclusions of the technical analysis.

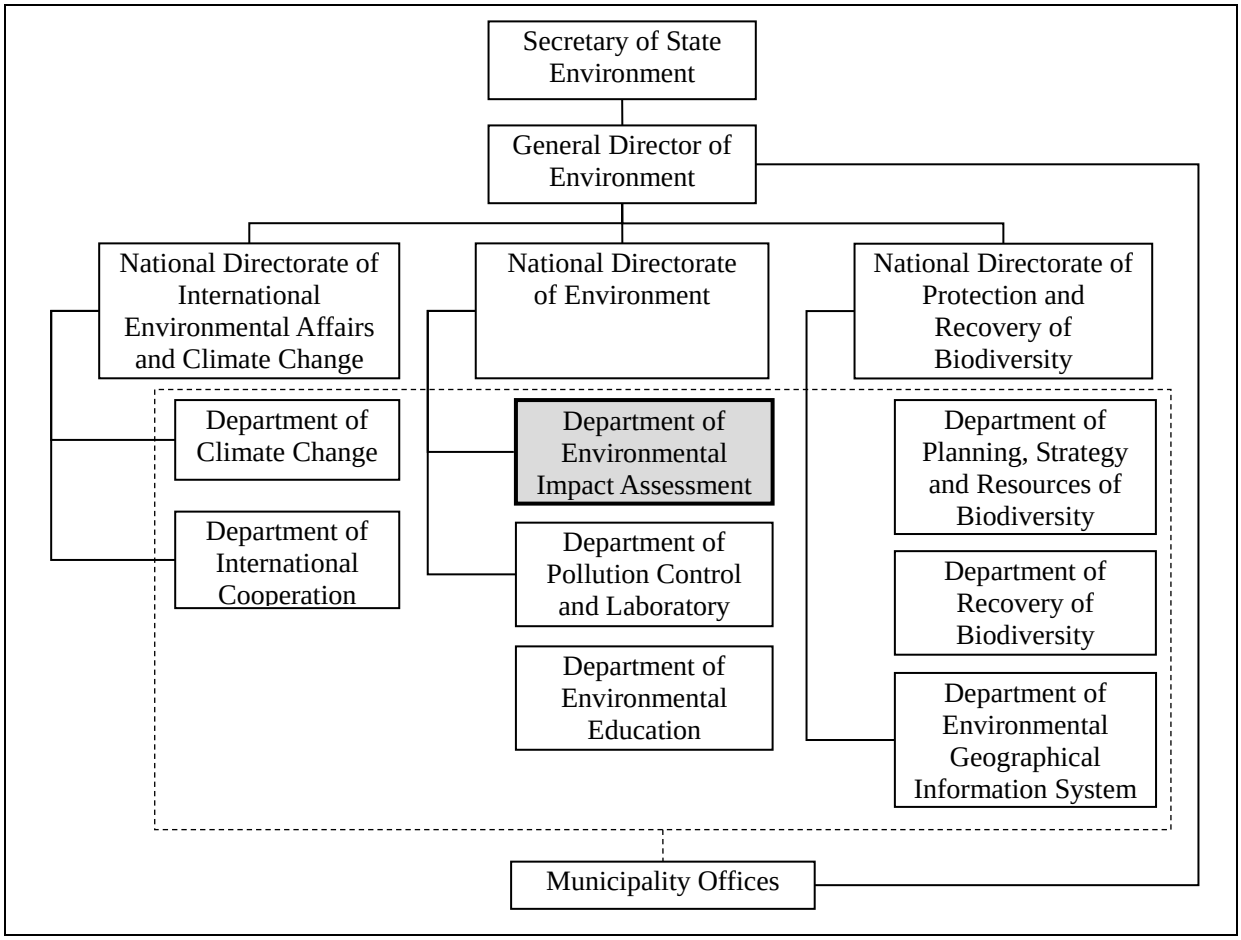
(xi) The superior environmental authority issues EL within 15 days from the recommendation of the evaluation committee.

(xii) The proponent is notified within five days regarding the results.

13.3.2 Institutional Framework

(1) Department of Environment, Ministry of Commerce, Industry, and Environment

The General Directorate of Environment, Ministry of Commerce, Industry and Environment, is responsible for the environmental administration in Timor-Leste which consist of three directorates: National Directorate of International Environmental Affairs and Climate Change, National Directorate of Environment, and the National Directorate of Protection and Recovery of Biodiversity. The Department of Environmental Impact Assessment under the National Directorate of Environment (DNMA) is in-charge of the environmental impact assessment. (See Figure 13.3.1)



Source: JICA advisor for environmental impact assessment, The Preparatory Survey on The Project for the Construction of Upriver Comoro Bridge in the Democratic Republic of Timor-Leste

Figure 13.3.1 Organization of General Directorate of Environment

(2) Department of Protected Areas and National Parks, National Directorate of Forestry, and Nature Conservation, Ministry of Agriculture and Fisheries

The protected areas of Timor-Leste are managed by the Department of Protected Areas and National Parks (DPANP) of the National Directorate of Forestry and Nature Conservation (NDFNC) in the Ministry of Agriculture and Fisheries. Thirty protected areas are listed including one national park and the Nino Konis Santana National Park. Regarding the strategy and action plan for the protected areas, the National Biodiversity Strategy and Action Plan of Timor-Leste (2011-2020) states that one of the priority strategies is building climate-resilient ecosystems through effectively managing protected areas and reducing threats to biodiversity. In the Strategic Plan 2014-2020 of the Ministry of Agriculture and Fisheries, the protected areas are regarded as key areas of forestry production which should be conserved.

Table 13.3.1 List of Protected Areas in Timor-Leste

Name	Name
1. Atauro Island	16. Mount Tatamailau and Talobu/Laumeta
2. Behau	17. Manucoco Protected Area
3. Nino Konis Santana National Park (Marine)	18. Ribeira De Clere and Lake Modomahut
4. Lamsanak	19. Mount Mundo Perdido
5. Mount Cablaque and Lake Welenas	20. Mount Fatumasin
6. Mount of Tapo/Saburai	21. Mount Cutete
7. Mount Loelako	22. Mount Manoleu and Area Mangal Citrana

8. Mount Taroman	23. Mount Burabo
9. Mount Kuri	24. Cristo Rei Protected Area
10. Mount Laretami	25. Mount Legumau
11. Mount Builo	26. Mount Altana
12. Mount Guguleur	27. Mount Bibileo
13. Lake Maurei	28. Nino Konis Santana National Park (Terrestrial)
14. Mount Matebian	29. Mount Diatuto
15. Area Protegida Reserva De Tilomar	30. Tasitolu

Source: Timor-Leste's Fourth National Report to the UN Convention on Biological Diversity

(3) National Directorate of Land and Properties, Ministry of Justice

The National Directorate on Land and Properties (NDLP) under the Ministry of Justice is responsible on land management in Timor-Leste. NDLP mainly deals with the establishment of a legal system, land registration, and mapping. In Timor-Leste, registration information before the conflict with Indonesia was lost so unconfirmed landholding became a critical problem. Therefore, the Ministry of Justice is preparing drafts of the land law to clarify and promote the first registration of parcels of land as mentioned above. Meanwhile, the ministry has been conducting cadastral investigation and promotes land registration. However, based on reports from the local people, there is still some duplication on land ownership and/or applications of ownership of public land and many boundaries are still unclear.

13.4 Strategic Environmental Assessment (SEA)

13.4.1 Scoping for SEA

As described in the beginning of this chapter, the basic policies of SEA include comparison and evaluation of alternatives and public involvement at the earlier study stages. Thus, JPT considers examining the alternatives on urban structure plans as the main target of SEA in the Project. For comparison of the alternatives, the indicators are studied with scoping to choose items that have potentially significant impacts (positive/negative) due to urban development and study methods. Therefore, JPT studied a preliminary scoping and briefly explained in the first public consultation meetings with the main counterpart, the National Directorate of Housing and Urban Planning (MPSI).

For public involvement, there are two types of public involvement, namely: working group meeting and public consultation meeting, that are being considered for the Project. The working group consists of related departments of ministries for strengthening collaboration and coordination system and technical discussion. The public consultation has a broader scope to disclose project information to the public and to promote public participations in the project process at the earlier study stages.

(1) Preliminary Scoping

The preliminary scoping was done based on the environmental and social conditions of DMA. The likely impacts were expected due to potential urban development projects comprising mostly of infrastructure constructions for the future of DMA. In the rating, it was mainly considered for Category B if the existing problems could worsen and likely impacts were expected in both construction and operation phases in the long-term, cumulatively, or in a broader area, and Category C is rated if the likely impacts were unclear and expected depending on the detailed plans or construction methods. The results are used for the scoping for SEA.

Table 13.4.1 Preliminary Scoping

	No.	Likely Impacts	Rating	Description of Impacts
Pollution	1	Air Pollution	B-	Exhaust gas and dust caused by operation of construction vehicles and equipment can temporarily deteriorate air quality around the construction sites. Increase in traffic, road construction, and factories due to urban development and population growth, which can generate more emission, and can deteriorate air quality.
	2	Water Pollution	B-	Soil erosion from cut and fill for the construction works of the urban development projects can temporarily contaminate river water. About 30% of households use septic tanks for human waste disposal in DMA. The growth of population and economic activities generates more wastewater, and the direct wastewater discharge without treatment can deteriorate the quality of surface water and groundwater (contamination) if no wastewater treatment system is established.
	3	Noise and Vibration	C-	The operation of construction vehicles and equipment can temporarily increase levels of noise and vibration near the construction sites.
	4	Soil Contamination	C-	If unintentional considerable spilled fuel and oil from construction vehicles or equipment occur, it may contaminate soil near the construction sites.
	5	Waste	B-	There are litter (polythene bags, pet bottles, papers) and burning of solid waste in the residential area in DMA. The growth of population and economic activities can increase solid waste and it can generate more litter (polythene bags, pet bottles, papers), burning of solid waste in the residential area if no sustainable solid waste disposal and management system are developed.
	6	Ground Subsidence	C-	If a large scale groundwater is developed as a source of water supply, risk of ground subsidence is increased.
	7	Offensive Odor	B-	The growth of population and economic activities generate more wastewater and the direct wastewater discharge without treatment can generate more offensive odor if no wastewater treatment system is established.
	8	Bottom Sediment	C-	If the construction works of the urban development projects are done without protection of cut and fill, it may temporarily generate soil erosion and affect bottom sediment.
Natural Environment	9	Protected Areas	C-	If the urban development (infrastructure) projects are proposed in the protected areas without environmental considerations and proper procedures, it may affect the flora, fauna, and/or biodiversity in the protected areas.
	10	Flora, Fauna, and Biodiversity	B-	The households of DMA are still highly dependent on firewood for cooking and fuel and the trees are being cut for them to use. If the urban development projects are implemented especially in the hilly areas without environmental considerations and proper procedures (forest protection/water shed management), it may worsen the deforestation and loss of vegetation cover.
	11	Hydrological Situation	B-	If the urban development projects are implemented especially in the hilly areas without environmental considerations and proper procedures (forest protection/water shed management), it may worsen deforestation and loss of vegetation cover. It may cause soil erosion, landslides, and flash flood. Siltation and sedimentation in streams, rivers, and drainage may also be expected and it may obstruct drainage and overflow of rainwater in the urbanized areas may occur. The litter due to lack of sustainable solid waste disposal and management system can also worsen this obstruction.
	12	Topography and Geographical Features	D	The master plan does not propose projects involving any major alteration in topography or geology.
	13	Soil Erosion	B-	Soil can be temporarily eroded from cut and fill for the construction works of the urban development projects. The households of DMA are still highly dependent on firewood for cooking and fuel and the trees are being cut for them to use. If the urban development projects are implemented especially in the hilly areas without environmental considerations and proper procedures (forest protection/water shed management), it may worsen deforestation, loss of vegetation cover, and consequently cause soil erosion on the thin soil layer.
	14	Groundwater	C-	If large-scale groundwater is developed for a source of water supply, the risk of groundwater resource depletion is increased.
	15	Coastal Zone	C-	If urban development projects are proposed in the coastal areas without environmental considerations, it may affect coastal biodiversity.
	16	Meteorology	D	The master plan does not propose projects to generate large emission of greenhouse gas like thermal power plant.

	No.	Likely Impacts	Rating	Description of Impacts
Social Environment:	17	Involuntary Resettlement	B-	The urban development projects require more lands and this demand increases land acquisition and resettlement. Lack of legal procedures of land acquisition and resettlement can lead to inadequate compensation.
	18	Local Economy such as Employment and Livelihood, etc.	B+/-	Inadequate compensation led by lack of legal procedures on land acquisition and resettlement can cause loss in livelihoods, difficulty to recover livelihoods, and/or degradation of previous living conditions of relocated people. The construction projects will activate the construction sector. Additionally, those activities will require employment of workers (especially unskilled), and it can provide a temporary boost to local employment. Local service sector can provide the construction workers accommodation, food, and beverages. It can facilitate business opportunities for the local service sector. As urban development including infrastructure, facilitate efficient logistics and transportation and local economic growth, the local people can obtain opportunities of employments and/or establish new businesses.
	19	Land Use and Utilization of Local Resources	B+	The master plan will contribute to effective land use and spatial use in the limited land of DMA.
	20	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	D	As the urban development projects will improve the local infrastructure as a public service, no negative impacts on social institutions are expected.
	21	Existing Social Infrastructures and Services	B+/-	The construction works of urban development projects can temporarily hinder the access to social services and/or require relocation of existing social infrastructure around the construction sites. Meanwhile, those projects can provide better and more reliable public services for the local people.
	22	Misdistribution of Benefit and Damage	D	Since the urban development projects will improve the local infrastructure as a public service, no misdistribution of benefit and damage are expected.
	23	Local Conflict of Interests	C-	Unclear land ownership and/or inadequate compensation led by lack of legal procedures on land acquisition and resettlement may raise local conflicts of interests.
	24	Water Usage or Water Rights and Rights of Common	C-	Water rights are unclear. However, about 90% of households in DMA use water utilities like pipe, pump, public tap or well/borehole, but not sourced from rainwater, spring water, or surface water.
	25	Sanitation	B-	Increase in wastewater discharge without treatment and solid waste due to growth of population and economic activities can deteriorate the conditions of hygiene and sanitation and may increase the risk of having mosquito-borne diseases (dengue fever, malaria) and/or diarrheal diseases, viral hepatitis, and other water borne infections.
	26	Hazards (Risk), Infectious Diseases such as HIV/AIDS	C-	As the local employment may be promoted by the urban developments, considerable influx of workers is unexpected. However, risk of infectious diseases due to mass inflow of laborers from other areas is unclear.
	27	Cultural Heritage	C-	No specific cultural heritages like historical urban districts were identified in DMA. However, there are architectural heritages from the Portuguese colonization period and the local sacred/holy places, although those locations are still unclear.
	28	Landscape	C-	If the urban development projects are proposed in the protected areas or coastal areas without environmental considerations, it may change or detract surrounding landscape.
	29	The Poor, Indigenous, and Ethnic People	C-	No indigenous and ethnic people were identified in DMA. However, poor households may be affected by relocation or involuntary resettlement due to the urban development projects.
	30	Accidents	B-	Increase in traffic volume and speed can generate more traffic accidents.

Rating:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown (examination is needed and impacts may become clear as study progresses)
D: No impact is expected
Source: JICA Project Team

(2) Indicators from Likely Impacts

The following likely impacts were derived from the opinions in public consultations in Dili, Hera, and Tibar.

(i) Pollution: Waste, Water Pollution, Air Pollution, Noise and Vibration, Offensive Odor, Soil Contamination

(ii) Natural Environment: Protected Areas, Soil Erosion, Hydrological Situation (Flood), Flora/Fauna (Deforestation), Groundwater

(iii) Social Environment: Involuntary Resettlement, Local Economy, Land Use, Culture, Hazard/Infectious Diseases, Poor People, Accidents

The JPT focused its attention on the following for the likely impacts (positive or negative) as indicators to be evaluated in order to compare the scenarios of spatial structures for appropriate urban structure plan of DMA.

- The preliminary scoping and opinions in the public consultation to be labeled as “more important likely impacts”; and
- Cumulative impacts: broader and long-term perspective; therefore, the items of likely impacts especially expected in the construction (temporary) phase were excluded from the indicators for SEA.

As a result, the indicators were set-up for evaluation of the scenarios as follows:

(i) Pollution: Waste, Water Pollution, Air Pollution

(ii) Natural Environment: Protected Areas, Soil Erosion, Hydrological Situation (Flood), Flora/Fauna (Deforestation), Groundwater

(iii) Social Environment: Involuntary Resettlement, Local Economy, Land Use, Culture

(3) Study Methods for Evaluations

The methods on the environmental and social study to evaluate the impacts is summarized in Table 13.4.2 based on the results of the scoping.

Table 13.4.2 Methods of Environmental and Social Study for Evaluations

	No.	Likely Impacts	Study Item	Study Method
Pollution	1	Waste	• Waste disposal system • Waste disposal volume • Capacity of Tibar dumping site	• Condition analysis by the JICA Project Team • Estimation of accumulated waste disposal volume • Estimation of the capacity of Tibar dumping site
	2	Water Pollution	• Existing situation of water pollution • Water supply and demand	• Condition analysis by the JICA Project Team • Estimation of the existing water supply capacity • Estimation of water demand
	3	Air Pollution	• Existing situation of air pollution • NOx volume from traffic	• Condition analysis by the JICA Project Team • Estimation of NOx emission in interregional roadside traffic volume
Natural Environment	1	Protected Areas and Flora/Fauna (Deforestation)	• Existing situation of protected areas • Population and habitable land	• Condition analysis by the JICA Project Team • Estimation of population and habitable land
	2	Soil Erosion and Hydrological Situation (Flood)	• Existing situation of soil erosion and hydrological situation • Population and habitable land	• Condition analysis by the JICA Project Team • Estimation of population and habitable land

	No.	Likely Impacts	Study Item	Study Method
	3	Groundwater	• Water supply capacity • Water demand	• Estimation of the existing water supply capacity • Estimation of water demand
Social Environment	1	Involuntary Resettlement	• Existing situation of resettlement • Population	• Condition analysis by the JICA Project Team • Estimation of population
	2	Local Economy such as Employment and Livelihood	• Existing situation of local economy • Population	• Condition analysis by the JICA Project Team • Estimation of population
	3	Land Use and Utilization of Local Resources	• Land use conditions • Population density of habitable land • Urban development perspective	• Condition analysis by the JICA Project Team • Estimation of population, habitable land and density • Assumption of urban development perspectives
	4	Cultural Heritage	• Existing situation of cultural heritages • Population and habitable land • Urban development perspective	• Condition analysis by the JICA Project Team • Estimation of population and habitable land • Assumption of urban development perspectives

Source: JICA Project Team

13.4.2 Comparison and Evaluation of the Alternatives

The alternatives of the Dili urban structure plans are proposed and described in Section 8.3.2. The alternatives of the Dili urban structure plans are compared and evaluated in Section 8.3.3. The detailed evaluations are explained in the following section.

13.4.3 Evaluation of Alternative Scenarios

The JPT proposed three scenarios for the spatial structure plans of DMA. Those alternative scenarios were evaluated and compared in SEA process through two types of evaluations depending on the perspectives of the development visions and environmental and social impacts. The results of evaluations are mentioned in Section 8.3.3.

This section explains the evaluation of the scenarios in the environmental and social impacts. Three scenarios were mainly evaluated in a qualitative manner because the extent of the impact and scale were not specified and the data of indicators were unclear to cover the project area over a wide range in the nature of the master plan study.

(1) Pollution

1) Solid Waste

i) The existing situation: There are litter (polythene bags, pet bottles, papers) and burning of solid waste in the residential area (drainage, concrete bin, street) in DMA. In the Tibar dumpsite, the operation of the solid waste disposal site, where no sanitary disposal was done, causes fire, heat, smoke, gases, and odor from the burning and unburnt wastes which were mainly produced by waste pickers in the site. Untreated leachate can also be generated from the dumpsite.

ii) Major causes: The growth of population, urban development, and economic activities will increase solid waste generation from the residential, commercial/business areas, and factories.

iii) Likely impacts: Increase in solid waste can go beyond the capacity of the Tibar dumpsite and its waste collecting system and can cause garbage pollution in the urban area and/or its surroundings. Consequently, these can post threats on the health/safety

of residents and the sanitation might also be affected because of contamination of groundwater due to the leakage of untreated leachate from the dumpsite.

iv) Evaluation: According to the JPT's study, no data collection systems for solid waste management were identified in the solid waste collectors and Tibar dumpsite. Therefore, necessary indicators were set-up in Table 13.4.3 to estimate the annual volume of waste disposal. Meanwhile, a manner of landfill was observed for sanitary management in Tibar dumpsite. The landfill shape is six meters filling up in a trapezoidal shape by three meters without pits as the site is located on the slope. The capacity of the dumpsite was estimated based on the existing areas which are composed of lower, middle, and upper spaces in Table 13.4.4.

Based on these set-ups, annual and accumulated (2010–2030) waste disposal volume of each scenario are estimated as follows. The accumulated solid waste disposal volumes reached beyond the capacity of the landfill site except Scenario 3, although Scenario 2 might mostly dispose the accumulated waste numerically. Furthermore, if the recycling rate is considered, Scenario 2 could cover the accumulated waste disposal. However, if the solid waste collection rate is raised for better solid waste management, the over capacity of landfill sites can be accelerated especially in the Scenarios 1 and 2.

- Scenario 1: Accumulated solid waste disposal volume was estimated at about 660,000 m^3 and the volume will reach beyond the capacity of the landfill site in 2027.
- Scenario 2: Accumulated solid waste disposal volume was estimated at about 530,000 m^3 and the volume will reach beyond the capacity of the landfill site in 2029.
- Scenario 3: Accumulated solid waste disposal volume was estimated at about 400,000 m^3 and the volume will stay within the capacity of the landfill site.

Table 13.4.3 Setup for Estimation of Accumulated Waste Disposal Volume

Items	Assumption
a) Yearly population	Prorated from 2010-2030 according to each scenario's population
b) Per capita waste generation (kg/day)	From 0.4 kg/day used with an assumed nominal annual increase of 1%: based on the recently completed waste characterization study (WACS) commissioned by the Asian Development Bank (ADB) study, the composite per capita waste generation was 0.393 kg.
c) Solid waste collection rate (excluding recycling)	2010-2020: 25%、2021-2030: 50%
d) Dumped volume density	0.5 ton/m^3
e) Covering soil ratio	10% of dumped volume
f) Stable volume weight after half a year	0.8 ton
g) Stable volume density	0.8 ton/m^3

Source: JICA Project Team

Table 13.4.4 Estimation of Dumpsite Capacity

Site	Approximate Area (ha)	Capacity (m^3)
Upper terrace	1.0	41,340
Middle terrace	2.7	129,600
Lower terrace	5.8	278,400
Total		449,340

Note: Capacities were estimated at six meters filling up in a trapezoidal shape by three meters high.
Source: JICA Project Team

2) Water Pollution

i) The existing situation: It is assumed that water pollution with chemical substance has not been more serious because secondary industry has not been developed and not many factories are located based on the existing land use conditions in DMA. However, night soil without septic tank and untreated household effluent are mostly directly discharged to a public water area. The pipelines of the wastewater have not been installed yet. The existing channels and pipelines are installed along the main streets for the drainage system in DMA, although there are sedimentation of sand or mud and dumping dusts found in the channel or the pipelines. Thus, these facilities have not met the requirement rapidly to drain rainwater. The Wastewater Treatment Plant (WWTP) is operated in Tibar for some of governmental facilities, hotels, hospitals, and companies based on their requests. Therefore, the entire treatment capacity of wastewater is unclear in DMA.

ii) Major causes: The growth of population, urban development, and economic activities will increase wastewater generation from the residential, commercial/business area, and factories. The untreated wastewater discharged can increase and reach beyond the treatment capacity if the treatment system is not planned and developed according to the increased wastewater volume.

iii) Likely impacts: The increased in untreated discharged wastewater can contaminate surface and groundwater.

iv) Evaluation: As water demand was estimated in the section of "groundwater" below. The wastewater volume on each scenario was also large in descending order of water demand from Scenarios 1 to 3. Thus, the wastewater volume can raise more risk of water pollution for Scenarios 1 to 3 in that particular order.

