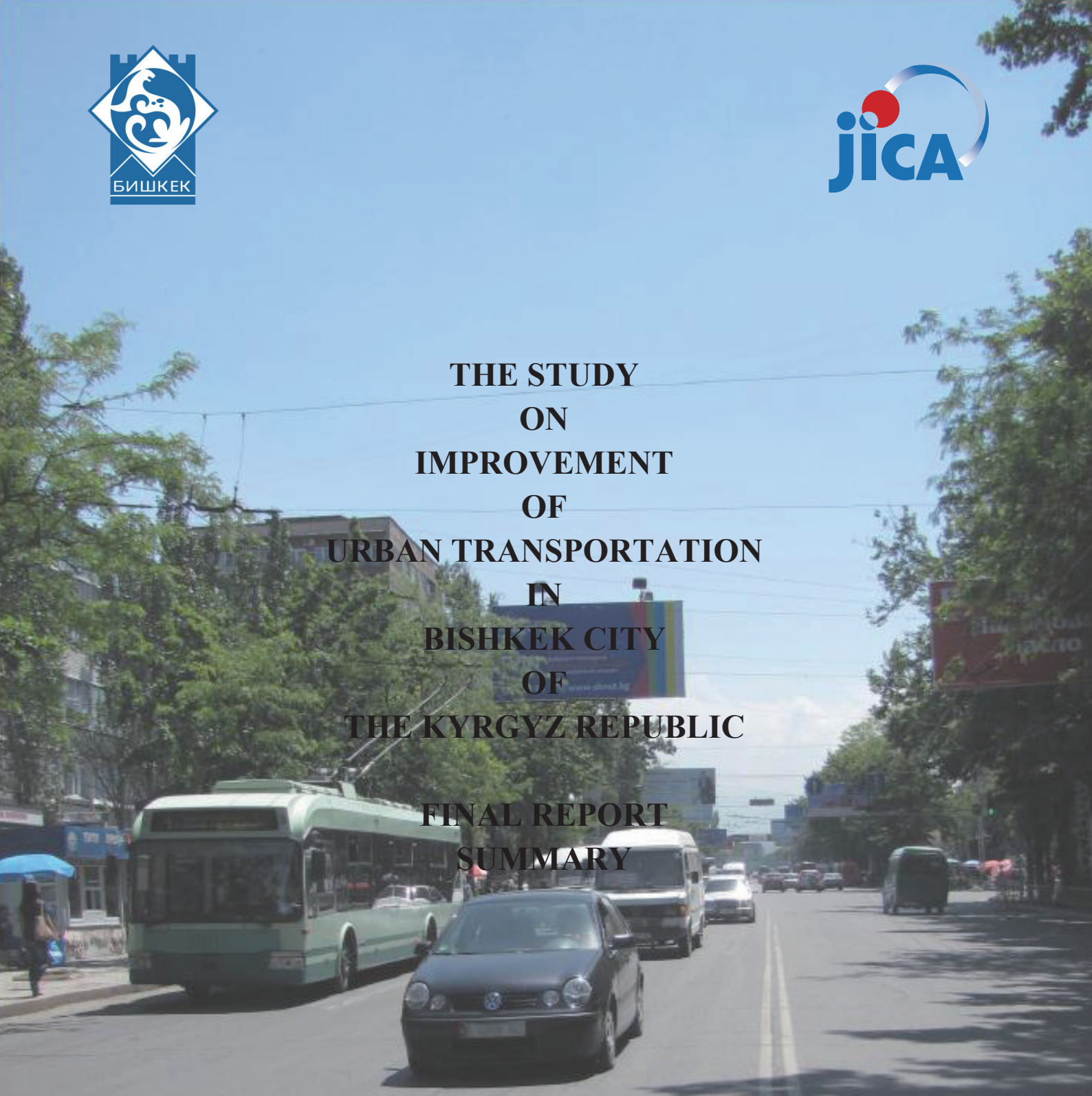

THE STUDY ON IMPROVEMENT OF URBAN TRANSPORTATION IN BISHKEK CITY OF THE KYRGYZ REPUBLIC

FINAL REPORT SUMMARY

OCTOBER 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

KATAHIRA & ENGINEERS INTERNATIONAL

RECS INTERNATIONAL INC.

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THE STUDY
ON
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OF
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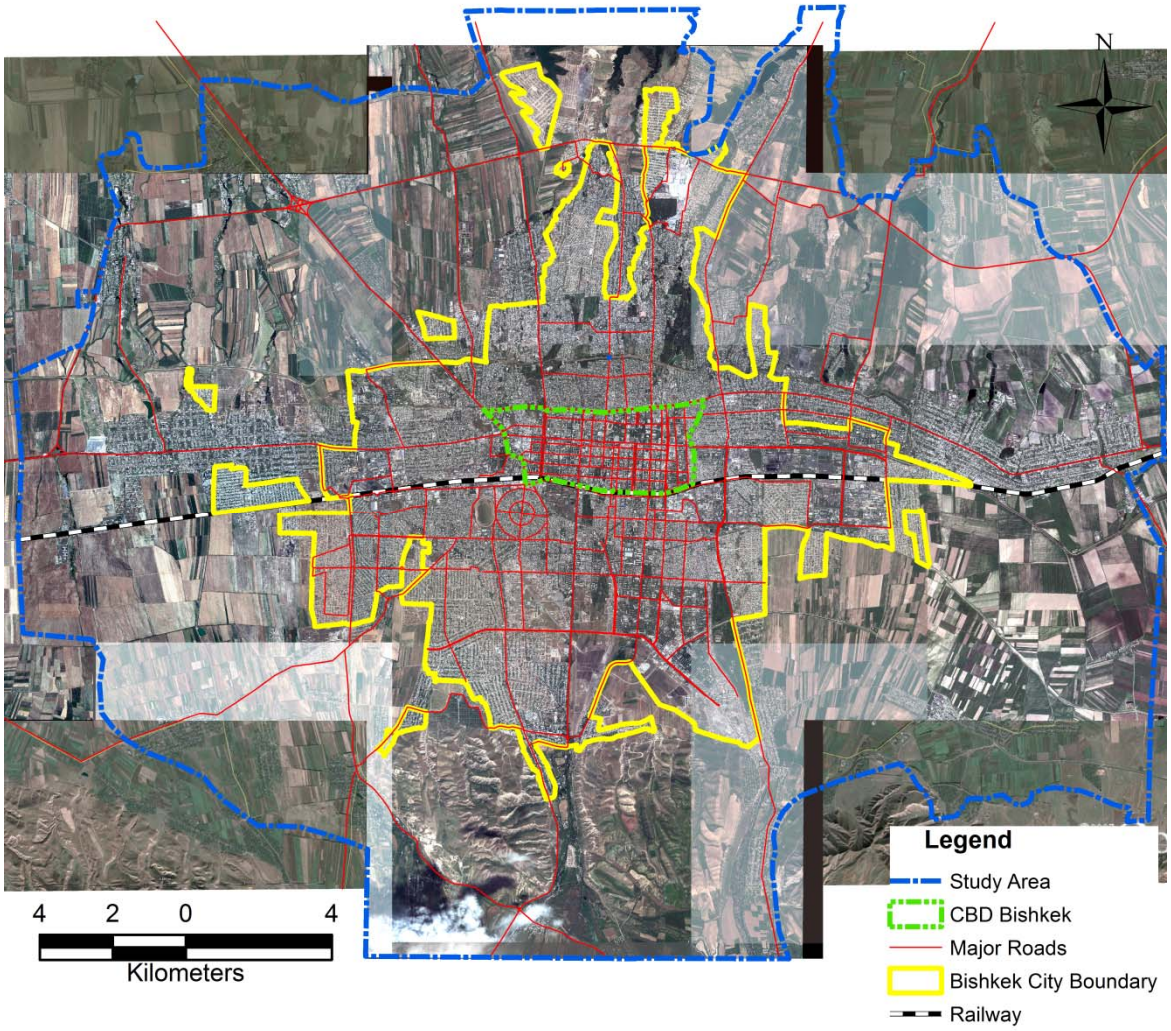
Exchange rate used in this Report

USD 1	=	SOMS	48.29
USD 1	=	JPY	97.84
SOMS 1	=	JPY	2.029

(As of May, 2013)

Central Asia

Kyrgyzstan



Bishkek City

LOCATION MAP

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Abbreviation

AC	Asphalt Concrete
ADB	Asian Development Bank
ATC	Area Traffic Control
BCCD	Bishkek Capital Construction Department
BCDA	Bishkek City Development Agency
BCDS	Bishkek City Development Concept
BCMDA	Bishkek City Main Department of Architecture
BOD_5	Five-day biochemical oxygen demand
BPTE	Bishkek Public Transportation Enterprise
BSDS	Bishkek City Sustainable Development Strategy
BTD	Bishkek Trolleybus Department
CAGR	Compound Annual Growth Rate
CBD	Central Business District
CC	Cement Concrete
CCTV	Closed-circuit Television
CHS	Central Heating Station
CIS	Commonwealth Independence States
CL	Cordon Line
CO	Carbon Oxide
D/D	Detail Design
DEM	Digital Elevation Model
DFI	Direct Foreign Investment Fund
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EST	Environmentally
EV	Electric Vehicle
F/S	Feasibility Study
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GIS	Geographic Information System
GKR	Government of Kyrgyz Republic
GRP	Gross Regional Product
HRD	Human Resource Development
HCOH	Hydroxyl Methylene
HIS	Home Interview Survey

HOA	Home Owners Associations
HV	Hybrid Vehicle
IC/R	Inception Report
ICT	Information Communication & Technology
IRI	International Roughness Index
IEE	Initial Environmental Examination
I/M	Inspection and Maintenance
IMF	International Monetary Fund
I/P	Implementation Program
IS	Intersection
ITC	Information Technology and Communication
ITS	Intelligent Transport System
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
LOS	Level of Service
LTA	Local Territorial Area
MP	Master Plan
MAC	Maximum Allowable Concentrations
MDG	Millennium Development Goal
MOF	Ministry of Finance
MOTC	Ministry of Transportation and Communication
MTA	Municipal Territorial Administrations
NMT	Non-Motorized Transport
NSDS	National Sustainable Development Strategy
NGO	Non-Governmental Organization
NH_3	Tri Hydrogen Nitride
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
OECD	Organization for Economic Co-operation and Development
OD	Origin-Destination
PA	Specially Protected Area
PCU	Passenger Car Unit
PK	Parking
PM	Particulate Matters
PPP	Public and Private Partnership
PR	Public Relation
PTI	Public Transportation Improvement

RAP	Resettlement Action Plan
RCCP	Rolled Compacted Cement Pavement
RCP	Renovated capital Program
RD	Record of Discussion
SC	Steering Committee
SME	Small and Medium Enterprise
SEA	Strategic Environmental Assessment
SL	Screen Line
SNIP	Kyrgyz Technical Standards and Regulations
SO_2	Sulfur Dioxide
SRTM	Shuttle Rader Topography Mission
TCS	Traffic Control System Improvement
TDM	Traffic Demand Management
TFC	Traffic Flow Improvement
TOD	Transit Oriented Development
TOR	Terms of References
TRACECA	Transport Corridor Europe – Caucasus – Asia
UNFCCC	United Nations Framework Convention on Climate Change
UPA	Urban Promotion Area
UTD	Urban Transportation Department
VCR	Vehicle per Road Capacity Ratio
VIMS	Vertical Index Measurement System
VOC	Volatile Organic Compound
WB	World Bank
WG	Working Group
WHO	World Health Organization
WTO	World Trade Organization
WWII	World War – II

EXECUTIVE SUMMARY

1. Purpose and Scope of the Study

The study aims to formulate a Master Plan (MP) with a target year of 2023, which is ten years henceforth, limiting the scope to devise plans as follows:

・a public transport plan

・a traffic control system improvement plan

・a traffic flow improvement plan

Additionally, it tackles short and medium-term challenges for which actions need to be taken immediately. Through the study, it was found that car parking was a serious problem. Hence, the MP included a parking improvement plan to examine transportation improvement comprehensively.

Japan International Cooperation Agency (JICA) dispatched a study team (JICA Study Team) formed by Katahira and Engineers International (KEI), Tokyo, Japan as lead consultant, in joint venture with RECS International, Tokyo, Japan. The study began in July 2011 and was completed in October 2013. The study objectives are summarized as follows:

(a) To formulate a simple[1] urban traffic MP of Bishkek with the target year of 2023.

(b) To implement technical transfer for enhancing the executing structure and capacity development related to urban traffic in the city.

2. Study Approach and Outcomes

2.1 Scientific Approach

The study is considered as the first MP of Bishkek City based on a scientific survey and approach. It differs significantly from conventional surveys in three aspects:

・Scientific survey and approach

・Demonstration by social experiment

・Human resource development

With the traffic, land use and population surveys, the study was able to obtain and analyze current detailed geographic situations and measure traffic data as original data. This type of scientific survey and approach is new to Bishkek City and to the country itself.

The traffic survey included a person/trip survey of approximately 4,000 sample home interviews (representing 1.7% of total population), roadside traffic surveys to obtain traffic conditions covering all

[1] The target area is limited originally to the three sectors and the target year is set as 2023, 10 years from now, and short- and mid-term challenges on which action needs to be taken urgently are tackled. The land use is the current city structure in principle.

city urban areas and these data were compiled in the Origin and Destination Table (OD Table) showing traffic circumstances in Bishkek City. In addition, the following detailed surveys were conducted:

- a public transportation with onboard survey,
- bus stop-facilities survey,
- passengers and drivers interview survey,
- parking demands and supply capacity survey,
- based parking survey,
- parking facility survey,
- an on-road (curb) parking survey, and a parking user survey,
- a survey to improve intersections with a traffic volume survey,
- a queue length and residual queue length survey,
- a signal cycle survey,
- a travel speed survey, and
- public interview survey

In the socio-economic survey, various GDP data and population statistics were analyzed. The latest satellite photographs and GIS (Geographical Information System) were used to estimate the existing land use. Estimated population distribution data were used to identify characteristics of populations in each traffic zone. City development trends and traffic in 2023 were studied, based on the population increase. A traffic analytical model applied was called a four-step estimate model, which consists of trip generation and attraction, trip distribution, modal shift, and route assignment. The results in 2013 were shown as “Do Nothing Case (DNC)”, or business as usual, with traffic congestions and bottlenecks. MP proposes a transportation improvement plan after evaluating alternative scenarios based on public transportation, combined with other transportation improvement plans. The results were summarized in the Project Implementation Program in **Table 3**.

As a result of the studies, the existing road network capacity is affordable notwithstanding traffic congestions that occur at different critical areas. It was found that an effective traffic program can be accomplished with proper planning and funding albeit the city budget constraints. The study finds that the present urban planning and public transportation policy seem competent. Since traffic congestions and bottlenecks are set to happen across the city due to traffic volume increase in the near future, preventive measures have to be taken to avoid serious repercussions. It is necessary to take the MP as a comprehensive transport and urban development approach that will work towards easing of traffic bottlenecks, efficient use of traffic network, town preservation and efficient utilization of road, and promotion of Low Carbon and Environmentally Sustainable Transport (EST), considering development as a "Compact City" concept.

2.2 Demonstration through Pilot Projects

The study conducted pilot projects as social experiments as follows:

・Utilization of pedestrian mall method

・Smooth traffic flow by intersection improvement

・traffic signal improvement

・bus stop facility improvement

These experiments achieved the desired results providing innovative ideas under extreme city budget constraints. In particular, the pedestrian mall method was appreciated by the citizenry. This method was learnt and utilized to promote education as initialized by the former president. The details of pilot projects are shown below.

No.	Pilot Project	Project Site	Implementation Schedule
1	Traffic Flow Improvement (I)	Chui-Fuchika intersection	Sep.-Oct. 2011
2	Traffic Flow Improvement (II)	Chui-Fuchika Intersection	Jan.-Oct. 2012
3	Traffic Control System	Chui-Fuchika Siaopina Intersection	Aug.-Oct. 2012
4	Public Transport Facility Improvement	Chui-Fuchika Intersection / Chui Avenue	Jan.- Oct. 2012
5	Pedestrian Mall	Kiyevskaya Street, Bishkek City	Sep. 16, 2012

2.3 Outcome of Human Resources Development Training by BCDA and in Japan

The scientific approach and pilot projects described above were utilized for human resources development. Various programs were provided by BCDA for human resources development and for the organizational competence improvement of BCDA and public employees. BCDA and the city government experienced the Pedestrian Mall method in planning, implementation and evaluation stages. The improvement in competence was remarkable. Utilization of the methods and continuous GIS trainings are expected as JICA has provided software and hardware. Training in Japan was provided in two sessions. The trainees learned advanced examples and Japan's city development strategies. This led to the decision to introduce compact city development, bus location system and bus-only (exclusive) lanes. The implementation of the Pedestrian Mall method was also one of the outcomes of the training.

2.4 Conclusion of the Study

The study concluded as follows:

(i) Albeit financial constraints, Bishkek city can avoid traffic congestions by investing within the time frame as proposed in the MP. Otherwise, the congestions could paralyze the entire city functions in the future.

(ii) It is important to implement small-scale projects and social experiments proposed herein, conduct various surveys for the future projects, utilizing the time before the traffic problems become serious.

3. Generation of Master Plan Components and Alternatives

3.1 Approach

The study results show that the traffic volume in road networks will be 1.0 or less than traffic mandate forecast for as far as 2023. However, local and limited traffic congestions occur during certain time periods -- particularly during peak hours. At specific locations, bottleneck situations occur. Due to roadside conditions, it is difficult to improve the traffic volume by Road Development approach to road widening and elevated intersections because they require new spans of land to expand the right of way.

In general, the road congestion and bottleneck situations are caused by various factors. Transport planning has to consider multiple mechanisms for solutions. The study has to limit its aims or objectives at the specific road and intersections to:

・reduce traffic congestion and

・eliminate traffic flow bottlenecks

Under these conditions, the MP will consider solutions as promoting use of public transportation and traffic management in order to reduce the traffic demands and vehicular trips. As solutions for "supply side" to improve the impeding factors to reduce road traffic volumes should be considered, including repair of damaged roads and conservation of road pavements and transportation facilities, remove of bottleneck situations at intersections, control of illegal road-side parking, and so on.

As shown in **Figure 1**, the MP will formulate alternative scenarios with feasible mechanisms within the time frame and financial capabilities of the City.

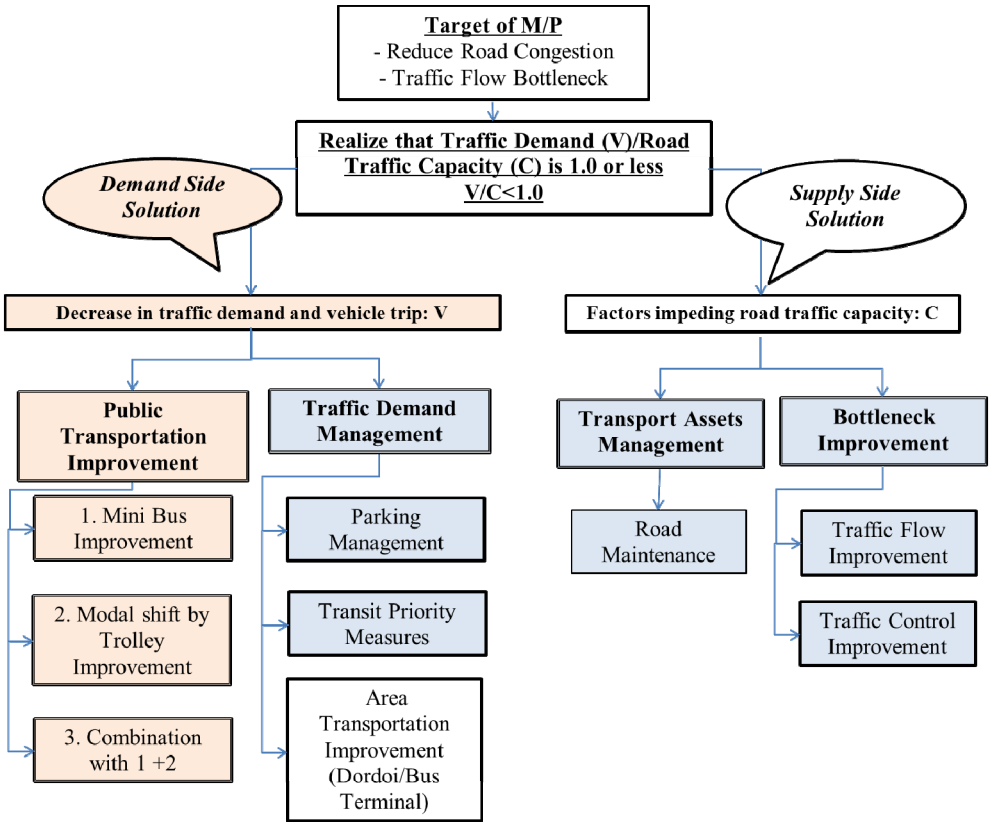


Figure 1 Approach to Generation of Master Plan Components and Alternatives

3.2 Basic Traffic Conditions (Do-Nothing Case)

Table 1 illustrates trip share by mode in 2013. Of the person trips (PT), passenger cars account for 87 percent of the total number of vehicles when the PT rate is 25 percent. Based on the PT and the number of passenger cars, transportation by passenger cars seems inefficient. The PT rate of minibus utilizations is high at 42 percent and accounts for 98 percent of public transportation by vehicle mode. This shows that vehicle congestion is mainly caused by passenger cars. The trolleybus accounts for only three percent of the PT and is below one percent of the number of vehicles. Thus, reduction of the number of trips on passenger cars and alternatively using public transportation were studied. As regards public transportation, since the minibus causes traffic congestions at bus stops and on specified roads (overlapping routes), regulating minibus operations need to be taken.