3) Air Pollution

i) The existing situation: It is assumed that air pollution with chemical substance of flue gas and exhaust gas have not been more serious because the secondary industry has not been developed and not many factories are located based on the existing land use conditions in DMA. Besides, the present number of vehicles in Dili is still small and the remarkable traffic congestion is not generated in DMA.

ii) Major causes: Increase in the number of vehicles and traffic demand due to growths in population, urban development, and economic activities will generate more exhaust emission.

iii) Likely impacts: Increased exhaust emission can pollute the air.

iv) Evaluation: The volumes of traffic and exhaust emission are roughly proportional to population size. However, Scenario 2 has a characteristic of urban structure that provides working places near homes so that the commuting traffic volume between Dili and Hera/Tibar can be reduced to avoid traffic congestion. Thus, the JPT focused on and estimated interregional roadside traffic volume and its NOx emission to compare them with scenarios from the perspective of the different commuting traffic volumes. The results showed NOx emission in different population scale.

However, the estimation was based on the interim results of the traffic survey and the traffic model formulation for comparison under limited terms. The annual NOx emission was simply estimated with the following calculation formula.

Calculation formula of NOx emission volume

NOx emission volume = LV × Le × D + SV × Se × D
LV: Large-sized vehicle volume (vehicle/day)
SV: Small-sized vehicle volume (vehicle/day)
Le: Emission coefficient of large-sized vehicle = 2.472 g/km/vehicle (average speed at 40 km/h)
Se: Emission coefficient of small-sized vehicle = 0.107 g/km/vehicle (average speed at 40 km/h)
D: Travel distance

- Scenario 1: Annual NOx emission in the interregional roadside traffic volume was estimated at 380.2 t/year.
- Scenario 2: Annual NOx emission in the interregional roadside traffic volume was estimated at 231.1 t/year.
- Scenario 3: Annual NOx emission in the interregional roadside traffic volume was estimated at 73.7 t/year.

Table 13.4.5 Estimation of NOx Emission in Interregional Roadside Traffic Volume

Estimation	Interregional Roadside Traffic Volume (all types, vehicle/day)			NOx Emission (t/year)		
Scenario	SCE1	SCE 2	SCE 3	SCE1	SCE 2	SCE 3
Dili – Tibar Total	267,529	186,338	28,368	252.2	176.7	24.5
Large-sized vehicle	10,263	7,241	887	120.9	85.3	10.4
Small-sized vehicle	257,266	179,097	27,481	131.2	91.3	14.0
Dili – Hera Total	89,801	27,463	11,488	128.0	54.5	49.3
Large-sized vehicle	6,921	3,431	3,707	84.3	41.8	45.2
Small-sized vehicle	82,879	24,032	7,781	43.7	12.7	4.1
Total				380.2	231.1	73.7

Source: JICA Project Team

(2) Natural Environment

1) Protected Areas/Flora and Fauna (Deforestation)

i) The existing situation: There are three protected areas, namely: Cristo Rei Protected Area, Tasitolu, and Behau, are located in DMA, although Behau will be abolished because the National Directorate of Forestry and Nature Conservation (NDFNC) is going to review the list of protected areas. These protected areas mostly overlap with the important biodiversity areas (IBA) designated by an international non-governmental organization (NGO), BirdLife International. Additionally, there is no approval system for development projects although the environmental laws are enforced. Legal effectiveness and relation between project approval and environmental license are unclear.

ii) Major causes: The growth of population, urban development, and economic activities will raise demand on land for development and urban development can reach the protected areas and the mountain (forest) areas. Ineffective environmental legislations and its enforcement ability are the main concerns because it can spur informal developments.

iii) Likely impacts: It can affect flora, fauna, and/or biodiversity in the protected areas and worsen deforestation and loss of vegetation cover.

iv) Evaluation: Total area of DMA was measured at 17,860 hectares through GIS analysis based on the land use survey managed by the JPT. Of these, the habitable land with an inclination below 15 degrees was calculated at 6,698 hectares, and the inhabitable land with inclination of more than 15 degrees was calculated at 11,162 hectares. The scenarios were evaluated based on development possibility on the inhabitable land

basically according to population sizes and consequently it can increase the risk of losing biodiversity.

In DMA, the sizes and boundaries of protected areas were not officially indicated. However, the land use policies of the Dili Urban Master Plan proposed to develop neither the protected areas nor the inhabitable land.

- Scenario 1: The largest population size following the rapid urbanization trend by the growing immigration from other regions can cause disordered urban development even using disaster-prone area like the inhabitable land with inclination of more than 15 degrees. Consequently, this scenario has the highest risk which may affect the flora, fauna, and/or biodiversity in the protected areas and worsen deforestation and loss of vegetation cover.
- Scenario 2: The habitable land can accommodate the growing population with urban development dominated by low to mid-rise buildings due to medium population size. It can decrease the risk of developing a disaster-prone area and affect the flora, fauna and/or biodiversity in the protected areas and worsen deforestation and loss of vegetation cover.
- Scenario 3: The smallest population size can reduce the risk of developing a disaster-prone area and it is the scenario least likely to affect the flora, fauna, and/or biodiversity in the protected areas and worsen deforestation and loss of vegetation cover.

2) Soil Erosion/Hydrological Situation (Flood)

i) The existing situation: The households of DMA are still highly dependent on firewood for cooking, fuel, and the trees are being cut for them in the mountain area. This deforestation and loss of vegetation cover are the major causes of soil erosion on thin soil layer. The siltation and sedimentation are also seen in streams, rivers, and drainages in DMA particularly along the four major rivers in Dili, Comoro, Maloa, Kuluhum, and Santana rivers, flood-prone areas are indicated in a wide sphere. The Maucau River in Tibar, and the Akanunu, and the Mota Kiik rivers in Hera are still in its natural states. High sediment yield can be seen in the basins.

ii) Major causes: The growth of population, urban development, and economic activities will raise demand on land for development and urban development can reach the inhabitable land with steep inclines.

iii) Likely impacts: The urban developments on the steep slopes can worsen deforestation and loss of vegetation cover, and consequently cause soil erosion on the thin soil layer. The eroded soil can generate siltation and sedimentation in streams, rivers, and drainages in DMA. It can obstruct the drainage system and overflow rain water in the urbanized areas and cause flooding.

iv) Evaluation: As was in the case of “Protected Area”, the scenarios were evaluated where development is possible on inhabitable land basically according to the population sizes and consequently it can increase the risk of soil erosion and flood.

- Scenario 1: The largest population size following the rapid urbanization trend by the growing immigration from other regions can cause disordered urban development even if they use disaster-prone areas like the inhabitable land with an inclination of more than 15 degrees. Consequently, this scenario has the highest risk which may cause soil erosion and flood.
- Scenario 2: The habitable land can accommodate the growing population with the urban development dominated by low to mid-rise buildings due to the medium population size. It can decrease the risk in developing disaster-prone areas and to cause soil erosion and flooding.

- Scenario 3: The smallest population size can reduce the risk of developing the disaster-prone area and it is the scenario least likely to cause soil erosion and flooding.

3) Groundwater

i) The existing situation: The groundwater covered half of the existing water supply capacity. Meanwhile, the project area is on the aquifer susceptible from the amount of rainfall and seawater level.

ii) Major causes: The growth of population, urban development, and economic activities will raise the water supply demand and will require developing more groundwater to have more source of water supply.

iii) Likely impacts: The development of groundwater can cause excessive use of groundwater and consequent risks of subsidence, salinization, and/or the groundwater depletion.

iv) Evaluation: The JPT calculated the demands of water supply according to the population sizes by scenario as shown in Table 13.4.7 based on the collected date in Table 13.4.6. Each result, 85,000 m^3/day for Scenario 1, 67,930 m^3/day for Scenario 2, and 52,000 m^3/day for Scenario 3, can exceed the existing capacity of 39,000 m^3/day (for dry season). It is considered that the larger the population size, the higher the dependency on groundwater, and the risks of subsidence, salinization, and/or groundwater depletion can be also high although detailed studies about the yield of surface water and groundwater are required to grasp appropriate yield of water sources.

- Scenario 1: The largest demand, 85,000 m^3/day demand for water supply was expected.
- Scenario 2: The medium demand, 67,930 m^3/day demand for water supply was expected.
- Scenario 3: The smallest demand, 52,000 m^3/day demand for water supply was expected.

Table 13.4.6 Existing Capacity of Water Supply

Project Area	Municipality	Surface Water		Groundwater	Total Capacity	
		Minimum (m^3/day)	Maximum (m^3/day)	Capacity (m^3/day)	Dry Season (m^3/day)	Rainy Season (m^3/day)
Dili	Dili	8,500	15,500	28,412	36,912	43,912
Hera	Dili	-	-	192	192	192
Tibar	Liquicia	-	-	1,900	1,900	1,900
Total		8,500	15,500	30,504	39,004	46,004

Source: Performance Survey of National Directorate of Water Supply, DNSA, JICA Project Team

Table 13.4.7 Estimated Demands of Water Supply by Scenario

Project Area	Municipality	Water Consumption per capita*	Population			Demand (m^3/day)		
		(m^3/day/capita)	ALT1	ALT2	ALT3	ALT1	ALT2	ALT3
Dili	Dili	0.15	476,000	401,000	329,000	72,000	61,000	50,000
Hera	Dili	0.07	94,000	32,000	11,000	7,000	2,240	1,000
Tibar	Liquicia	0.07	80,000	67,000	10,000	6,000	4,690	1,000
Total			650,000	500,000	350,000	85,000	67,930	52,000

Source: Performance Survey of the National Directorate of Water Supply (DNSA), JICA Project Team
Note: *Water consumption per capita: 0.15 m^3/day/capita (utilized in the DNSA based on their practical study of current situation), 0.07 m^3/day/capita (the minimum requirement stipulated in Law 2004 No.4)

(3) Social Environment

1) Involuntary Resettlement

i) The existing situation: The urban population including immigrants is growing although flat land for urban development is limited in DMA. In this situation, informal settlement is also increasing and the establishments and enforcements of land management policies and legislations should follow.

ii) Major causes: The growth of population, urban development, and economic activities will boost more demand on land for residential, industries, and infrastructure and those developments will demand more lands for the developments and redevelopment. Additionally, deficiencies of legal procedures and the ability of enforcement for land acquisition and resettlement are issues and concerns.

iii) Likely impacts: The demand for land for urban development will increase land acquisition and resettlement and the deficiencies on legal procedures and the ability of enforcement on land acquisition and resettlement can lead to inadequacy in implementation including compensation.

iv) Evaluation: The master plan study does not specify the scale on land acquisition and resettlement. Therefore, it is considered that the larger the population size, the higher the risks of inadequate land acquisition, resettlement, and compensation.

- Scenario 1: The largest population size will increase the demand on developed lands and it is the scenario most likely to cause inadequate land acquisition, resettlement, and compensation.
- Scenario 2: The medium population size will require medium demand on developed lands and the scenario also has the medium risks to cause inadequate land acquisition, resettlement, and compensation.
- Scenario 3: The smallest population size will minimize the demand to develop lands and it is the scenario least likely to cause inadequate land acquisition, resettlement, and compensation.

2) Local Economy

i) The existing situation: The structure of economic activities can be explained by percentages of the employed population. The statistics of Dili Municipality showed that Dili was outstanding in the tertiary sector (commercial and service) at 74.3% of the employed population in 2010, although the primary sector (agriculture, forestry, and fishing) was the majority in the country. In the tertiary sector, the employed population especially is engaged in “Public Administration and Defense (19.4%)” and “Wholesale and Trade (16.1%)”. The primary sector has more employment opportunities than the secondary sector in Dili Municipality. The secondary sector has the most minor economic activity. Thus, the local economy is on the administration and commerce in Dili Municipality.

ii) Major causes: The growth of population, urban development, and economic activities will boost more demand on land for residential, industrial, and infrastructure and those developments will demand more lands for development and redevelopment. Additionally, the main concerns are about the deficiencies on legal procedures and the ability of enforcement for land acquisition and resettlement.

iii) Likely impacts: Inadequate compensation due to lack of legal procedures on land acquisition, resettlement, and its enforcement will cause loss of livelihoods, difficulty to recover livelihoods, and/or degradation of previous living conditions of relocated people.

The construction projects will boost the construction sector. For the local economy, the construction activities will require employment of workers (especially unskilled) and it can provide a temporary boost to local employment. The local service sector can also receive the benefit by providing the construction workers accommodation, food, and beverages. It can facilitate business opportunities for the local service sector.

The consuming market will grow as the population increases and the urban developments, including infrastructure can facilitate to develop the local economy as well as the developments of commercial/transportation/logistics sectors. Given these situations, the local people can be expected to obtain opportunities of employment and/or establish new businesses.

iv) Evaluation: The master plan study does not specify the scale of urban and infrastructure developments. Therefore, it is considered that the larger the population size, the higher the impacts on the local economy.

- Scenario 1: While the largest population size will increase the demand to develop lands, it is the scenario that most likely to cause loss of livelihood, difficulty to recover livelihood, and/or degradation of previous living conditions of relocated people, this can create the largest consuming market and the opportunities for employment and/or establishment of new businesses.
- Scenario 2: As the medium population size increases, it can cause medium adverse impact on livelihood, difficulty to recover livelihood and/or degradation of previous living conditions of relocated people, and positive impact on the local economy development to create the medium consuming market and opportunities for employments, and/or establishment of new businesses. On the basis of both adverse and positive impacts, it can be comparatively the best scenario.
- Scenario 3: While the smallest population size will minimize the demand to develop lands, and it is the scenario least likely to cause loss of livelihood, difficulty to recover livelihood and/or degradation of previous living conditions of relocated people, this can create the smallest consuming market and the opportunities for employment and/or establishment of new businesses.

3) Land Use

i) The existing situation: The existing land use of DMA is significantly affected by the geographical features of limited flat plain. The present land use patterns are mainly characterized by Urban Center, Center Fringe, and Suburban (Hera, Tibar) in DMA. The land of the Urban Center block was occupied mainly by residential areas and government land followed by commercial and business areas. Most lands of Center Fringe and Suburban are dominated by natural/mountainous land at around 50% to over 90% of the total area.

ii) Major causes: The growth of population, urban development, and economic activities will require the changes of the existing land use.

iii) Likely impacts: The changes in land use can be done in a manner of inefficient and/or ineffective distribution of the limited spaces of the DMA.

iv) Evaluation: The JPT proposes a land use policy; the land with inclination below 15 degrees is suitable for the urban area (the habitable land) in the limited space of DMA. The habitable land was calculated at 6,698 hectares through GIS analysis based on the land use survey managed by the JPT. The existing population densities of habitable land in 2014 was calculated at 33 population/ha in DMA, 56.1 population/ha in Dili, 4.7 population/ha in Hera, and 2.3 population/ha in Tibar. Efficient and effective land use is necessary for the population growth and that requires land conversion for residential-related purposes (residential/commercial/business mixed), agriculture, open land, natural land, and/or other land.

The population density of habitable land for each scenario was calculated at 97 population/ha, 75 population/ha, 52 population/ha, which are equivalent to 3 times, 2.3 times and 1.6 times of the existing density, respectively. The density would give the scenarios images of urban areas dominated by medium-rise buildings for Scenario 1, low to medium-rise buildings for Scenario 2, and low-rise buildings for Scenario 3. It is noted that these densities are calculated for gross population density and the habitable land will not be all developed.

- Scenario 1: The largest population size following the rapid urbanization trend by the growing immigration from other regions will require maximum and densely uses of habitable land. It can cause disordered urban development even if they use the disaster-prone area like the inhabitable land with inclination of more than 15 degrees. Moreover, a lot of investment for social infrastructure is required including recovery cost to deal with the disordered development. Consequently, land use can be done inefficiently and ineffectively, and not be well-managed given the limited space.

- Scenario 2: Several urban functions such as administration, residential, industry/business, commercial and education will be allocated to achieve the Urban Cluster Development particularly in Hera and Tibar which have extremely low population densities with few urban functions. The existing and planned infrastructure can be maximally utilized in Urban Cluster Development. The limited habitable land can accommodate the growing population with realistic density. The scenario allows land use to be efficient, effective and well-managed.

- Scenario 3: In order to achieve the Compact City Development, the scenario will be incomplete without every urban development achieved by 2030, to absorb certain magnitude of population and employment in each major town of Timor-Leste. There would be no extreme changes on land use except for facilitating mixed land uses in agricultural/open lands or other lands according to population growth and if the present trend of population concentration is reduced. Land use is still inefficient and ineffective in Hera and Tibar which have extremely low population densities in DMA.

Table 13.4.8 Habitable Land Area of DMA

Land Use	Total (ha)	Residential-related	Agriculture/ Open Land	Others	Natural Land
Habitable land (incline below 15 degrees)	6,698	1,931	772	1,102	2,893

Source: JICA Project Team

Table 13.4.9 Distribution of Population Density by Scenario

Area	Habitable land (ha)	2010		2030					
		Population	(pop/ha)	Scenario 1		Scenario 2		Scenario 2	
				Population	(pop/ha)	Population	(pop/ha)	Population	(pop/ha)
Dili	3,805	213,321	56.1	476,000	125.1	401,000	105.4	329,000	86.5
Hera	1,566	7,376	4.7	94,000	60.0	32,000	20.4	11,000	7.0
Tibar	1,328	3,096	2.3	80,000	60.3	67,000	50.5	10,000	7.5
Total	6,698	223,793	33.4	650,000	97.0	500,000	74.6	350,000	52.3

Source: JICA Project Team

4) Culture

i) The existing situation: there are churches, cultural monuments, and architectural heritages from the Portuguese colonization period scattered in DMA. The State Secretariat of Arts and Culture (SSAC) under the Ministry of Tourism is surveying, recording, making an inventory, mapping, and classifying the architectural heritages of from the Portuguese colonization period. Meanwhile, local communities have sacred/holy places of old trees, rocks, and/or traditional houses.

ii) Major causes: The growth of population, urban development, and economic activities will demand more land for residential, industries, and infrastructure. Advancement on urbanization can raise concerns of citizens about cultural heritages.

iii) Likely impacts: The pressure of urban development from land requirements and/or the concerns of the citizens can raise the risks of deterioration or loss of cultural heritages or its attractiveness.

iv) Evaluation: The SSAC had not completed the survey of the architectural heritages in Dili as previous evaluation work, numbers, and locations are unknown. Then, the scenarios were evaluated basically according to the population sizes and the impacts on land uses of the scenarios. However, the evaluation paid attention on Scenario 2 has the characteristic urban structure that puts homes and places of work in closer proximity to each other.

- Scenario 1: The largest population size following the rapid urbanization trend by the growing immigration from other regions will require maximum and densely uses of habitable land. It can cause disordered urban developments. Moreover, the immigrants from other regions would reach nearly half of the total population, and they may decrease awareness on the local cultural heritages. Consequently, it is the scenario most likely to raise the risks of deterioration or loss of cultural heritages or its attractiveness.

- Scenario 2: The medium population size will require medium demand to develop lands. However, several urban functions such as administration, residential, industry/business, commercial and education will be allocated to achieve the "Urban Cluster Development" particularly in Hera and Tibar which have extremely low population densities with few urban functions. The "Urban Cluster Development" that puts homes and places of work in closer proximity to each other can promote to settle the population in Dili, Hera, and Tibar. Those residents can foster cultural activities and it can create a virtuous cycle to promote conservation and utilization of the cultural heritages.

- Scenario 3: The smallest population size will decrease the demand to develop lands and it is the scenario least likely to raise the risks of deterioration or loss of cultural heritages or its attractiveness. However, the possibility to activate the social cultural activities by citizens is also the least.

13.4.4 Proposed Mitigation Measures

The JPT proposes Scenario 2 as the appropriate urban structure for DMA in Section 8.3.3. Scenario 2 will raise adverse impacts and the mitigation measures are proposed for Scenario 2 in Table 13.4.10.

Table 13.4.10 Proposed Mitigation Measures

Assessment Indicators		Likely Impacts	Mitigation Measures
Pollution	Waste	• Garbage pollution in the urban area, Tibar dumpsite and/or its surroundings • Deterioration of health and safety of residents, sanitation workers and/or of groundwater	• Establishment of a comprehensive law which provides regulations and guidelines on the various aspects of management from generation through collection, diversion, treatment, and disposal including the educational, institutional, and financial aspects. • Rehabilitation of the Tibar dumpsite and development of an environmentally acceptable disposal facility. • Education campaign regarding proper solid waste management.
	Water Pollution	• Contamination of surface and groundwater due to increased and discharged wastewater untreated	• Wastewater treatment plants should be scrutinized in locations and numbers and implemented in coordination with the development plan proposed in the Dili Urban Master Plan. • Review the Dili Sanitation and Drainage Master Plan according to the future demand of wastewater and its implementation.
	Air Pollution	• Air pollution due to increased exhaust emission	• Reduce traffic congestion which increase emission by increasing the traffic capacity: road constructions (bypass, road-widening, flyover, etc.), ITS (signal control, etc.), traffic regulation. • Traffic demand management: introduction of mass transit (BRT, LRT), cut peak demand.
	Noise and Vibration, Offensive Odor, Soil Contamination	• Pollutions due to construction works	• Potential pollutions during construction period can be reduced through construction management, monitoring, and evaluation. • Contractors are required to provide construction manuals, environmental management plan including monitoring and evaluation.
Natural Environment	Protected Areas	• Degradation and/or loss of biodiversity due to disordered urban developments	• Establish and enforce the Protected Area Management Plans. • Establish and enforce the entire project approval system.
	Soil Erosion	• Increase in soil erosion on the steep slope due to disordered urban developments	• Adequate land use control and regulation on the fragile land in hilly areas which have potential natural hazard risks in order to avoid inappropriate urban sprawl.
	Hydrological Situation (Flood)	• Increase in flood due to the generated siltation and sedimentation in streams, rivers, and drainages from the eroded soil	• Adequate land use control and regulation on the fragile land in hilly areas which have potential natural hazard risks in order to avoid inappropriate urban sprawl. • Prepare a more accurate or smaller scale hazard maps for municipalities and communities to prepare practical warning systems. • Improve institutional and technical capacities for early warning, planning, and education. • Improve monitoring equipment, facilities, and technological capacities in the area for hazard monitoring/assessment, early warning system for floods, tropical storms, and landslides
	Flora/Fauna (Deforestation)	• Degradation of deforestation and loss of vegetation cover due to disordered urban developments	• Adequate land use control and regulation on the fragile land in hilly areas which have potential natural hazard risks in order to avoid inappropriate urban sprawl.

Assessment Indicators		Likely Impacts	Mitigation Measures
	Groundwater	• Subsidence, salinization and/or groundwater depletion due to the excessive use of groundwater	Promote appropriate sustainable use of water sources with: • Detailed studies about the yield of surface water and groundwater. • Instruction to the customers to reduce water use and water demand.
Social Environment	Involuntary Resettlement	• Increased land acquisition and resettlement, and monitor lands to those with inadequate implementation of the resettlement plan	• Land acquisition and resettlement plans should be properly designed, implemented, and those activities are monitored and evaluated.
	Local Economy, Poor People	• Loss of livelihood, difficulty to recover livelihood, and/or degradation of previous living conditions of relocated people	
	Land Use	• Inefficient and/or ineffective land use in the limited space of DMA	• Adequate land use control and regulation on the fragile land in hilly areas which have potential natural hazard risks in order to avoid inappropriate urban sprawl. • Efficient land use and management in buildup areas. • Land use guidelines to reduce negative impacts, harmonize the surrounding environment and traffic conditions and plans. • Balanced land use development in order to formulate sustainable urban structure.
	Culture	• Deterioration and/or loss of cultural heritages or its attractiveness	• Conservation of local culture and historical heritages especially Portuguese colonial buildings by: registration of cultural heritages, establish development control regulations and prevention act, and its enforcement • Development control in the land use plan. • Utilization of historical heritages as Portuguese colonial buildings remained in the urban center of Dili.
	Hazard/Infectious Diseases	• Emergence of infectious diseases	• Contractors sensitize workers and communities with the cooperation of respective health centers.
	Accidents	• Increase of traffic accidents	• Promote traffic safety education for drivers and local people. • Provide traffic signs in appropriate locations.

Source: JICA Project Team

13.4.5 Public Involvement

(1) Working Group Meeting-1

A working group meeting was conducted to discuss the following topics with invited members mentioned in Table 13.4.11. The main contents explain the process of SEA for the Project including concept of SEA, differences between EIA and SEA, advantages of SEA, and the process. However, the participants are generally not that knowledgeable about SEA because it is not popular in Timor-Leste. Therefore, in the further study of SEA, simplified contents and explanations in Tetun (the local language) are necessary in order to give the stakeholders better understanding about SEA.

Contents of

(i) Outline of the Project

(ii) Introduction to JICA Guidelines and Strategic Environmental Assessment in the Project

(iii) Process of SEA for the Project

Table 13.4.11 Invitation of Working Group Members

Ministry	Department
Ministry of Commerce, Industry, and Environment	• National Directorate of Environment: Department of Environmental Impact Assessment, Department of Control pollution and Laboratory • National Directorate of International Environmental Affairs and Climate Change • National Directorate of Protection, Recovery, and Biodiversity
Ministry of Justice	• Chief Department of Land and Properties
Ministry of Health	• National Directorate of Environmental Health
Ministry of Agriculture and Fisheries	• National Directorate of Forestry and Nature Conservation
Ministry of Tourism	• National Directorate of Art and Culture • National Directorate of Tourism
Ministry of Public Works	• Chief Department of Water supply • Chief Department of Basic Sanitation • Chief Department of Water Quality Control
Others	• ADN

Source: JICA Project Team (JPT)

(2) Working Group Meeting-2

The second working group meeting was conducted to discuss the following topics especially for the evaluation of three urban structure scenarios before the second public consultations. Generally, the participants agreed that Scenario 2 was the appropriate Dili urban structure. Major opinions are summarized in Table 13.4.12.

(i) Evaluation of the Scenarios in Applicability or Suitability to the Visions

(ii) Evaluation of the Scenarios in Environmental and Social Impacts

(iii) Overall Evaluation

(iv) Draft Mitigation Measures

Table 13.4.12 Major Opinions of the 2nd Working Group Meeting

Organization	Department
National Directorate of Environment, MCIE	• Tasi Tolu should be conserved as it has cultural characteristics and religious history. • Each development scenario has environmental and social impacts and it is important to know how to minimize the adverse impacts for successful developments. • The master plan should be coordinated with another master plan for drainage.
National Directorate of Art and Culture, Ministry of Tourism	• While Dili should become a beautiful city, urban development is necessary and may affect the cultural heritages, therefore, historical buildings from the Portuguese colonization period should be protected. • In case of the Project in protected areas like in Cristo Rei, it should be coordinated among line ministries but not only between the MOCIE and MoPWTC.
Department of Basic Sanitation, MoPWTC	• This master plan can be utilized for the Dili Sanitation Master Plan.
National Directorate of Building, MoPWTC	• The master plan should be based on the laws because it becomes a planning benchmark. • Municipality administrators should be involved in the master plan study because they know the regional situations.

	• Line ministries should cooperate for the master plan study.
ADN	• The airport and sea port developments should be given attention in the urban master plan. • The container terminal development may affect the Tasi Tolu area according to the location.

Source: JICA Project Team (JPT)

(3) Public Consultations-1

1) Purposes

The main counterpart, the National Directorate of Housing and Urban Planning (MoPSI), conducted the first public consultation meetings in Dili, Hera, and Tibar, which are the main development areas in DMA. The JPT is proposing Dili as the urban center, Hera as the tourism/recreation and eco-business zone, and Tibar as the industrial zone.

The purposes of these public consultations are: to disclose and share the project information among the stakeholders and to collect their opinions. The counterpart explained the following topics in the meetings with the support of the JPT. They used presentation materials in Tetun language. The second public consultation meeting will be conducted especially to compare the alternative DMA urban spatial structure plans in December 2014.

i) Outline of the Project (project brief, issues in master plan formulation, major technical approaches, and work schedule of the Project)

ii) Draft Visions and Urban Spatial Structures of DMA

iii) Environmental and Social Considerations in the Project (policies for environmental and social considerations in the Project, the present environmental and social conditions in the DMA, the environmental problems arising, major changes to the future in DMA, explanation of likely impacts, upcoming second public consultation meeting)

2) Participants

The counterparts with the JPT planned mainly to invite the village (Suco) administrators including the chiefs and the secretaries as the representatives of local people for public consultations. Additionally, related ministries of the working group members, NGOs related to environmental and social matters, international donors (ADB, WB, UNDP, and JICA), and academic institutions were given invitation for Dili. For less populated areas, the villages of Hera and Tibar, community chiefs, representatives of security/women/youths were given the invitation.

3) Likely Impacts Concerned

The counterpart and the JPT asked the participants important (more significant) impacts showing a scoping list with 30 items of likely impacts after presentations of the existing environmental and social conditions, the existing problems, and likely impacts due to urban developments in DMA. It was to identify the more likely impacts expected from the views of local perspectives. The results are summarized in Table 13.4.13.

Dili: There were 41 participants from the invited institutions. Pollutions, especially for air/water pollutions and waste, were the concerns of the participants which

were followed by noise and vibration and offensive odor. They gave adverse impacts on the protected areas and erosion due to urban development especially from construction works for natural environment. For other concerns, social impacts were highlighted especially on involuntary resettlement and local economy.

Hera: There were a total of 14 participants in the village administration including the village chief and secretaries, community chiefs, securities, representatives of youths in the public consultation meeting. They were mostly concerned about "waste", "flora/fauna (deforestation)" and "involuntary resettlement".

Tibar: There were a total of 17 participants in the village administration including the village chief and secretaries, community chiefs, securities, representatives of women and youths in the public consultation meeting. They are deeply concerned about the adverse impact of "waste" because the waste disposal site is located in Tibar. They stated that there will be an increase in solid waste disposal due to population growth and concerns about sanitary waste disposal management at the waste disposal site. The other expected impacts on pollution were noise and vibration and offensive odor. On the natural environment, they stated risk of hydrological situation (flood), loss of flora/fauna (deforestation), and soil erosion. Resettlement due to land acquisition for urban development was also a major concern. Followed by other concerns like loss of holy places/traditional houses (cultural properties of community), and increase of traffic accidents.

Table 13.4.13 Opinions on Likely Impacts due to Urban Developments

Venue	Date	Participants	Opinions on Expected Likely Impacts		
			Sector	More important	Important
Dili	29 August 2014	41 persons	Pollution	Waste, Water Pollution, Air Pollution, Noise and Vibration, Offensive Odor	Soil Contamination
			Natural Environment	Protected Areas, Soil Erosion	Flora/Fauna (Deforestation), Groundwater
			Social Environment	Involuntary Resettlement, Local Economy	Hazard/Infectious Diseases, Poor People, Accidents
Hera	5 September 2014	14 persons	Pollution	Waste	
			Natural Environment	Flora/Fauna (Deforestation)	
			Social Environment	Involuntary Resettlement	Culture
Tibar	8 September 2014	17 persons	Pollution	Waste, Noise, and Vibration	Offensive Odor
			Natural Environment	Hydrological Situation (Flood)	Flora/Fauna (Deforestation), Soil Erosion
			Social Environment	Involuntary Resettlement	Land Use, Culture, Accidents

Source: JICA Project Team (JPT)

(4) Public Consultation Meetings-2

The National Directorate of Housing and Urban Planning conducted the second public consultation meetings in Dili, Hera, and Tibar in December 2014.

1) Purposes

The purposes of these public consultations are: to disclose and share the project information among the stakeholders and to collect their opinions. The counterpart explained the following topics in the meetings with the support of the JPT.

i) Current Position, Planning Issues

ii) Draft Development Visions

iii) Draft Urban Structure Scenarios of DMA

iv) Evaluation of the Urban Structure Scenarios of DMA (characteristics of the scenarios, evaluation of the scenarios in applicability or suitability to the visions, evaluation of the scenarios in environmental and social impacts, overall evaluation, and draft mitigation measures)

2) Participants

The counterparts with the JPT planned mainly to invite the village (Suco) administrators including the chiefs and the secretaries as the representatives of local people for the public consultations. Additionally, the Dili Municipality administrator, the related ministries of the working group members, NGOs related to environmental and social matters, international donors (ADB, WB, UNDP, and JICA), and academic institution were invited for Dili. For the less populated areas, the villages of Hera and Tibar, community chiefs, representatives of security/women/youths were invited. The Liquicia Municipality administrator was also invited for Tibar.

3) Opinions from the Participants

Major opinions stated in each public consultation are summarized in Table 13.4.14.

Dili: There were 35 participants from the invited institutions. The participants expressed the conservation of local culture and historical heritages, historical buildings, especially the Portuguese colonial buildings and the city (downtown) landscape in Dili which was regarded as a historical city.

Other concerns were immediate establishment and enforcement of the Land Law and the Spatial Planning Law to control the land use. Regarding institutional matters, the Ministry of Public Works should cooperate and coordinate with other ministries to implement many urban and infrastructure development projects. In terms of coordination, the technical working groups were more effective if those could be a permanent mechanism for consistent inter-ministerial coordination.

Hera: There were a total of nine participants including the community chiefs, securities including the navy and police in the second public consultation meeting. The navy was concerned about land security matters especially to protect the coastal area and protected areas from informal development activities. For land matters, they stated that the Land Law should be immediately established and enforced to prevent encroachment of informal occupants in the public land and their resettlement which were included in the issues on land acquisition and resettlement due to future road development and infrastructure development.

Another concern was the land use control for risk management of power plant and to effectively use the limited space of Hera if new urban developments are developed. They also mentioned that cultural properties should be maintained.

Tibar: There were a total of 71 participants of the village administration including the village chief and secretaries, community chiefs, securities, representatives of women, the representative of Liquicia Municipality Administrator and the Bazartete Administrative Post Administrator in the second public consultation meeting. Most were the community chiefs because they are respected top local administrations, both municipality and administrative post administrators joined the meeting.

They talked about the alternative route between Tibar and Dili. They were concerned about the local people losing access between Tibar and Dili in case the coastal road is impassable. Meanwhile, for the road development, they requested the government to respect private ownership in land.

The other concern was solid waste disposal at the Tibar landfill site. They considered solid waste collected from DMA to the landfill site undesirable. However, both administrators stated that solid waste could provide benefits through recycling. They also expected positive impacts from the results of the Dili Urban Master Plan.

Table 13.4.14 Major Opinions in Public Consultation Meetings

Venue	Date	Participants	Major Opinions
Dili	18 December 2014	35 persons	• "City of Heroes" was recommended for the Development Visions. • The Ministry of Public Works should cooperate and coordinate with other ministries for many urban and infrastructure development projects especially with the Ministry of Environment. • Land Law and Spatial Law should be established and enforced. • Negative and positive impacts of the scenarios should be explained. (Advantages and disadvantages of the scenarios were not easy to understand.) • Conservation of local culture and historical heritages, historical buildings, especially the Portuguese colonial buildings in Dili. • Dili should become a historical city. • The downtown should have no factories to maintain the landscape of the city. • Roads between Dili and Hera/Tibar are necessary. • Dili should not become a densed city like Singapore. • Consistency is necessary for the technical working groups to become a permanent mechanism for inter-ministerial coordination.
Hera	19 December 2014	9 persons	• Provide protection of coastal areas and protected areas from informal development activities. • Land Law should be established and enforced to prevent informal occupants in the public land and their resettlement. • It is also necessary to control the land use for risk management of power plant. • Carefully control the land use to effectively use the limited space of Hera, if new urban developments are developed. • Land issues related with land expansion for the Navy and the National University of East Timor (*Universidade Nacional Timor Lorosa'e:* UNTL), and on land acquisition and resettlement due to future road development and infrastructure development. • Cultural properties should be maintained.
Tibar	22 December 2014	71 persons	From local participants: • Need another access road between Tibar and Dili because there is no alternative route except the existing coastal road. • No need for solid waste to be collected from DMA and how Tibar landfill site can be removed. • Tibar should be urbanized and planned by the government as well as Dili. • Request more respect to private land property for development.
			From administrators:

			• The solid waste of Tibar landfill site can provide not only the negative impact but also the positive impact as it can provide benefits by recycling. • The alternative road between Tibar and Dili is still under the discussion process. • Municipality managers will be assigned from January 2015 to 2017. • The master plan will provide positive impacts for Tibar Village of the Bazartete Administrative Post, and will accept it.

Source: JICA Project Team (JPT)

13.5 Initial Environmental Evaluation (IEE) for the Road Transportation Sector

The JPT proposes a road and public transportation plan and six potentialprojects as mentioned in Chapter 10. The Project-1, -2, -3, and -6 are priority projects in the short-term, and Project-4 and -5 are for the medium and long term. Neither a pre-feasibility nor a feasibility study is not included in the scope of the Project, consequently, the project alignments and scales are still not clear particularly for the medium and long term. Thus, the JPT studied IEE for the six potentialprojects at the early level of planning. Further detailed evaluations of environmental and social impacts should be conducted in the feasibility study phase.

Table 13.5.1 Proposed Project Summary

No.	Proposed Project	Main Component	Project Priority
1	Development of off street parking and fringe parking	• Off street parking (in the central business district (CBD)) • Fringe parking (in suburbs area or nearby BRT station) • Bus terminals (Comoro, Becora)	Short Term: Priority Project
2	Improvement of ring-road	• Introduction of traffic signal • Improvement of intersection • Reconsidering one-way regulation in CBD • Road widening (including utilization of river space) of the narrow section	Short Term: Priority Project
3	Road widening of current road network between Comoro and CBD	• Road widening of "Rua dos Martires da Patria" • Improvement of intersection • Improvement of sidewalk or introduction of bike-lanes	Short Term: Priority Project
4	New by-pass development	• Short cut route between banana road and ring-road (Estrada De Balide)	Mid-Long Term Project
5	Improvement of Tibar Road	• New by-pass passing the mountainous areas between Tibar junction to ring road	Mid-Long Term Project
6	Improvement of mass transit	• Microlet services include the development of related facilities • Formation of public transportation organization • Introduction of priority lane for public transportation • Introduction of large size bus • Introduction of bus rapid system (BRT)	Short Term: Priority Project, Mid-Long Term Project

Source: JICA Project Team

13.5.1 Outlines of the Project Sites

The outlines of the project sites are explained by the present conditions of DMA on the natural environment, social environment, and pollution which are described in Chapter 2.

13.5.2 Legal and Institutional Frameworks of Environmental and Social Considerations

The legal and institutional frameworks of environmental social considerations in Timor-Leste is described in Section 13.3.

13.5.3 Study of Alternatives

As mentioned at the beginning of this chapter, the JPT proposes potential projects at the planning level before the feasibility study. Therefore, the alternatives were not studied and compared.

13.5.4 Scoping and TOR of Environmental and Social Study

(1) Scoping

The scoping was done based on site reconnaissance with the environmental and social conditions of DMA as shown in Table 13.5.2. The likely impacts were expected due to the potential projects proposed in the road and public transportation plan for future DMA.

Table 13.5.2 Scoping

	No.	Likely Impacts	Rating		Reasons of Rating
			Pre-/Construction	Operation	
Pollution	1	Air Pollution	B-	B+/-	[Construction Phase] Exhaust gas and dust caused by operation of construction vehicles and equipment can temporarily deteriorate air quality around the construction sites. [Operation Phase] Decrease in traffic congestion can reduce emission. Meanwhile, traffic on newly developed road can generate emission and it can deteriorate air quality in the nearby road.
	2	Water Pollution	B-	D	[Construction Phase] Soil erosion from cut and fill for construction works particularly in the rainy season and wastewater from site offices or material yards can temporarily contaminate the river water.
	3	Noise and Vibration	B-	B+/-	[Construction Phase] The operation of construction vehicles and equipment can temporarily increase levels of noise and vibration near the construction sites. [Operation Phase] While decrease in traffic can reduce the noise and vibration, traffic on newly developed roads can generate noise and vibration.
	4	Soil Contamination	C-	D	[Construction Phase] If unintentional considerable spilled fuel and oil from construction vehicles or equipment occur, it may contaminate the soil near the construction sites.
	5	Waste	B-	D	[Construction Phase] Waste can be temporarily generated like construction waste soil from the construction works, domestic wastes and night soil from construction site offices.
	6	Ground Subsidence	D	D	Since the potential projects in the transportation sector do not require use of large scale groundwater, no serious adverse impacts are expected on ground subsidence.
	7	Offensive Odor	B-	D	[Construction Phase] Operation of construction vehicles, equipment, and site offices can temporarily generate offensive odor from exhaust gas, discharging water, or domestic waste.
	8	Bottom Sediment	D	D	If the construction works are done without protection of cut and fill, it may temporarily generate soil erosion. However, as the rivers in DMA are dry most of the year, no serious adverse impacts are expected on the bottom sediment.

	No.	Likely Impacts	Rating		Reasons of Rating
			Pre-/Construction	Operation	
Natural Environment	9	Protected Areas	D	D	Since the potential project sites are not located in the protected areas, no impacts are expected on the protected areas.
	10	Flora, Fauna, and Biodiversity	B-	D	[Construction Phase] A new by-pass development would pass through mountain side and some trees can be removed due to construction activities.
	11	Hydrological Situation	D	D	The potential projects in the transportation sector can pass along or cross rivers in some locations; however, as the rivers in DMA are dry most of the year, no serious adverse impacts are expected on the hydrological situation.
	12	Topography and Geographical Features	D	D	The potential projects in the transportation sector do not involve any major alteration on topography or geology.
	13	Soil Erosion	B-	D	[Construction Phase] Soil can be temporarily eroded from cut and fill for the construction works or material yards.
	14	Groundwater	D	D	The potential projects in the transportation sector do not require the use of large-scale groundwater, so no serious adverse impacts are expected.
	15	Coastal Zone	D	D	Since the project sites are not located close to the coastal zone, no adverse impacts are expected.
	16	Meteorology	D	D	Since the construction areas and periods of potential projects are limited, no adverse impacts are expected on meteorology.
Social Environment	17	Involuntary Resettlement	B-	D	[Construction Phase] Since the potential projects in the transportation sector can pass in the urban area in some locations, there could be temporary relocation or involuntary resettlement according to project scale.
	18	Local Economy such as Employment and Livelihood	B+/-	B+	[Construction Phase] Inadequate compensation led by lack of legal procedures on land acquisition and resettlement can cause loss of livelihood, difficulty to recover livelihood, and/or degradation of previous living conditions of relocated people. The construction activities will require employment of workers (especially unskilled), and it can provide a temporary boost to local employment. Local service sector can provide the construction workers accommodation, food, and beverages. It can facilitate business opportunities for the local service sector. [Operation Phase] Since road improvements can facilitate efficient transportation and local economic growth, the local people can obtain opportunities of employments and/or to establish new businesses.
	19	Land Use and Utilization of Local Resources	B-	B+	[Construction Phase] As the construction activities do not seriously change the existing land use; however, temporary change of land use is necessary for diversions or material yards for construction works. [Operation Phase] Facilitated traffic by road improvement that can lead to roadside development and can contribute effective utilizations of land and local resources in the urban area.

	No.	Likely Impacts	Rating		Reasons of Rating
			Pre-/Construction	Operation	
	20	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	D	D	Since the potential projects in the transportation sector can facilitate ease in local traffic and provide accesses to public services, no adverse impacts are expected on social institutions.
	21	Existing Social Infrastructures and Services	B-	B+	[Construction Phase] The construction works can temporarily require relocation of the existing roadside social infrastructure and hinder access to social services around the construction sites. [Operation Phase] Facilitated traffic by road improvement that can increase accessibility for public services in the neighborhoods and regions.
	22	Misdistribution of Benefit and Damage	D	D	The potential projects aim to improve the traffic conditions as a public service in the master plan perspective to contribute to the development of DMA. This item is, therefore, not affected specifically.
	23	Local Conflict of Interests	D	D	The potential projects aim at improvement of traffic conditions as a public service in the master plan perspective to contribute in the development of DMA. This item is, therefore, not affected specifically.
	24	Water Usage or Water Rights and Rights of Common	D	D	Water rights are unclear; however, about 90% of households in DMA use some water utilities like pipe, pump, public tap or well/borehole, but not sourced from rainwater, spring water, or surface water. Besides, the rivers are dry most of the year, thus, no serious adverse impacts are expected on water usage or water rights.
	25	Sanitation	D	D	Since the construction areas and the periods in constructing the potential projects are limited, risk for deterioration of the conditions of hygiene and sanitation is not seriously expected.
	26	Hazards (risk), Infectious Diseases such as HIV/AIDS	C-	D	[Construction Phase] As the local employment may be promoted for the construction works, considerable influx of workers is unexpected. However, risk for infectious diseases due to the mass inflow of laborers from other areas is unclear.
	27	Cultural Heritage	C-	D	[Construction Phase] As there are architectural heritages from the Portuguese colonization period, religious properties, and the local sacred/holy places in DMA, the construction activities can affect them. However, those locations are unclear.
	28	Landscape	D	D	Since the project sites are located on the coastal area nor the protected areas, these do not seriously change or detract surrounding landscape.
	29	The Poor, Indigenous, and Ethnic People	C-	D	[Construction Phase] No indigenous and ethnic people were identified in DMA; however, poor households may be affected by relocation or involuntary resettlement due to the potential projects in the transportation sector.
	30	Working Conditions, Accidents	B-	B+/-	[Construction Phase] There is a possibility of accidents involving workers and the local people caused by the operation of construction vehicles and equipment. It can temporarily disturb their health and security. [Operation Phase] While increase in traffic volume and speed can generate more traffic accidents, traffic safety can be improved by road expansion and sidewalk.