Table 1 Trip Share by Mode in 2013 (Do-nothing)

Mode	Passenger / Vehicle	Person trip/day (Bishkek City Zone 1-61)			Vehicle trip/day (All Zones 1-98)	
	Passenger	Trip No.	Share	PT Share	Trip No.	(%)
1. Trolleybus	28.2	72,181	3.2%	7.0%	3,194	0.3%
2. Midibus	27	27,750	1.2%	2.6%	8,619	0.9%
3. Minibus	17	934,832	42.0%	90.4%	94,119	9.8%
Total (Public Transport: PT)			46.5%	100.0%		
4. Truck	1.3	3,171	0.1%	-	12,966	1.4%

Mode	Passenger / Vehicle	Person trip/day (Bishkek City Zone 1-61)			Vehicle trip/day (All Zones 1-98)	
	Passenger	Trip No.	Share	PT Share	Trip No.	(%)
5. Passenger Car	1.5	560,234	25.2%	-	839,550	87.6%
6. Walk	-	629,316	28.3%	-		
Total			100.0%	-	958,448	100.0%

Source : JICA Study Team

3.3 Alterative Scenarios

- Scenario 1 is a basic strategy and alternative scenario, a modal shift from passenger car utilization to public transport utilization. Initially, the minibuses operated by private companies must be changed to larger ones, which will reduce the number of vehicles and trips, hence mitigating congestion on the minibus routes. It will entail a big slice of the city's budget and much time until full-scale operations utilizing new trolleybuses can come into consideration. Additionally, the minibus currently overloads or takes passengers way over allowable passenger numbers. Some passengers are forced to stand. Increasing the size of buses would contribute to better service and passenger safety. In Scenario 1, the city government only needs to set regulations and additional expenditure is unnecessary.

- Scenario 2 is set to improve the operational efficiency of new trolleybuses by repairs and extension of its operational routes. A modal shift from passenger cars to trolleybus is to be encouraged. Factors include review of distance between bus stops, punctual operation with use of timetable, an information system or schedule of buses and a park-and-ride scheme. The use of passenger cars will be limited with a control on parking lots, zonal and road spaces - based on time - need to be established. It is necessary to consult with citizens if the passenger car controls will be introduced for the purpose of improvement of public transportation and services. The city government should decide whether to encourage to use them with the proper guidance, or regulate them forcibly, or both.

- Scenario 3: If the trolleybus operation improves and the control on passenger car utilization is implemented, an integrated operation management of public transportation will be needed. It is necessary to underline the functions and roles of each mode, to establish an integrated management organization, to create a fare system with common IC card under the organization, and to guarantee the convenience of bus transfers in terms of improvement of service for users. **Table 2** shows a summary of alterative scenarios in consideration of the issues described above.

Table 2 Summary of Alterative Scenarios

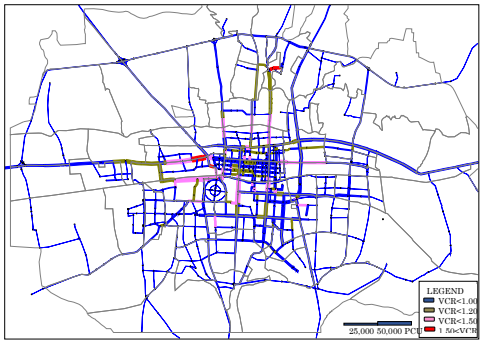
Scenario	Objective	Measures	Effects
Scenario 0	Do-nothing	No	As usual
Scenario 1	Using high occupancy bus for small minibus	25% of small minibus trip share to big ones	Reduce the number of minibus trips
Scenario 2	Modal shift to	10% in vehicle trip share of trolleybus	Increase trolleybus users

Scenario	Objective	Measures	Effects
	trolleybus	10% reduction of passenger car trip	Decrease the number of car use along transit corridor
Scenario 3	Scenario 1 + Scenario 2	Combination of Scenario 1 and 2 ・Measures to improve services ・Establishment of integrated management organization ・IC card introduction, etc.	Combination of effects of Scenario 1 and 2 ・Improvement of convenience ・Increase in users ・Improvement of profitability

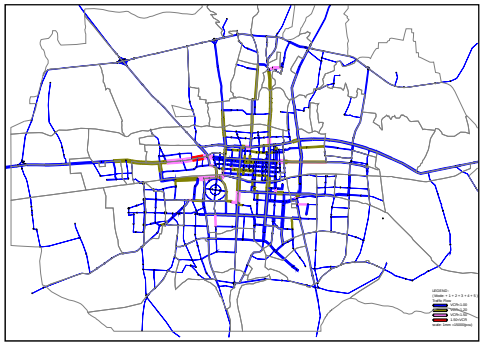
Source: JICA Study Team

1.1 Impacts of Scenarios

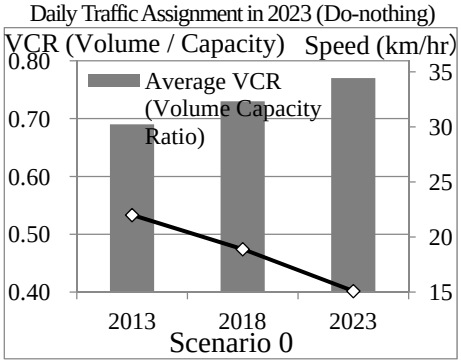
The individual impact of each of the three scenarios above are shown in comparison with daily traffic volume in the "Do-nothing" case in 2023, and peak-time congestion rate and speed. It shows reduction of congestion in road networks. The congestion rate will improve from 0.77 to 0.70 and average speed will improve from 15.1 to 20.4 km/hr. It is therefore necessary to further promote the utilization of public transportation and the modal shifts.



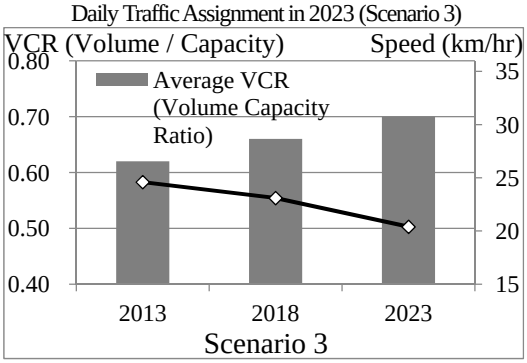
Daily Traffic Assignment in 2023 (Do-nothing)



Daily Traffic Assignment in 2023 (Scenario 3)



VCR and Travel Speed (Peak) in 2023 (Do-nothing)



VCR and Travel Speed (Peak) in 2023 (Scenario 3)

2. Project Implementation Plan

The project implementation period is divided as shown below in consideration of the priority order and budget constraints of the city government[2].

[2] 7.7 million USD is required (8% of 135 million USD of the total budget in 2013).

Table 3 Implementation Program

Unit: million USD

Priority	Project (Project type)	Cost	Urgent	Short	Mid.
			2014-6	2017-9	2020-23
1	3. High occupancy vehicle for minibus: (private)	-	0.0		
2	1. Enhancement of road maintenance and improvement capacity: (equipment procurement + technical assistance (TA))	10.0	10.0		
2	24. Pedestrian mall for vitalization of town economy: (private)	-	0.0		
2	30. Eco-car promotion: (pilot project (PP))	1.0	1.0		
5	31. Pedestrian way rehabilitation: (FS + PP)	1.0	1.0		
6	34. "No car day for commuting" program: (PP)	0.1	0.1		
7	15. East and west bus terminal improvement: (FS + PP)	1.0	1.0		
7	36. Capacity Development of BCDA: (technical assistance (TA))	1.0	1.0		
9	10. Public transport priority system: (FS + PP)	1.0	1.0		
9	11. Bus lane for peak hour: (FS + PP)	0.8	0.8		
11	4. Roadside management for bus stops with tax and car parking (PP + TA)	0.5	0.5		
11	16. Traffic flow improvement at bottleneck intersection: (design (DD) + construction (CW))	15.0	5.0	5.0	5.0
11	17. Traffic signal control improvement: (DD + CW)	15.0	3.0	12.0	
14	12. Bus priority signal installation: (FS + PP)	0.8	0.8		
14	26. Pilot Project for transit corridors improvement: (FS + PP)	1.0		1.0	
14	28. Police community post for tourism promotion: (PP)	0.1		0.1	
14	33. Driving manner improvement program: (PP + traffic police human resources development (HRD))	0.1		0.1	
14	35. Staggered office hours campaign: (PP)	0.1		0.1	
19	6. Bus route network reformation: (PP + TA)	0.3		0.3	
19	7. BRT introduction plan: (PP + TA)	0.5		0.5	
21	13. Bus operation monitoring system: (FS)	0.8		0.8	
21	14. Bus approach information system: (FS + PP)	1.0		1.0	
21	25. Introduction of area traffic management at Dordoi market: (FS + PP)	2.0		2.0	
24	22. Parking information system (PPP): (FS + PP)	1.0			1.0
25	2. Local Road and Pavement Improvement in the Poor Area: (DD + CW)	15.0			15.0
25	23. Promotion of parking and ride (PPP): (FS + PP)	1.0			1.0
25	27. Urban Section of Bishkek-Osh Road improvement (national budget)*: (FS + CW)	(50.0)			(50.0)
25	32. Traffic safety promotion for accident reduction program: (PP + HRD)	1.0			1.0
29	8. ICT ticket for trolleybus (on-going with EBRD)	1.0		1.0	
29	9. ICT ticket for all transit modes: (FS + PP)	1.0		1.0	
31	5. Public transportation management and service improvement: (FS + PP)	0.9		0.9	
31	29. Introduction of bicycle lane for NMT promotion: (PP)	0.2			0.2
33	19. Introduction of parking fee payment card (PPP): (FS + PP)	1.0			1.0
33	21. Parking facility construction (PPP by ADB): (FS)	0.6			0.6
35	18. Illegal parking control at specific areas: (FS + PP)	0.8			0.8
35	20. Integrated parking law and management: (PP)	0.3			0.3
	Total Cost	**76.9**	**25.2**	**25.8**	**25.9**

Note : * The MPWT is in charge of the project for the zone outside Bishkek area. However, the national budget (NB) that is included as it is in the affected area is not included in the total cost of the city budget.

: City revenue increase project

Source : JICA Study Team.

3. Recommendations

Recommendations for Bishkek City

(a) The city government should approve the MP and implement it according to as implementation program.

(b) The city government should organize the utilization of Pedestrian Mall method as there is popular demand from citizens.

(c) The city government should establish an integrated management organization for all public transportation modes.

(d) The city government should introduce funding schemes to involve the private sector in public transport operation.

(e) The city government should establish a new public parking management authority to alleviate the issue of parking.

(f) The city government should promote Compact City and future Smart City concepts as its vision, aiming to develop a Low-Carbon City.

Recommendation of enhancement of BCDA functions

(a) BCDA should improve the functions in planning and implement a city or urban planning and a transportation planning.

(b) BCDA should enhance the coordinating function with the donors and the private investors.

(c) BCDA should independently assume the responsibility for new mandate (i.e. Public-Private Partnership), in which other city departments or agencies will not be involved.

(d) BCDA should improve education and training functions for technical competence of the City staff.

Recommendation of continuation and extension of the social experiments and pilot projects

(a) Development of Pedestrian Mall scheme for the vitalization of the City center and tourism promotion

(b) Expansion of intersection improvement in consideration of traffic safety of pedestrians and universal design

(c) Expansion of outcomes of traffic light improvement

(d) Expansion of outcomes of bus-stop improvement

Urgent policy recommendation for aid or support agencies

(a) Aid or support agencies should establish and promote results, or aid assets, from past technical cooperation.

(b) Government and aid or support agencies should recognize the strategic importance of Urban Development.

(c) Government and aid or support agencies should recognize the importance of technical assistance and ensure continuity.

(d) Government and aid or support agencies should exchange views on aid policies and strategies in urban transport and city development.

Recommendations for urgent action

(a) The city government should act to implement urgent projects based on the MP.

(b) The city government should act to implement the projects that expect to increase city revenues, by utilizing the private sector.

(c) The city government should act to implement the capacity improvement of BCDA including the PPP as city think-tank.

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

Bishkek is the capital of the Kyrgyz Republic. It has approximately 0.87 million inhabitants. The number of vehicle registrations exceeds 150 thousands. Currently, Bishkek City is suffering badly from traffic congestions, traffic accidents (3,767 cases in January to November 2010), and air pollution caused by vehicle emission gas. The city trunk roads are still in good conditions at present. Traffic volume on the roads, however, has increased dramatically in recent years. A traffic control system introduced in the era of former Soviet Union's is still working but it's performance is low. Because of outdated facilities, the operation of existing traffic signals is inappropriate to control the current traffic volumes and traffic flows. It is anticipated that current capacity of road network cannot accommodate the increased traffic volume in the very near future. This will cause to worsen traffic congestions and traffic safety, in particular, at bottlenecks intersection. These problems are getting serious in the City Center.

Without the traffic survey since 1970s in Bishkek, the City was not able to prepare a long-term transportation improvement plan based on the engineering data; the plan of countermeasures were also not prioritized. The City, hence, planned to carry out the study of urban transportation conditions including the present and future traffic demands, and in particular, the public transportation capacity, with the rapid increase in the population and vehicles for an urban transport improvement strategy and plan.

In order to prepare the strategy and plan, the City requested to the Government of Japan for the technical cooperation for the "Study for Comprehensive Urban Transport Master Plan in Bishkek". The aims were to prepare an urban transportation master plan to meet the future traffic demands and launch immediate countermeasures with priority among "soft" and "hard" interventions based on the master plan.

In response to the City request, Japan International Cooperation Agency (JICA) conducted a detailed planning survey from 14 February to 2nd March 2011, and agreed to revise the title from the original request to "the Study on Improvement of Urban Transportation in Bishkek City (the Study)" and concluded the Scope of Works (the S/W) with the City by the Minutes of Meeting (M/M) signed on 1st March , 2011.

This agreement defined the scope and its terms of reference (TOR) of the consultants, as urban transportation improvement in public transportation, traffic flow control and traffic flow, having the target year of the urban transportation master plan is 2023, as the short and medium term solutions. Through the initial survey of traffic conditions, the Study added the city parking improvement for its scope due to its serious conditions.

JICA dispatched a consortium of the Consultants; Katahira & Engineers International (KEI), Tokyo, Japan (as Leading Consultant) in joint venture with RECS International, Tokyo, Japan (the JICA Study Team) to carried out the study. The Study started with the explanation of Inception Report (IC/R) in July 2010 and ended in October 2013 with four month extension due to suspension for two unexpected elections.

1.2 Objectives of the Study

The objectives of the Study are to formulate an urban transport master plan of Bishkek City and to conduct technical transfer to the counterparts in the course of the Study.

1.3 Scope of the Study

The scope of the Study includes;

(a) Review and Analysis of the Current Condition

(b) Traffic and Parking Surveys

(c) Implementation of Pilot Projects

(d) Formulation of the Urban Transport Master Plan

(e) Technical / knowledge Transfer

1.4 Study Area

The Study Area covered the current administrative area of Bishkek City and the surrounding area out of the city boundary in Chui Province due to the area of "Gen Plan 2006". Local Territorial Area, LTA 14 and LTA 16, are excluded because of separated and newly developed in the north, 14 km from the City Center. Hence, the total area of the Study Area is approximately 575 square kilometer. However, traffic survey was conducted only in urban area within the current administrative boundary of the Bishkek City.

1.5 Administration Structure of the Study

(1) Responsible Organization

The Mayor's Office of Bishkek City Government assumed the overall responsibility for the administration and implementation of the Study.

(2) Steering Committee

A Steering Committee (SC), chaired by Mayor of Bishkek City Government, was established to review and discuss contents of reports at each stage of the Study.

(3) Working Group

For effective implementation of the Study, the Working Groups were established in the field of "Public Transportation Plan", "Improvement Plan of Traffic Control System", and "Improvement Plan of Traffic Flow".

The originally planned Planning Group was operated in WG as both members were the same.

1.6 Pilot Projects

The pilot projects were implemented as follows

No.	Pilot Project	Project Site	Implementation Schedule
1	Traffic Flow Improvement (I)	Chui-Fuchika intersection	Sep to Oct, 2011
2	Traffic Flow Improvement (II)	Chui-Fuchika Intersection	Jan to Oct, 2012
3	Traffic Control System	Chui-Fuchika Siaopina Intersection	August to October, 2012
4	Public Transport Facility Improvement	Chui-Fuchika Intersection / Chui Avenue	Jan to October, 2012
5	Pedestrian Mall	Kiyevskaya Street, Bishkek City	16 September, 2012

PART I : PRESENT CONDITIONS
CHAPTER 2 GENERAL CONDITIONS OF BISHKEK CITY

2.1 Natural Settings

Bishkek is situated on the northern foot of Ala-Too Mountains. As belonging to the step climate, having hot summer and cold winter. The average maximum temperature in July is around 31.7℃, while the average minimum temperature in January is around -7℃. There is a fault called Issyk-Ata running on the south end of the city's territory. **Figure 2.1-1** shows a zoning map of seismically hazardous area in Bishkek City, indicating higher risk in north and south ends of the city.

Source: Chief Architect Office of Bishkek City

Figure 2.1-1 Zoning Map of Seismically Hazardous Area in Bishkek City

2.2 Socio - Economy

According to the 2009 census results, the permanent population of Bishkek City was around 644,000 persons, 17.3 percent of the national population. Within the city, people who speak Kyrgyz Republic as a mother language were 66.2 percent, which is low as compared to the entire country. People who

speak Russian as a mother language were 26.5 percent in Bishkek City.

The national economy has rapidly shifted to a market-oriented economy immediately after independence. This has caused a decline in manufacturing industries, but helped promoting FDIs. The prime industry of Kyrgyz Republic is agriculture, which is competitive, supported by an abundance in water supply. Based on this, urban services, such as logistics, transport, and other services, have likewise shown brisk growth. In spite of political turmoil, the annual growth of GDP was over four percent in five years from 2005 to 2010. **Table 2.2-1** shows macroeconomic indices of Kyrgyz Republic.

Table 2.2-1 Major Macroeconomic Indices of Kyrgyz Republic

Year	Unit	1995	2000	2005	2010
Population	Million	4.60	4.92	5.19	5.48
GDP (nominal)	Billion SOMS	16.15	65.36	100.90	212.18
GDP (real)	Billion SOMS	16.15	21.20	25.52	31.19
Deflator	%	100.00	308.24	395.33	680.39
Real GDP Growth Rate (CAGR)	%	-	5.59	3.78	4.09
GDP (purchasing power parity)	Billion USD	4.61	6.58	8.89	12.05
Per Capita GDP (purchasing power parity)	USD	1,003.16	1,337.43	1,712.52	2,200.13

Source: World Economic Outlook, IMF (September, 2011)

As to GDP structure, agriculture accounted for 12.5 percent, while industry was 21.5 percent in the second quarter of 2011. The trade and repair sector were recorded at 15.6 percent. Liberalization of the national economy has enabled integration with the international economy. Kyrgyzstan became a member of IMF, the World Bank, and ADB in 1992, and WTO in 1998. Due to its geographical location, this has enabled Kyrgyzstan to re-export Chinese products to Central Asian countries and beyond. The trade has resulted in consistent excess of imports.

Bishkek was one of the centers of manufacturing in the former Soviet bloc which had industries of machinery, automobiles assembly, textile, furniture, meat, and others, triggered by the exodus of the munitions industry from Moscow in WWII. Most of these large-scale industries have disappeared due to the change in its economic system after the collapse of the Soviet Union. The annual growth of GRDP marked 10 percent or over after 2000, until the international economy became stagnant in 2008 due to the international financial crisis. The rapid growth of the city's economy has been led by the growth of the service sector backed by the expansion of trade and consumption. The service sector GRDP of Bishkek was equivalent to 50 percent of the service sector GDP, showing the concentration of services in the capital city. This holds true likewise with the manufacturing sector. The rate of Bishkek's food production amounts to 45 percent of the national production. As to the trade partners, 46.8 percent was to or from CIS countries. Among the goods exported from Bishkek City, gold dominated with 78.9 percent of the total value of exports. Trade has resulted in excess of imports.

CHAPTER 3 LAND USE COMPOSITION OF YEAR 2010

3.1 Urbanization

The origin of Bishkek can be traced back to a caravan rest along one of the branches of the Silk Route in the 19th century, when the Tsarist Russians settled at a garrison and built a town. The then Russian government promoted migration of Russian farmers by giving out land for cultivation around the garrison. After the establishment of the socialist regime, the government of the Soviet Union helped formulate the General Plan of Bishkek City. The plan was approved in 1975 and legally enforced until 2006. The area of the General Plan in 1975 covered most parts of the current administrative area of Bishkek City, and helped create the basic structure of the city. A new General Plan was prepared and approved in 2006. Major policies introduced in the General Plan 2006 included promotion of urbanization to the east and west directions, a new urban axis along Akhumbaev Avenue, in addition to Chuy Avenue, new public centers along the urban axes and ring roads, and the green and open space network extending to the forest parks in the north and south end of the city. **Figure 3.1-1** shows the drawing of the future land use as visualized by the General Plan 2006.