	No.	Likely Impacts	Rating		Reasons of Rating
			Pre-/Construction	Operation	
	31	Gender, Children's Rights	D	D	The potential projects aim at improving the traffic conditions as a public service. This item is, therefore, not affected specifically.

Rating:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown (examination is needed and impacts may become clear as study progresses)
D: No impact is expected
Source: JICA Project Team

(2) TOR of Environmental and Social Study

A terms of reference (TOR) of the Environmental and Social Study to evaluate the impacts is summarized in Table 13.4.2 based on the results of the scoping. The study methods were mainly on site reconnaissance, hearing with relevant organizations, Suco chiefs or nearby residents because data was limited in Timor-Leste.

Table 13.5.3 TOR of Environmental and Social Study

	No.	Likely Impacts	Phase/ Rating	Study Item	Study Method
Pollution	1	Air Pollution	Const. B- Operation B+/-	• Air standard • The existing situation of air pollution around the project sites • NOx volume from traffic	• Site reconnaissance • Hearing with relevant organizations, local administrations, or nearby residents • Estimation of NOx emission in traffic volume
	2	Water Pollution	Const. B-	• Water quality standard • The existing situation of water pollution around the project sites	• Site reconnaissance • Hearing with relevant organizations, local administrations, or nearby residents
	3	Noise and Vibration	Const. B- Operation B-	• Noise standard • The existing situation of noise/ vibration around the project sites	• Site reconnaissance • Hearing with relevant organizations, local administrations, or nearby residents
	4	Soil Contamination	Const. C-	• Soil contamination standard • The existing situation of soil contamination around the project sites	• Site reconnaissance • Hearing with relevant organizations, local administrations or nearby residents
	5	Waste	Const. B-	• Waste disposal system	• Hearing with relevant organizations
	7	Offensive Odor	Const. B-	• The existing situation of offensive odor around the project sites	• Site reconnaissance • Hearing with relevant organizations, local administrations, or nearby residents
Natural Environment	10	Flora, Fauna, and Biodiversity	Const. B-	• Types of flora and fauna around the project sites • Existence of indigenous and endangered species	• Study on the existing information (literature survey) • Site reconnaissance • Hearing and data collection with/from relevant organizations • Hearing with nearby residents
	13	Soil Erosion	Const. B-	• The existing situation of soil erosion around the project sites	• Site reconnaissance
Envir	17	Involuntary Resettlement	Pre-const. B-	• Possibility of resettlement • Policy of resettlement	• Site reconnaissance • Study on existing land use map • Collection of relevant legislations

	No.	Likely Impacts	Phase/ Rating	Study Item	Study Method
	18	Local Economy such as Employment and Livelihood	Const. B+/- Operation B+	• Socio-economic situations around the project sites	• Study on existing information (literature survey) • Site reconnaissance • Hearing with local administrations
	19	Land Use and Utilization of Local Resources	Const. B- Operation B+	• Land use conditions near the project sites	• Site reconnaissance • Study on existing land use map
	21	Existing Social Infrastructures and Services	Const. B- Operation B+	• Infrastructure and public facilities around the project sites	• Site reconnaissance • Hearing with local administrations
	26	Hazards (risk), Infectious Diseases such as HIV/AIDS	Const. C-	• Situations of diseases including HIV/AIDS around the project sites	• Study on existing information (literature survey) • Hearing with relevant organizations • Hearing with local administrations
	27	Cultural Heritage	Const. C-	• Existence of religious properties, monuments and historical buildings nearby the project sites	• Site reconnaissance • Hearing with local administrations or residents nearby the project sites
	29	The Poor, Indigenous, and Ethnic People	Const. C-	• Existence of poor people, indigenous, and ethnic people nearby priority bridges	• Hearing with local governments or residents nearby the project sites
	30	Working Conditions, Accidents	Const. B- Operation B+/-	• Policy and measures for working security • Traffic accident occurrence	• Collection of relevant legislations • Hearing with police or residents nearby the project sites

Source: JICA Project Team

13.5.5 Results of the Study

(1) Priority Projects

For the four priority projects of (i), (ii), (iii) and (vi), anticipated environmental and social impacts were studied by the Project incorporating the results of the JPT studies, site survey, and interviews with various stakeholders particularly the Suco chiefs, which were done with the counterpart. The results are summarized as shown in Table 13.5.4,

Table 13.5.16, and Table 13.5.11. Two projects, the development of off street parking and fringe parking and improvement of mass transit are studied together because they are planned on the same route between Comoro (the western gate) and Becora (the eastern gate) passing through the Dili Urban Center.

Table 13.5.4 Results of Environmental and Social Study for "Development of Off Street Parking and Fringe Parking" and "Improvement of Mass Transit"

<table>
<tr><th></th><th>No.</th><th>Likely Impacts</th><th>Study Results</th></tr>
<tr><td rowspan="6">Pollution</td><td>1</td><td>Air Pollution</td><td>Air pollution due to SOx/smoke dust/dust originating from factories (particulate matter: PM) have not been more serious because not many factories are located along the project route based on the results of site reconnaissance and land use survey. However, according to the hearing with the Suco chiefs along the project route, they expressed concern over air quality deterioration due to daily generation of exhaust gas (mainly NOx) and dust stirred up (mainly PM) from passing vehicles, smoke from garbage burned by residents. Particularly, they are more concerned about the over generation of exhaust gas from passing vehicles. Incidentally, the environmental standards and the emission standard have not been established in Timor-Leste.
As the priority projects are proposed in the road traffic sector, the impact due to traffic emission was the main focus which includes NOx as an important air pollutant for a study item. Based on the results of traffic demand analysis in Chapter 10, NOx volume along the project route was estimated in Table 13.5.5. The NOx volume of Do-maximum case in 2030 including the project route was less than the one of Do-nothing case, and it can contribute to reduce air pollution due to automobile exhaust fumes.

Table 13.5.5 Estimation of NOx Emission in Project Route
<table>
<tr><th rowspan="2">Case</th><th colspan="2">Existing Condition</th><th colspan="2">2030 Do-Nothing Case</th><th colspan="2">2030 Maximum Case</th></tr>
<tr><th>Traffic (vehicle/day)</th><th>NOx (t/year)</th><th>Traffic (vehicle/day)</th><th>NOx (t/year)</th><th>Traffic (vehicle/day)</th><th>NOx (t/year)</th></tr>
<tr><td>Small car</td><td>12,342</td><td>5.4</td><td>23,747</td><td>10.4</td><td>10,435</td><td>4.6</td></tr>
<tr><td>Large car</td><td>5,413</td><td>54.6</td><td>9,576</td><td>96.5</td><td>4,160</td><td>41.9</td></tr>
<tr><td>Total</td><td>17,755</td><td>60.0</td><td>33,323</td><td>106.9</td><td>14,595</td><td>46.5</td></tr>
</table>
Source: JICA Project Team</td></tr>
<tr><td>2</td><td>Water Pollution</td><td>The water pollution due to chemical substance has not been serious because not many factories are located along the project route based on the results of site reconnaissance and land use survey. Besides, according to the hearing with the Suco chiefs along the project route, they expressed no concern over water pollution. However, they expressed a concern over partial water contamination due to silt and solid wastes into rivers or drainage diches. Incidentally, the environmental standards and the effluent standard have not been established in Timor-Leste.</td></tr>
<tr><td>3</td><td>Noise and Vibration</td><td>According to the hearing with the Suco chiefs along the project route, they expressed concerns over the daily noise and vibration generated by passing vehicles although it was not serious.</td></tr>
<tr><td>4</td><td>Soil Contamination</td><td>According to the hearing with the Suco chiefs along the project route they expressed no concern over soil contamination.</td></tr>
<tr><td>5</td><td>Waste</td><td>According to the hearing with the Suco chiefs along the project route, they expressed concerns over the daily litter on the roads, garbage burning at waste-collection points, litter because a lot of people disobey time regulations on solid waste collection.</td></tr>
<tr><td>7</td><td>Offensive Odor</td><td>According to the hearing with the Suco chiefs along the project route, they expressed concerns over partial offensive odor from household effluent and litter.</td></tr>
<tr><td rowspan="2">Natural Environment</td><td>10</td><td>Flora, Fauna and Biodiversity</td><td>There are street trees along the project route which is located in the Dili urban area. Most trees are typical type of Timor-Leste such as *Calophyllum inophyllum*, Monkeypod tree, mango, and banana.</td></tr>
<tr><td>13</td><td>Soil Erosion</td><td>According to the hearing with the Suco chiefs along the project route, they expressed no soil erosion.</td></tr>
</table>

<table>
<tr><th></th><th>No.</th><th>Likely Impacts</th><th>Study Results</th></tr>
<tr><td rowspan="5">Social Environment</td><td>17</td><td>Involuntary Resettlement</td><td>Since major project components are to develop the off road parking lots and to operate large public buses along the project route although the project scales are still unclear, no large-scale involuntary resettlement is expected. There are sections with many setback buildings along the route; however, no setback buildings are located especially in the urban center. Therefore, the constructions of off parking lots can affect buildings and demand resettlement according to the locations.
Meanwhile, no land acquisition is required for bus terminal developments in Becora and Comoro because the government owns the planned sites which are vacant lands. However, since there are detached houses or mixed used houses with cottage, cottage industries, and retail shops in front of the vacant land for the planned site of the Comolo bus terminal, they can be relocated.</td></tr>
<tr><td>18</td><td>Local Economy such as Employment and Livelihood</td><td>Since the project route passes through the Dili urban area between the east gate in Becora and the west gate in Comoro as the major route of DMA, business, commercial, and administrative activities dominated the local activities along the route. Household income levels were assumed at the mid-high level according to the hearing with the Suco chiefs along the project route.</td></tr>
<tr><td>19</td><td>Land Use and Utilization of Local Resources</td><td>As the project route passes through the Dili urban area, the results of land use survey showed that half of the land along the route was occupied by residential land followed by commercial land, public land, and vacant land.

Table 13.5.6 Distribution of Land Uses on the Project Route
<table>
<tr><th>Land use</th><th>North Side (%)</th><th>South Side (%)</th><th>Total (%)</th></tr>
<tr><td>Agriculture Land</td><td>0.0</td><td>0.1</td><td>0.0</td></tr>
<tr><td>Commercial</td><td>18.3</td><td>18.3</td><td>18.3</td></tr>
<tr><td>Educational Facilities</td><td>4.3</td><td>2.2</td><td>3.2</td></tr>
<tr><td>Forest Area</td><td>0.0</td><td>0.2</td><td>0.1</td></tr>
<tr><td>Public Administration</td><td>7.0</td><td>8.1</td><td>7.6</td></tr>
<tr><td>Health, Social, and Welfare</td><td>1.0</td><td>0.3</td><td>0.7</td></tr>
<tr><td>Industry</td><td>5.2</td><td>1.2</td><td>3.2</td></tr>
<tr><td>Military Facilities</td><td>0.5</td><td>0.9</td><td>0.7</td></tr>
<tr><td>Others</td><td>0.7</td><td>0.7</td><td>0.7</td></tr>
<tr><td>Public Infrastructure</td><td>0.2</td><td>1.1</td><td>0.7</td></tr>
<tr><td>Park and Recreational</td><td>1.9</td><td>2.2</td><td>2.1</td></tr>
<tr><td>Residential</td><td>50.1</td><td>51.0</td><td>50.6</td></tr>
<tr><td>Security Offices</td><td>0.8</td><td>0.4</td><td>0.6</td></tr>
<tr><td>Transportation</td><td>2.6</td><td>2.1</td><td>2.3</td></tr>
<tr><td>Vacant Land</td><td>6.1</td><td>9.7</td><td>7.9</td></tr>
<tr><td>Water Surface Area</td><td>1.3</td><td>1.3</td><td>1.3</td></tr>
<tr><td>Total</td><td>100.0</td><td>100.0</td><td>100.0</td></tr>
</table>
Source: JICA Project Team</td></tr>
<tr><td>21</td><td>Existing Social Infrastructures and Services</td><td>There are existing roadside social infrastructure (water pipes, electric wires, telecommunication cables, drains, street lamps) along the project route. Wells/boreholes could also be located according to the hearing with the Suco chiefs along the project route.
Therefore, the constructions of off parking lots require temporary relocation according to the locations.
As mentioned in Chapter 10, traffic congestions are solved based on the traffic demand forecast and it can facilitate the accessibility to public facilities located along the project route.</td></tr>
<tr><td>26</td><td>Hazards (risk), Infectious Diseases such as HIV/AIDS</td><td>In Timor-Leste, the cases of positive diagnosis of HIV/AIDS have increased since 2003 to 2013 according to the data provided by MOH (HIV/AIDS unit, Department of CDC). The accumulated positive cases were 408 and 38 persons have died. On the other hand, in Indonesia, adults aged 15 to 49, the prevalence rate was estimated at 0.5% (0.3% - 0.7%) in 2013 by the USAIDS. If 408 persons have tested positive in the adults aged bracket, the prevalence rate is estimated at 0.07% in Timor-Leste. This shows that the prevalence rate of HIV/AIDS in Timor-Leste is still low although the actual age-group and medical examination rate are still unknown.</td></tr>
<tr><td>27</td><td>Cultural Heritage</td><td>There were architectural heritages during the Portuguese colonization period including the Government Palace recognized along the project route especially in the Dili City Center based on the results of site reconnaissance and land use survey. Suco chiefs along the project route expressed that no local sacred/holy places are located along the route in the hearing.</td></tr>
</table>

<table>
<tr><th></th><th>No.</th><th>Likely Impacts</th><th>Study Results</th></tr>
<tr><td></td><td>29</td><td>The Poor, Indigenous and Ethnic People</td><td>According to the hearing with the Suco chiefs along the project route, no indigenous and ethnic people were identified along the project route, although poor households could reside along the route which migrated from outside DMA and have no regular work/employment.</td></tr>
<tr><td></td><td>30</td><td>Working Conditions, Accidents</td><td>In Timor-Leste, the Labor Law was enforced in 2012 which include occupational safety, hygiene, and health. The Directorate General of Labor Inspection, Secretary State of Vocational Training and Employment is implementing regular inspection of the working conditions of business establishments. The department guides them if they do not follow the Labor Law. Nevertheless, if they do not follow the guidelines, the department imposes penalties such as fines or temporary business suspension. The department receives grievances from workers and/or complaints from residents around construction sites. The department noted that the major issues of construction sites are the lack of safety gears and work break for workers and dust from construction vehicles. Therefore, health hazards and accidents involving workers and the local people can be expected.
Meanwhile, the MTCPW requires environmental safeguards for civil works according to the Standard Specification (November 2014), for the contractor of construction projects. Environmental safeguards are also important to provide environmental countermeasures and actions to perform any civil works required under a contract which includes impacts on water resources, air quality, noise, traffic, adjoining properties and utilities, human health and safety, flora and fauna, soil, disposal of waste, cultural heritage. For human health and safety, the contractor is required to take all reasonable precautions to maintain the health and safety of the Contractor's personnel and shall appoint an accident prevention officer at the sites responsible for maintaining safety and protection against accidents. The Contractor shall, at all times, take necessary actions to protect the health and well being of the Contractor's personnel employed on the site by ensuring that all parts of the worksite are regularly kept clean and sanitary.
Traffic accident cases between vehicles involving cars and motorcycles accounted for about 80% every year although the locations were not identified according to data from the Traffic and Road Safety Department of National Operation Command in National Police. Meanwhile, cases involving pedestrian were around 10%. The accident cases involving pedestrian increased in 2013 although the cases between vehicles had been on the decline. The major causes of accidents are due to human error followed by vehicle trouble and road condition. No places where frequent traffic accidents occur were heard from the Suco chiefs along the project route.

Table 13.5.7 Traffic Accident Cases in Timor-Leste
<table>
<tr><td rowspan="2">Type of Accident</td><td colspan="2">2013</td><td colspan="2">2012</td><td colspan="2">2011</td><td colspan="2">2010</td></tr>
<tr><td>Case</td><td>(%)</td><td>Case</td><td>(%)</td><td>Case</td><td>(%)</td><td>Case</td><td>(%)</td></tr>
<tr><td>Car and Car</td><td>604</td><td>29.8</td><td>669</td><td>29.2</td><td>712</td><td>25.3</td><td>869</td><td>32.3</td></tr>
<tr><td>Motorcycle and Motorcycle</td><td>700</td><td>34.5</td><td>741</td><td>32.3</td><td>886</td><td>31.5</td><td>625</td><td>23.2</td></tr>
<tr><td>Car and Motorcycle</td><td>204</td><td>10.1</td><td>559</td><td>24.4</td><td>611</td><td>21.7</td><td>558</td><td>20.7</td></tr>
<tr><td>Car and Pedestrian</td><td>204</td><td>10.1</td><td>121</td><td>5.3</td><td>169</td><td>6.0</td><td>194</td><td>7.2</td></tr>
<tr><td>Motorcycle and Pedestrian</td><td>150</td><td>7.4</td><td>97</td><td>4.2</td><td>127</td><td>4.5</td><td>110</td><td>4.1</td></tr>
<tr><td>Others</td><td>167</td><td>8.2</td><td>107</td><td>4.7</td><td>306</td><td>10.9</td><td>334</td><td>12.4</td></tr>
<tr><td>Total</td><td>2,029</td><td>100.0</td><td>2,294</td><td>100.0</td><td>2,811</td><td>100.0</td><td>2,690</td><td>100.0</td></tr>
</table>
Source: Traffic and Road Safety Department of National Operation Command in National Police</td></tr>
</table>

Source: JICA Project Team

Table 13.5.8 Results of Environmental and Social Study for "Improvement of Ring-road"

<table>
<tr><th></th><th>No.</th><th>Likely Impacts</th><th>Study Results</th></tr>
<tr><td rowspan="6">Pollution</td><td>1</td><td>Air Pollution</td><td>The results of the study on air pollution are the same as shown in Table 13.5.4.
Based on the results of traffic demand analysis in Chapter 10, the NOx volume along the project route was estimated in Table 13.5.18. The NOx volume of Do-maximum case in 2030 including the project route was less than the one in Do-nothing case and can contribute to reduce air pollution due to automobile exhaust fumes.

Table 13.5.9 Estimation of NOx Emission on the Project Route
<table>
<tr><th rowspan="2">Case</th><th colspan="2">Existing Condition</th><th colspan="2">2030 Do-Nothing Case</th><th colspan="2">2030 Maximum Case</th></tr>
<tr><th>Traffic (vehicle/day)</th><th>NOx (t/year)</th><th>Traffic (vehicle/day)</th><th>NOx (t/year)</th><th>Traffic (vehicle/day)</th><th>NOx (t/year)</th></tr>
<tr><td>Small car</td><td>5,425</td><td>1.2</td><td>7,998</td><td>1.8</td><td>7,518</td><td>1.7</td></tr>
<tr><td>Large car</td><td>2,374</td><td>12.2</td><td>3,420</td><td>17.5</td><td>2,978</td><td>15.3</td></tr>
<tr><td>Total</td><td>7,799</td><td>13.4</td><td>11,418</td><td>19.3</td><td>10,496</td><td>17.0</td></tr>
</table>
Source: JICA Project Team</td></tr>
<tr><td>2</td><td>Water Pollution</td><td>Water pollution due to the chemical substance is not that serious because not many factories are located along the project route based on the results of site reconnaissance and land use survey. Besides, according to the hearing with the Suco chiefs along the project route, they expressed no concern over water pollution except partial water contamination due to domestic sewage. Incidentally, the environmental standards and the effluent standard have not been established in Timor-Leste.</td></tr>
<tr><td>3</td><td>Noise and Vibration</td><td>According to the hearing with the Suco chiefs along the project route, they expressed concerns over daily noise and vibration generated by passing vehicles although it was not serious.</td></tr>
<tr><td>4</td><td>Soil Contamination</td><td>According to the hearing with the Suco chiefs along the project route, they expressed no concern over soil contamination.</td></tr>
<tr><td>5</td><td>Waste</td><td>According to the hearing with the Suco chiefs along the project route, they expressed concerns over daily litter on the roads, garbage burning at waste-collection points, litter because a lot of people disobey time regulations on solid waste collection.</td></tr>
<tr><td>7</td><td>Offensive Odor</td><td>According to the hearing with the Suco chiefs along the project route, they expressed concerns over seasonal and partial offensive odor due to household effluent.</td></tr>
<tr><td rowspan="2">Natural Environment</td><td>10</td><td>Flora, Fauna, and Biodiversity</td><td>There are partial street trees along the project route which is located in the Dili urban area. Most trees are typical type of Timor-Leste such as Ficus microcarpa, Calophyllum inophyllum, Monkeypod tree, and mango.</td></tr>
<tr><td>13</td><td>Soil Erosion</td><td>According to the hearing with the Suco chiefs along the project route, there is no soil erosion in the area; however, partial erosion on river bank was noted in the Kuluhun River.</td></tr>
<tr><td rowspan="2">Social Environment</td><td>17</td><td>Involuntary Resettlement</td><td>Major project components include improvement of intersections and partial road widening along the project route, although the project scales are still unclear. Since residential and commercial buildings are located along the route, involuntary resettlement is expected; however, road widening can be planned and share a part of the river bank in order to minimize adverse impact on the residential and commercial buildings. Given the above plan and scenario, no large-scale involuntary resettlement is expected.</td></tr>
<tr><td>18</td><td>Local Economy such as Employment and Livelihood</td><td>As the project route passes through the Dili urban area, business, commercial and administrative activities dominated the local activities along the route. Household income levels are assumed at mid-high level according to the hearing with the Suco chiefs along the project route.</td></tr>
</table>

<table>
<tr><th></th><th>No.</th><th>Likely Impacts</th><th>Study Results</th></tr>
<tr><td></td><td>19</td><td>Land Use and Utilization of Local Resources</td><td>The project route passes through circling the Dili urban center and the results of the land use survey showed that half of the land along the route is occupied by residential land, followed by commercial land, water surface area (the Kuluhun River), and public land as shown Table 13.5.10.

Table 13.5.10 Distribution of Land Uses on Project Route
<table><tr><th>Land Use</th><th>North Side (%)</th><th>South Side (%)</th><th>Total (%)</th></tr><tr><td>Agriculture Land</td><td>0.8</td><td>0.0</td><td>0.4</td></tr><tr><td>Commercial</td><td>13.7</td><td>18.1</td><td>15.9</td></tr><tr><td>Educational Facilities</td><td>7.3</td><td>2.2</td><td>4.8</td></tr><tr><td>Public Administration</td><td>16.0</td><td>6.5</td><td>11.3</td></tr><tr><td>Industry</td><td>2.3</td><td>2.4</td><td>2.3</td></tr><tr><td>Institution</td><td>0.0</td><td>0.9</td><td>0.4</td></tr><tr><td>Park and Recreational</td><td>2.5</td><td>0.2</td><td>1.4</td></tr><tr><td>Residential</td><td>56.2</td><td>38.6</td><td>47.6</td></tr><tr><td>Transportation</td><td>0.6</td><td>0.0</td><td>0.3</td></tr><tr><td>Vacant Land</td><td>0.6</td><td>1.7</td><td>1.2</td></tr><tr><td>Water Surface Area</td><td>0.0</td><td>29.5</td><td>14.5</td></tr><tr><td>Total</td><td>100.0</td><td>100.0</td><td>100.0</td></tr></table>Source: JICA Project Team</td></tr>
<tr><td></td><td>21</td><td>Existing Social Infrastructures and Services</td><td>There are the existing roadside social infrastructure (water pipes, electric wires, telecommunication cables, drains, street lamps) along the project route. Wells/boreholes are also located according to the hearing with the Suco chiefs along the project route. Therefore, the improvement of intersections and the partial road widening can require temporary relocation according to locations.
As mentioned in Chapter 10, the traffic congestions are being solved based on the traffic demand forecast, and it can facilitate the accessibility to the public facilities locating along the project route.</td></tr>
<tr><td></td><td>26</td><td>Hazards (risk), Infectious Diseases such as HIV/AIDS</td><td>The results are the same as shown in Table 13.5.4.</td></tr>
<tr><td></td><td>27</td><td>Cultural Heritage</td><td>There are architectural heritages from the Portuguese colonization period partially recognized along the project route especially in the Dili City Center based on the results of site reconnaissance and the land use survey. Suco chiefs along the project route expressed that no local sacred/holy places are located along the route in the hearing.</td></tr>
<tr><td></td><td>29</td><td>The Poor, Indigenous and Ethnic People</td><td>According to the hearing with the Suco chiefs along the project route, no indigenous and ethnic people are identified along the project route although poor households could reside along the route, who migrated from outside DMA and have no regular work/employment.</td></tr>
<tr><td></td><td>30</td><td>Working Conditions, Accidents</td><td>The results are the same as shown in Table 13.5.4.</td></tr>
</table>

Source: JICA Project Team

Table 13.5.11 Results of Environmental and Social Study for "Road Widening of Current Road Network between Comoro and CBD"

<table>
<tr><th></th><th>No.</th><th>Likely Impacts</th><th>Study Results</th></tr>
<tr><td rowspan="6">Pollution</td><td>1</td><td>Air Pollution</td><td>The results of study for air pollution are the same as shown in Table 13.5.4.
Based on the results of the traffic demand analysis in Chapter 10, the NOx volume along the project route was estimated in Table 13.5.12. The NOx volume of Do-maximum case in 2030 including the project route was less than the one in the Do-nothing case, and it can contribute to the reduction of air pollution due to automobile exhaust fumes.

Table 13.5.12 Estimation of NOx Emission on the Project Route
<table>
<tr><td rowspan="2">Case</td><td colspan="2">Existing Condition</td><td colspan="2">2030 Do-Nothing Case</td><td colspan="2">2030 Maximum Case</td></tr>
<tr><td>Traffic (vehicle/day)</td><td>NOx (t/year)</td><td>Traffic (vehicle/day)</td><td>NOx (t/year)</td><td>Traffic (vehicle/day)</td><td>NOx (t/year)</td></tr>
<tr><td>Small car</td><td>10,315</td><td>0.8</td><td>15,025</td><td>1.1</td><td>10,570</td><td>0.8</td></tr>
<tr><td>Large car</td><td>4,521</td><td>7.8</td><td>5,780</td><td>9.9</td><td>3,935</td><td>6.7</td></tr>
<tr><td>Total</td><td>14,836</td><td>8.6</td><td>20,805</td><td>11.0</td><td>14,505</td><td>7.5</td></tr>
</table>
Source: JICA Project Team</td></tr>
<tr><td>2</td><td>Water Pollution</td><td>Water pollution due to chemical substance is not that serious because not many factories are located along the project route based on the results of site reconnaissance and land use survey. Besides, according to the hearing with the Suco chiefs along the project route, they expressed no concern over water pollution.</td></tr>
<tr><td>3</td><td>Noise and Vibration</td><td>According to the hearing with the Suco chiefs along the project route, they expressed concerns over daily noise and vibration generated by passing vehicles although it is not serious.</td></tr>
<tr><td>4</td><td>Soil Contamination</td><td>According to the hearing with the Suco chiefs along the project route, they expressed no concern over soil contamination.</td></tr>
<tr><td>5</td><td>Waste</td><td>According to the hearing with the Suco chiefs along the project route, they expressed concerns over daily litter on the roads, garbage burning at waste-collection points, litter because a lot of people disobey time regulations on solid waste collection.</td></tr>
<tr><td>7</td><td>Offensive Odor</td><td>According to the hearing with the Suco chiefs along the project route, they expressed concerns over offensive odor due to household effluent, river water, or solid waste.</td></tr>
<tr><td rowspan="2">Natural Environment</td><td>10</td><td>Flora, Fauna and Biodiversity</td><td>There are few trees along the project route which is located in the Dili urban area. Some trees were typical type in Timor-Leste such as mango, coco, and banana.</td></tr>
<tr><td>13</td><td>Soil Erosion</td><td>According to the hearing with the Suco chiefs along the project route, they expressed no concern about soil erosion.</td></tr>
<tr><td rowspan="3">Social Environment</td><td>17</td><td>Involuntary Resettlement</td><td>Major project components include road widening and improvement of intersection along the project route although the project scales are still unclear. As residential and commercial buildings are located along the route, involuntary resettlement is expected.</td></tr>
<tr><td>18</td><td>Local Economy such as Employment and Livelihood</td><td>As the project route passes through the Dili urban area, business, commercial activities dominated the local activities along the route. Household income levels were assumed at mid-high level according to the hearing with the Suco chiefs along the project route.</td></tr>
<tr><td>19</td><td>Land use and utilization of local resources</td><td>The project route connects Banana Road and the ring-road in the Dili urban area. The results of land use survey showed that half of the land along the route was occupied by residential land, followed by commercial land, and public land as shown Table 13.5.13.

Table 13.5.13 Distribution of Land Uses on Project Route
<table>
<tr><th>Land use</th><th>North Side (%)</th><th>South Side (%)</th><th>Total (%)</th></tr>
<tr><td>Commercial</td><td>14.1</td><td>34.7</td><td>24.5</td></tr>
<tr><td>Educational Facilities</td><td>4.2</td><td>0.0</td><td>2.1</td></tr>
<tr><td>Public Administration</td><td>6.3</td><td>11.8</td><td>9.1</td></tr>
<tr><td>Industry</td><td>0.0</td><td>1.4</td><td>0.7</td></tr>
<tr><td>Park and Recreational</td><td>10.6</td><td>0.0</td><td>5.2</td></tr>
<tr><td>Residential</td><td>64.1</td><td>51.4</td><td>57.7</td></tr>
<tr><td>Water Surface Area</td><td>0.7</td><td>0.7</td><td>0.7</td></tr>
<tr><td>Total</td><td>100.0</td><td>100.0</td><td>100.0</td></tr>
</table>
Source: JICA Project Team</td></tr>
</table>

	No.	Likely Impacts	Study Results
	21	Existing Social Infrastructures and Services	There are existing roadside social infrastructure (water pipes, electric wires, telecommunication cables, drains, street lamps) along the project route. Wells/boreholes could also be located according to the hearing with the Suco chiefs along the project route. Therefore, the improvement of intersections and partial road widening will require temporary relocation according to locations. As mentioned in Chapter 10, traffic congestions are solved based on the traffic demand forecast and it can facilitate accessibility to public facilities located along the project route.
	26	Hazards (risk), Infectious Diseases such as HIV/AIDS	The results are the same as shown in Table 13.5.4.
	27	Cultural Heritage	There are few architectural heritages during the Portuguese colonization period recognized along the project route based on the results of site reconnaissance and land use survey. Suco chiefs along the project route expressed that no local sacred/holy places are located along the route in the hearing.
	29	The Poor, Indigenous, and Ethnic People	According to the hearing with the Suco chiefs along the project route, no indigenous and ethnic people were identified along the project route although poor households could reside along the route and have no regular work/employment.
	30	Working Conditions, Accidents	The results are the same as shown in Table 13.5.4.

Source: JICA Project Team

(2) Mid-Long Term Projects

For two mid-long term projects of (iv) and (v), anticipated environmental and social impacts are more roughly studied incorporating the results of the JPT studies, site survey, and interviews with various stakeholders particularly the Suco chiefs which were done with the counterpart. The results are summarized as shown in Table 13.5.14 and Table 13.5.15.

Table 13.5.14 Results of Environmental and Social Study for "New-bypass development"

	No.	Likely Impacts	Study Results
Pollution	1	Air Pollution	As no traffic on roads and factories, which generates sources of emission, are located in the project site, no air pollution is expected. The Project was included in the Do-maximum case in the traffic demand analysis in Chapter 10, and it can also contribute to reduce air pollution due to automobile exhaust fumes as described in the above tables. However, the traffic on the bypass will generate sources of emission for the residents along the project route.
	2	Water Pollution	As no factories, which generate sources of chemical substance, are located in the project site, no water pollution is expected based on the results of site reconnaissance and land use survey. Besides, according to the hearing with the Suco chiefs in the project site, they expressed no concern over water pollution.
	3	Noise and Vibration	As no traffic on roads, which generates sources of emission, are located in the project site, no noise and vibration are expected. Besides, according to the hearing with the Suco chiefs in the project site, they expressed no concern over noise and vibration. However, the traffic on the bypass will generate sources of noise and vibration for residents along the project route.
	4	Soil Contamination	According to the hearing with the Suco chiefs in the project site, they expressed no concern over soil contamination.
	5	Waste	According to the hearing with the Suco chiefs in the project site, they expressed no concern over the waste.
	7	Offensive Odor	According to the hearing with the Suco chiefs in the project site, they expressed no concern over offensive odor.
Natural Environment	10	Flora, Fauna, and Biodiversity	There are typical trees which can be found in Timor-Leste such as Monkeypod tree, Leucaenamango, coconut and cotton tree in the project site which is located in the Dili urban area.
	13	Soil Erosion	According to the hearing with the Suco chiefs in the project site, they expressed soil erosion in the Maloa River during rainy season.

	No.	Likely Impacts	Study Results
Social Environment	17	Involuntary Resettlement	As the project route may be designed in the residential area between Banana Road and the ring-road, involuntary resettlement is expected.
	18	Local Economy such as Employment and Livelihood	As the project route passes through the residential area, household income levels were assumed at low-mid level according to the hearing with the Suco chiefs in the project site.
	19	Land Use and Utilization of Local Resources	The project route will be designed between Banana Road and the ring-road in the Dili urban area. The area was dominated by residential land.
	21	Existing Social Infrastructures and Services	There are the existing social infrastructure (water pipes, electric wires, and telecommunication cables) in the project site. Wells/boreholes could also be located according to hearing with Suco chiefs in the project site. Therefore, the new bypass can require them temporary relocation according to locations. Meanwhile, public facilities such as education and public administration/institution are also located in the site. The new bypass may affect these public facilities and can facilitate accessibility to public facilities located along the project route.
	26	Hazards (risk), Infectious Diseases such as HIV/AIDS	The results are the same as shown in Table 13.5.4.
	27	Cultural Heritage	No architectural heritages during the Portuguese colonization period were identified in the project site based on the results of site reconnaissance and land use survey. Suco chiefs in the project site expressed that no local sacred/holy places were located.
	29	The Poor, Indigenous, and Ethnic People	According to the hearing with the Suco chiefs in the project site, no indigenous and ethnic people were identified along the project route although poor households which had no regular work/employment could reside in the site.
	30	Working Conditions, Accidents	The results are the same as shown in Table 13.5.4.

Source: JICA Project Team

Table 13.5.15 Results of Environmental and Social Study for "Improvement of Tibar Road"

	No.	Likely Impacts	Study Results
Pollution	1	Air Pollution	The results are the same as the priority projects. The project was included in the Do-maximum case in the traffic demand analysis in Chapter 10, and it can also contribute in reducing air pollution due to automobile exhaust fumes in the entire area of DMA as described in the above table.
	2	Water Pollution	According to the hearing with the Suco chiefs in the project site they expressed no concern over the water pollution.
	3	Noise and Vibration	The results are the same as the priority projects.
	4	Soil Contamination	According to the hearing with the Suco chiefs in the project site, they expressed no concern over the soil contamination.
	5	Waste	According to the hearing with the Suco chiefs in the project site, they expressed concerns over daily litter on the roads, garbage burning at waste-collection points, litter because a lot of people disobey time regulations on solid waste collection.
	7	Offensive Odor	The results are the same as the priority projects.
Natural Environment	10	Flora, Fauna, and Biodiversity	There are typical trees which can be found in Timor-Leste such as *Ficus microcarpa*, cotton tree, Monkeypod tree, mango, coconut and banana in the project site.
	13	Soil Erosion	According to the hearing with the Suco chiefs in the project site, they mentioned about soil erosion in the Comoro River during rainy season.
Social Environment	17	Involuntary Resettlement	The project route may be designed with expansion on the existing road passing the southern edge of the Dili urban area. Since residential buildings are located along the route, involuntary resettlement can be expected.
	18	Local Economy such as Employment and Livelihood	As the project route passes the southern edge of the Dili urban area, commercial and farming activities dominated the local activities along the route. Household income levels are assumed at the low-mid level according to the hearing with the Suco chiefs in the project site.

<table>
<tr><th></th><th>No.</th><th>Likely Impacts</th><th>Study Results</th></tr>
<tr><td></td><td>19</td><td>Land Use and Utilization of Local Resources</td><td>The project route may be designed on the existing road passing the foot of the southern mountain in the Dili urban area and may build a tunnel at a mountain section in Tibar. The area along the existing road was dominated by residential land, and the land on the mountain section in Tibar was forest and bush/grass land.

<table>
<tr><th>Land Use</th><th>North Side (%)</th><th>South Side (%)</th><th>Total (%)</th></tr>
<tr><td>Agriculture Land</td><td>4.7</td><td>1.4</td><td>3.0</td></tr>
<tr><td>Natural Bush, Grass Land</td><td>12.1</td><td>19.4</td><td>15.7</td></tr>
<tr><td>Commercial</td><td>2.6</td><td>1.9</td><td>2.3</td></tr>
<tr><td>Educational Facilities</td><td>0.4</td><td>2.9</td><td>1.6</td></tr>
<tr><td>Forest area</td><td>21.4</td><td>20.5</td><td>21.0</td></tr>
<tr><td>Public Administration</td><td>1.2</td><td>0.2</td><td>0.7</td></tr>
<tr><td>Industry</td><td>1.1</td><td>0.0</td><td>0.5</td></tr>
<tr><td>Residential</td><td>46.7</td><td>42.8</td><td>44.7</td></tr>
<tr><td>Vacant Land</td><td>8.9</td><td>9.9</td><td>9.4</td></tr>
<tr><td>Water Surface Area</td><td>1.1</td><td>1.1</td><td>1.1</td></tr>
<tr><td>Total</td><td>100.0</td><td>100.0</td><td>100.0</td></tr>
</table>
Source: JICA Project Team</td></tr>
<tr><td></td><td>21</td><td>Existing Social Infrastructures and Services</td><td>There are existing roadside social infrastructure (water pipes, electric wires, telecommunication cables, drains, street lamps) along the project route. Wells/boreholes are also located according to hearing with the Suco chiefs along the project route. Therefore, the partial road widening can require them temporary relocation according to locations.</td></tr>
<tr><td></td><td>26</td><td>Hazards (risk), Infectious Diseases such as HIV/AIDS</td><td>The results are the same as shown in Table 13.5.4.</td></tr>
<tr><td></td><td>27</td><td>Cultural Heritage</td><td>No architectural heritages from the Portuguese colonization period were identified in the project site based on the results of site reconnaissance and land use survey. Suco chiefs in the project site expressed that no local sacred/holy places are located.</td></tr>
<tr><td></td><td>29</td><td>The Poor, Indigenous, and Ethnic People</td><td>According to the hearing with the Suco chiefs in the project site, no indigenous and ethnic people were identified along the project route although poor households could reside along the route, who migrated from outside DMA and had no regular work/employment.</td></tr>
<tr><td></td><td>30</td><td>Working Conditions, Accidents</td><td>The results are the same as shown in Table 13.5.4.</td></tr>
</table>
Source: JICA Project Team

13.5.6 Evaluation of Anticipated Environmental and Social Impacts

(1) Priority Projects

The environmental and social studies for four priority projects of (i), (ii), (iii), and (vi) showed the same results. Therefore, anticipated environmental and social impacts are evaluated and summarized together as shown in

Table 13.5.16 Evaluation of Anticipated Environmental and Social Impacts for Priority Projects

	No.	Likely Impacts	Rating by Scoping		Rating by Study Results		Reasons of Rating
			Pre-/Construction	Operation	Pre-/Construction	Operation	
Pollution	1	Air Pollution	B-	B+/-	B-	B+	[Construction Phase] Although exhaust gas (NOx) and dust (PM) caused by operation of construction vehicles and equipment can temporarily deteriorate air quality around the construction sites, limited impacts are anticipated because project scales are not large and the locations are distributed. Besides, no chemical air pollution due to SOx and PM from factories was found along the project routes. However, air pollution due to daily generation of exhaust gas (NOx) and dust stirred up (PM) from passing vehicles were reported along the project routes. Therefore, air pollution from the construction sites should be minimized to avoid worsening the existing situation by implementing the safeguard measures for environmental management. [Operation Phase] As the NOx volume generated by passing vehicles will be decreased on the project routes, it can contribute in the reduction of air quality deterioration near the project routes.
	2	Water Pollution	B-	D	B-	N/A	[Construction Phase] Since the project routes are located on flat urban area and the construction works will not involve any major alteration of the topography or civil engineering works, limited water pollution due to soil erosion is anticipated. Besides, no chemical water pollution was found along the project routes; however, water pollution due to domestic water and garbage in rivers or drains was partially reported along the project routes, generation of water pollution due to wastewater and solid waste from the construction sites should be minimized by implementing the safeguard measures for environmental management.
	3	Noise and Vibration	B-	B-	B-	B+	[Construction Phase] Although the operation of construction vehicles and equipment can temporarily increase levels of noise and vibration near the construction sites, the impact is limited because the project scales are not large and the locations are distributed. However, daily noise and vibration from the passing vehicles were reported along the project routes; therefore, the noise and vibration from the construction vehicles and equipment should be minimized by implementing safeguard measures for environmental management. [Operation Phase] Since the traffic volume decreased in the project routes, the noise and vibration from passing vehicles are also reduced.
	4	Soil Contamination	C-	D	D	N/A	[Construction Phase] Although unintentional spilled fuel and oil from construction vehicles or equipment may contaminate soil near the construction sites, the project scales are small and the locations are distributed. Besides, no soil contamination was reported along the project sites and the impact is limited on soil contamination. However, the unintentional spilled fuel and oil from construction vehicles or equipment should be avoided by implementing the safeguard measures for environmental management.

	No.	Likely Impacts	Rating by Scoping		Rating by Study Results		Reasons of Rating
			Pre-/Construction	Operation	Pre-/Construction	Operation	
	5	Waste	B-	D	B-	N/A	[Construction Phase] Although waste can be temporarily generated from the construction sites, the impact is limited because the project scales are not large and the locations are distributed. However, as litter is daily found along the project routes, the waste from construction sites should be disposed by implementing safeguard measures for environmental management.
	6	Ground Subsidence	D	D	N/A	N/A	
	7	Offensive Odor	B-	D	B-	N/A	[Construction Phase] Although operation of construction vehicles and equipment can temporarily generate offensive odor from exhaust gas or oil, and discharging water or domestic waste from construction sites also can be a source of offensive odor, the impact is limited because the project scales are not large and the locations are distributed. However, offensive odor from garbage and domestic wastewater was partially reported along the project routes, generation of offensive odor should be minimized by implementing safeguard measures for environmental management.
	8	Bottom Sediment	D	D	N/A	N/A	
Natural Environment	9	Protected Areas	D	D	N/A	N/A	
	10	Flora, Fauna, and Biodiversity	B-	D	D	N/A	[Construction Phase] The construction works of projects will demand cutting down roadside trees; however, the impact is limited because the types of trees are domestically typical, the project scales are not large, and the locations are distributed.
	11	Hydrological Situation	D	D	N/A	N/A	
	12	Topography and Geographical Features	D	D	N/A	N/A	
	13	Soil Erosion	B-	D	D	N/A	[Construction Phase] The project routes are located on flat urban area and the construction works will not involve any major alteration of the topography or civil engineering works. Besides, no soil erosion was found along the project routes. Therefore, limited impact is anticipated from soil erosion although soil erosion from cut and fill for construction works should be minimized by implementing safeguard measures for environmental management.
	14	Groundwater	D	D	N/A	N/A	
	15	Coastal Zone	D	D	N/A	N/A	
	16	Meteorology	D	D	N/A	N/A	
Social Environment	17	Involuntary Resettlement	B-	D	B-	N/A	[Pre-Construction Phase] As 60% to 80% of land along the project routes is used for residential and commercial land, there can be temporary relocation or involuntary resettlement according to project locations. As there are detached houses or mixed used houses with cottage, cottage industries, and retail shops in front of the vacant land for the planned site of the Comoro Bus Terminal, they, also, can be resettled.

No.	Likely Impacts	Rating by Scoping		Rating by Study Results		Reasons of Rating
		Pre-/Construction	Operation	Pre-/Construction	Operation	
18	Local Economy such as Employment and Livelihood	B+/-	B+	B+/-	B+	[Pre-construction Phase] As many business/commercial and government buildings are located along the project routes, temporary relocation or involuntary resettlement can be demanded according to project locations. Typically, household income level is higher, inadequate compensation led by lack of legal procedures of land acquisition can cause loss of livelihood, difficulty to recover livelihood, and/or degradation of previous living conditions of relocated people. [Construction Phase] Meanwhile, the construction activities will require employment of workers (especially unskilled), and it can provide a temporary boost to local employment. The neighborhood service sector can benefit by providing food and beverages. [Operation Phase] As the traffic congestions will be alleviated, the accessibility to the roadside can be enhanced and it can lead to revitalization of the roadside businesses.
19	Land Use and Utilization of Local Resources	B-	B+	D	B+	[Construction Phase] Nearly half of land along the project routes is being used for residential purposes. Commercial and public uses are also in demand. These lands can be affected by the construction works of projects according to the locations; however, the land uses are not extremely changed because the project scales are not large and the locations are distributed. [Operation Phase] As the traffic congestions are alleviated, accessibility to the roadside can be enhanced and it can lead to roadside developments. The developments can contribute effective utilizations of land and local resources in the urban area.
20	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	D	D	N/A	N/A	
21	Existing Social Infrastructures and Services	B-	B+	B-	B+	[Construction Phase] The construction works can temporarily require relocation of existing roadside social infrastructure (water pipes, electric wires telecommunication cables, drains, street lamps, or wells/boreholes) according to the locations. [Operation Phase] As the traffic volume will be decreased on the project routes, the reduced traffic congestion can improve the accessibility for public services located along the project routs.
22	Misdistribution of Benefit and Damage	D	D	N/A	N/A	
23	Local Conflict of Interests	D	D	N/A	N/A	
24	Water Usage or Water Rights and Rights of Common	D	D	N/A	N/A	
25	Sanitation	D	D	N/A	N/A	

No.	Likely Impacts	Rating by Scoping		Rating by Study Results		Reasons of Rating
		Pre-/Construction	Operation	Pre-/Construction	Operation	
26	Hazards (risk), Infectious Diseases such as HIV/AIDS	C-	D	D	N/A	[Construction Phase] As the scales of the construction work are not large and local labors will be employed, there are few tangible risks for disaster or occurrence of infectious diseases (HIV/AIDS) due to the mass inflow of laborers from other areas. If the influx occurs, risk for HIV/AIDS spread is low because the prevalence rate of HIV/AIDS in Timor-Leste is low. However, the external workers could induce/illicit sexual relationships with the local peoples and sensitizations are necessary for both of them.
27	Cultural heritage	C-	D	B-	N/A	[Construction Phase] Since there are architectural heritages from the Portuguese colonization period especially in the Dili city center, the construction activities can affect them in some locations.
28	Landscape	D	D	N/A	N/A	
29	The poor, indigenous and ethnic people	C-	D	B-	N/A	[Pre-construction Phase] No indigenous and ethnic people were identified along the project routes; however, poor households may be affected in involuntary resettlement, livelihoods due to land acquisition for the projects according to their locations.
30	Working Conditions, Accidents	B-	B+/-	B-	B+/-	[Construction Phase] Directorate General of Labor Inspection, Secretary State of Vocational Training and Employment notes lack of safety gears and work break for workers in construction sites and dust rising from construction vehicles. Therefore, health hazards and accidents involving workers and the local people can be temporarily expected. [Operation Phase] As the traffic volume will be decreased on the project routes, the traffic accidents can be reduced. However, the entire traffic speed will be slightly up and traffic safety should be promoted to prevent traffic accidents for drivers, citizens, and students.
31	Gender, Children's Rights	D	D	N/A	N/A	

Rating:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown (examination is needed and impacts may become clear as study progresses)
D: No impact is expected
N/A: Not Applicable
Source: JICA Project Team

(2) Mid-Long Term Projects

The environmental and social studies for two mid-long term projects of (iv) and (v), anticipated environmental and social impacts were evaluated and summarized as shown in Table 13.5.17.