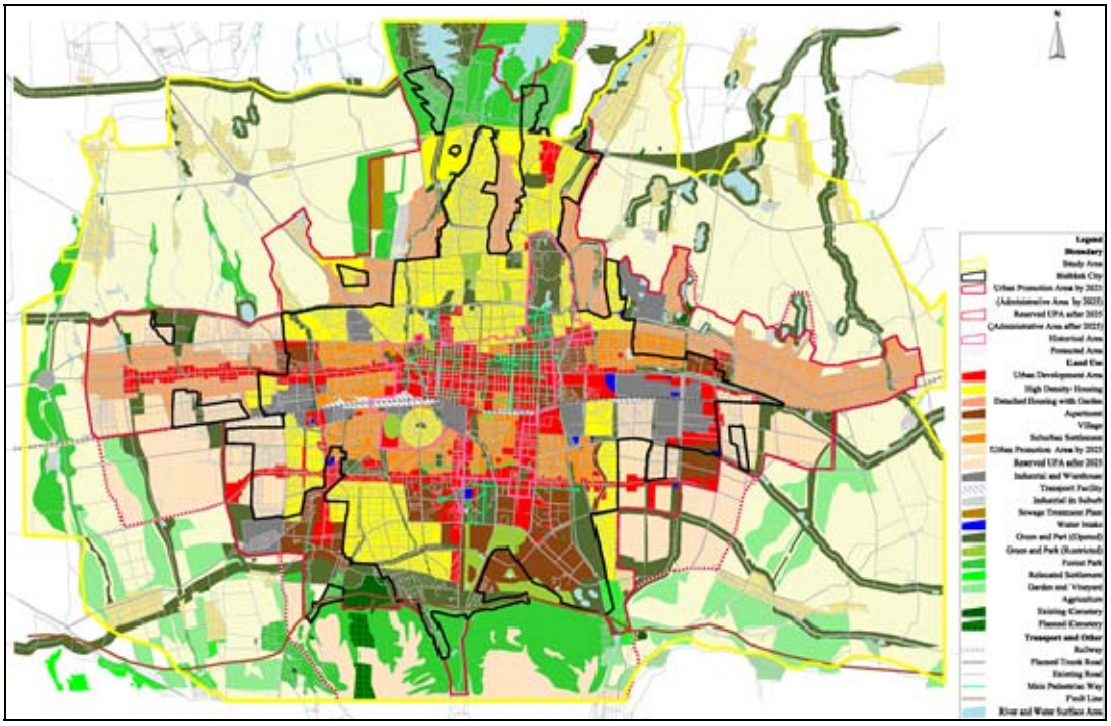
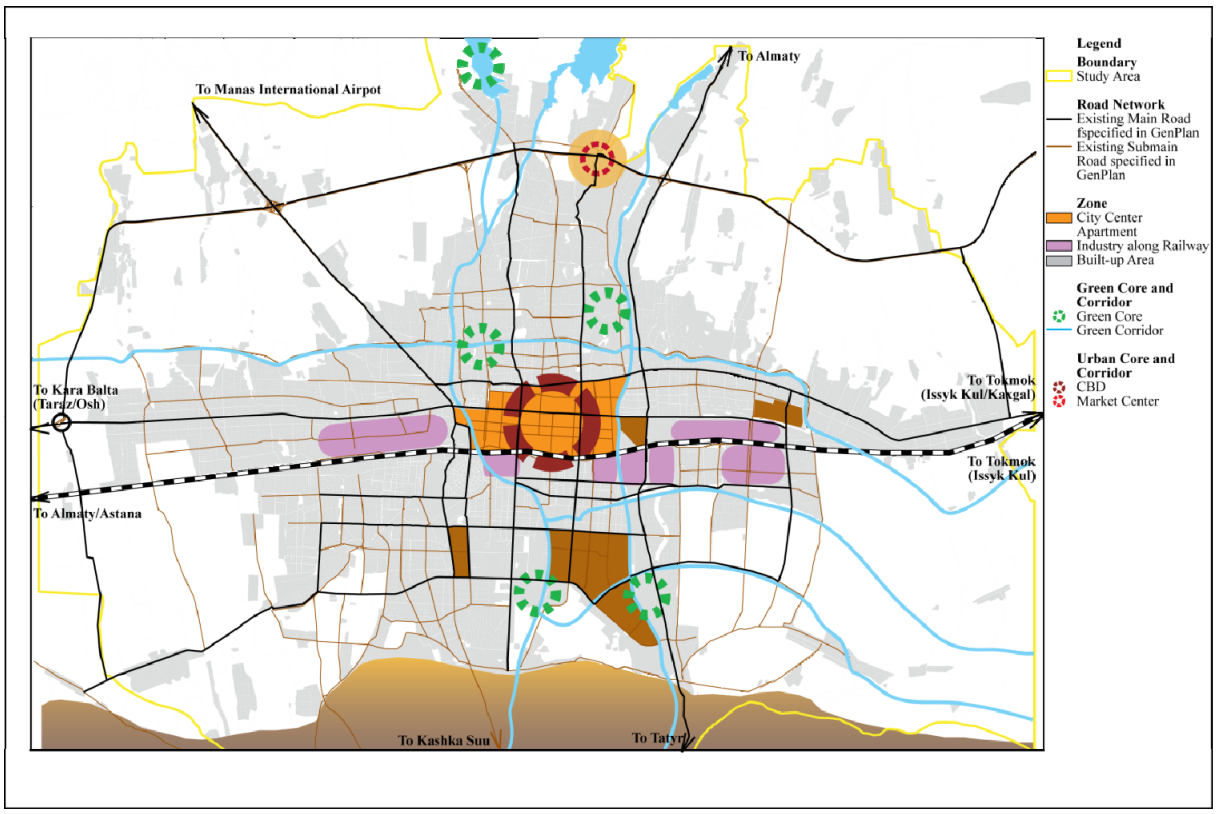


Figure 3.1-1 Future Land Use by General Plan 2006

The urban structure of the city can be represented by a large central area and the surrounding detached residential areas. The central area is formed by a grid of road networks, which makes blocks filled by medium-rise apartments with a common playground in each block. The low-rise residential area extends from the end of the city center to the outskirts along major trunk roads. There is a railway running through the middle of the city's built-up area for east-west direction, creating a transport barrier. **Figure 3.1-2** shows a conceptual drawing of the current urban structure of Bishkek City.



Source : JICA Study Team

Figure 3.1-2 Current Urban Structure of Bishkek City

3.2 Outline for Preparing Existing Land Use Map

A set of Satellite imagery was used for preparing the land use map of 2010. The employed images were obtained in the period from April 25th to August 2nd, 2010 by the WorldView-2 Satellite with 50 cm high-resolution pan-sharpen format. The mapping work was conducted based on the satellite imagery, and then modified by reflecting the results of field surveys.

The central part of Bishkek City is mostly formed by medium-rise buildings (5 to 8 stories) which are used for housing, commercial, and office purposes. On the other hand, urban sprawl areas in the suburbs are mostly made up of detached housings, although small complexes of apartments and factories can be observed in some specific areas. Taking these characteristics into account, the type of land use was identified for every plot of land in the central area based on the field survey, while the land use was defined for every block of land consisting of a group of plots and bounded by existing roads in the conurbation areas.

3.3 Result of Land Use Mapping for the Year 2000

The result of the survey and mapping works is presented in **Figure 3.3-1**. Most of the land within Bishkek City was urbanized in 2010 as 90 percent of the total land area within the city's territory was used as residential, commercial, industrial, transport, education, and other facilities purposes. The available land for

the new urbanization would be limited to a mere 1.8 percent of the city, consisting of the agricultural and vacant lands.

The share of the urbanized area in the Study Area, on the other hand, was much smaller as estimated to be 41.1 percent. The remaining parts include agricultural lands (48.1%), parks (9.0%), and rivers (1.7%) in the Study area (**Table 3.3-1**). This implies that there are plenty of spaces to be converted to urban use or for further future urbanization.

Table 3.3-1 Land Area by Land Use Category in the Study Area, 2010

No	Land Use Category	Bishkek City		Study Area		No	Land Use Category	Bishkek City		Study Area	
		ha	%	ha	%			ha	%	ha	%
1	Detached Housing	6,647	44.06	12,876	22.25	17	Forest Park	4	0.03	749	1.30
2	Low-rise Apartment (3 floors or less)	165	1.10	271	0.47	18	Garden and Vineyard	250	1.66	3,602	6.23
3	Apartment (4 floors or higher)	1,001	6.64	1,031	1.78	19	Parking Area, Gas Station, and Car Maintenance	214	1.42	233	0.40
4	Business and Administrative	191	1.27	357	0.62						
5	Commercial	382	2.53	446	0.77	20	Transport Company	122	0.81	123	0.21
6	Culture and Religious	47	0.31	48	0.08	21	Utility (Power, Gas, and Heat)	9	0.06	288	0.50
7	Institute	212	1.40	223	0.39	22	Industrial and Manufacturing	1,237	8.20	1,285	2.22
8	University and Higher Education	131	0.87	131	0.23	23	Warehouse	154	1.02	196	0.34
9	School and Kindergarten	285	1.89	408	0.70	24	Industrial in Suburb	41	0.27	1,066	1.84
10	Hospital and Public Health Service	109	0.72	111	0.19	25	Utility (Water Supply and Sanitation)	79	0.52	137	0.24
11	Military, Police, and Jail	151	1.00	164	0.28	26	River, Main Canal, and Pond	134	0.89	996	1.72
12	Railway Station, Bus Terminal, and Airport	102	0.67	177	0.31	27	Agriculture	266	1.76	27,825	48.09
13	Stadium and Gymnasium	91	0.60	94	0.16	28	Road	2,009	13.31	3,653	6.31
14	Park for Public Use	784	5.20	788	1.36	29	Railway	142	0.94	191	0.33
15	Park for Special Purpose (Restricted)	64	0.42	67	0.12	30	Unclassified	10	0.07	24	0.04
16	Cemetery	53	0.35	297	0.51		**Total**	**15,087**	**100.00**	**57,857**	**100.00**

Source : JICA Study Team

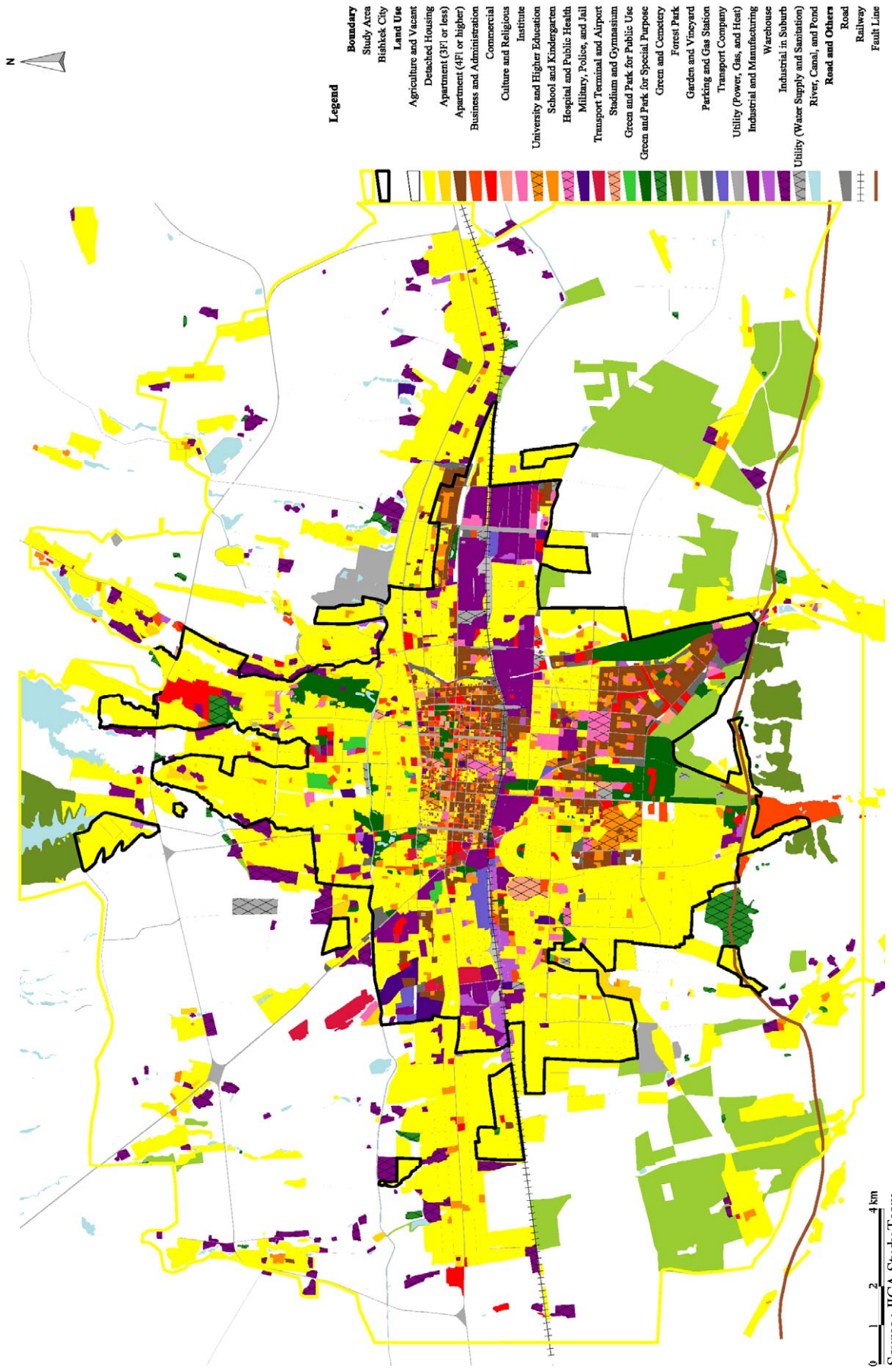


Figure 3.3-1 Land Use Map of 2010

CHAPTER 4 ESTIMATED POPULATION DISTRIBUTION OF YEAR 2010

4.1 Estimated Population Based on Land Use 2010

The population in 2010 was estimated at 1,117,800 persons in the Study area and 868,556 persons in Bishkek City respectively, based on the land use map of 2010 and associated population density analysis. The estimated population for the city area was slightly larger than that of the result of Census 2009 by four percent points. This seems reasonably accurate for further use in the work of the transport master planning, as the difference may be marginal after including the population increase from 2009 to 2010 into the census result.

4.2 Estimated Workers and Students Based on Household Interview Survey

The household interview survey (HIS) queried the employment situation and the school attendance of every family member of the 4,000 interviewed households. The results of the HIS provided useful information to estimate the number of workers by economic activity and the number of students by education level. **Table 4.2-1** shows the estimated number of workers and students in the city and the Study Area in 2010.

Table 4.2-1 Esimated Population, Workers, and Students, 2010

Item		Unit	Estimated Amount
Population		person	1,117,300
Economically Active		person	509,952
Employment		person	405,358
	Agriculture	person	2,976
	Manufacturing	person	37,648
	Service	person	364,734
Unemployment		person	104,594
	Unemployment Rate	%	20.5
Student	Grade 1~Grade 9	person	143,171
	Grade 10~Grade 11	person	38,559
	Higher	person	97,930

Source : JICA Study Team

Note : The education level consists of three groups : i) compulsory education from Grade 1 to 9 for pupils at the age from seven to 15 years old, ii) secondary education from Grade 10 to 11 for pupils of 16 and 17 years old, iii) higher education for students at 16 years old and over.

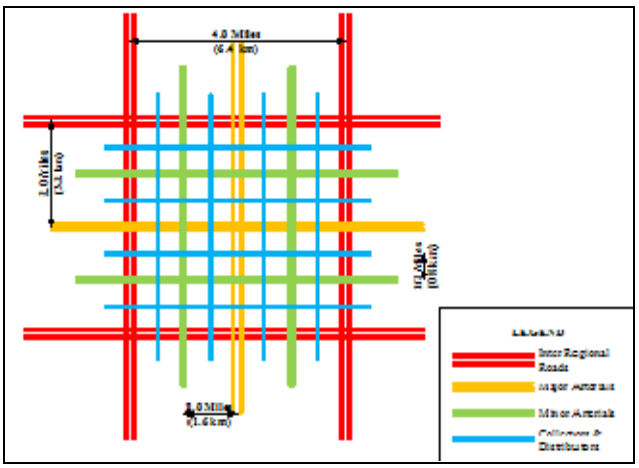
4.3 Distribution of Workers, Students, and Daytime Population by Traffic Zone, 2010

The estimated number of workers and students in the Study Area are assigned to each traffic zone. Subsequently, the daytime and night-time populations were estimated for each traffic zone.

CHAPTER 5 CITY ROAD NETWORK

5.1 Road Networks

The road network system in Bishkek City consists of a Grid Patten System. Four categories of roads and streets, namely Interregional Roads (Category IB), Major Arterials and Minor Arterials (Category II and III), Collectors and Distributors (Category IV) and Local Streets (Category V), basically formulate the city's road networks. (See **Figure 5.1-1**)



Source : JICA Study Team

Figure 5.1-1 Conceptual Road Network Hierarchy in Bishkek City

5.2 Technical Standards for Road Design

Technical standards for road design elements in the Kyrgyz Republic is stipulated by SNIP 32-01-2003. In SNIP 32-01-2003, roads are categorized into five (5) categories with two sub-categories of I shown in **Table 5.2-1**.

Table 5.2-1 Parameters of Road Cross-section Profile by Road Category

Parameters of cross-section profile	Road category					
	IA	IB	II	III	IV	V
1. Number of lanes	4; 6; 8	4; 6; 8	2	2	2	1
2. Width of lane, meter	3,75	3,75	3,75 3,5	3,5	3,0	4,5 4,0
3. Width of carriageway, meter	2x7,5 2x11,25 2x15,0	2x7,5 2x11,25 2x15,0	7,5 7,0	7,0	6,0	4,5 4,0
4. Width of strengthen (treated) lane shoulder, meter	0,75	0,75	0,75 0,5	0,5	0,5 0,25	-
5. Width of shoulders, meter	3,75	3,75	3,75 3,5 3,25	2,5 2,25 2,0	2,0 1,75 1,5	1,75 1,5 1,0
6. Width of separating lane between both traffic direction not less then, meter	6,0	4,0	-	-	-	-
7. Width of edge strengthen (treated) lane on separating lane, meter	1,0	0,75	-	-	-	-

Source : SNIP 32-01-2004, Highway Design (5. Technical Regulations for road Design Elements)

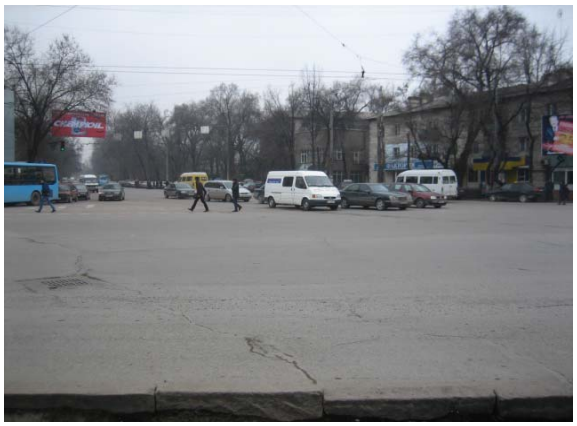
The law in the Kyrgyz Republic defines Right of Way (ROW) as shown in **Table 5.2-2**. However, most of the roads were constructed during Soviet period, thus, the actual widths of ROW might be different.

Table 5.2-2 Width of Right of Way by Road Category

Road Category	Road Type	Width of RoW
IA, IB	International Trunk Road	64 m (32 m from center line in each side)
II	Inter- regional Road	32 m (16 m from center line in each side)
III	Highway	28 m (14 m from center line in each side)
IV	Main Road	26 m (13 m from center line in each side)
V	Sub-main Road	20 m (10 m from center line in each side)

5.3 Intersections

Intersections are confusing to the road users since there are neither lane markings nor pedestrian crossings at most intersections, even if the sizes of the intersections are generally large. They cause traffic jams and traffic accidents. Providing road markings, such as 'Through', 'Left Turn', 'Right Turn', traffic lanes, stop lines, and 'Pedestrian Crossing' can improve the traffic flow at most intersections.



Picture 5.3-1 Intersections in Bishkek City

5.4 Sidewalk

The sidewalks with the greenbelts are provided on both sides of the most of major roads in the City. However, pavements of the sidewalks and drainage facilities are not well provided for, except in places where the private individuals improve their frontage space for their own interest or at their own expense.

Deteriorated Drainage Facility & Discontinued Pedestrian Crossing

Picture 5.4-1 Sidewalks in Bishkek City

5.5 Parking Space

Both public and private sectors provide on-street and off-street parking spaces in the city. Particularly, parking on streets have become obstructions for smooth traffic flow since they are not properly separated from the carriageway, in addition to limited space of carriageways.

5.6 Traffic Safety Facilities

Issues on traffic safety were observed at many areas in the city as described below. The disorder should be

corrected through proper introduction of law enforcement, education, and engineering.

(1) Traffic Sign

Traffic signs are installed to control traffic in significant numbers of locations in the city. However, mini-buses and taxies customarily stop and wait for passengers to get on and off, blocking one or two lanes within intersection or very nearby intersections despite being prohibited by traffic regulations or as clearly indicated by traffic signs. These types of illegal traffic activities cause traffic accidents and bottleneck traffic in the City.

(2) Lane Marking

Center lines are basically well-installed. However, lane markings to separate one from the other along dual sections and/or side lines, to separate flow from parking spaces are not well installed in the City.

(3) Pedestrian Crossing

At the pedestrian crossing point, traffic signs and signals are basically installed, however markings such as zebra and stop lines are often ill-maintained.

(4) Pedestrian Underpass

In some locations, underground pedestrian crossings are provided. However, such facilities are not well-maintained and sometimes vandalized, hence not well-utilized, except where the city arranged underground kiosks for pedestrians.