Table 13.5.17 Evaluation of Anticipated Environmental and Social Impacts for Mid-Long Term Projects

	No.	Likely Impacts	Rating by Scoping		Rating by study results		Reasons of Rating
			Pre-/Construction	Operation	Pre-/Construction	Operation	
Pollution	1	Air Pollution	B-	B+/-	B-	B+/-	[Construction Phase] No chemical air pollution was found along the project routes. However, exhaust gas and dust caused by operation of construction vehicles and equipment can temporarily deteriorate air quality around the construction sites. Besides, air pollution due to daily generation of exhaust gas and dust from passing vehicles was reported along the project route. Therefore, air pollution from the construction sites should be minimized to avoid worsening the existing situation by implementing the safeguard measures for environmental management. [Operation Phase] The projects are included in the Do-maximum case in the traffic demand analysis in Chapter 10, and they can also contribute to the reduction of air pollution due to automobile exhaust fumes in the entire area of DMA.
	2	Water Pollution	B-	D	B-	N/A	[Construction Phase] In the project sites located on flat urban area, as the construction works will not involve any major alteration of the topography or civil engineering works, limited water pollution due to soil erosion is anticipated. Besides, no chemical water pollution was found along the project routes. However, water pollution due to domestic water and garbage in rivers or drains was partially reported along the project route, generation of water pollution due to the wastewater and solid waste from the construction sites should be minimized by implementing the safeguard measures for environmental management.
	3	Noise and Vibration	B-	B-	B-	B+	[Construction Phase] The operation of construction vehicles and equipment can temporarily increase the levels of noise and vibration near the construction sites. Besides, daily noise and vibration from the passing vehicles were reported along the project route; therefore, the noise and vibration from the construction vehicles and equipment should be minimized by implementing the safeguard measures for environmental management. [Operation Phase] The project is included in the Do-maximum case in the traffic demand analysis in Chapter 10, and it can also contribute to the reduction of noise and vibration from the passing vehicles in the entire area of DMA.
	4	Soil Contamination	C-	D	B-	N/A	[Construction Phase] No soil contamination was reported along the project routes; however, unintentional spilled fuel and oil from construction vehicles or equipment may contaminate soil near the construction sites. The unintentional spilled fuel and oil from construction vehicles or equipment should be avoided by implementing the safeguard measures for environmental management.
	5	Waste	B-	D	B-	N/A	[Construction Phase] Waste can be temporarily generated with construction waste soil from the construction works and domestic wastes. As litter was also found daily along the project route, the waste from construction sites should be disposed by implementing the safeguard measures for environmental management. Besides, the tunneling work will generate waste soil and it should be disposed in designated disposal site.
	6	Ground Subsidence	D	D	N/A	N/A	

	No.	Likely Impacts	Rating by Scoping		Rating by study results		Reasons of Rating
			Pre-/Construction	Operation	Pre-/Construction	Operation	
	7	Offensive Odor	B-	D	B-	N/A	[Construction Phase] As operation of construction vehicles and equipment can temporarily generate offensive odor from exhaust gas or oil and discharging water or domestic waste from the construction sites also can be sources of offensive odor. However, offensive odor from garbage and domestic wastewater was partially reported along the project route, generation of offensive odor should be minimized by implementing the safeguard measures for environmental management.
	8	Bottom Sediment	D	D	N/A	N/A	
Natural Environment	9	Protected Areas	D	D	N/A	N/A	
	10	Flora, Fauna, and Biodiversity	B-	D	B-	N/A	[Construction Phase] The construction works can demand cutting down the roadside trees in the residential area and the inlet/outlet of tunnel.
	11	Hydrological Situation	D	D	N/A	N/A	
	12	Topography and Geographical Features	D	D	N/A	N/A	
	13	Soil Erosion	B-	D	B-	N/A	[Construction Phase] The project routes are located on flat urban area and the construction works will not involve any major alteration of the topography or civil engineering works. However, river bank or tunneling work can cause soil erosion at the inlet and outlet. Therefore, soil erosion from cut and fill for construction works should be minimized by implementing the safeguard measures for environmental management.
	14	Groundwater	C-	D	C-	N/A	Tunneling work can affect groundwater in the eastern mountain area of Tibar; however, its location is unclear.
	15	Coastal Zone	D	D	N/A	N/A	
	16	Meteorology	D	D	N/A	N/A	
Social Environment	17	Involuntary Resettlement	B-	D	A/B-	N/A	[Pre-construction Phase] New bypass between Banana Road and ring-road can be designed in the residential area and Tibar Road may improve an existing road where nearly half of land along the project route is being used for residential purposes. Therefore, temporary relocation or involuntary resettlement can be expected.
	18	Local Economy such as Employment and Livelihood	B+/-	B+	B+/-	B+	[Pre-construction Phase] As residential buildings are located along the project routes, temporary relocation or involuntary resettlement can be demanded. Typically, household income level is not higher, inadequate compensation led by lack of legal procedures on land acquisition can cause loss of livelihoods, difficulty to recover livelihoods, and/or degradation of previous living conditions of relocated people. [Construction Phase] Meanwhile, the construction activities will require employment of workers (especially unskilled), and it can provide a temporary boost to local employment. The neighborhood service sector can benefit by providing food and beverages. [Operation Phase] Since traffic congestions can be alleviated, the accessibility to the roadside can be enhanced. It can also lead to revitalization of the roadside business activities.

No.	Likely Impacts	Rating by Scoping		Rating by study results		Reasons of Rating
		Pre-/Construction	Operation	Pre-/Construction	Operation	
19	Land Use and Utilization of Local Resources	B-	B+	B-	B+	[Construction Phase] Over half of the land along the project routes is being used for residential purposes. Although some residential lands can be affected by the road construction or expansion and will change the road space, the change is not large scale as the project areas cannot be widened. [Operation Phase] Since traffic congestions can be alleviated, the accessibility to the roadside can be enhanced and it can lead to roadside developments. The developments can contribute effective utilizations of land and local resources in the urban area.
20	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	D	D	N/A	N/A	
21	Existing Social Infrastructures and Services	B-	B+	B-	B+	[Construction Phase] The construction works can temporarily require relocation of the existing roadside social infrastructure (water pipes, electric wires telecommunication cables, drains, street lamps, or wells/boreholes) according to locations. [Operation Phase] Although few public facilities are located along the project routes, these bypasses can contribute in reducing traffic congestions in DMA. It can improve the entire accessibility to public facilities in DMA.
22	Misdistribution of Benefit and Damage	D	D	N/A	N/A	
23	Local Conflict of Interests	D	D	N/A	N/A	
24	Water Usage or Water Rights and Rights of Common	D	D	N/A	N/A	
25	Sanitation	D	D	N/A	N/A	
26	Hazards (Risk), Infectious Diseases such as HIV/AIDS	C-	D	D	N/A	[Construction Phase] As the scale of construction work is not large and local laborers will be employed, there are few tangible risks of disaster or occurrence of infectious diseases (HIV/AIDS) due to mass inflow of laborers from other areas. If the influx occurs, the risk for HIV/AIDS spread is low because the prevalence rate of HIV/AIDS in Timor-Leste is low. However, the external workers could induce/illicit sexual relationships with the local people and sensitizations are necessary for both of them.
27	Cultural Heritage	C-	D	D	N/A	[Construction Phase] As there are no architectural heritages from the Portuguese colonization period and local sacred/holy places, no impacts are expected on cultural heritages.
28	Landscape	D	D	N/A	N/A	
29	The Poor, Indigenous, and Ethnic People	C-	D	B-	N/A	[Construction Phase] No indigenous and ethnic people were identified in the project sites. However, poor households may be affected by relocation or involuntary resettlement. Livelihood will also be affected due to the off street parking projects according to locations.

No.	Likely Impacts	Rating by Scoping		Rating by study results		Reasons of Rating
		Pre-/Construction	Operation	Pre-/Construction	Operation	
30	Working Conditions, Accidents	B-	B+/-	B-	B+/-	[Construction Phase] Directorate General of Labor Inspection, Secretary State of Vocational Training and Employment notes lack of safety gears and work break for workers in the construction sites and dust rising from construction vehicles. Therefore, health hazards and accidents involving workers and the local people can be temporarily expected. [Operation Phase] Traffic accidents can occur on the newly constructed roads. Traffic safety should be promoted to prevent traffic accidents for drivers, citizens, and students.
31	Gender, Children's Rights	D	D	N/A	N/A	

Rating:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown (examination is needed and impacts may become clear as study progresses)
D: No impact is expected
N/A: Not Applicable
Source: JICA Project Team

13.5.7 Mitigation Measures

Table 13.5.18 summarizes the proposed mitigation measures for adverse impacts from the projects. In the pre-construction phase, land acquisition and resettlement are major adverse impacts from the proposed projects. These will be basically mitigated in accordance with the Resettlement Action Plan (RAP) which will be prepared by the Directorate for Roads, Bridges and Flood Control (DRBFC) in the feasibility study stage preferably for the draft and designing stage for finalization.

On the other hand, for the adverse impacts on the natural environment and pollution expected in the construction phase, the mitigation measures are incorporated into the Environmental Safeguards in the Standard Specifications to provide environmental countermeasures and actions to perform any civil works under a contract required by the DRBFC.

Table 13.5.18 Proposed Environmental Mitigation Measures

No.	Item	Possible Adverse Impacts	Proposed Environmental Mitigation Measures	Implementing Organization	Responsible Organization
Pre-construction and Construction Phases					
1	Air Pollution	Deterioration of air quality due to dust	• Contractor will regularly spray water on the working area to minimize dust generation • Back of hauling equipment will be covered by sheet during their operations • The construction vehicles and machineries will be regularly washed and cleaned by high pressure water spray	Supervising Consultant, Contractor	DRBFC/ DNE
		Deterioration of air quality due to emission gases	• Contractor will use modern equipment and regularly maintain the construction vehicles and machineries		
2	Water Pollution	Deterioration of river water due to eroded soil from cut and fill works	• Contractor will construct stable slope with temporary protection • Drainage will be temporarily installed to drain heavy rain water	Supervising Consultant, Contractor	DRBFC/ DNCQA/ DNE
		Deterioration of river water due to waste water from site office	• Septic tanks will be installed in site offices to treat wastewater primarily		

No.	Item	Possible Adverse Impacts	Proposed Environmental Mitigation Measures	Implementing Organization	Responsible Organization
		Deterioration of river water due to hazardous liquid	• Any hazardous liquid such as fuel, hydraulic, or lubricating oils, dropped or spilled, will be cleaned and collected • Washing of vehicles and equipment will be permitted in designated and equipped areas		
3	Noise and Vibration	Disturbance on residents or structures due to noise and vibration generated by equipment	• Contractor will use modern construction vehicles and machineries to generate low noise and vibration and regularly maintain them • Contractor will effectively schedule operation hours considering disturbance in nearby communities	Supervising Consultant, Contractor	DRBFC/ DNE
4	Soil Contamination	Deterioration of soil due to spilled fuel and oil from equipment	• Contractor will regularly maintain the construction vehicles and machineries to avoid spillage • Any hazardous liquid such as fuel, hydraulic, or lubricating oils dropped or spilled will be cleaned and collected • Washing of vehicles and equipment will be permitted in designated and equipped areas	Supervising Consultant, Contractor	DRBFC/ DNE
5	Waste	Domestic wastes from construction site	• All garbage will be put in the trash can and regularly dispose to an assigned place where feasible in coordination with the municipality	Supervising Consultant, Contractor	DRBFC/ Municipality
		Construction waste soil	• Construction waste soil will be disposed to an assigned place by the community where feasible in coordination with the municipality • The waste soil will be reused for construction materials		
7	Offensive Odor	Disturbance on residents due to offensive odor generated by exhaust gas from equipment	• Contractor will use modern construction vehicles and machineries to generate less emission, and regularly maintain them • Contractor will effectively schedule operation hours considering disturbance in nearby communities	Supervising Consultant, Contractor	DRBFC/ DNE
		Generation of offensive odor due to domestic wastes and discharging water	• All garbage will be put in the trash can and regularly disposed to an assigned place where feasible in coordination with the community		
10	Flora, Fauna and Biodiversity	Loss of street trees	• Cash compensation in full replacement cost for loss of privately-owned trees for the owners • Re-plant the street trees	Supervising Consultant, Contractor	DRBFC
13	Soil Erosion	Soil erosion from cut and fill works	• Contractor will construct stable slope with temporary protection • Drainage will be also temporarily installed to drain heavy rain water	Supervising Consultant, Contractor	DRBFC
17	Involuntary Resettlement	Loss of lands and structures	• Consultant will plan detailed designs to avoid or minimize resettlement	Consultant	DRBFC
			• Prepare and implement Land Acquisition and Resettlement Plan (RAP) • Conduct public consultations for local people with affected persons	DRBFC/ Consultant	DRBFC/ DNPTSC
			• Appropriate compensations for loss of lands and structures with full replacement cost.	DRBFC	DRBFC/ DNPTSC
18	Local Economy such as	Losses of incomes	• Consultant will plan detailed designs to avoid or minimize the damages on livelihoods	Consultant	DRBFC

No.	Item	Possible Adverse Impacts	Proposed Environmental Mitigation Measures	Implementing Organization	Responsible Organization
	Employment and Livelihood		• According to the RAP, disruption allowances will be provided for households with income losses during reconstruction or repair of houses, and for employees on income losses during re-establishment period • Disruption allowance for business owners on losses of business revenues during re-establishment period	DRBFC	DRBFC/ DNPTSC
21	Existing Social Infrastructures and Services	Displacement of installed social infrastructure	• Contractor will temporarily relocate and rehabilitate the social infrastructure after the project construction works are completed under the coordination with owner institution	Supervising Consultant/ Contractor	DRBFC/ Local Authority
		Partial losses of community or public facilities	• Consultant will plan detailed design to avoid or minimize damages on the structures of public facilities	Consultant	
			• If some structures are inevitably and partially lost, the contractor will rehabilitate them under the coordination with the owner institution.	Supervising Consultant/ Contractor	
26	Hazards (risk), Infectious Diseases such as HIV/AIDS	Expansion of HIV/AIDS	• Contractor will conduct explanatory meetings to sensitize workers and communities through cooperation with respective local health centers.	Contractor/ Health Centers	DRBFC/ MOH
27	Cultural Heritage	Partial damages of historical buildings	• Consultant will plan detailed designs to avoid or minimize damages on structures and historical buildings.	Consultant	DRBFC / NDAC
			• If structures are inevitably and partially damaged, contractor will rehabilitate them under the cooperation with National Diving and Activity Centre (NDAC).	Supervising Consultant/ Contractor	
29	The Poor People	Same as Items 17 and 18	• Same as Item 17 and 18	Same as Items 17 and 18	
30	Working Conditions, Accidents	Accidents of construction workers and local residents	• Supervising consultant and contractor take responsibility to ensure occupational safety, hygiene, and health in accordance with the Labor Law. • Under a contract, the contractor complies with the Standard Specifications of DRBFC including the environmental safeguard for any civil works to secure the overall safety for persons involved, workers, and local residents, and environmental conservation around construction site. • Environmental countermeasures may include water resources, air quality, noise, traffic, adjoining properties and utilities, human health and safety, flora and fauna, soil, disposal of waste, and cultural heritage.	Supervising Consultant/ Contractor	DRBFC/ DGLI
Operation Phase					
30	Accidents	Increase in traffic accidents	• Local governments with schools will conduct traffic safety campaign to promote awareness to prevent traffic accidents in the communities and schools along the project routes.	Local Government/ School	DRBFC/ Police Office

Source: JICA Project Team

13.5.8 Monitoring Plan

A monitoring plan is proposed as shown in Table 13.5.19. Most important monitoring items are "involuntary resettlement" activities which includes mitigations for losses and rehabilitation of livelihood and those for poor people. The other items are for pollutions, damages on structures and accidents during construction period. These items will be monitored according to the environmental safeguards which is included in the Standard Specification made and required by DRBFC for civil works. The proposed monitoring items should be reviewed depending on the project details in the feasibility studies, the design works, or contractor procurement process.

Table 13.5.19 Proposed Monitoring Plan

Environmental Item	Monitoring Item	Location	Frequency	Responsible Organization
Pre-construction Phase				
Involuntary Resettlement	As described in Section 13.6.9	Project affected sites	Monthly	DRBFC
Construction Phase				
Air Pollution	Dust (PM10)	Nearby project sites	At the start of construction/ every month	Supervising consultant/ Contractor
Water Pollution	pH, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD),(Suspended Solid (SS)	Nearby project sites (rivers)	At the start of construction/ every month	
Noise and Vibration	Ambient noise level in dB(A), vibration level in dB(A)	Nearby project sites	At start of construction/ Every month	
Waste	Amount of construction waste soil disposed and domestic waste	Disposal sites	Monthly	
Existing Social Infrastructures and Services	Number of damaged parts by damage type, coordination meetings, rehabilitation methods, number of relocated and rehabilitated infrastructure by item	Nearby project sites	Monthly	
Cultural Heritage	Number of damaged parts by damage type, coordination meetings, rehabilitation methods	Nearby project sites	Monthly	
Accidents	Number of incidence of accident case, description of accident, coping process	Nearby project sites	Monthly	
Operation Phase				
Accidents	Number of incidence of traffic accident	Project routes	Monthly (for half a year after commencement of service)	DRBFC/police office

Source: JICA Project Team

13.5.9 Stakeholder Meetings

As the proposed projects are not at the feasibility study phase, stakeholder meetings are not conducted.

13.6 Land Acquisition and Resettlement

13.6.1 Necessity of Land Acquisition and Resettlement

As mentioned at the beginning of this chapter, the JPT proposes the potential projects in the road and public transportation sector at the planning level before the feasibility study phase. Therefore, the alignments, scales, and right-of-ways (ROWs) of the projects have not been studied and

proposed yet in the Project. However, as the potential projects are located in the urbanized area, land acquisition and resettlement will be expected to some extent.

13.6.2 Legal Framework

(1) Legislations

The land related laws are explained in Section 13.3.1.

(2) JICA Policy for Resettlement

The key principles of JICA policies on involuntary resettlement are summarized below.

I. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.

II. When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.

III. People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.

IV. Compensation must be based on the full replacement cost as much as possible.

V. Compensation and other kinds of assistance must be provided prior to displacement.

VI. For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.

VII. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.

VIII. Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.

IX. Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

The above principles are complemented by World Bank OP 4.12, since it is stated in the JICA Guideline “JICA confirms that projects do not deviate significantly from the World Bank’s Safeguard Policies”. Additional key principle based on World Bank OP 4.12 is as follows.

X. Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.

XI. Eligibility of benefits include, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who do not have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.

XII. Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.

XIII. Provide support for the transition period (between displacement and livelihood restoration).

XIV. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.

XV. For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc.

(3) Gaps between JICA Guidelines and Laws of Timor-Leste on Resettlement

Table 13.6.1 explains that the Draft Expropriation Law mostly covers the JICA Guidelines and the WB OP 4.12. However, a few gaps were identified between them, which were not clearly stated for: the preparation of resettlement action plans made available to the public and its implementation, the early surveys with the cut-off date, the eligibility of the PAPs who do not have formal legal rights, land-based resettlement strategies for displaced persons whose livelihood are land-based, support for the transition period, particular attention to the needs of the vulnerable groups.

Table 13.6.1 Gaps between JICA Guidelines and Legislations of Timor-Leste

No.	JICA Guidelines (GL)/World Bank (WB)	Laws of Timor-Leste	Gaps Relative to JICA GL/WB	Guidelines of the Project
1	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	Constitution: Article 54 states that 1. Every individual has the right to private property and can transfer it during his or her lifetime or on death, in accordance with the law. 2. Private property should not be used to the detriment of its social purpose. 3. Requisitioning and expropriation of property for public purposes shall only take place following fair compensation in accordance with the law. 4. Only national citizens have the right to ownership of land. Draft Expropriation Law (EL): Article 1.3 states that the nature of expropriation is always exceptional and it shall only be used when it is not possible to acquire or use another real estate property for another purpose. Expropriation Law (EL): Article 32.1 states that the decision to expropriate must be justified and must specifically mention the following ...: c) The need to expropriate pursuant to Article 1(3), including consideration of other alternatives and the proposals submitted during public consultation;"	No major gaps to the principles of the Constitution and the draft EL, however, these do not clearly state the avoidance of involuntary resettlement.	Follow JICA GL and Draft EL
2	When population displacement is unavoidable,	Same as above	No major gaps	Follow JICA GL and Draft EL

No.	JICA Guidelines (GL)/World Bank (WB)	Laws of Timor-Leste	Gaps Relative to JICA GL/WB	Guidelines of the Project
	effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)			
3	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	Draft Expropriation Law (EL): Article 4 states that an expropriation shall leave affected persons as defined in Article 6 in circumstances such that their standard of living is equal to or higher than the one that they enjoyed before the expropriation took place.	No major gaps	Follow JICA GL and Draft EL
4	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	Draft Expropriation Law (EL): Article 20 states that: the amount of compensation is calculated using the value of the land and adding the cost of replacing existing buildings or plantations.	No major gaps	Follow JICA GL and Draft EL
5	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	Draft Expropriation Law (EL): Article 38.3 states that the expropriated parties must be granted a reasonable period of time to vacate the expropriated asset, but that period cannot be longer than 30 days counting from the publication of the declaration of public interest [although in some instances a longer period can be granted].	Draft EL stipulates the reasonable period is; however, it does not clearly stated the compensation prior to displacement.	Follow JICA GL and Draft EL
6	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	None	No laws stipulate this item.	Follow JICA GL
7	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA GL)	Draft Expropriation Law (EL): Article 15 stipulates that the public hearings shall be convened to present the project and to seek the views of interested parties.	Draft EL stipulates the public hearings; however, it does not express the preparation of resettlement action plan.	Follow JICA GL
8	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	None	No laws stipulate this guideline.	Follow JICA GL
9	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	Draft Expropriation Law (EL): Article 12 states early consultation in the preconditions for expropriation.	The draft EL provides early consultation; however, it does not provide participation of affected people in planning, implementation, and monitoring of resettlement action plans.	Follow JICA GL
10	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	Draft Expropriation Law (EL): Article 40 states establishment of the amount of compensation by arbitration, with appeal to the common courts.	No major gaps	Follow JICA GL and Draft EL

No.	JICA Guidelines (GL)/World Bank (WB)	Laws of Timor-Leste	Gaps Relative to JICA GL/WB	Guidelines of the Project
		Chapter II of Title IV expresses the grievance redress mechanism.		
11	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	None	No laws stipulate the early surveys with a cut-off date.	Follow WB OP4.12.
12	Eligibility of benefits includes, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who do not have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	Draft Expropriation Law (EL): Article 6 defines the affected persons as: i) the expropriated party; ii) a person who has an interest (including an encumbrance securing a loan) in the asset to be expropriated; iii) a person who occupies the asset and fulfils the requirements to be considered to be a resident in a family home as set out in the draft Land Law.	The draft EL unclearly defines the eligibility of the PAPs who do not have formal legal rights and they may be excluded from the eligibility.	Follow WB OP4.12.
13	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para.11)	None	No laws stipulate this item.	Follow WB OP4.12.
14	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	Draft Expropriation Law (EL): Article 4 states that affected persons' standard of living is equal to or higher than the one that they enjoyed before the expropriation took place. Article 19 (2) states that the payment of compensation is intended to ensure that the expropriated party is not left in worse circumstances than the ones it would find itself in if the expropriation had not taken place.	Partial gaps: the draft EL does not specify to support provision for the transition period.	Follow WB OP4.12.
15	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities, etc. (WB OP4.12 Para.8)	Draft Expropriation Law (EL): Article 4 states that affected persons' standard of living is equal to or higher than the one that they enjoyed before the expropriation took place.	Partial gaps: the draft EL does not specify to support provision for the vulnerable groups.	Follow WB OP4.12.
16	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP4.12 Para.25)	None	No laws stipulate this item.	Follow WB OP4.12.