Pedestrian Crossing (Zebra)Marking

Picture 5.6-1 Pedestrian Crossing (At - Grade Level)

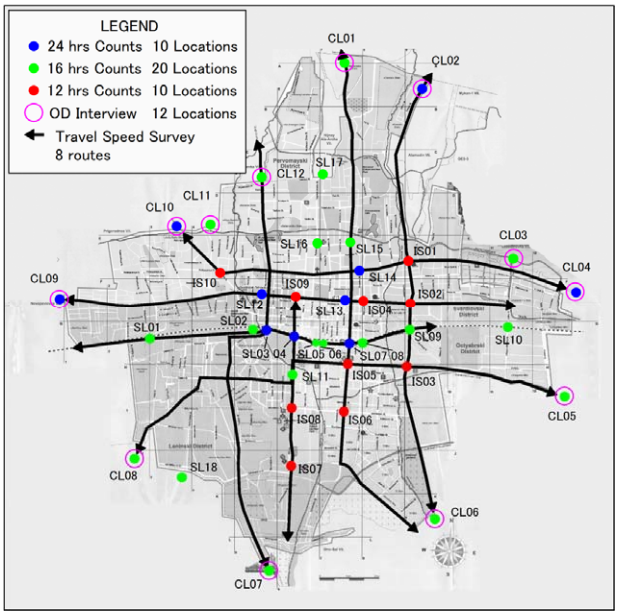
5.7 Road Improvement and Operation & Maintenance Plan and System

The Capital Construction Department, a department under jurisdiction of Bishkek City government, is responsible for planning, design and maintenance management of road networks in Bishkek City. Capital Construction Department is responsible for creating budget plans for road network improvements, including regular and periodic maintenance plans. However, due to lack of funds, mainly arterials with intensive passenger and traffic flow are only currently maintained and rehabilitated by the Department.

CHAPTER 6 TRAFFIC SURVEY AND ANALYSIS

6.1 Traffic Survey

The traffic surveys were carried out to obtain comprehensive traffic characteristics, existing problems and information necessary for the transport master plan of Bishkek City. There are two components of the traffic surveys, namely traffic statistics and interviews. The main objective of the Study was to get the information about current traffic composition and volume. The following traffic surveys were planned and conducted in the Study.



Source : JICA Study Team

Figure 6.1-1 Location Map

Vehicle classification was categorized in the survey as follows:

i) Car/Pickup/Van /Taxi
ii) Minibus
iii) Midibus
iv) Trolleybus/Large Bus (i.e. intercity bus 50 seats more)
v) Light Truck (2-Axle Truck)
vi) Heavy Truck (>2-Axle Truck) / Trailer.

Table 6.1-1 shows the list of the five types of traffic surveys with corresponding objectives and methodology.

Table 6.1-1 Objective and Methodology for the Traffic Survey

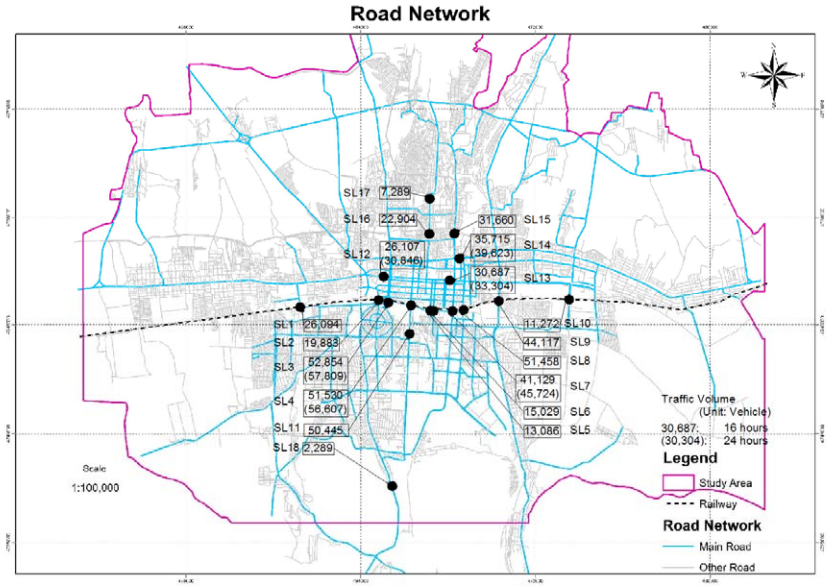
Survey	Objective	Methodology
(1) Screen line survey (SL)	To obtain information for calibration of the OD matrices formulated from the person trip by zone survey	・SL Location : 18 locations ・Survey hour : 16 hours (7:00-23:00) 12 locations/24 hours (7:00-7:00 next morning) 6 locations
(2) Cordon line survey (CL)	To collect the in and out transportation condition at the boundary of Bishkek and to calibrate the result of person trip survey	・CL Location : 12 locations ・Survey hour : 16 hours (7:00-23:00) 8 locations/24 hours (7:00-7:00 next morning) 4 locations ・Interview survey and traffic survey of in and out traffic at cordon line area ・Number of passenger/origin and destination, purpose of trip, kind of freight and load capacity (truck)
(3) Traffic survey at intersection (TS)	To collect data of main traffic bottleneck, intersection congestion	・TS Location : 10 intersections ・Duration of the survey : 12 hours (7:00-19:00) ・Length of congestion survey and Length of signal cycle survey will be conducted during peak hour : 7:00-9:00/12:00-14:00/17:00-19:00
(4) Travel speed	To obtain data of bottleneck section and its condition	・Floating car method/GPS was used ・Survey Route : 8 routes

Survey	Objective	Methodology
survey		・Travel hour, Travel speed ・Survey hour : Peak hour and off peak hour 7:00-9:00/12:00-14:00/17:00-19:00
(5) Parking survey	To grasp the balance of demand and supply of parking in the center of the city	・Survey area : 5 areas (Major commercial complex, etc.) ・Survey hour:12 hours (7:00-19:00) ・Parking capacity, parking charge, parking hour

6.1.1 Survey Result

(1) Screen Line Survey

The Screen Line Survey was conducted to identify major traffic movements between two areas divided by a Screen Line during the weekdays, 7, 8, 15, and 20 of September. The result of Screen Line Survey is shown in **Figure 6.1-2**.

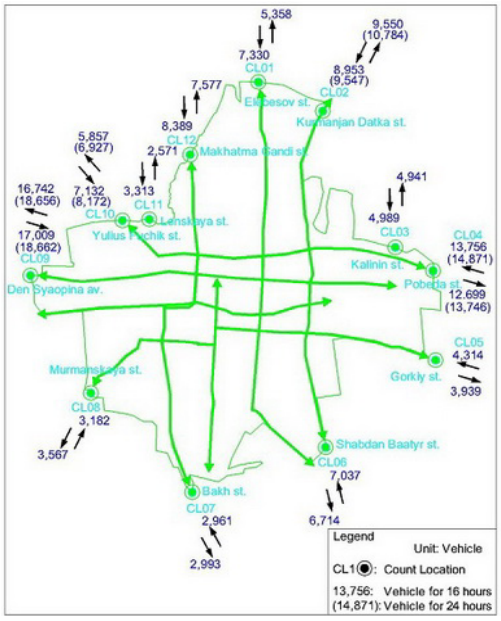


Source : JICA Study Team

Figure 6.1-2 Traffic Volume at Screen Line

(2) Cordon Line Survey

The survey was conducted on 13, 14 and 21 of September 2011. The Traffic Count survey on major CL stations shows the volume of traffic entering and departing Bishkek City Center and other surrounding areas. Vehicle classification for the CL survey was also made, similar to the procedure of the Screen Line survey. CL traffic count survey and Roadside OD interviews were conducted for 12 hours from 07:00 to 19:00 at the same hours of day. Around 10 percent of traffic was stopped at random and drivers were interviewed. The highest traffic volume (more than 33,000) was recorded at CL9. **Figure 6.1-3** shows the results of traffic counting at survey stations.



Source : JICA Study Team

Figure 6.1-3 Traffic Volume at Cordon Line

(3) Intersection Survey

An intersection survey was conducted on weekdays of 22, 27 and 28 of September 2011. At the same time the survey team conducted queue length and traffic signal cycle surveys. The survey results are shown in **Chapter 6** of the main report.

Table 6.1-2 Location, Traffic and Pedestrion Volumes Intersection Survey

Survey Location	Road Name	Traffic Volume for 12 hrs (PCU)	Pedestrian for 12 hrs
IS01	Jct. Jibek-Jolu Avenue and Alma Atinskaya Street	65,274	22,256
IS02	Jct. Chui Avenue and Alma Atinskaya Street	75,768	16,817
IS03	Jct. Gorky Street and Shabdan Baatyr Street	79,143	2,714
IS04	Jct. Chui Avenue and Ibraimov Street	67,122	16,075
IS05	Jct. Gorky Street and Sovetskaya Street	49,685	18,796
IS06	Jct. Isa Akhunbaev Street and Sovetskaya Street	64,269	23,674
IS07	Jct. Southern Arterial Road and Mir Avenue	25,223	936
IS08	Jct. Akhunbaev Street and Mir Avenue	50,587	21,584
IS09	Jct. Chui Avenue and Manas Avenue	59,775	2,778
IS10	Jct. JibekJolu Avenue and Fuchik Street	35,394	1,183

(4) Travel Speed Time

Average travel speed almost exceeded 30 km/h in the City. Average travel time varies from 20 to 30 minutes for one way trip of the sections. Average travel speed with stop time is shown in **Table 6.1-3**.

Table 6.1-3 Average Travel Speed with Stop Time

No	Road name	Section	Distance (km)	Average speed (km/h)			
				Morning peak	Noon	Evening peak	Total
1	Mir avenue	Semetei str - Jibek-Jolu str	9.0	44.8	37.9	45.0	42.6
		Jibek-Jolu str - Semetei str		49.2	47.2	41.4	45.9
2	Tolstoy street	Sadigalieva street - Puteprovodnaya street	7.6	41.4	41.3	43.3	42.0
		Puteprovodnaya street - Sadigalieva street		43.3	41.3	45.4	43.3
3	Baha - Molodaya Gvardiya	Chodronova street - Prigorodnaya street	14.6	47.0	42.3	43.6	44.3
		Prigorodnaya street - Chodronova street		44.7	42.6	39.8	42.4
4	Jibek-Jolu street	Fuchik - Pobeda	13.6	44.2	46.3	43.9	44.8
		Pobeda - Fuchik		47.2	45.3	45.9	46.1
5	Bakinskaya-Sovetskaya Street	12 micro - Obezdnaya	16.2	42.9	39.2	39.6	40.6
		Obezdnaya - 12 micro		44.2	39.3	38.1	40.5
6	Alma Atinskaya Street	Karagul Akmash street - Obezdnaya	14.9	48.3	48.9	50.8	49.3
		Obezdnaya - Karagul Akmash street		50.9	47.5	45.8	48.1
7	Muromskaya - Gorky	Barbi Alykulova - Auezova street	17.2	41.6	42.6	44.9	43.0
		Auezova street - Barbi Alykulova		41.6	43.4	43.5	42.8
8	Den Syaopin Avenue - Chui avenue	Barbi Alykulova - Auezova street	15.3	45.3	43.6	43.3	44.1
		Auezova street - Barbi Alykulova		44.3	40.5	40.2	41.7

Source : JICA Study Team

(5) Parking Survey

Parking survey was executed two times (on a weekday and a weekend) for each location to compare the capacity and occupancy of parking places. The following parking locations

were chosen for this survey. Parking survey areas are located on the following streets (See **Table 6.1-4** and **Figure 6.1-4**).

Table 6.1-4 Location of Parking Survey

Location	Road Name and Section
PK01	Gorky Street from Tynystanova to Baitik Baatyra Street (VEFA Center)
PK02	Chui Avenue from Beishenalieva Street to Molodaya Gvardiya Boulevard
PK03	Shabdan Baatyr Street near by the Alamedin Market
PK04	Auezova Street from Lenina Avenue to Kolbaeva Street
PK05	Abdyrakhmanova Street from Moskovskaya Street to Bokonbayeva Street

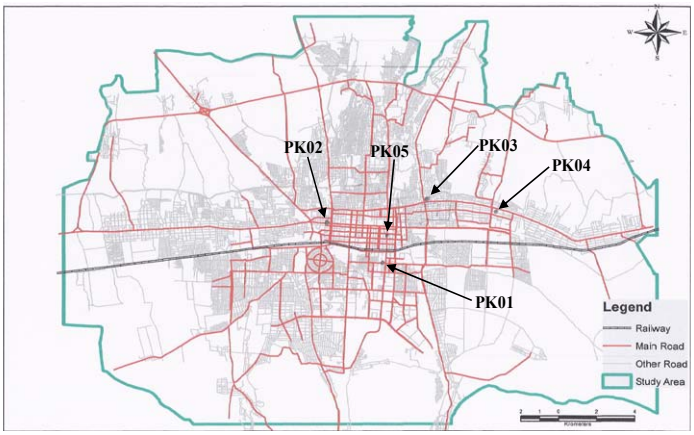


Figure 6.1-4 Location Map for Parking Survey

The summary of Parking Survey result is shown in **Table 6.1-5** and **Table 6.1-6**.

Table 6.1-5 Average Parking Time on Weekday

No	Parking area	Street name	Parking type	No of Vehicles												Total	Average parking time hh:mm:ss
				1. Passenger car	Average parking time hh:mm:ss	2. Taxi	Average parking time hh:mm:ss	3. Mini bus	Average parking time hh:mm:ss	4. Midi bus	Average parking time hh:mm:ss	5. Small truck	Average parking time hh:mm:ss	6. Heavy truck	Average parking time hh:mm:ss		
PK01	legal	Gorky street	on-road	146	0:22:38	50	0:19:59	8	0:22:53	1	0:11:00	3	0:15:20	1	0:26:00	209	0:19:38
	illegal		on-road	155	0:17:57	26	0:18:37	5	0:22:24							186	0:19:39
PK02	legal	Chui Avenue	on-road	238	0:18:50	40	0:17:45	14	0:13:33			5	0:40:24			297	0:22:38
	illegal		on-road	241	0:22:52	14	0:15:40	9	0:24:00			3	0:39:40			267	0:25:33
PK03	legal	Alma-Atinskaya street	on-road	284	0:19:14	40	0:20:10	16	0:33:30			8	0:23:07	2	0:11:30	350	0:21:30
	illegal		on-road	222	0:13:58	86	0:14:44	25	0:14:32	15	0:10:00	5	0:11:12	5	0:08:12	358	0:12:06
PK04	legal	Auezova street	on-road	182	0:18:06	66	0:17:59	12	0:16:45			8	0:17:50	2	0:02:00	270	0:14:32
	illegal		on-road	140	0:16:45	15	0:12:30	14	0:21:05			2	0:05:00	1	0:10:00	172	0:13:04
PK05	legal	Sovetskaya street	on-road	193	0:15:25	23	0:16:55	1	0:53:00			1	0:07:00			218	0:23:05
	legal		on-road	390	0:12:16	67	0:10:44	8	0:04:34							465	0:09:11

Source : JICA Study Team

Table 6.1-6 Average Parking Time on Weekend

No	Parking area	Street name	Parking type	No of Vehicles												Total	Average parking time hh:mm:ss
				1. Passenger car	Average parking time hh:mm:ss	2. Taxi	Average parking time hh:mm:ss	3. Mini bus	Average parking time hh:mm:ss	4. Midi bus	Average parking time hh:mm:ss	5. Small truck	Average parking time hh:mm:ss	6. Heavy truck	Average parking time hh:mm:ss		
PK01	legal	Gorky street	on-road	186	0:18:55	46	0:14:42	8	0:13:26	1	0:07:00	1	0:28:00			241	0:16:25
	illegal		on-road	122	0:19:45	42	0:15:22	4	0:14:00			2	0:32:00			170	0:20:17
PK02	legal	Chui Avenue	on-road	224	0:16:51	18	0:14:42	9	0:15:33			1	1:05:00			251	0:28:01
	illegal		on-road	342	0:17:25	35	0:18:15	20	0:18:56			4	0:39:30			401	0:23:32
PK03	legal	Alma-Atinskaya street	on-road	266	1:30:49	29	0:25:51	18	0:26:15			3	1:02:00			316	0:51:14
	illegal		on-road	264	0:24:28	86	0:31:12	22	0:20:17			1	0:11:00			373	0:21:44
PK04	legal	Auezova street	on-road	184	0:16:28	142	0:16:13	14	0:20:09	2	0:12:13	2	0:33:00	3	0:30:20	347	0:21:24
	illegal		on-road	224	0:19:14	24	0:23:13	10	0:02:00			7	0:23:00	1	0:33:00	266	0:20:05
PK05	legal	Sovetskaya street	on-road	290	0:17:48	37	0:22:07	3	0:16:20			2	0:06:30			332	0:15:41
	legal		on-road	335	0:10:38	52	0:08:00	7	0:14:20			3	0:15:20			397	0:12:05

Source : JICA Study Team

6.2 Interview Survey

The main objectives of this survey are to acquire information on people's daily traffic records on typical weekdays and the socio-economic characteristics of Bishkek City residents. This survey conducted two types of interview survey, namely, Household Interview Survey (Person Trip Survey) and Transport User Survey.

Table 6.2-1 Scope and Methodology for the Interview Survey

Survey	Objective	Methodology
(1) Household Interview Survey (Person Trip Survey)	To collect information on traffic demand, traffic preference as data for the traffic demand forecast	・ Home interview survey ・ Number of sample: 1.7% of the population ・ Questionnaire Items - Household information - Attribute of individual: Member of family - Trip information
(2) Transport user survey	To obtain the characteristic and issue of present public transportation	・ 8 locations: major commercial complex, etc. ・ Sample:1,600-2,400 ・ Questions to public transportation users 1) When 2) Where 3) Purpose 4) Reason of the selection 5) Fare ・ Attribute of individual (Occupation, Industry, Income level, etc.)

6.2.1 Survey Result

(1) Household Interview Survey

(a) Number of Interviews

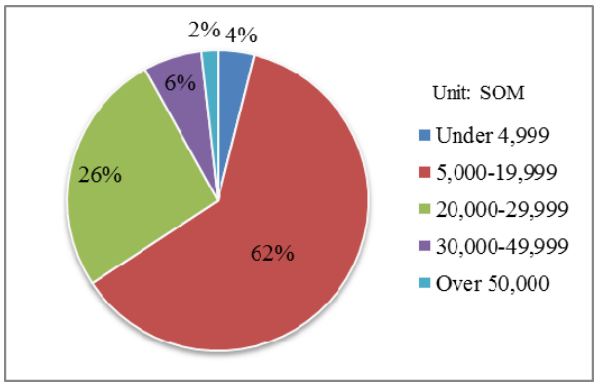
The total population in the Study area is approximately 884,000. The interviews were made on 4,000 households, and family members aged seven years old or over were interviewed. There are about 1.7 percent of the population aged seven years and over in the Study Area.

(b) Household Income

Figure 6.2-1 shows that more than 92 percent of households have monthly incomes less than 30,000 SOMS. Only two percent of households have monthly income over 50,000 SOMS. There is 62 percent of the population who have monthly income between 5,000 and 19,999 SOMS -- the highest income level.

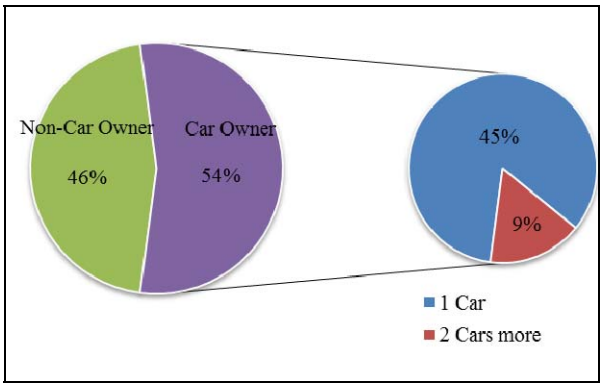
(c) Number of Owned Car

The number of cars registered was 1.19 million in 2010 and 1.52 million in 2011, respectively. Among 4,000 households, 2,168 own a car (excluding motorbikes), which is approximately 54 percent. About nine percent of households own two or more cars, as shown in **Figure 6.2-2**.



Source : JICA Study Team

Figure 6.2-1 Household Monthly Income

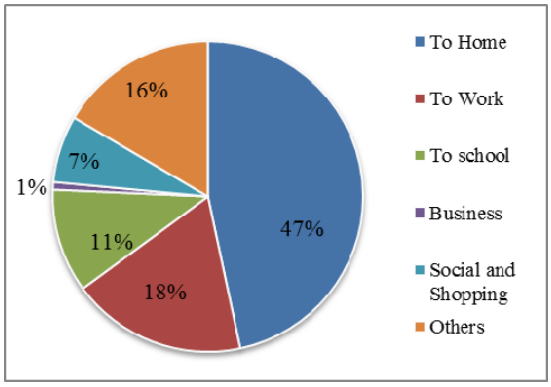


Source : JICA Study Team

Figure 6.2-2 Number of Owned Car

(d) Trip Purpose

Trip composition by purpose is shown in **Figure 6.2-3**, in which the trips "To Home" trips are 47 percent, "To Work" at 18 percent, "To School" at 11 percent, and "Social and Shopping" at seven percent, and others at 16 percent. "Eat a meal", To Church", "Medical" and so on belong to "Other". The average number of daily trips per person is 2.8.

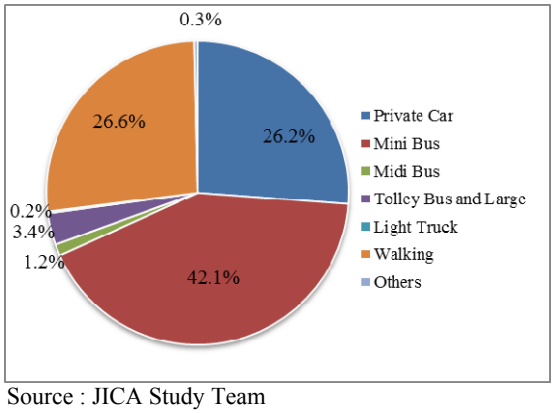


Source : JICA Study Team

Figure 6.2-3 Trip Purpose

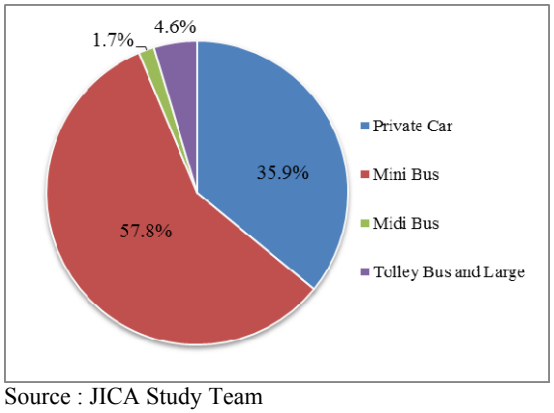
(e) Trip Mode

Seven types of travel modes were used in the survey. Trip composition by travel mode is shown in **Figure 6.2-4** and **Figure 6.2-5**. Trip by minibus was the highest at 42 percent, while walking trips are 27 percent. **Figure 6.2-5** shows the trip mode excluding by light trucks, and walking trip, and others. The share of minibus is 58 percent while by private car is 36 percent.



Source : JICA Study Team

Figure 6.2-4 Share of Travel Mode



Source : JICA Study Team

Figure 6.2-5 Trip Mode (Excluding Walking, Truck and Others)

(2) Transport User Survey

There are 76 percent of public users who are traveling at nine SOMS or less. Private car users answered that 42 percent of cars require 50 to 74 SOMS as the travel cost on their cars.

The survey result shows travel time for public transport users as follows:

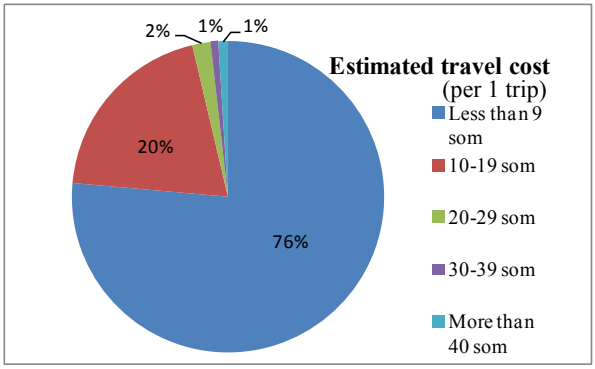
- less than 9 minutes are four percent
- 10 to 19 minutes are 25 percent
- 20 to 29 minutes are 27 percent

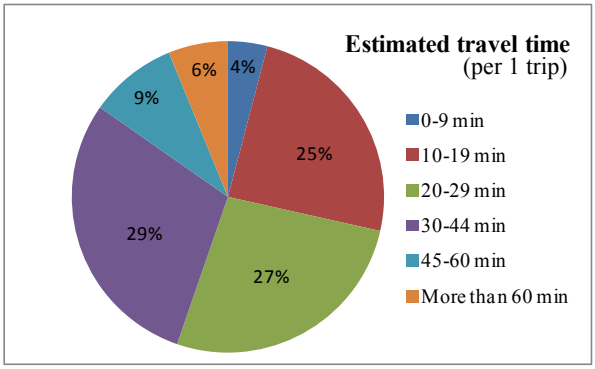
Whereas, the share of travel time for private car users with the same travel time were as follows:

- less than 9 minutes are nine percent
- 10 to 19 minutes are 41 percent
- 20 to 29 minutes are 35 percent.

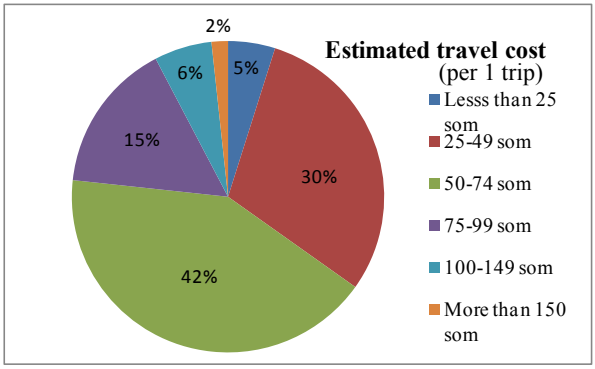
The result of the service opinions on reasons of choosing transport mode for public transport user shows that comfort and good accessibility are their reasons, both at 24 percent. Private cars users answered that they are comfortable, with the highest rate at 50 percent.

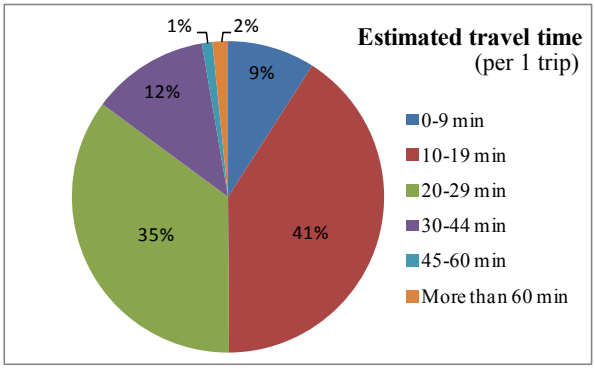
For Public Transport User





For Private Transport User





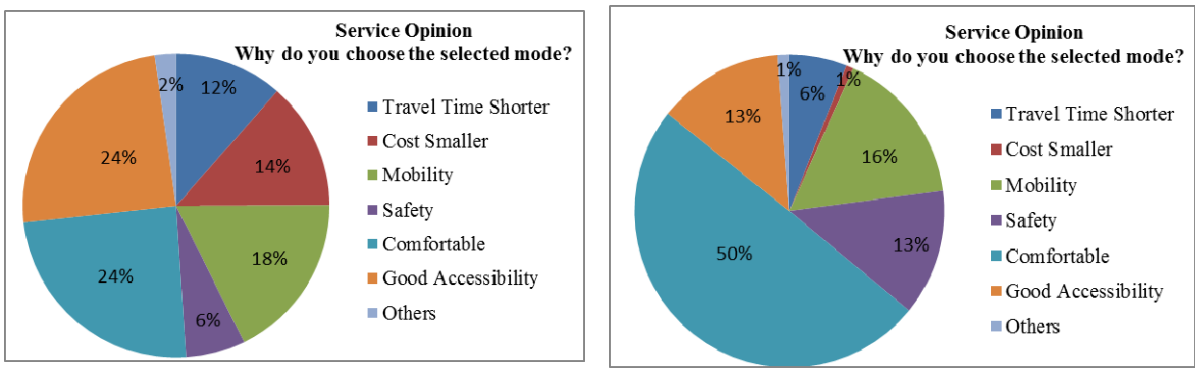


Figure 6.2-6 Summary of Answer for Private and Public Transport User

CHAPTER 7 URBAN PUBLIC TRANSPORTATION

7.1 General

Urban public transportation in Bishkek consists of trolleybus, midibus and minibus (Marshrutka). The trolleybuses and the midibuses are operated by public organizations, whereas the minibuses are operated by private bus companies. The minibus route is tendered for five years franchise. Fares are fixed as flat rates. The trolleybuses and the midibuses cost eight SOMS and the minibuses cost 10 SOMS in the City center. There is a fare exemption for citizens on municipal transportation. To compensate for the fare exemptions, Bishkek City has to subsidize to the public bus operators according to the amount of free rides.

Picture 7.1-1 Trolleybus (Low Floor)

Picture 7.1-2 Trolleybus

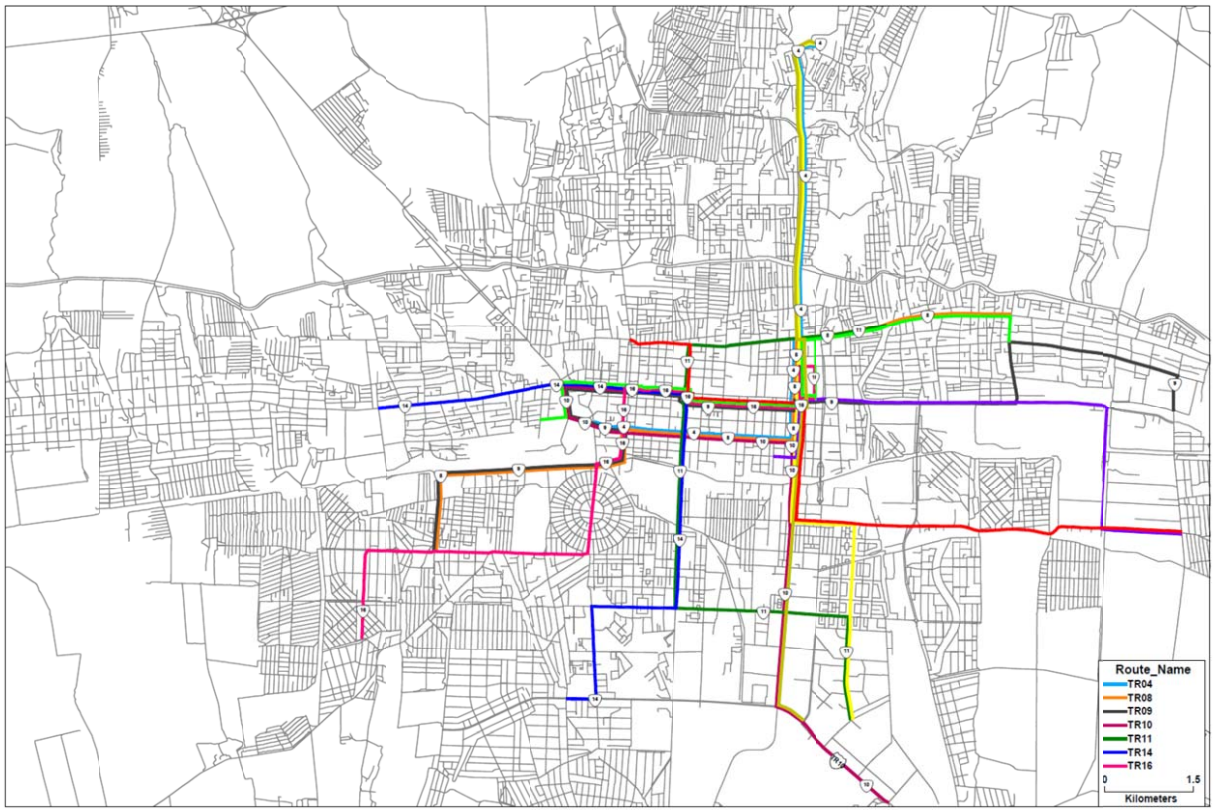
Picture 7.1-3 Public Midibus

Picture 7.1-4 Minibus

Table 7.1-1 Characteristics of Public Transportation

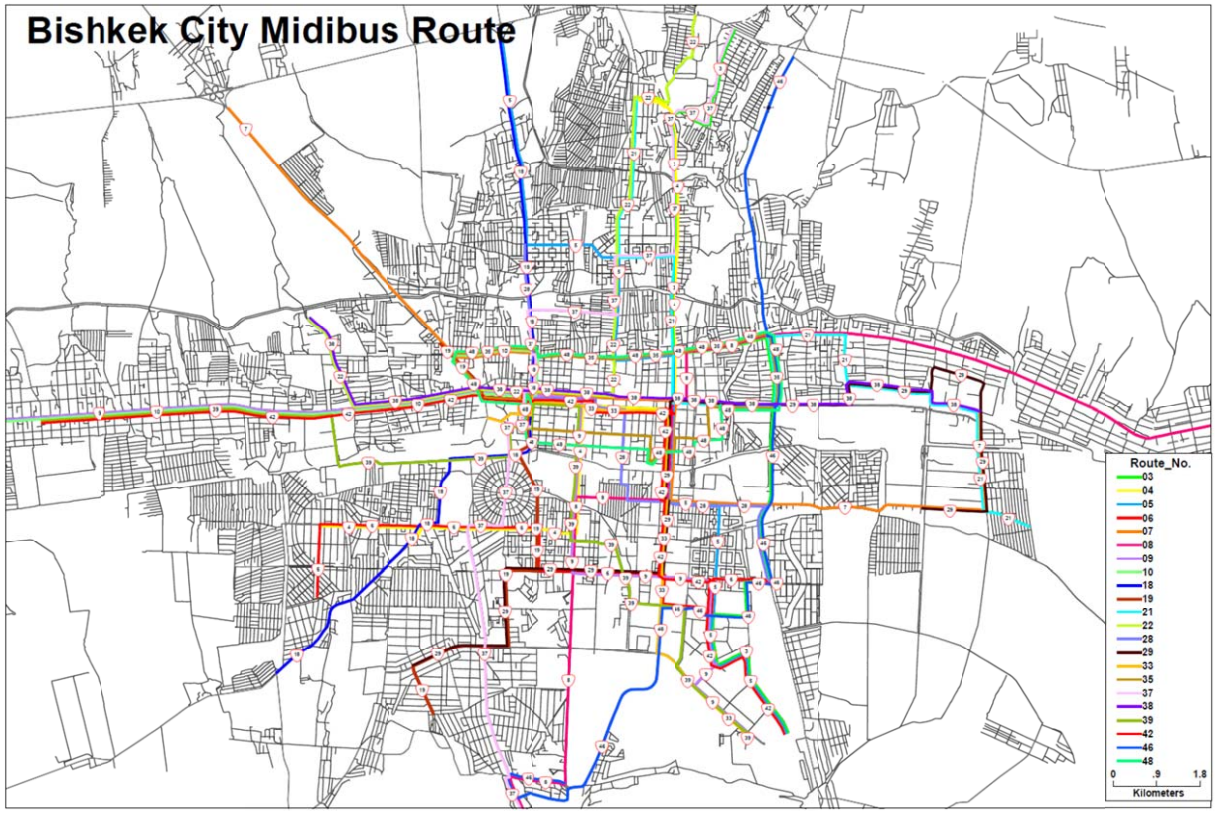
Transportation Mode	Number of Routes (2011)	Length (2011)	Operator	Number of Vehicles (2011)	Number of Passenger (Million pax, 2009)
Trolleybus	7	104 km	BTD (Public)	87	19 (10%)
Midibus	21	418 km	BPTE (Public)	460	41 (20%)
Minibus	121	4,300 km	Private Companies	About 3,800	140 (70%)

Source : UTD



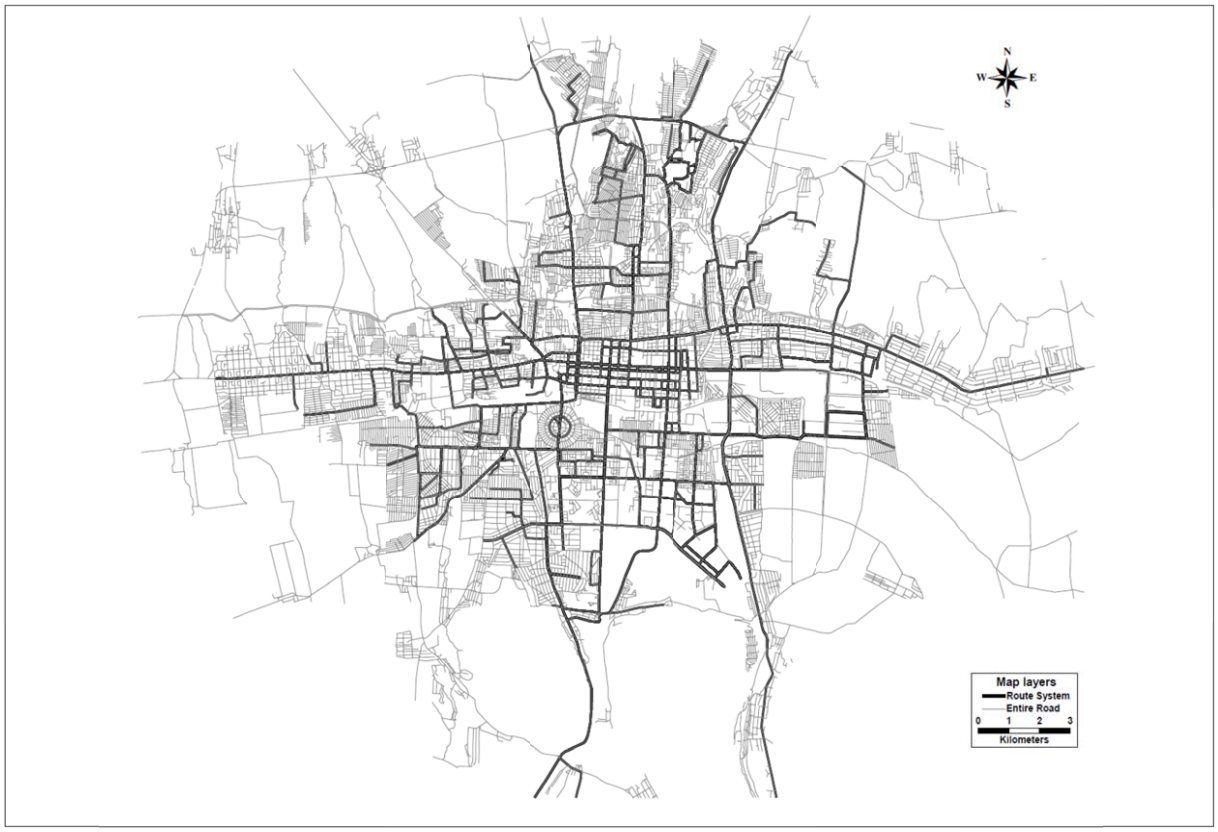
Source : JICA Study Team

Figure 7.1-1 Trolleybus Routes



Note) Route No 10 is only for test operation.
Source : JICA Study Team

Figure 7.1-2 Midibus Routes



Source : JICA Study Team

Figure 7.1-3 Minibus Routes

7.2 Administration

The Urban Transportation Department (UTD) at the Bishkek City Mayor's Office was established in 2008, and has authority to organize urban public transportation networks in Bishkek City. UTD grants urban public transportation licenses to operators in public and private sectors. To the private companies, UTD provides route franchises on the basis of competitive tender bidding. On April 2012, Decree No. 102 was promulgated to reorganize UTD and to cut down the number of staff.

Fares of urban public transportations in Bishkek are determined by the Bishkek Mayor's Office and the City Council. Both public agencies under Bishkek City Mayor's Office, Bishkek Trolleybus Department (BTD) and Bishkek Passenger Transportation Enterprise (BPTE), are responsible for its operation and fare collection. Minibus private companies are controlled by franchise contract with UTD.

7.3 Summary of Public Transportation Survey Results

The public transportation surveys revealed characteristics and issues in public transportation in Bishkek City. **Figure 7.3-1** shows minibus route duplication and **Figure 7.3-2** shows daily bus passengers and volume capacity ratio on weekday.