Source: Land Acquisition and Resettlement Safeguards in the Transport Sector in Timor-Leste (ADB), JICA Project Team

13.6.3 Scope of Land Acquisition and Resettlement

The scale of land acquisition and resettlement has not been identified at the planning level without the studies for the alignments, scales, and ROWs.

13.6.4 Measures of Compensation and Supports

As mentioned in Section 13.3.1, the expropriation law has not been enacted and the Ministry of Justice is preparing drafts of the Land Law and Expropriation Law. Meanwhile, the DRBFC, which is responsible for road development in the MoPWTC, expressed that they follow the resettlement plan studied in the JICA study entitled The Preparatory Survey on the Project for the Construction of Upriver Comoro Bridge in the Democratic Republic of Timor-Leste, in 2014. Therefore, the Project also follows this resettlement policy.

Table 13.6.2 Proposed Entitlement Matrix

Type of loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation Issues/Guidelines	Organization Responsible
1. Loss of lands (residential and agricultural lands)	Owners of lands	Cash compensation at full replacement cost	• Measurement of land demarcation • Assessment of replacement cost based on market value and other alternative measures • Full replacement cost may include market value (ex-transaction), administrative fees, and taxes • Coordination and negotiations with the owners	DRBFC, DNTPSC, Valuation Specialist/Social Safeguard Team/ESU
2. Loss of structures (residential/business/commercial structures)	Owners of structures (including informal occupants)	Cash compensation at full replacement cost	• Measurement of property • Assessment of replacement cost based on market value and other alternative measures • Full replacement cost may include material cost of building, labor cost, transport cost, and administrative fees • Coordination and negotiations with the owners	
3. Loss of perennial trees and standing crops	Owners of the land or customarily recognized owners of trees and standing crops	Cash compensation at full replacement cost	• Replacement cost is assessed by type, size, age, and productive values • Coordination and negotiations with the owners	DRBFC, Valuation Specialist/ Social Safeguard Team/ ESU
4. Loss of business due to dislocation	Owners of businesses	Disruption allowance for business owners on losses of business revenues during re-establishment period	• Allowance is calculated by unit labor cost • Coordination and negotiations with the owners	
5. Loss of income and work days due to dislocation	Employed workers who reside in the area	Disruption allowance on losses of incomes during the re-establishment period	• Allowance is calculated by unit labor cost • Coordination and negotiations with the workers	
6. Damages of community or public structures	Owners/representatives of community or public structure	Rebuilding of damaged structures	• Coordination and negotiations with owners/representatives of structures	DRBFC, DNTPSC, Valuation Specialist/ Social Safeguard Team/ ESU
7. Displacement and damages of social infrastructure	Owners/operators of social infrastructure services	Temporary relocation of social infrastructure and rehabilitations	• Coordination and negotiations with owners/operators of social infrastructure services and communities	DRBFC, DNTPSC, Valuation Specialist/ Social Safeguard Team/ ESU, Supervising Consultant/Contractor

Source: The Preparatory Survey on the Project for the Construction of Upriver Comoro Bridge in the Democratic Republic of Timor-Leste, JICA Project Team

13.6.5 Grievance Redress Mechanism

A Grievance Redress Committee (GRC) is established as a grievance redress mechanism. As Suco chiefs have traditionally dealt with land issues at Suco level in Timor-Leste, the chiefs will become members of the GRC as representatives to receive grievances from affected persons as the first step.

The process of grievance redress is summarized in Table 13.6.3 Proposed Grievance Redress ProcedureTable 13.6.3.

Table 13.6.3 Proposed Grievance Redress Procedure

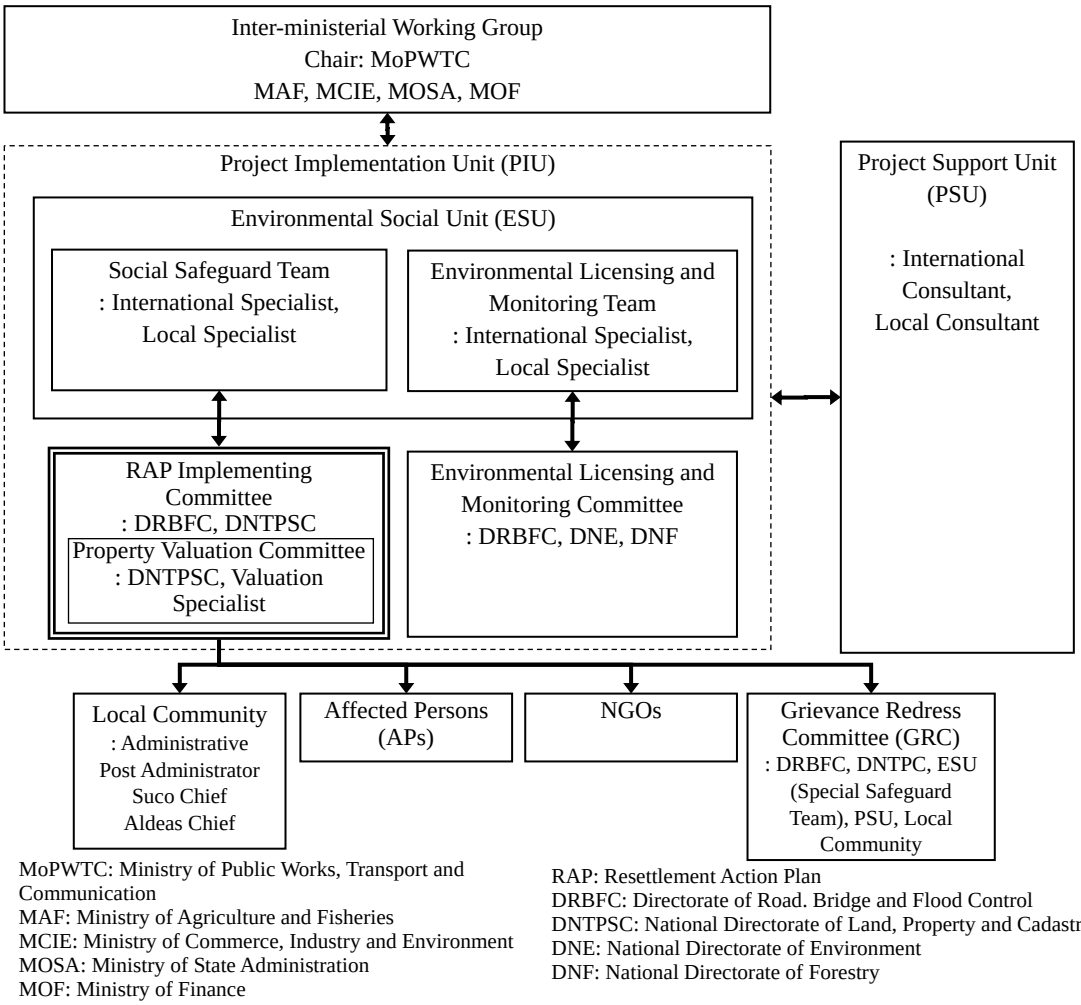
Step	Implementation Steps	Activities
1.	Submission of grievance document ⇩ Consultation with RAP Implementation Committee ⇩ Consultation with the affected person ⇩ Reach consensus	• An affected person files a complaint letter to the Suco chief. • The Suco chief reports the complaint to the RAP Implementation Committee in the PIU. • The Suco chief confers with the RAP Implementation Committee on the solutions and reports to the affected person the results of consultation.
2.	No reach consensus ⇩ Consultation with GRC ⇩ Consultation with the affected person ⇩ Reach consensus	• When the conciliation is not successful, the Suco chief reports to the GRC within one week after no reach consensus. • The GRC discusses solutions to the grievances within one week and reports to the affected person the results within five days.
3.	No reach consensus ⇩ Appeal to the Secretary of State ⇩ Consultation with the Suco chief and affected person ⇩ Reach consensus	When the conciliation is not successful, the Suco chief and the affected person report to the Secretary of State within one week after no reach consensus. • The Secretary of State convenes a meeting and discusses solutions in the MoPWTC in cooperation with the DNTPSC within one week. • The Secretary of State reports to the affected person the results within five days.
4.	No reach consensus ⇩ Appeal to Court ⇩ Determination by Court	• The Suco chief or the affected person files a motion with the court. • The court determines the solutions.

Source: The Preparatory Survey on the Project for the Construction of Upriver Comoro Bridge in the Democratic Republic of Timor-Leste, JICA Project Team

13.6.6 Institutional Framework

(1) Organizations

The land acquisition and resettlement will be led and implemented by a RAP Implementing Committee consisting of the DRBFC and DNTPSC. A Social Safeguard Team including international specialists and local specialists will work to support the committee. Figure 13.6.1 explains the entire implementation structure for the land acquisition and resettlement.



Source: The Preparatory Survey on the Project for the Construction of Upriver Comoro Bridge in the Democratic Republic of Timor-Leste

Figure 13.6.1 Proposed Implementation Structure

(2) Roles of Related Organizations

The RAP Implementing Committee will lead the land acquisition and resettlement activities in the Project Implementation Unit (PIU). The Environmental Social Unit (ESU) will work to support the RAP Implementing Committee, which includes the Social Safeguard Team and the Environmental Licensing and Monitoring Team consisting of international specialists and local specialists. The Project Support Unit (PSU) will be established with an international consultant and a local consultant in order to entirely support the PIU. The Inter-Ministerial Working Group will deal with inter-ministerial issues through stakeholder meetings to support the PIU. Table 13.6.4 explains the roles of related organizations.

Table 13.6.4 Roles of Related Organizations

Group/Unit	Organization	Role
Inter-ministerial Working Group	MoPWTC (Chair), MAF, MCIE, MOSA, MOF	• Inter-ministerial support the PIU through the inter-ministerial stakeholder meetings
Project Implementation Unit (PIU)	DRBFC, DNTPSC, DNE, DNF	• Socio-economic survey with PSU • RAP preparation with PSU • Implementation of land acquisition and resettlement and management • Finance and payment of compensation • Establishment and management of RAP implementation

		Committee • Coordination with PSU • Public consultations, stakeholder meetings, information disclosure • Valuation and determination of replacement cost for compensation • Coordination with local communities and NGOs • Monitoring the resettlement activities • Management of grievance redress activities
Project Support Unit (PSU)	International Specialist, Local Specialist	• Socio-economic survey with PIU • Support for RAP preparation • Support for implementation of land acquisition and resettlement • Support for public consultations and stakeholder meetings • Support for information disclosure • Support for replacement cost related activities • Support of monitoring • Support for GRC meetings
Grievance Redress Committee (GRC)	DRBFC, DNTPC, ESU, PSU, Local Community	• Grievance redress activities

Source: The Preparatory Survey on the Project for the Construction of Upriver Comoro Bridge in the Democratic Republic of Timor-Leste, JICA Project Team

13.6.7 Implementation Schedule

An implementation schedule of land acquisition and resettlement is still unclear because the feasibility studies have not been implemented for the proposed projects. In light of the proposed action plans, the feasibility studies may start in 2015 and the detailed designs may be studied by 2018. Therefore, the DRBFC, the expected project proponent, will draft the RAPs in the feasibility studies and start to establish the implementation structure. Cooperating with the DNTPSC, the inventory works and property evaluation will be done and the RAP will be updated and finalized during the design phase. According to the RAP, negotiation, contract, payment, relocation and clearance will be completed before the start of construction. The proposed schedule of land acquisition and resettlement works is shown Table 13.6.5 by project step.

Table 13.6.5 Proposed Schedule

<table>
<tr><th colspan="3">Resettlement Steps</th><th>Project Steps</th></tr>
<tr><td>A. Pre-Resettlement Implementation Phase</td><td rowspan="3">• Census (Number of Affected Persons, Socio-economic Survey)
• Draft Resettlement Action Plan
• Establishment of the Implementation Units and Formation of Structure mentioned in Figure 13.6.1</td><td rowspan="4">C. Cross-cutting Issues
(10) Public Consultation Meeting
(11) Grievance Redress Mechanism
(12) Monitoring and Evaluation</td><td rowspan="3">Feasibility Study (F/S) 2015-2016</td></tr>
<tr><td>(1) Resettlement Planning</td></tr>
<tr><td>(2) Institutional Arrangements</td></tr>
<tr><td>B. Resettlement Implementation Phase</td><td rowspan="4">• Detailed Measurement Survey
• Replacement Cost Survey
• Compensation Calculation
• Entitlement (Beneficiaries and Compensation Package)
• Budgeting</td><td rowspan="4">Design (B/D, D/D) 2017-2018</td></tr>
<tr><td>(3) Inventory Works</td></tr>
<tr><td>(4) Property Evaluation</td></tr>
<tr><td>(5) RAP Updating and Approval</td></tr>
<tr><td>(6) Negotiation and Contract</td><td rowspan="2">• Consent Building and Grievance Redress
• Budget Disbursement</td><td rowspan="3">Procurement from 2019</td></tr>
<tr><td>(7) Payment</td></tr>
<tr><td>(8) Relocation and Clearance</td><td rowspan="2">• Income Restoration Program as appropriate</td></tr>
<tr><td>(9) Registration of Land</td><td>Construction</td></tr>
</table>

Source: JICA Project Team

13.6.8 Cost and Finance

The RAP implementation cost was not calculated because the project details including scales, alignments, and ROWs were not studied and proposed before the feasibility studies. However, the MoPWTC will provide the necessary budget to ensure the mitigation commitments including compensation and monitoring programs.

13.6.9 Monitoring System

The Environmental Licensing and Monitoring Committee consisting of DRBFC, National Directorate for Environment (NDE), and the National Directorate of Forestry (NDF) will lead the monitoring of the land acquisition and resettlement activities mentioned in Table 13.6.6 by project step. The Environmental Licensing and Monitoring Team will support the monitoring committee.

Table 13.6.6 Proposed Monitoring Items and Indicators

Project Steps	Item	Indicator	Frequency
(1) Feasibility Study (F/S) Phase	Establishment of the Implementation Units	• Number of staff allocated • Man-months achieved the activities	Monthly
(2) Design (B/D, D/D) Phase	Inventory Works (with Detailed Measurement Survey)	• Status of preparedness of inventory • Completed and approval dates of inventory	
	Property Evaluation and RAP Finalization	• Status of preparedness of RAP including Replacement Cost Survey, Compensation Calculation, Entitlement (Beneficiaries and Compensation Package) • Finalization and approval dates of RAP	
	Budgeting	• Amount of budget requested • Application and approval dates of budget	
(3) Procurement Phase	Negotiation and Contract	• Number of persons negotiated and reached agreement or disagreement	
	Budget Disbursement	• Timely (immediately after determination of compensation package) allocation and appropriate amount of compensation fund • Scheduled allocation of administrative funds	
	Compensation Payment for Livelihood	• Number of persons paid • Amount of payment evaluated and approved	
	Compensation Payment for Assets (land, structure, trees)	• Number of persons paid • Amount of payment evaluated and approved	
	Relocation and Clearance	• Number of households relocated • Number of structure demolished and cleared • Area (ha) cleared	
	Registration of Land	• Number of lots and area (ha) registered	
(4) Construction Phase	Income Restoration Program as appropriate	• Number of persons received the programs • Contents of programs	
Cross-cutting Activities	Public Consultations	• Contents of consultations, questions, and answers, issues • Attendance list	
	Stakeholder Meetings	• Contents of discussions, issues, conclusions • Attendance list	
	Grievance Redress	• Number of petitioners and solutions • Contents (records) of grievances and solutions	
	Preparation of Resettlement Sites (when necessary)	• Site profiles (location, scale, geographical features, infrastructure provided) • Status of preparedness of sites • Number of applicant households/persons	

Source: JICA Project Team

13.6.10 Stakeholder Meeting

Since the proposed projects are not at the feasibility study phase, stakeholder meetings are not conducted.

CHAPTER 14 : ACTION PLAN

14.1 Overview of Action Plan

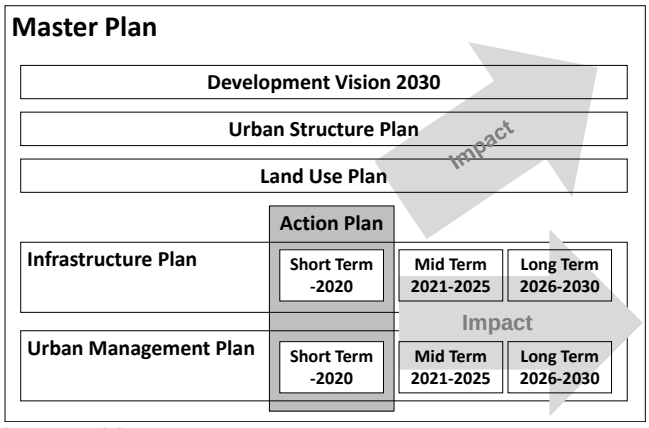
This chapter shows the overview of the action plan, position of action plan in the master plan, and the action plan. To carry out policies and plans on land use, infrastructure development, and urban management, the executing agencies in association with other concerned organizations are required to take actions based on the action plan. Implementation of the action plan is the very first stage of the master plan implementation to achieve the proposed urban structure and vision 2030. The implementation of the action plan is very important and will influence the activities in the next phases starting from 2021.

The action plan has two types, namely, i) action plan for priority project implementation and ii) action plan to be implemented by MPSI. The target year of the action plan for priority project is 2020. The action plan shows necessary projects or activities to be implemented by 2020, and executing agency for each activity and project, as shown in Section 14.3. On the other hand, the action plan to be implemented by MPSI is a one-year activity plan as mentioned in Section 14.4.

Development road map in Table 8.4.2 narrates possible events, activities to be achieved, possible changes due to the events and the activities by item such as spatial pattern, socio-economy, and infrastructure for each phase by 2030. On the other hand, this action plan shows the implementation schedule of priority projects and activity plan to be taken by DNHPU of MPSI among the infrastructure developments and urban management to be implemented during Phase 1 from 2015 to 2020 of the road map.

14.2 Position of Action Plan in the Master Plan

Action plan mainly covers short-term projects of the infrastructure plan and urban management plan to be implemented between 2015 and 2020. The master plan consists of five components, namely: i) development vision 2030, ii) urban structure, iii) land use plan, iv) infrastructure plan, and v) urban management plan. Action plan is comprehensive and detailed plan for the short-term projects proposed in the infrastructure plan and urban management plan. Taking actions based on the action plan will influence the projects and activities to be implemented in the medium and long term as well as land use plan, urban structure plan, and development vision 2030 as shown in Figure14.2.1.



Source: JICA Project Team

Figure 14.2.1 Position of Action Plan in the Master Plan

14.3 Action Plan for Priority Project Implementation

(1) Priority Project Implementation

The list of short-term projects including priority projects is shown in Table 14.3.1. There are 39 projects to be implemented by 2020. Among the 39 projects, JPT proposed 19 priority projects. The background of the proposal of the priority projects is explained in each sector plan as shown in Chapters 10 and 11. JPT prepares the action plan for priority projects in order to focus on important projects and actions.

Table 14.3.1 List of Short-term Projects Including Priority Projects

No	Sector	Project	Execution Agency
1	Urban Management	**[Priority Project] Dili Urban Development Management Project**	DNHPU of MPSI
2	Road & Transportation	**[Priority Project] Development of Off-street Parking and Fringe Parking**	DNTT of MOPWTC
3		**[Priority Project] Improvement of Ring Road and Traffic Management in Central Business District (CBD)**	DRBFC of MOPWTC
4		**[Priority Project] Road Widening of Current Road Network Between Comoro and CBD**	DRBFC of MOPWTC
5		**[Priority Project] Improvement of Mass Transit**	DNTT of MOPWTC, DRBFC of MOPWTC
6	Seaport	**[Priority Project] Domestic Ferry Terminal and Other Related Facilities Project**	MOPWTC (APORTIL)
7		**[Priority Project] International Cruise Terminal and Other Related Facilities Project**	MOPWTC (APORTIL)
8		**[Priority Project] Comprehensive Bus Terminal and Other Related Facilities Project**	MOPWTC (APORTIL)
9		Development of Security Facilities and System Project	MOPWTC (APORTIL)
10		Pilot and Tugboat Base Development Project	MOPWTC (APORTIL)
11		Seaside Tourism Center Construction Project	MOPWTC (APORTIL)
12		Formulation of Waterfront Redevelopment Plan of Coastal Area	MOPWTC (APORTIL)
13	Airport	**[Priority Project] President Nicolau Lobato International Airport Development Project (1)**	MOPWTC (AACTL)
14	Disaster Prevention	**[Priority Project] Hazards, Risks and Vulnerability Assessment on Dili Metropolitan Area**	NDMD of MSS

15		Installation of Monitoring Equipment for Hydro-meteorological and Geological Hazards	NDMC and NDWQC of MOPWTC / IPG-IP of MPMR
16		Capacity Development of Hydro-meteorological and Geological Staff for Weather Forecasting and Early Warning Systems	NDMC and NDWQC of MOPWTC / IPG-IP of MPMR
17		Review of the Drainage Master Plan from Watershed Management Aspects and Implementation of Flood Control Measures for the Five Rivers in Dili	NDBS of MOPWTC
18		Formulation of Flood and Sediment Control Master Plan for the Rivers in Hera and Tibar and Implementation of Priority Measures	NDBS of MOPWTC
19	Water Supply	**[Priority Project] Survey on the Capacity of the Groundwater for Water Supply**	DEGUS
20		Master Plan of Water Supply	DEGUS
21		Reconstruction of the Distribution Network	DEGUS
22	Sewerage/Drainage	Construction of CSTS	DNSB of MOPWTC
23		Construction of the Decentralized Wastewater Treatment Plant	DNSB of MOPWTC
24		Strengthening of DNSB	DNSB of MOPWTC
25		**[Priority Project] Establishing the Standards of Sewerage System for Buildings**	DNSB of MOPWTC
26		Removal of Dust and Dirt from Drainage Channels, Improvement of Inclination of Drainage Channels, Reshaping of Section of Drainage Channels	DNSB of MOPWTC
27		**[Priority Project] Establishment of Standards of Kerb, Rainwater Collection Pits, and Connection Pipelines to Drainage System Between the Responsible Organizations for Roads and Drainage System**	DNSB of MOPWTC
28		Instructing Communities for Cooperative Maintenance of the Drainage System	DNSB of MOPWTC
29		Survey of Rainfall	DNSB of MOPWTC
30	Solid Waste Management	**[Priority Project] Improvement of Tibar Dumpsite Conditions and Operations**	Sanitation Dept. of MOSA
31		Improvement of Waste Collection	Sanitation Dept. of MOSA
32		Regulatory Strengthening	Sanitation Dept. of MOSA
33		Information, Education and Communication (IEC) Campaign and Social Preparation	Sanitation Dept. of MOSA
34		Capacity Building on Solid Waste Management (SWM)	Sanitation Dept. of MOSA
35	Power	**[Priority Project] Upgrade Dili Substation**	EDTL
36		**[Priority Project] Extension of Distribution Network**	EDTL
37	Telecommunication	**[Priority Project] Development of Submarine Fiber Link**	ANC of MOPWTC
38		**[Priority Project] Development of Optic Trunk Communication Network**	ANC of MOPWTC
39		**[Priority Project] Development of National Information and Communications Technology (ICT) Center**	ANC of MOPWTC

Source: JICA Project Team

Table 14.3.2 shows the action plan for the implementation of priority projects.