Table 7.3-1 Public Transportation Surveys Results

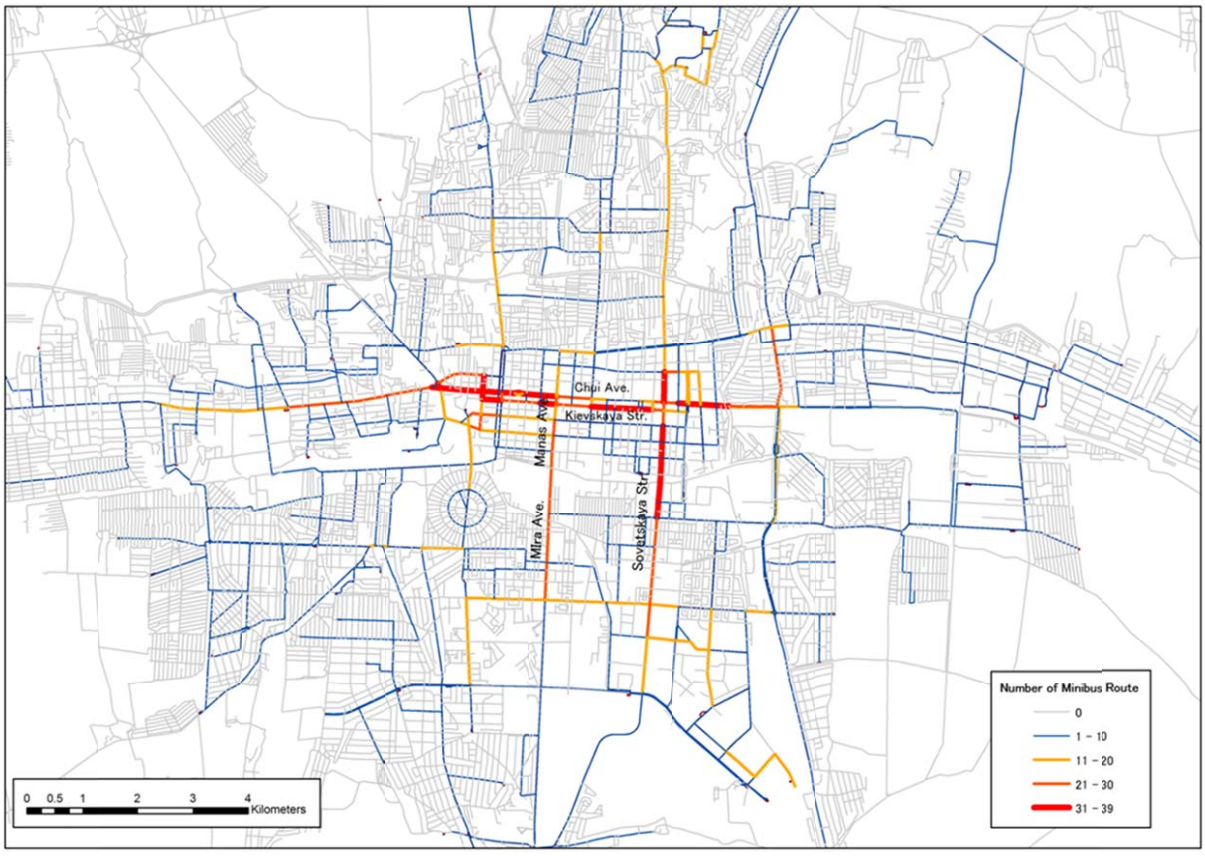
Characteristics	Issues
Public Transportation Users' Character ・92% of public transportation users have no option to use a car ・18% of public transportation users are exempted from fares	・Public transportation policy should consider the citizens who do not have any other transportation means other than the public transportation. ・Increasing passengers of the trolleybus and the midibus might press the finances of the City, since the number of fare exempted passengers equivalent to the amount of the subsidy would increase as well.
Share of public transportation mode ・Occupancy survey estimates composition ratios of passengers: trolleybus 10%, midibus 20% and minibus 70% ・Composition ratios of operation number are: trolleybus 4%, midibus 9% and minibus 87% ・Occupancy ratios are: trolleybus 45%, midibus 53% and minibus 117%	・The occupancy ratio of the trolleybus, which has a larger capacity, is low, whereas smaller capacity minibus is in frequent operation. That condition derives traffic congestion on the road.
Minibus ・Age of minibus is from 11 to 26 years and the average is 17.2 years ・Drivers work 5.6 days a week and 12 hours a day in average ・Average profits of drivers is about 13,300 SOMS / month	・It is dangerous for old vehicles running long hours. ・The collected fare is source of the income of minibus driver, thus a driver intends to catch as many passengers as possible.
Fare and Fare Collection ・Fares are fixed as flat rates; the trolleybus and the midibus are eight SOMS and the minibus is 10 SOMS in the City Center. ・The fare is usually paid by cash hand to hand.	・Assured fare collection system and efficient audits are required.
Trolleybus users ・Revision of tariffs of public transportation, which came into force on 1st May 2012, the fare of the trolleybus and the midibus hiked and came to the same price, and the price gap to the minibus came to smaller. ・The passenger surveys conducted before and after the fare hike revealed that it caused declining of the number of trolleybus users.	・To reform fare system to lead and achieve desirable share of transportation is considered.
Information of the Bus Routes ・The trolleybus routes have not been changed in recent years. The number of midibus route decreased from 23 in 2011 to 17 in August 2012. The number of minibus routes is changing from time to time. And, entire route network and designed frequency of bus operation are not open to public.	・To announce the public the transportation network charges including minibus routes to the citizen.
Route Duplication ・Many route franchises in the same route of the network in the City Center are being given to the different companies. More than 30 marshrutka routes are registered on Chui Ave., Kievskaya str. and Sovetskaya str. (**Figure 7.3-1**) ・The total number of passengers is over the capacity of operating public transportation which causes operation of over clouded	・As bus routes are duplicated, excessive competition between public and private sectors, even among private companies occurs. ・The desirable share of transportation to realize comfortable and safe public

Characteristics	Issues
minibuses on Chui Ave., Kievskaya str. and Sovetskaya str. (**Figure 7.3-2**)	transportation is considered.
Operation Management ・The trolleybus runs chiefly in the evening time period from 19:00 to 21:00, whereas the midibus in the morning time period from 9:00 to 11:00 and in the evening time period from 19:00 to 21:00. Scheduled running intervals of minibus are determined by the number of vehicles designated on the franchise contract. ・Bus operators are required to report to UTD the actual number of operating vehicles every day. However, this is an honor system with no verification.	・To enhance the capability of the administrator, and to monitor the actual operation number of the minibus is required.
Vehicle Capacity ・The vehicle capacities of trolleybus and midibus of each fleet are defined by seats and standing passengers, whereas the capacity of minibuses is defined by the number of seats. Traffic law does not allow a minibus to carry standing passengers on board, however many minibuses run with pack of standing passengers in fact. The capacities by type of transportation are shown in **Table 7.3-2**.	・Revision of the regulation of the capacity in accordance with safety enforcement of the regulation is considered.
Service Frequency ・Scheduled running interval of the midibus is generally shorter than that of the trolleybus. However, the actual operation is almost the same between the two or even that of the trolleybus is shorter than the midibus. Generally, the trolleybus more sticks to the schedule than the midibus.	・To operate bus as it scheduled and monitor the operation.
Accessibility of Bus Stop ・Approximately 400 bus stops of the trolleybus and the midibus in Bishkek City are identified. The bus catchment area covers 100 km^2 which is 60% of Bishkek city area. ・The trolleybus, the midibus and the minibus use the same bus stop. Thereby, at the bus stop, some congestion of the trolleybus, midibus and minibus occurs.	・Improvement of the bus stop designs, countermeasures to car parking around bus stops and education on the bus driver are required. ・To enforce the prohibition of boarding and alighting on the road, especially the trunk road, other than at bus stops, in order to realize safety and smooth traffic.
Connectivity of Bus Routes with Intercity Bus ・In Bishkek, there are two bus terminals, east and west bus, for long distance. Those terminals are not connected by the public transportation network or good access to the City Center. ・The entire bus network is not designed to take into account the interchange of bus routes.	・Improvement of the public transportation network by facilitating interchange is required.
Security / Safety ・Every citizen uses public transportation safely in general, however pickpocket incidents are frequently reported.	・Crime deterrents.
Route Information on board ・The trolleybus, the midibus and the minibus display their respective destination and route number in the front. The trolleybus and the midibus show their schematic route maps inside the bus but the minibus do not post. At the bus stop, there is no information of any bus service.	・Display the public transportation network and frequency of the bus service.
Users Request	

Characteristics	Issues
・"Drive gently", "Increase speed" and "Bigger bus" are common requests to public transportation. For the trolley bus user, "Increase speed" is more important than other modes and for the minibus users "Bus location information" is more important.	・To increase bus speed. ・To enhance the safety of bus driving. ・To provide bus approach information.
Financial Condition of Bus Operator ・Financial conditions of BTD and BPTE are in continuously deficit. ・There are about 50 private bus companies which operates 120 routes with franchise contracts. Many private bus companies are small. Only 9% of bus companies have more than 200 bus fleets, whereas 48% has less than 50 bus fleets.	・To improve financial management of BTD and BPTE. ・Fostering private companies.

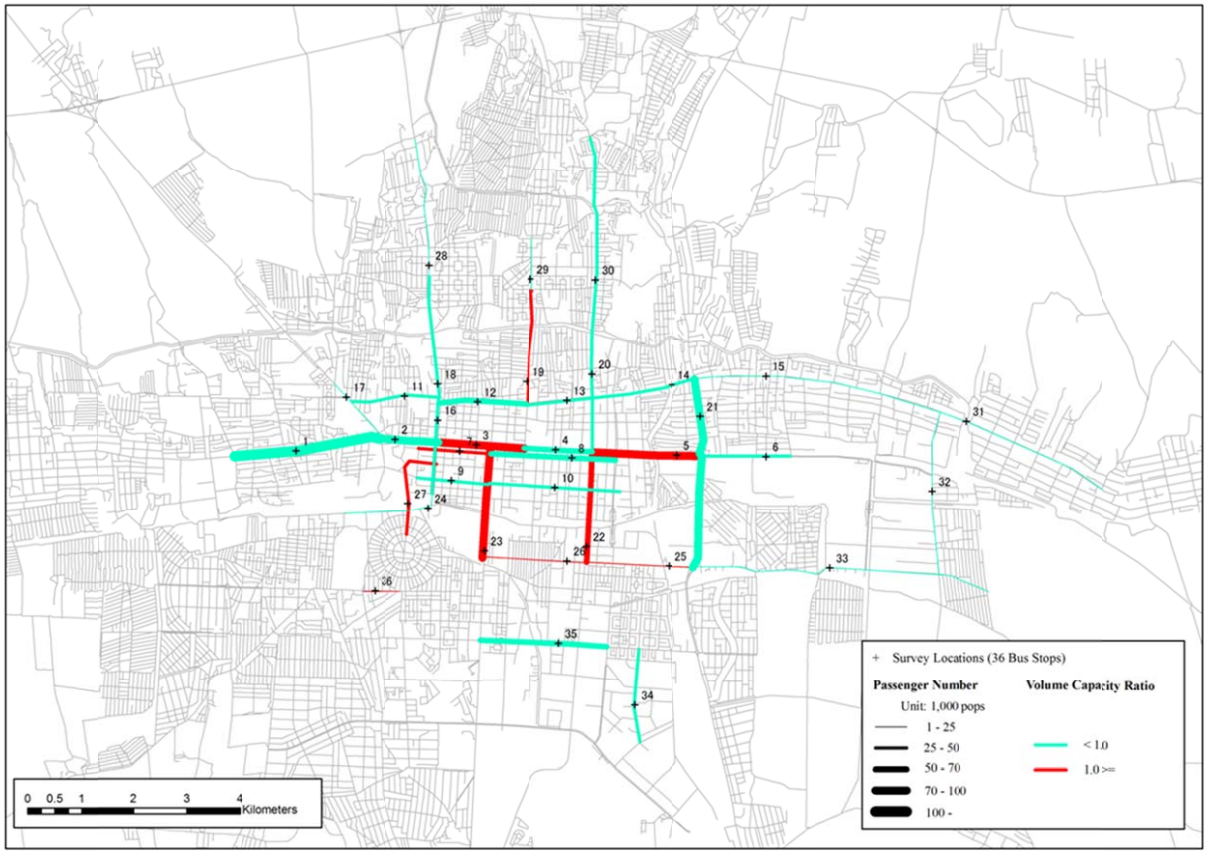
Table 7.3-2 Vehicle Capacities of Public Transportation Fleet

Transportation Mode	Type	Seats	Vehicle Capacity (pax)	Remarks
Trolleybus	311y-9b 9GI-21	30 41	100 126	9GI-21 is low floor type, made in Belarusian
Midibus	JS6811GH JS6851H1	22 27	51 59	Buses are made in China
Minibus	Short Medium Long	10 12 15	(10) (12) (15)	Traffic law shows seat numbers as vehicle capacity. Actual operation is full of standing passengers; it is assumed that from 20 to 30 pax in the car maximum.



Source : JICA Study Team, as of 2011

Figure 7.3-1 Minibus Route Duplication



Source : JICA Study Team

Figure 7.3-2 Daily Bus Passengers and Volume Capacity Ratio on Weekday

7.4 Problems and Issues to be Considered

The problems in urban public transportation in Bishkek are identified as follows:

➢ Physical Extension/ Improvement

1. Bus routes are duplicated and excessive competition between public and private sectors, and among private companies are happening.
2. Bus route information and bus operations' frequency are not provided to citizens.
3. Fare collection system is inefficient due to manual collection method.
4. Transportation terminals are not designed with a perspective of connectivity to the City enter and there likewise do not facilitate transfers.
5. It is necessary to improve bus service speed.

➢ Institutional/ Law & Regulation Improvement

1. Minibus drivers are more inclined to catch as much passengers as possible rather than obey traffic and working rules.
2. Minibus operation is controlled by planned vehicle numbers and actual reported operating vehicle numbers from private companies. Thus, actual operation records, such as frequencies, are not reported

to UTD.

3. Financial conditions of BTD and BPTE have been continuously in a shortfall.
4. Revision of tariffs in public transportation, which came into force on May, 2012, caused the decline of trolleybus users.
5. Cheap fare rates and fare exemptions affect profitability on public transportation revenue.
6. UTD is designed to have the authority to formulate the urban transportation network in Bishkek City, however, UTD is similar to two other public companies and does not work as comprehensive transportation planning bureau.

CHAPTER 8 CITY PARKING

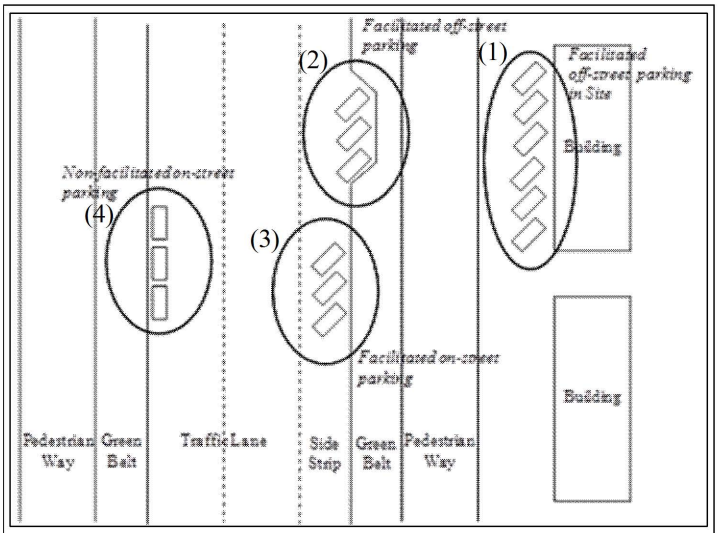
8.1 Background

The parking conditions in the City Center has become worse due to the increase in numbers of private cars. In response, the government of Bishkek City highlighted the improvement of the parking conditions as one of the key issues in the Development Concept of Bishkek City for 2012 to 2015. Thereafter, the JICA Study Team conducted a survey on the current parking conditions and to identify factors for its improvement in the City center.

8.2 Parking Survey in the City Center

8.2.1 Methodology

Parking was classified into facilitated parking and non-facilitated parking. The facilitated parking consists of (1) off-street parking on premises of a building, (2) facilitated off-street parking, (3) facilitated on-street parking, and (4) non-facilitated parking (on-street parking in a traffic lane). **Figure 8.2-1** illustrates the typical location of four types of parking.



Source : JICA Study Team

Figure 8.2-1 Type of Parking Defined in Parking Survey

Table 8.2-1 shows the contents of four parking surveys; i) an inventory or survey to identify the location of the parking areas in the City Center, ii) a parking condition survey to count the number of parked cars by type of parking, iii) a detailed parking survey and, iv) an interview survey of drivers at selected areas.

Table 8.2-1 Contents of Parking Survey in the City Center

Component	Survey Item
i) Inventory Survey of Parked Area Note : ( ) type of parking	1. Location of parking area : 1) Municipal car park in Bishkek City (1) 2) Other facilitated parking area in the City Center (1), (2), (3) 3) Non-facilitated parking area in the City Center (4) 2. Number of parking lot of facilitated parking areas 3. Length of curb allowable and non-allowable for on-street parking
ii) Parking Condition Survey	1. Number of parked car by type of parking on weekday and weekend 2. Video shooting of parking condition

Component	Survey Item
	3. Photo of surveyed parking area
iii) Detailed Parking Condition at Selected Area	1. Target area : Three selected areas of large-scale commercial areas 2. Survey date and period : 12 hours on weekday and weekend 3. Method : Record of number plate of parked car every 30 minutes
iv) Interview Survey	1. Interview survey to driver who parks a car in a car park

Source : JICA Study Team

8.2.2 Results and Findings

(a) The inventory survey identified 747 facilitated parking areas that included 55 municipal car parks and the other 692 facilitated parking areas in the City Center. The facilitated parking areas had 14,522 parking lots that included 2,232 parking lots in the municipal car parks.

(b) The length of a curb occupied by the non-facilitated parking was measured in the inventory survey. The total length of allowable and non-allowable on-street parking are 147 and 33 km, respectively.

(c) The number of non-facilitated on-street parking was counted at 6,624 cars on weekday and 3,641 cars on weekend respectively. The number of parked cars was decreased in four traffic zones of 8, 10, 32, and 33 in the central part of the City Center on weekend. The parked cars may be from visitors to large-scale shopping centers including Osh Market in traffic zone 11 and CUM in traffic zone 51. The parked cars were supposed to be from residents of apartments in the traffic zone 44 and detached housing in traffic zone 9. **Figure 8.2-2** shows the number of parked cars on weekday and weekend.

Source : JICA Study Team

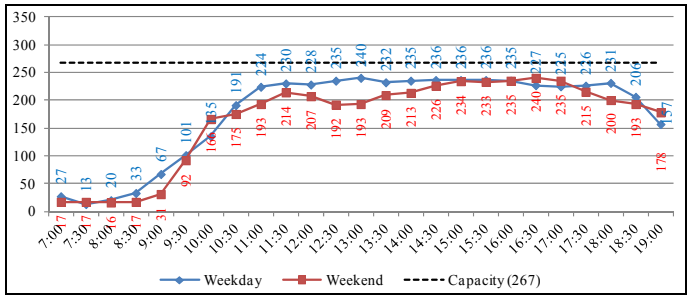
Figure 8.2-2 Number of Parked Car by Block in the City Center

(d) Although the facilitated parking zones have the remaining capacity of 6,344 parking lots, 6,624 cars were parked on street as non-facilitated parking on weekdays.

(e) The most common price for the parking fee was a fixed rate at 10 SOMS per parking, without any extra charges.

(f) A detailed time parking survey revealed that commercial areas attracted the visitors, regardless of weekday and weekend as shown in **Figure 8.2-3**.

(g) The purpose of most frequent visit was shopping (44%), followed by business (23%).



Source : JICA Study Team

Figure 8.2-3 Number of Parked Cars by Time at CUM on Weekday and Weekend

8.3 Issues for Improvement of Parking Conditions

Based on the parking survey, the following were identified as the issues for improvement of the parking conditions.

(a) Remaining Capacity of Facilitated Parking

Although the facilitated parking areas still had the remaining capacity of 6,344 parking lots on weekday, the large number of 6,624 cars was parked on street. Countermeasures should be taken to encourage drivers to park their cars in the facilitated parking areas.

(b) Unclear Definition of Allowable Space for Parking

Private individuals sometimes install a sign that declare a part of public land and road as a parking space, although no official authorization has been granted. It is necessary to review these parking spaces for the public parking.

(c) Parking at Public Lands by Residents

A large number of parked cars were observed on the streets on weekends, and these parked cars were supposedly from residents. A proper place is necessary to be designated parking areas for residents. The existing lax penalty can be the reason for illegal parking.

(d) Fixed Rate of Parking Fee

A parking fee was set at a low fixed rate. The parking fee needs to be modified to a variable rate based on the duration of parking and the location of parking areas to mitigate the concentration of the parking demand in central part of the City center. In addition, parking fees should be collected from all drivers of parked cars without exemptions. The existing enforcement is unable to control non-payment of parking, hence, the penalty for non-payment of parking should be set and the proper authority for parking management should be established.

(e) Strict Enforcement of Penalty for Illegal Parking

The existing illegal parking penalty is a mere 300 SOMS. The regulation should be amended to impose higher penalties to be able to strictly implement a ban on illegal parking.

(f) Improvement of Mandatory Parking Lots

The current building standards have become outdated to meet a motorized society. The building standards should be updated to provide mandatory parking lots based on the scale and type of buildings to meet the parking demands.

CHAPTER 9 TRAFFIC CONTROL

9.1 Present Traffic Signal System

9.1.1 Traffic Signal Facility

(1) Traffic Signals in Bishkek City

As of August 2012, there have been traffic signals operating at 203 intersections in Bishkek City as shown in **Figure 9.1-1**. Although new signals have been installed in recent years, 75 percent of the signals are twenty years or older.

Source : JICA Study Team

Figure 9.1-1 Location of Signalized Intersection

(2) Vehicle Detector

According to the CMOD, vehicle detectors were used in the past and a traffic response control was adopted, in which a signal timing plan was selected among the predefined plans, according to the time of day and traffic flow conditions including vehicle counts, vehicle speeds or congestion levels (occupancy rates). However, no vehicle detectors exist at present, due to deterioration of the device. As there is no vehicle detector, there is no actual control at present.

(3) Signal Monitoring at Control Center

Bishkek City used to have a centrally controlled signal system. Due to lack of maintenance, the system no longer functions. Some of the centrally controlled signals are still connected with the Traffic Control Center through communication cable installed and owned by Traffic Police. A wall map display showing the schematic map of the control areas and locations of the centrally controlled signals is installed at the Control Center.

Picture 9.1-1 Wall Map Display

9.2 CMOD New Automated Traffic Control System Project

CMOD has prepared a proposal for an automated traffic control system. The outline of the proposal is summarized below. Due to lack of funds, introduction of the proposed system is not certain.

1.	Project Title	"Upgrade of Automated Traffic Control System and traffic lights facilities (equipping with LED traffic lights, environmental sensors, vehicle detector, countdown light panel for permissive/restrictive signal, additional sound associated devices), modern software and technical reequipping of control centers of ATCS with communication channels, hardware for communication with peripheral facilities, setting up radio channel in Bishkek City".
2.	System Components	30 − 50 traffic lights (first stage), 150 traffic lights (final stage) Vehicle detector (video camera type) Control panel (wall map and control console) Communication cable or wireless
3.	Type of Signal Control	Adaptive
4.	Funding Requirements	12.0 million USD
5.	Feasibility Study/Detailed Design	(To be required)

CHAPTER 10 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

10.1 Outline

The JICA Study Team surveyed the environmental and social conditions of Bishkek City and recommended the improvement approach in terms of urban traffic. Based on three aspects of the environmental and social consideration shown in **Figure 10.1-1**, the following surveys were conducted :

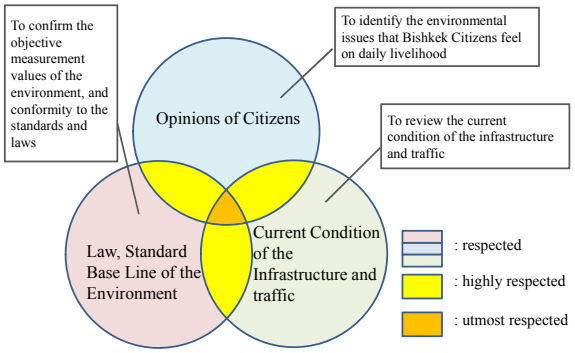


Figure 10.1-1 Three Aspects of the Environment and Social Consideration in the Study

i) Standards on the environment in the Kyrgyz Republic

ii) Baseline data in Bishkek City (air pollution and water quality)

iii) Opinions of citizens

iv) Current condition of the infrastructure and traffic

Using collected information, issues were extracted and improvement approaches were recommended.

10.2 Survey

10.2.1 Baseline of the Environment

(1) Air quality

The air quality data in Bishkek City showed that the nitrogen oxide (NOx) concentrations on the roadside highly exceed MAC (Maximum Allowance Concentration). On the other hand, the concentrations on the suburbs and of other pollutants (e.g. SO_2) met MAC. Hence, the air pollution derived from vehicle emissions occur in Bishkek City.

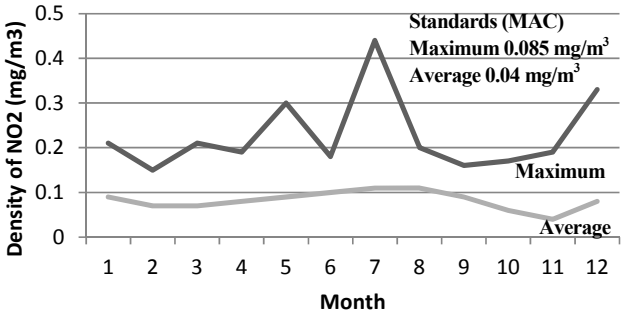


Figure 10.2-1 NO_2 Concentration in the City Center (Roadside of Manas Avenue)

(2) Water quality

The water qualities of two major rivers, Ala-Archa and Alamedin, which run through Bishkek City, generally meet the criteria. However, where a mass of garbage is dumped into the river, it is anticipated that the downstream of the river is specifically polluted.

10.2.2 Opinions of the Citizens

The JICA Study Team conducted questionnaire surveys for the purpose of collecting the citizen's opinions for Bishkek Environment.

(1) Methodology

Two groups, the authority and the public of Bishkek City, were targeted. Regarding the authority, a questionnaire survey was conducted, targeting for attendants on the workshop which was held on 5 June 2012. Regarding the public, a questionnaire survey was conducted randomly targeting citizens (100 people) who dropped in at the Pedestrian Mall experiment on 9 September 2012. The contents of the two surveys are almost same.

(2) Findings

Authority Opinions

The authorities raised the environmental issues of dust, air quality, green declining. As a desirable environment, conservation of green and clean was raised.

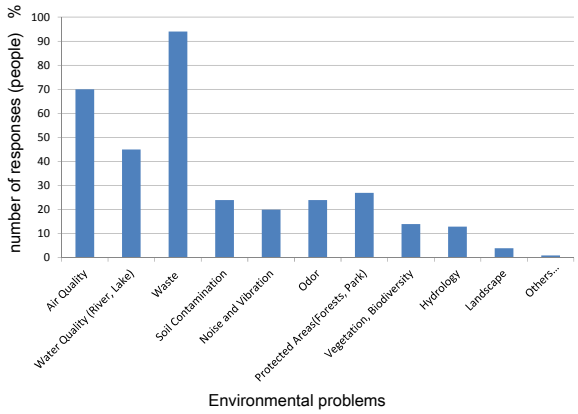


Figure 10.2-2 Environmental Problems Raised by Bishkek Citizens

The Public Opinions

As the comprehensive evaluation for the Bishkek environment, the negative responses including 'poor' and 'bad' were approximately beyond 60 percent. Regarding each environmental factor, "dust" collected most respondents, secondly "air quality". Regarding "desirable environment", answers are summarized as "clean and attractive city", "abundant greenery", "policy for the environment and development" and "sustainable growth and modernization of the city".

10.2.3 Current Conditions of Urban Infrastructure and Traffic

(1) Land Use (Building Concentration and Height, Road Width, Emission Source)

The land use of Bishkek City composes of abundant space and greenery. Main streets have extensive median strips which work as greenery parks. Moreover, roadside buildings are mainly low-rise. These conditions contribute to the reduction or dispersion of air pollutions and road noise.

(2) Road Infrastructure

Sub-arterial roads and collector roads are poor, partly deteriorated or unpaved. These can cause issues related to dust.

(3) Emission Source

The vehicles operated in Kyrgyz Republic are generally old. Over 90 percent of vehicles have been operating for more than ten years (survey in 2005). Aging vehicles with slack standards and deterioration may cause air pollution (See **Picture 10.2-1**). Moreover, traffic congestion occurs at some intersections, causing more air pollution. The traffic congestion can be improved by modernization of traffic control systems.

Picture 10.2-1 Aging Vehicles Discharging White Smoke

10.2.4 Summary of the Survey

In **Table 10.2-1**, the JICA Study Team evaluated the findings of the survey compared with the environmental factors in JICA Guidelines, and examined the requirement on traffic planning.

The high pollutants concentration on roadsides and the considerable interest of the citizens suggest that air quality is the most critical issue of the environment in Bishkek City. Noise and vibrations, which are common issues regarding traffic, have not become issues because of the considerable distance between roads and buildings and housing structures in the cold region.

Table 10.2-1 Evaluation by the Environmental Factors of JICA Guidelines

Categories	Items	(1) Opinions of Citizens	(2) Baseline of the Environment	(3) Current Condition of the Infrastructure and Traffic	Requirement on traffic planning
Anti-pollution	Air quality	A	A	A	A
	Water quality	C	C	C	D
	Waste	A	N/A	A	D
	Soil contamination	D	N/A	D	D
	Noise and vibration	B	N/A	B	B
	Subsidence	D	N/A	C	D
	Odor	B	N/A	C	B
	Sediment	D	N/A	D	D
Natural environment	Protected areas	A	N/A	B	D
	Ecosystem	A	N/A	B	B
	Hydrology	B	N/A	B	D
	Topography and geology	D	N/A	D	D
	Management of abandoned sites	D	N/A	D	D
Social environment	Resettlement	D	N/A	D	D
	Living and livelihood	D	N/A	D	D
	Heritage	D	N/A	D	D
	Landscape	B	N/A	B	B
	Ethnic minorities and indigenous peoples	D	N/A	D	D
	Working conditions	D	N/A	D	D

A: Significant impact is expected.
B: Impact is expected to some extent.
C: Extent of impact is unknown. (Further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Source : JICA Study Team

10.3 Recommendation in Terms of the Environmental and Social Considerations

From the findings of the survey, it is drawn that one of the most and pressing issues is the air quality. The policies and recommendations are shown on **Table 10.3-1**.

Table 10.3-1 Practical Approaches for Environmental and Social Considerations

Approaches	Approaches Recommendations
Reduction of vehicle gas emission	Reduction of emission gas (shifting to "European Emission Standards")
	Promotion of low emission vehicle (EV, pHV)
	Vehicle operation aiming for emission reduction (Eco driving education for the public transportation drivers)
	Regulation for operation of aging vehicles (e.g. regulation against trading or importing of aging vehicles)
	Provision of mandatory technical inspection of vehicle
Elimination of air pollutants	Preservation of the existing greenery
	Controlling dust by repair of road pavement
Avoidance of traffic congestion	Road network development
	Public transport development, Modal shift to public transport
	Influx regulation, Road pricing
	Application of NMT (Non Motorized Transport e.g. bicycle)
Control of traffic flow	Improvement of existing road
	Strict regulation against illegal parking
	Effective utilization of existing parking
	Promotion of staggered business hours
	Introduction of advanced traffic control system
Dispersion of emission sources	Securement of open space, Control of building height
	Dispersion of facilities to control heavy traffic

Note : EV. Electric Vehicle
pHV. plug-in Hybrid Vehicle
Source : JICA Study Team

CHAPTER 11 SUMMARY OF PROBLEMS AND ISSUES IN CURRENT CONDITIONS

11.1 Problems and Issues

Based on the results of surveys and analysis in the previous chapters, problems and solutions to issues in current conditions in Bishkek are summarized as follows:

Category	Present Situation	Problems and Solutions to Issues in Transportation
(1) Socio - Economic Conditions	Trade : Expanding trade deficits (export : 1,488.4 million USD against import : 3,223.1 million USD in 2010) Tax League: Competitive advantage declining due to neighboring countries' membership to the WTO.	Problems ・Competitiveness declining due to increase of transport cost for a landlocked country ・Declining city status for a regional logistic terminal for ex-CIS countries Solutions to Issues ・More efficient transport by improving freight transport network to smoothen connection with international highways ・Ensuring the city's regional advantages by making the City a regional and state transport hub, with substantial urban transport development. ・Enhancement of International Logistic Center (Dordoi Market) with improving transport access
	The City Finance ・Increase of expenditure and reducing tax revenues causing financial deficits ・Reduction of state budgetary allocation to the city ・Improving financial situation of the City	Problem ・Declining level of city' public services ・Lack of public projects for income and tax generation ・Low payment by transportation facility users (road, transit, and parking user) Solutions to Issues ・Review transit fares, parking, etc. by beneficially-pay's principle ・Privatization of public transportation operation ・Promotion of private sector involvement in new transportation business ・Tax increase policy by stimulating urban economy through transportation improvement
	Demography ・1,173,000 habitants (estimate in 2010) ・Economically Active Population (62%) ・Inactive population (aged and children) (10.8%) ・Increase of labor population and insufficient employment opportunities in the near future ・Inflow of labor in the City and migration t overseas	Problem ・Rapid rate of population increase ・High unemployment rate Solutions to Issues ・Creating jobs for urban setting ・Development of urban industries by transport sector ・Promote urban tourism and business reactivation ・Traffic facility improvement for increase in the traffic vulnerable with barrier-free (universal design) and strengthening traffic safety
(2) Land Use	Urban Planning and Structure ・City construction by historical urban planning ・Urban structure with a grid road pattern ・Compact urban structure by planning	Problem ・Little awareness of city's history and buildings as tourist attractions ・Less usage of cultural facilities for tourism Solutions to Issues ・Preservation of historical streets ・*Spreading business cores to CBD and bazaars, and "flatting urban" without an urban core (land*

Category	Present Situation	Problems and Solutions to Issues in Transportation
		marks)
	Land use : CBD ・Low buildup with wider CBD where administrative and service facilities are located, including City hall, cultural buildings, universities, parks, ・Low apartments by mixed use of residence, shops, and office ・Insufficient attractive power to consumers by lack of business core ・Ongoing construction of tall complex buildings	Problem ・Declining competitiveness with surrounding shopping centers (bazaars), old CBD activities ・Lack of area renovation plan for CBD Solutions to Issues ・Planning of CBD renovation and implementation ・Arrangement of business spaces and specific facilities to attract pedestrian shoppers ・Utilizing Pedestrian Mall method as a successful social experiment
	Land use : Urban Area ・Disorderly dispersed exiting factories ・Vacant spaces in old factories along the rail station ・Rail grand crossing causing not so heavy congestion due to infrequent trains passing ・Railway undercrossing for trunk roads	Problem ・Discontinuation of town development by railway ・No clear renovation strategy for the existing factories and spacing near the rail station ・No planning for zone renovation in urban area Solutions to Issues ・Road planning to ensure continuation of town development ・Promotion of buildup of industrial factories and planning of efficient freight and passenger flows ・Renovation, urban planning of railways and stations ・Long-term review of city development as Transit Oriented Development (TOD)
	Land use : Suburbs ・Urbanization in the suburbs ・Illegal housing development against Land Use Plan (General Plan 2006)	Problem ・Unexplained and unauthorized land use ・Insufficient provisions for road and public transportation service ・Sprawling housing development causing difficult provision of public service Solutions to Issues ・Management of housing development due to insufficient road and transit services ・Requirement for public consultation for General Plan 2006 ・Formulate clear procedures for public participation to ensure accountability
(3) Road and Facilities, and Maintenance Management	Road Network and Structure ・Sufficient capacity as network (see (4) Traffic) ・Grid pattern road network ・Wide road right of way (ROW): 30 to 50 meters width for trunk road ・Complete separation between vehicle and pedestrian traffic ・North-south roads across railway mostly at-grade level	Problem ・Underused existing road assets ・Insufficient road and traffic facility repair and maintenance management ・Lack of improvement for roads other than trunk roads Solutions to Issues ・Development control of housing, and lacking road and transit services ・Establish or clarify road functions and classifications for the prioritization of road improvement ・Establishing road maintenance management
	Road Facilities and Maintenance ・Climate conditions having min -34°C	Problem ・Obstructions of smooth traffic flow caused by

Category	Present Situation	Problems and Solutions to Issues in Transportation
	in winter and max +43°C in summer causing rapid deterioration of pavement (cracks &potholes) ・Increasing maintenance required annual repair expense ・Maintenance of road markings every year due to poor quality materials used ・Deteriorated road drainage facilities such as uncovered and manholes. ・Limited traffic signs ・Unused underground pedestrian lanes crossing due to unsafe and dirty conditions	pavement damages during winter ・Requirement of road maintenance work of patching and sealing of cracks resulting in financial burden ・Inadequate repair of roads and traffic facilities ・Short life span of work on roads, pavements and facilities Solutions to Issues ・Optimization of maintenance budget by adopting proper road markings and technical specifications ・Establishing of road maintenance system with proper inspection and repair ・Reviewing cost-saving methods and new maintenance-free pavement (Concrete with asphalt cover) and supply of equipment to contractors ・Reviewing traffic sign location, including review of regulation and application of traffic signs for travel speed, one-way direction, reversible and exclusive transit way, parking, and roadside management ・Need of clearing and installation of surveillance cameras at underground crossings at North and South Bus terminals
	Road Greenbelt and Park in Road ・Locating parks and urban green belts in ROW providing highly environmental consciousness ・A sophisticated gravity irrigation canal / ditch system for the greens ・Park in roads becoming a “Pedestrian Reservoir” for citizen ・Reducing green belts by using parking space	Problem ・Insufficient repair of irrigation facilities ・Lack of knowledge in use of water cooling systems to mitigate summer heat ・Insufficient preservation of road greens ・Lack of comprehensive planning incorporating road green belts and parks Solutions to the Issues ・Establishment of repair and maintenance management for road drainages, green belts, and parks ・Promoting the road greening and reviewing usage of the irrigation system with roadside waterfront environment ・Using road spaces for preservation of urban ecosystem as “Green and Park City”
(4) Traffic (V/C = vehicle volumes/ road capacity)	Road capacity: V/C Ratio ・In 2011, 0.5 (daily traffic), 0.6 (peak hour), in 2023, increasing at 0.6 and 0.7, respectively Travel Speed ・In 2011, 30 km/h of daily traffic and 22.7 km/h of peak hour. In 2013, reducing at 15.1 km/h of peak hour. CO_2 Emission ・In 2011, 330 kilo ton/year, in 2023 increase at 416 kilo ton/year	Problem ・Sufficient road capacity as a network; but insufficient use of network capacity due to unclear road function and hierarchy Solutions to Issues ・Separating through traffic and local traffic by clarifying the road classifications ・Clear function for each road, such as transit priority, parking control, one way, pedestrians first, and others ・Reducing CO_2 emission from transport sector
	Traffic Congestion Ratio/ Bottleneck ・1.2 near Dordoi Market and 1.0 and more at intersections of CBD	Problem ・Congestions and bottlenecks at certain locations, intersections and near the markets Solutions to Issues ・Definitive measures taken at each bottleneck

Category	Present Situation	Problems and Solutions to Issues in Transportation
		(parking control, traffic flow smoothness at intersections, traffic signal control, area traffic improvement, and others)
(5) Public Transportation (PT)	Transit Modes and Management ・City trolleybus and city bus, and private minibus (Marshrutka) operating as public transportation mode ・Bus routes duplications causing congestions at bus stops ・Insufficient coordination among each PT departments of the City ・Unclear operating regulations for all transit modes ・Low numbers of riders (passengers by a bus) of city PT due to a lack of clear functioning policy and planning share for each PT mode ・Extension of minibus routes covering a no-service area by trolleybus and midibus ・A lack of PT service standards and no response to bus users' opinions on bus services	Problem ・Causing competition on service routes operated by all transit modes ・Improper functional distinction or definition of all modes ・Lack of service standards ・Prompting traffic obstructions and causing accidents through congestion and risky driving Solutions to Issues ・Review of mandate for all relevant departments and establishment of integrated authority covering all public transportation services ・Establishing PT service standards and regulating Level of Service (LOS) of bus operators ・Review of roles of trolleybus, midibus and minibus (Marshrutka) and proper allocation of all modes with improvement of LOS ・Review of City's public transport policy by introducing the private sector into public transportation service ・Management of safety operation and driver training
	City Trolleybus and Midibus ・New trolleybus (approximately 100 units) in 2013 and renewal of its route ・Restoration of 100 city buses in 2011 ・Fix fare system ・City subsidy for bus operation ・Infrequent and long distance between bus stops	Problem ・Low operation frequency and service routes ・Increase in the City financial deficiency by subsidies ・Inconvenient bus stop location due to a long interval for bus user Solutions to Issues ・Improvement of number of riders ・Improvement of LOS ・Establishment of a mechanism to obtain user and community opinions by periodic bus survey ・Review of new routes and route extension ・Review of introducing PPP ・Service improvement by Park and Ride
	Private Minibus (Marshrutka) ・Most used mode (90% of PT) ・During old city trolleybus and midibus service, only private minibuses are operating efficiently ・Operation on franchise contract by route with the City and the private firm	Problem ・Standing passengers in a small sized vehicle ・Neglect of safety and traffic rules by driver for his fare revenue ・No planning of route extension between CBD and suburbs Solutions to Issues ・Optimizing the number of midibus by introducing a big sized bus and improvement of profitability for each bus ・Control of safety driving ・Coordination of routes and frequency with the city trolleybus and bus ・Improvement of LOS by on-time operation by time table and introducing bus approach information

Category	Present Situation	Problems and Solutions to Issues in Transportation
		system at bus stop ・Clear function and role of minibus
	Bus Stop ・No bus time tables or a route map, only simple seats and shelters ・A lack of bus routes information covering all transits ・Unfavorable bus operation and bus stop location not to meet the users request ・Risk of bus and passenger accidents ・Improper taxi parking location at bus stops	Problem ・A lack of on-time operation at bus stop due to a lack of time table ・Inconvenient bus operation for users due to a lack of route maps and time table ・Risk of traffic accident ・Unsafe bus stop design Solutions to Issues ・Improvement of safety bus operation at bus stop ・Review of proper bus stop design ・Introducing bus information system ・Extension of an improving model of bus stop introduced during social experiment of the Study
	Bus Fare ・Inefficient bus fare collection and unsustainable bus fare system ・Introducing IC ticket to trolleybus by a feasibility study of PPP by EBRD	Problem ・Unclear fare collection system by cash handling Solutions to Issues ・Preparation of bus fare policy with detailed cost and passenger survey ・Introduction of “cashless fare” system for all transit modes
(6) City Parking	On Street Parking ・On-street parking causing traffic obstruction and congestion ・Traffic police and the city cannot control and remove illegally parked cars due to inappropriate parking law and regulation. ・Illegal on-street parking, unauthorized private parking lots along street due to the lack of penalty ・Illegal parking nearby intersections and bus stops by private car and taxies Off Street Parking ・Unclear regulations in setting up parking facilities by commercial and office buildings ・Unutilized off-street parking facilities due to the lack of parking information Parking Fee ・Low parking fee not covering all social costs ・Manual collection by the contractors	Problem ・On-street car parking becoming traffic obstruction ・Misuse of parking facilities due to a lack of information ・Illegal parking and insufficient parking control ・Low parking fees promoting car use in CBD ・Lack of parking laws and regulations ・Car parking obstructing bus operation Solutions to Issues ・Law enforcement against illegal parking ・Provision of parking facilities ・Preparation of parking laws and regulations ・Parking information system using ICT system of mobile phone system ・Introducing cashless parking fee collection system ・Introducing of PPP for parking operation ・Establishment of sole parking authority with coordination of relevant departments ・Parking control at intersections ・Introducing roadside (curb) management in coordination with all stakeholders and departments ・Parking policy coordination with traffic demand management in CBD ・Introducing no car and parking zone
(7) Intersection and Traffic Control	Intersection ・Improper configuration for increasing traffic of intersections ・Lack of safety facilities for pedestrian crossing	Problem ・Causing traffic congestions and accidents ・High risk of traffic accident for pedestrian crossing Solutions to Issues ・Improvement of intersection ・Priority for critical intersections to install pedestrian safety islands for smooth traffic flow and

Category	Present Situation	Problems and Solutions to Issues in Transportation
		pedestrian ・Introducing universal design for traffic ・Extension of an improving model of intersection introduced during social experiment of the Study
	Traffic Control ・A lack of management of traffic signals ・Use of old traffic signals ・Time for pedestrians crossing too short ・Inappropriate signal cycles and signal phasing with isolated and fixed pattern for all 203 signal units ・Outdated signal system (75% are more than 20 years old)	Problem ・Improper traffic control causing peak hour congestions ・High risk of pedestrian safety and traffic accidents Solutions to Issues ・Introduction of management of traffic signals with automatic traffic detectors in accordance with traffic volume at the intersections ・Extension of improved traffic control introduced during social experiment ・Introducing all city signal control connections with a control center system
Environmental and Social Considerations	・Abolishing of a vehicle inspection system (VIS)	Problem ・Causing increase in air pollution and traffic accidents by aged cars and a lack of car inspection system Solutions to Issues ・Review of the present VIS and improvement with new inspection system for car emission gas ・Promoting a low carbon car

PART II: FUTURE SOCIO - ECONOMIC FRAMEWORK, LAND USE PROJECTION, TRAFFIC DEMAND FORECAST

CHAPTER 12 FORECAST OF FUTURE SOCIO - ECONOMIC FRAMEWORK

12.1 Population Projection up to 2023

The future population of the Study area was estimated to years 2013, 2018, and 2023. In order to obtain indices on the changes in population growth, the population of 2002 and 2005 were estimated, based on the available aerial photographs for those years. Since the population data that covered the Study area was not available, the aerial photographs were the sources used to estimate the population in the past. By the result of the estimates, it was revealed that the immigration trend has been greater after 2005 as the annual growth rate increased from 1.15 to 1.7 percent in the entire Study area. As the rate of an economically active population in the rural areas of the country was high at 67.0 percent in 2009, the migration to Bishkek City may further accelerate in coming years. The annual growth rate will further increase to 2.0 percent in 2018 and then ease to 1.85 percent in 2023. The future population of the Study area is projected to become nearly 1.4 million in 2023.