Table 14.3.2 Action Plan for Priority Project Implementation

	Project Name	2016	2017	2018	2019	2020	2021-	Execution Agency	Total Cost (million US)	Possible Funding Source	Remarks
Urban Management Project											
1	Dili Urban Development Management Project	Arrangement		Implementation				DNHUP, MPSI	2.00	Public	
Transport Development Projects											
2	Development of off street parking and fringe parking		Feasibility Study	Detailed Design		Bidding and Land Acquisition	up to 2022	DNRBFC, MoPWTC	13.00	PPP or Private	2023-2024 Construction 2025 Commencement of Operation
3	Improvement of Ring-road and traffic management in CBD		Feasibility Study	Detailed		Bidding and Land Acquisition	up to 2022	DNRBFC, MoPWTC	19.80	Public	2023-2024 Construction 2025 Commencement of Operation
4	Road widening of current road network between Comoro and CBD		Feasibility Study	Detailed Design		Bidding and Land Acquisition	up to 2022	DNRBFC, MoPWTC	15.50	Public	2023-2024 Construction 2025 Commencement of Operation
5	Improvement of Mass transit		Feasibility Study Coordination for Organization Formation		Introduction of Bus Vehicle Improvement of Bus Stop			DNRBFC, MoPWTC	24.00	Public or PPP	2022-2024 Introduction of Priority Lane 2025-2030 Introduction of BRT
6	Domestic Ferry Terminal and other related Facilities Project		Detailed Design and Bidding		Construction			APOTIL	10.50	Public	
7	International Cruise Terminal and other related Facilities Project		Detailed Design and Bidding		Construction	Construction		APOTIL	3.00	Public	
8	Comprehensive Bus Terminal and other related Facilities Project		Detailed Design and Bidding				up to 2025 Establishment of Inland Bus System	APOTIL	3.90	Public	
9	President Nicolau Lobato International Airport Development Project (1)		PPP Feasibility Study and Detailed Design		Construction			AACTL	100.00	Public	
Urban Infrastructure Projects											
10	Hazards, Risks and Vulnerability Assessment on Dili Metropolitan Area		Preparation Collection of basic data at Suco Level		Hazard Analysis, Preparation of Hazard Map		Risks and vulnerability assessment	National Disaster Management Committee	1.60	Public	
11	Survey on the Capacity of the Ground Water for Water Supply		Survey					DNWQC, MoPWTC	2.00	Public	
12	Establishing the Standard of the Sewerage System for Buildings		Survey					DNSB, MoPWTC	1.00	Public	
13	Establishment of Standard on Kerb, Rainwater Collection Pits and Connection Pipelines		Survey					DNSB and DNRBFC, MoPWTC	0.50	Public	
14	Improvement of Tibar Dumpsite Conditions and Operations		Environment Assessment Improvement of internal access road	Establishment of Materials Recovery Facility		Site grading, compaction and soil cover		Sanitation Dept., MoSA	2.40	Public	
15	Upgrade Dili substation		Bidding and Construction Feasibility Study and Detail Design		Commencement of Operation			EDTL	1.00	Public	
16	Extension distribution network		Feasibility Study	Detailed Design	Bidding	Construction	Commencement of Operation	EDTL	6.20	Public	
17	Development of Submarine Fiber Link		Feasibility Study	Detailed Design	Bidding	Construction	Commencement of Operation	NDIT, MoPWTC	16.50	Public	
18	Development of Optic Trunk Communication Network		Feasibility Study	Detailed Design	Bidding	Construction	Commencement of Operation	NDIT, MoPWTC	1.00	PPP	
19	Development of National ICT Center		Feasibility Study	Detailed Design	Bidding	Construction	Commencement of Operation	NDIT, MoPWTC	6.00	Public	
								Total Cost	229.90		

Source: JICA Project Team

There are 19 priority projects including both construction projects and technical cooperation projects. Project sheets for each priority project are shown in Appendix 10. The period between 2015 and 2017 is the preparation stage which shall include the conduct of feasibility study, detailed design, and bidding for most of the priority projects. Construction of the seaport, solid waste management, power, and telecommunication projects will start from 2018. It will take long time for road projects to execute preparatory works including feasibility study, detailed design, and land acquisition.

(2) Possible Funding Source

The funding scheme of the priority projects is classified into three, namely: i) public, ii) private, and iii) both public and private such as public private partnership (PPP). Public is divided into government fund of Timor-Leste and foreign assistance including loan and grant.

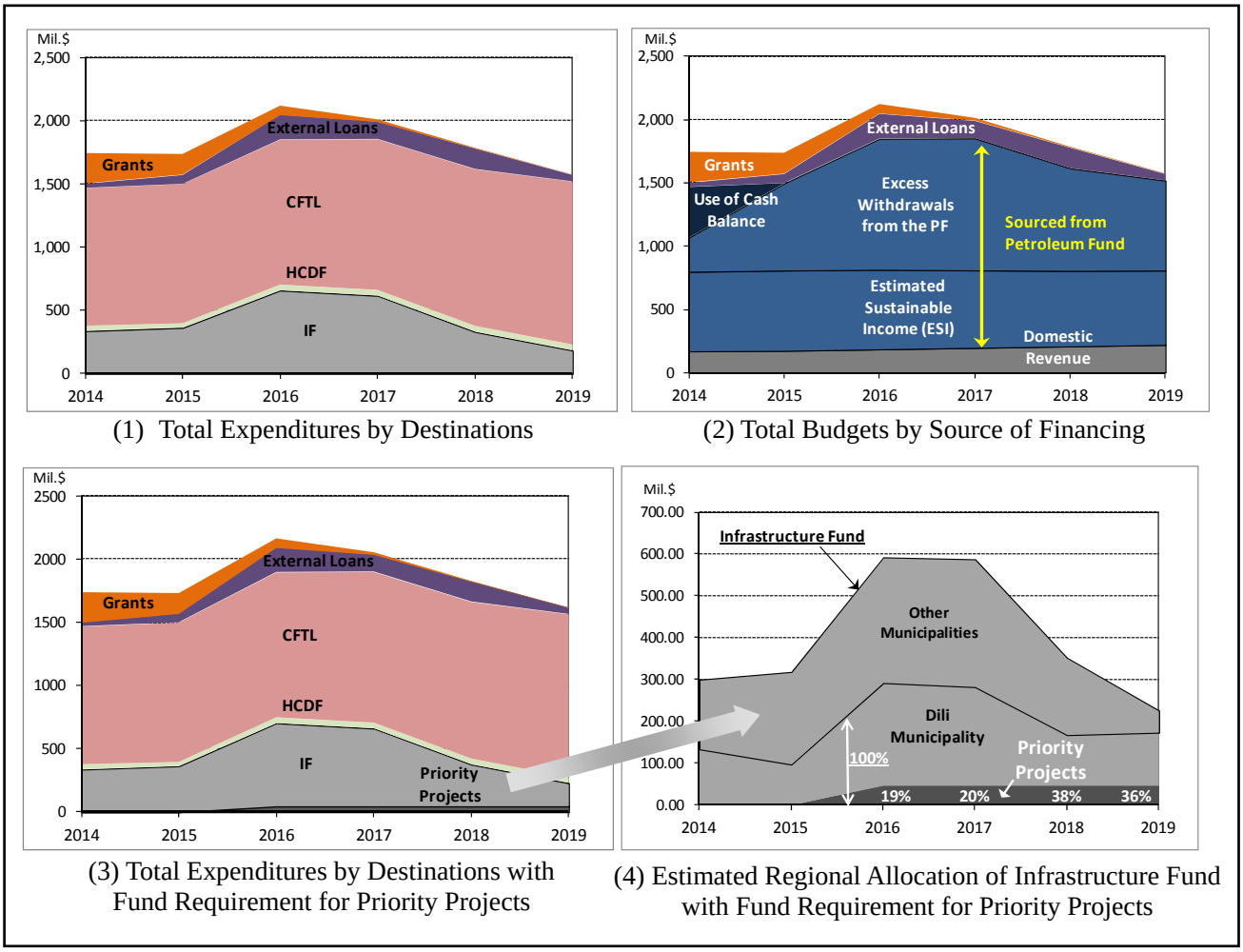
Table 14.3.3 presents the annual budget and expenditure of GoTL for the 2014-2019 period. The figures for 2014, 2015, and 2016 onwards represent the actual, budget, and planned amounts, respectively. The estimated total cost of the priority projects is USD 229.9 million as shown in Table 14.3.2. Assuming that the total cost would be used for five years, the annual cost is USD 45.98 million, which is shown in the bottom of the table. Furthermore, Figure 14.3.1 is an illustration of Table 14.3.3 combined with the estimated regional allocation of the infrastructure fund (IF).

Table 14.3.3 Government Budget and Expenditure, 2014-2019

Item	2014 Actual	2015 Budget	2016 Plan	2017 Plan	2018 Plan	2019 Plan	Remarks
(a) Total Government Expenditures	**1,500**	**1,570**	**2,046**	**1,991**	**1,778**	**1,570**	Sum of 1), 2), 3) and 4)
1) Consolidated Fund of Timor-Leste (CFTL)	1,091	1,104	1,148	1,194	1,242	1,291	CFTL includes all expenditures for line ministries and autonomous agencies except for HCDF and IF.
2) Human Capital Development Fund (HCDF)	40	32	44	44	45	45	HCDF provides support for the training and development of skills across the Timorese population
3) Infrastructure Fund (IF)	338	364	660	617	331	184	IF includes expenditures for all large scale (above USD 1.0 million), multi-year infrastructure projects. Major maintenance costs are included in IF.
4) External Borrowing / Loans	31	70	194	136	160	50	Loans from development partners (currently road projects are the majority). Foreign loans as public debt are designated to be directed only to the construction of infrastructures with strategic importance for the development of Timor-Leste.
(b) Total Budgets	**1,500**	**1,570**	**2,046**	**1,991**	**1,778**	**1,570**	(c) + (e)
(c) Domestic Revenue	166	170	182	194	206	218	It comprises tax, fees, charges, interests, and revenues from state-owned companies
(d) Non-Oil Fiscal Deficit	-1,334	-1,400	-1,864	-1,797	-1,572	-1,352	(a) – (c)
(e) Financing	1,334	1,400	1,864	1,797	1,572	1,352	Sum of 1), 2), 3) and 4)
1) Estimated Sustainable Income (ESI)	632	639	632	616	600	591	Annual permanent income from the investment returns from the PF. PF Law regulates that the maximum withdrawal for ESI is 3% of the Petroleum Wealth
2) Excess Withdrawals from the Petroleum Fund (PF)	271	689	1,037	1,045	812	711	Excess withdrawals from the PF exceeding the ESI.
3) Use of Cash Balance	400	2	0	0	0	0	Rollover cash balance from the

							previous year
4) External Borrowing / Loans	31	70	194	136	160	50	Foreign loans from the development partners
(f) Grants	242.8	165.5	75.9	21.5	6.2	1.9	Development Partners Commitment
(g) Priority Projects	**-**	**-**	**45.98**	**45.98**	**45.98**	**45.98**	-

Source: State Budget 2015 Book 1, MOF



(1) Total Expenditures by Destinations

(2) Total Budgets by Source of Financing

(3) Total Expenditures by Destinations with Fund Requirement for Priority Projects

(4) Estimated Regional Allocation of Infrastructure Fund with Fund Requirement for Priority Projects

Source: JICA Project Team based on the State Budget 2015 Book 1 and Book 6, MOF

Figure 14.3.1 Projection of Budget/Expenditure and Regional Allocation of Infrastructure Fund

The table and figure above represent the fiscal situation of the GoTL that possesses heavy dependence on Petroleum Fund, which need to be improved although domestic revenue (mainly tax revenue) gradually increases (upper-right in Figure 14.3.1). The lower charts in Figure 14.3.1 include additional fund requirement for priority projects. Assuming that all priority projects would be financed by the Infrastructure Fund, financing requirement for priority projects in 2016 will be equivalent to 19% of the fund that is planned to be allocated to Dili Municipality. Similarly, the proportions will be 20%, 38%, and 36% for 2017, 2018, and 2019, respectively. These proportions are somewhat substantial amounts compared with the fund amount allocated to Dili Municipality. In particular, President Nicolau Lobato International Airport Development Project shares large amount of total costs among the priority projects.

Thus, the GoTL would need to diversify the source of fund for priority projects into external loans, grants, and private sector involvement. Currently, Petroleum Fund (PF) balance is around USD 14.5 billion, and it has been receiving 4.6% annual returns. Therefore, it would be rationally better to finance by external loans rather than increasing withdrawals from the PF, if external loans offer much lower interest rate than annual performance of the PF.

14.4 Action Plan to be Implemented by MPSI

When the Urban Development Implementation and Management Project for Dili Metropolitan Area starts, MPSI should execute what they can do by their own. The following are actions to be taken by MPSI for the time being. Table 14.4.1 shows the schedule for the action plan.

(1) Establishment and Operation of Coordination Board

To implement the master plan, an organization which manages the master plan and monitors and evaluates the proposed projects should be established. JPT proposed to establish a coordination board to play important roles during the implementation stage as mentioned in Section 12.3. The establishment of coordination board is the most important among the activities. MPSI should take initiatives to establish the coordination board.

(2) Publicity and Communication

MPSI is required to take initiatives to promote the Dili Urban Master Plan. It is necessary to get cooperation of other key stakeholders including concerned government organizations, NGOs, and general public, and implement the master plan. MPSI should provide information and communicate with other key stakeholders.

1) Holding public meetings for explanation of the master plan

Public meetings to familiarize the public with the master plan should be held. It is important to gain further understanding and cooperation of the general public for implementing the master plan and encouraging involvement on development and conservation of land.

2) Distribution of the master plan to the concerned stakeholders

The master plan including future land use map should be distributed to the concerned stakeholders such as the other concerned government officials. The plan should be delivered at least to the national directorate level of all ministries and suco level of Dili and Liquica municipalities. Officials at the suco level should cooperate in informing the municipalities and MPSI in case they find problematic land use which does not comply with the future land use map in their sucos.

(3) Urban Development Management

1) Update of database

Urbanization is progressing in DMA; and demography, economy, and development in DMA are dynamic. It is important for MPSI to capture the change, grasp the current

situation, and reflect it to the implementation of the master plan and revision of the master plan. MPSI should keep collecting information for updating the database.

2) Internal training for MPSI staff

MPSI should prepare internal training program for capacity development of MPSI staff. Internal trainings have merit to meet the needs of the target officials. Sharing experience of senior officials with junior officials in lecture style is a good way of capacity development for both senior officials and junior officials. Reporting of external trainings and seminars among the MPSI is important. This internal training should be encouraged, because it can be conducted by making full use of internal resources.

(4) Arrangements for Implementation of Urban Development Projects

To implement the proposed projects in this master plan, internal arrangements, such as preparation of application letters, project brief, and approval by other concerned government organizations, are necessary. For international projects, some other arrangements such as preparation of formal request to the concerned donors are necessary. The coordination board as mentioned in (1) should monitor the progress of the arrangements and find solutions to remove bottlenecks in the arrangements.

Table 14.4.1 Action Plan Implemented by MPSI

No.	Activity	Number of Months												Execution Agency
		1	2	3	4	5	6	7	8	9	10	11	12	
1	**Establishment and Operation of Coordination Board**	Establishment	Board Meeting			Board Meeting	Operation		Board Meeting			Board Meeting		MPSI
2	**Publicity and Communication**													
(1)	Holding public meetings for explanation of the master plan			Public Meeting						Public Meeting				MPSI
(2)	Distribution of the master plan to the concerned stakeholders													MPSI
3	**Urban Development Management**													
(1)	Update of database						Periodical update (monthly)							MPSI
(2)	Internal training for DNHPU staff						Periodical training (lecture, workshop, discussion)							MPSI
4	Arrangements for Implementation of Urban Development Projects													Concerned Exectution Agency for Priority Projects, MPSI, MOF

Source: JICA Project Team

CHAPTER 15 : CONCLUSION AND RECOMMENDATION

15.1 Conclusion

The Dili Urban Master Plan covers the development vision, structure plan, land use plan, transport development plan, infrastructure development plan, urban management plan, and action plan. Through the process of the master plan formulation, a series of working group meetings and public consultation meetings were conducted. The following are the main points of the Dili Urban Master Plan.

Vision: DMA vision 2030, i.e., “Beloved and Brilliant National Capital”, supported by four pillars, namely: “Robust Economic Hub”, “High Quality of Life”, “Rich Social and Cultural Center”, and “Healthy and Eco-friendly Society”, was proposed. To form the four pillars, four viewpoints, namely: “Linkage”, “Human Resources”, “Sustainability”, and “Resilience” are to be addressed.

Urban Structure: The concept of “Urban Cluster Growth” development with 450,000-550,000 population is expected through moderate utilization of land within habitable lands to formulate main urban center and satellite town developments in Hera and Tibar. Dili would play the national center role in leading political, administrative, business-commercial, and national level of urban services such as national health center and national cultural center, while Hera and Tibar would play satellite town roles in serving each core urban function of university in Hera and industrial zone in Tibar enabling them to formulate self-sustaining city.

Land Use: Land use policies including “Establishing Compact Urban Form with Optimum Dense Settlement” and “Strengthening Resilient Land Use by Protection of Sensitive Areas” are set and defined as implementable framework for land use planning involving several essential planning measures such as “density formulation”, “use classification”, and “use distribution”.

Transport Development Plan: Transport development plan covers road and transportation plan including road network improvement and promotion of mass transit; seaport sector plan including future development of Dili Port and waterfront redevelopment of coastal area; and airport sector plan including the development of Presidente Nicolau Lobato International Airport (PNLIA) as “safe and comfortable airport”.

Urban Infrastructure Development Plan: Infrastructure development plan covers disaster management, water supply, sewerage and drainage, solid waste management, power supply,

and telecommunications. The plan contributes to the pillars of DMA Vision 2030 such as "Robust Economic Hub", "High Quality of Life", and "Healthy and Eco-friendly Society".

Urban Management Plan: Both the counterparts and the JICA Project Team (JPT) developed urban management plan for the efficient implementation of the Dili Urban Master Plan. Urban management plan addresses institutional arrangement, organizational development, human resources development, and database management. Among them, establishment of the coordination board is key to improve spatial management coordination.

Priority Projects: Both the counterparts and JPT identified 19 priority projects as the projects to be urgently implemented among the 39 proposed projects. The priority projects include both construction projects and soft components such as capacity development.

Action Plan: Two types of action plans, namely, i) action plan for priority project implementation and ii) action plan to be implemented by MPSI, are formulated. The action plan shows necessary projects or activities to be implemented by 2020, and the executing agency for each activity and project.

JPT has transferred the technology on six themes, namely: land use, urban management, socio-economy, road and public transportation, infrastructure, and environment, to the counterparts through daily discussions, working group meetings, and stakeholder meetings to formulate the master plan.

15.2 Recommendation

It is recommended that the Government of Timor Leste (GoTL) implement the Dili Urban Master Plan to achieve DMA Vision 2030, i.e., "Beloved and Brilliant National Capital". In order to ensure the smooth implementation of the master plan, the following recommendations are prepared:

(1) Formation of Urban Cluster in DMA

Densification in Dili has been progressing to date, and the flow of people and goods has been concentrated toward Dili. As population and population density increase, the living environment and environmental loads to the natural environment are getting worse. To avoid this, formation of main urban center and satellite towns in Hera and Tibar should be promoted. To form this structure, new port development in Tibar and relocation of the Universidade Nacional Timor Lorosa'e (UNTL) campus to Hera are major prerequisites. The GoTL should continue ongoing efforts on these developments in Tibar and Hera.

(2) Implementation of Priority Projects

Implementation of priority projects covering urban development management, road and public transportation, seaport, airport, disaster management, water supply, sewerage and drainage, solid waste management, power supply, and telecommunication is the important initial step to achieve DMA Vision 2030. The executing agencies of GoTL for each proposed priority project should take initiatives to implement the priority projects. Feasibility study including economic/financial evaluation, environmental impact assessment, should be duly conducted for the projects implementation.

(3) Environmental and Social Consideration

When the above measures are taken, the negative impacts on the natural and social environment are expected. To minimize the negative impacts, the GoTL should undertake the mitigation measures on solid waste management, water quality control, air pollution control, resettlement, and land use management, among others.

(4) Establishment and Operation of Coordination Board

The GoTL should establish a coordination board which manages the master plan, and monitors and evaluates the proposed projects. This board plays an important role during the implementation stage.

(5) Strengthening of Urban Development Management

For efficient implementation of the Dili Urban Master Plan, including realizing the structure plan, land use plan, and infrastructure development plan, urban development management has to be strengthened. Urban development management includes institutional arrangement, human resources development, and database management plan. In the development control measures of institutional arrangement, ensuring consistency between future land use plan and development plan is critical.

- Institutional arrangement for urban development management is composed of (i) development control measures such as land development permit and building permit, and (ii) development promotion measures such as urban development project, policy on housing development, and land management and infrastructure development to guide development in Hera and Tibar.

- Human resources development is proposed to accommodate tasks required for establishing urban management and targeting concerned organizations including central government organization, local government organization, and coordination agency (to be established).

- Database management plan is utilized for land use control and infrastructure development.

(6) Implementation of the Master Plan

MPSI is responsible for the implementation of the master plan, including establishment of the coordination board, publicity and communication, urban development management and arrangements for implementation of urban development projects.