12.2 Socio - Economic Framework up to 2023

The future socio-economic framework of the Study area was forecasted for the years 2013, 2018, and 2023. It is assumed that the GRDP growth rates for the first three years will be around six percent until 2013, 5.5 percent from 2013 to 2018, and five percent from 2019 to 2023. The following scenarios were taken into consideration to set the growth rates for projection:

(a) The economic growth of the city will be stable after recovering from the financial crisis and gain more maturity in production and services.

(b) The agricultural industry will preserve the precious green areas in the periphery area of Bishkek City. It is expected that these areas will serve as the primary source of vegetables along with other agro-products for urban consumption.

(c) The Study area will continue to be the center of the manufacturing industry of the country, while the service industry will continue to be the leading industry of the city.

The enrolment rate in compulsory education from Grades 1 to 9 will be retained at 100 percent. The enrolment rate will gradually increase from 87 to 90 percent in the age group 16 to 20 years old for secondary and higher education. The enrolment rate for the age group of 21 years old and over in higher education will also increase along with the rise of the GRDP per capita.

Table 12.2-1 shows the result of the projection of socio-economy within the Study Area up to 2023.

Table 12.2-1 Socio - Economic Framework up to 2023

Item		Unit	2010	2013	2018	2023
Population		1,000	1,117.3	1,185.7	1,309.1	1,434.8
	Growth Rate	% / year	1.70	2.00	2.00	1.85
GRDP		million SOMS	78,328	93,195	121,802	155,454
	Agriculture	million SOMS	614	665	720	744
	Industry	million SOMS	23,520	29,119	38,192	44,810
	Service	million SOMS	54,193	63,411	82,891	109,900
GRDP Growth Rate		% / year	-	6.0	5.5	5.0
	Agriculture	% / year	-	2.7	1.6	0.7
	Industry	% / year	-	7.4	5.6	3.2
	Service	% / year	-	5.4	5.5	5.8
GRDP Structure	Agriculture	%	0.8	0.7	0.6	0.5
	Industry	%	30.0	31.2	31.4	28.8
	Service	%	69.2	68.0	68.1	70.7
GRDP per Capita		SOMS	70,105	78,599	93,043	108,345
	Growth Rate	% / year	-	3.9	3.4	3.1
Economically Active		1,000	509,952	538,176	592,429	647,510
Employment		1,000	405,358	442,935	505,198	583,320
	Agriculture	1,000	2,976	2,905	2,828	2,800
	Industry	1,000	37,648	40,738	45,127	46,272
	Service	1,000	364,734	399,292	457,243	534,248
Employment Structure	Agriculture	%	0.7	0.7	0.6	0.5
	Industry	%	9.3	9.2	8.9	7.9
	Service	%	90.0	90.1	90.5	91.6
Unemployment		1,000	105	95	87	64
	Unemployment Rate	%	20.5	17.7	14.7	9.9
Student	G1 ~ G9	1,000	143,171	152,053	167,878	183,997
	G10 ~ G11	1,000	38,559	41,257	46,171	51,284
	Higher	1,000	97,930	106,582	118,811	131,344
Enrolment Rate	G1 ~ G9	%	99.9	100.0	100.0	100.0
	G10 ~ G11	%	33.0	33.2	33.7	34.1
	Higher (16 ~ 20 yrs. old)	%	53.9	54.3	55.1	55.9
	Higher (> = 21 yrs. old)	%	5.0	5.2	5.3	5.3

Source 1) : BCDA for GRDP in 2010
Source 2) : JICA Study Team for the other indicators

CHAPTER 13 FORECAST OF FUTURE POPULATION DISTRIBUTION BASED ON LAND USE PROJECTION

13.1 Considerations on Future Urbanization

The future distribution of population was forecasted based on the possible occupancy of land within the Study area. For this purpose, the future urbanization of the city was initially examined considering future land use composition.

For the forecast of the future land use composition, two alternatives were formulated in accordance with the possible future urban structures by a trend basis (do-nothing case) and a planned basis (policy intervention case). The following section describes the land use composition and future population based on the plan that was given a preference for future prospect in the Study area. Expected Future Urban Structure by Planned Basis is shown in **Figure 13.1-1**.

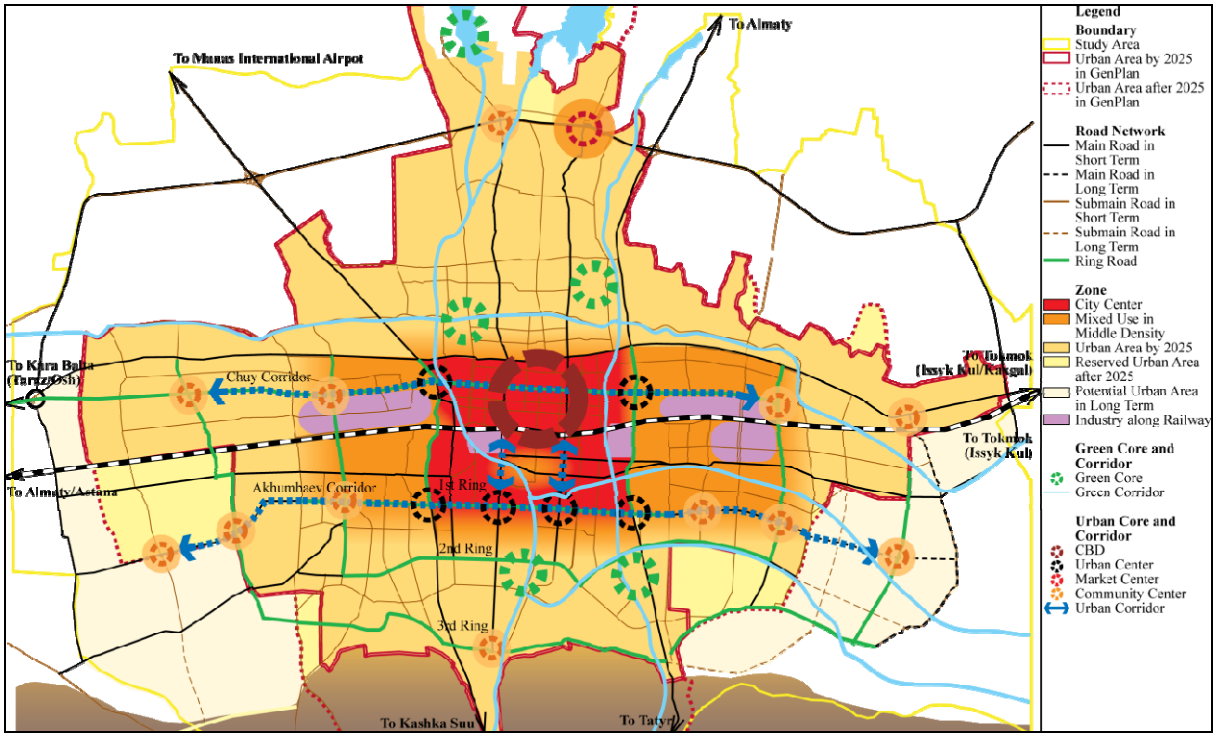


Figure 13.1-1 Expected Future Urban Structure by Planned Basis

13.2 Future Land Use Composition by Planned Basis

The General Plan 2006 showed an ideal land use of the city for future development. However, the recent urbanization has spoiled some of the major concepts of the General Plan 2006, largely due to the accelerated population growth, as well as the lack of effective tools to manage the land use under the market economy system. The future land use composition by planned basis is formulated in a way to pursue the concepts of the General Plan 2006 wherever applicable, while adjusting them to fit the current land use formulated in past developments. The major policies adopted were as follows.

(a) Expansion of Urbanization Area

The urban growth boundary set by the General Plan 2006 seemed insufficient to accommodate the total land demand up to 2025. Hence, the area allowed for urbanization needed to be expanded. This was done by taking some of the Reserved Area category designated by the General Plan 2006.

(b) Greenery in the South and North

Lands in south and north of Bishkek City are designated as green areas to preserve existing forest areas, although the current urbanization encroaches on the forest areas. This designation aims to prevent the remaining forest areas from further encroachment.

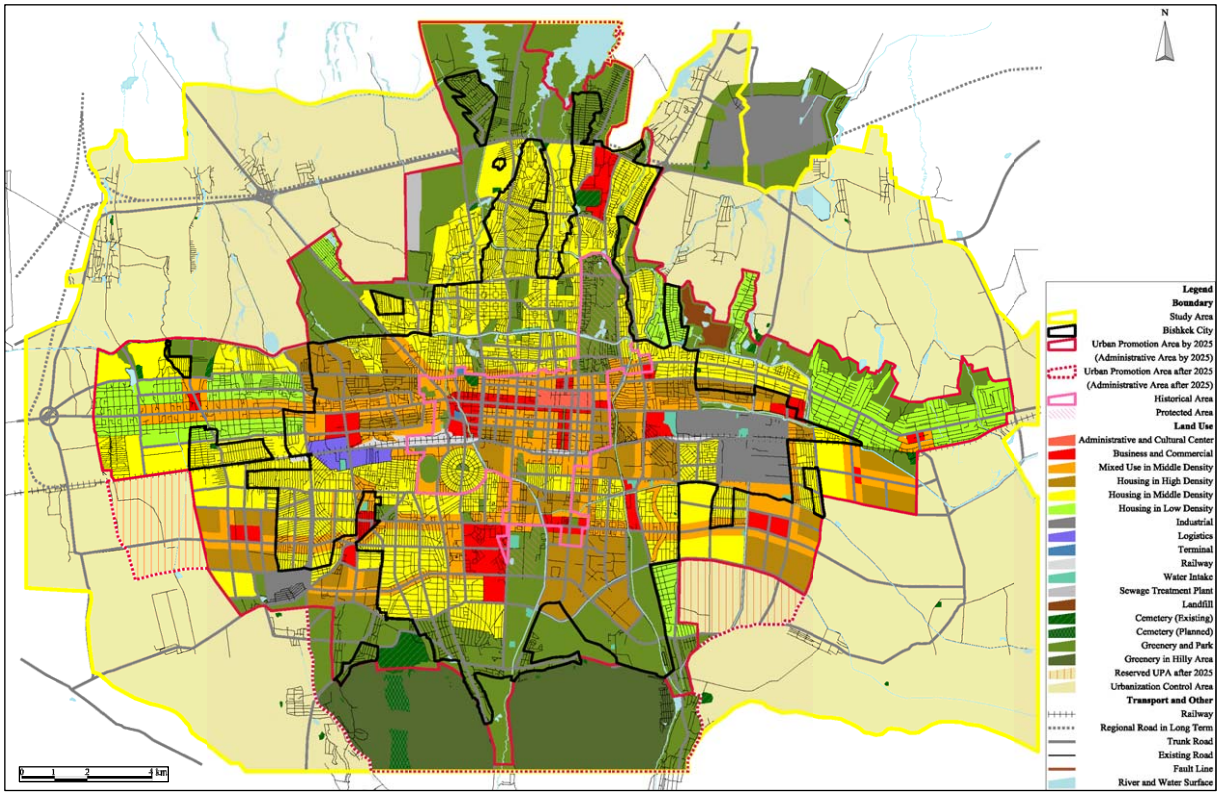
(c) Formulation of Urban Axis and Urban Center

Urban centers are designated at the areas of on-ongoing urban development and the candidate sites indicated in the future urban structure. The urban centers are connected by the urban axes that will be formed by public centers, apartments, and commercial facilities.

(d) Restructuring of Industrial Area

A new industrial area is designated in the northeast, close to the outer ring road to accommodate the land for the industrial activities.

Figure 13.2-1 shows the future land use pattern in the planned basis in the Study Area. **Table 13.2-1** shows the estimated land area by land use category in the future land use pattern.



Source: JICA Study Team

Figure 13.2-1 Future Land Use Pattern in Study Area in Planned Basis in 2023

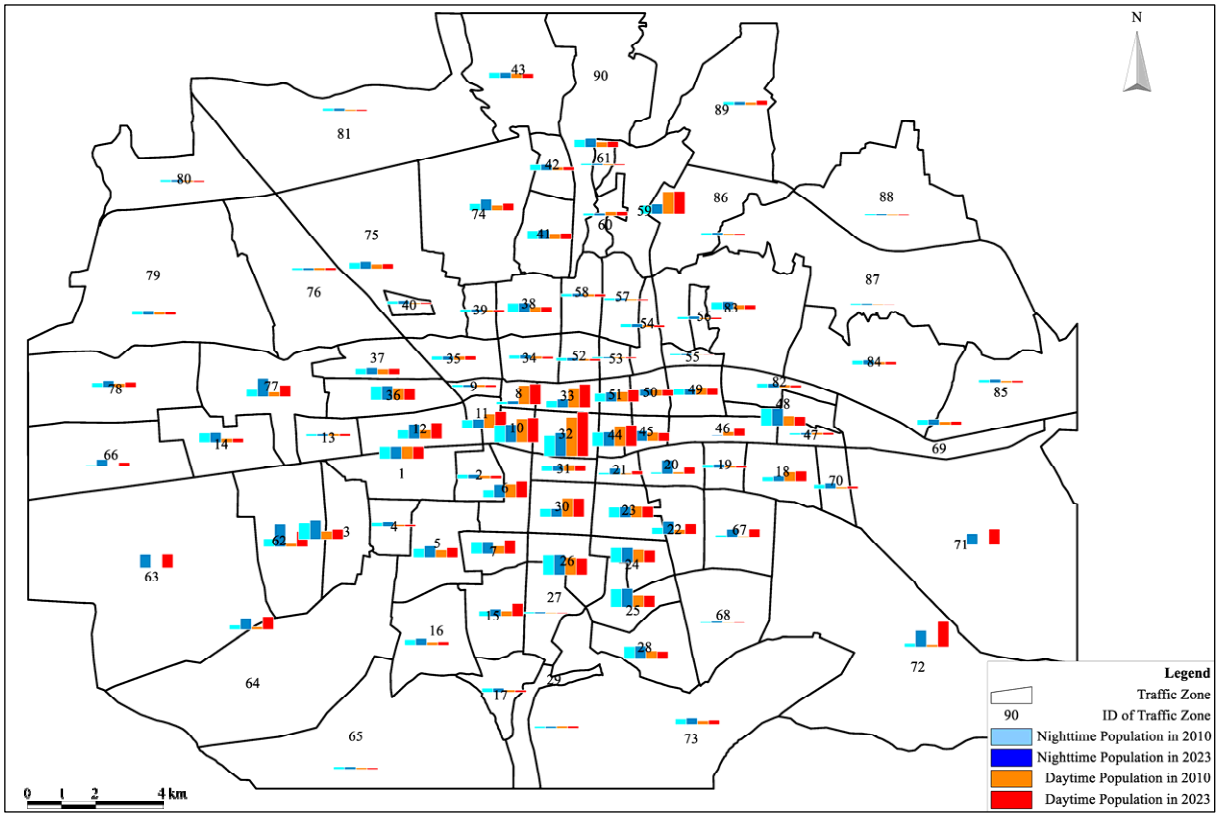
Table 13.2-1 Land Area by Land Use Category in Future Land Use Pattern in Planned Basis

Land Use Category	Land Area (ha)	Land Area (%)	Land Use Category	Land Area (ha)	Land Area (%)
Administrative and Cultural Center	93	0.2	Sewage Treatment Plant	116	0.2
Business and Commercial	1,273	2.2	Landfill	103	0.2
Mixed Use in Middle Density	3,770	6.5	Cemetery (Existing)	296	0.5
Housing in High Density	2,856	4.9	Cemetery (Planned)	140	0.2
Housing in Middle Density	8,301	14.3	Greenery and Park	8,108	14.0
Housing in Low Density	2,265	3.9	Greenery in Hilly Area	2,761	4.8
Industrial	818	1.4	Reserved UPA after 2025	1,376	2.4
Logistics	154	0.3	Urbanization Control Area	24,055	41.6
Terminal	15	0.0	River and Water Surface	996	1.7
Railway	271	0.5	Total	57,857	100.0
Water Intake	89	0.2			

Source : JICA Study Team

13.3 Assignment of Population, Worker, and Student by Traffic Zone in Planned Basis in 2023

The incremental population is distributed to the new urbanized areas within the urban promotion area. The urban promotion area will accommodate approximately 1.37 million residents or 95 percent of the total population in 2023. **Figure 13.3-1** illustrates comparison of the nighttime population and the daytime population by traffic zone in 2010 and 2023.



Source: JICA Study Team

Figure 13.3-1 Nighttime Population and Daytime Population by Traffic Zone in 2010 and 2023

CHAPTER 14 TRAFFIC DEMAND FORECAST

14.1 General

A traffic demand forecast based on the current and future (projected) socio-economic condition is necessary in formulating the transportation Master Plan (MP) that can address the future socio-economic changes and traffic volume. Therefore, the JICA Study Team performed traffic demand forecasting for the years 2013, 2018 and 2023. It provides a basis for setting MP policy and formulating transportation MP.

14.2 Road Network and Present OD Table

The present OD, which was made based on PT data and Cordon Line data of the present condition, was distributed to the road networks. Computed results and actual observed traffic volumes (converted into PCU) were compared to verify or check the productivity of the assigned method.

14.3 Traffic Demand Forecast

The model targeted for representing the travel demand of the residents of the Study area, and their usage of private and public transportation such as private cars, taxi, minibus, midibus, and trolleybus is shown in **Figure 14.3-1**. JICA STRADA system and EXCEL spreadsheets were used to show the traffic demand.

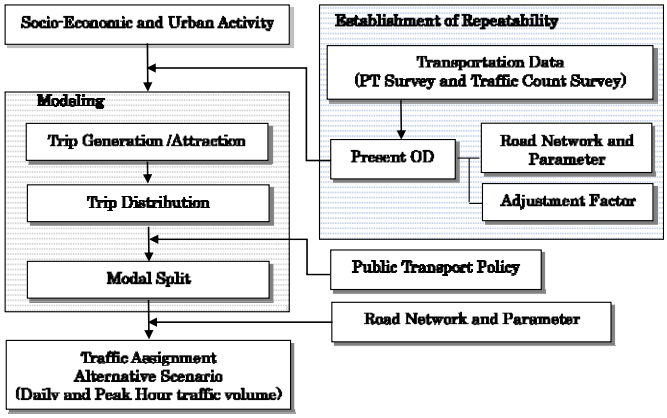


Figure 14.2-1 Concept of Four Step Approach of Transportation Modeling

14.4 Trip Generation and Attraction

The generation and attraction model was built based on the multiple regression analysis. The future framework in 2023 (projected) was compared with the 2011 framework as shown in **Figure 14.4-1**.

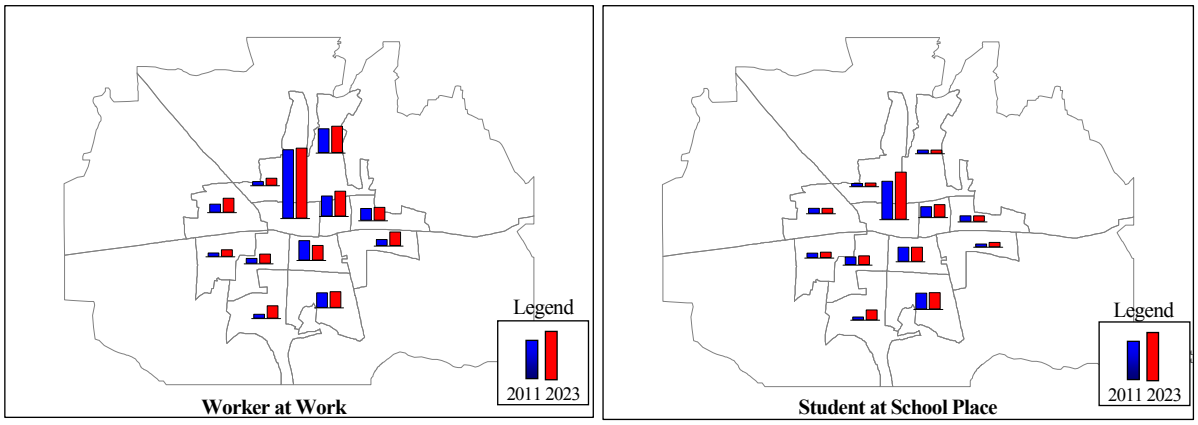


Figure 14.4-1 Zonal Framework in 2011 and 2023

14.5 Trip Distribution

The trip distributions of all modes in 2023 are shown in **Figure 14.5-1**. The distribution pattern in 2023 is basically the same pattern as that in 2011. The volume will slightly expand due to future population outside Bishkek City.

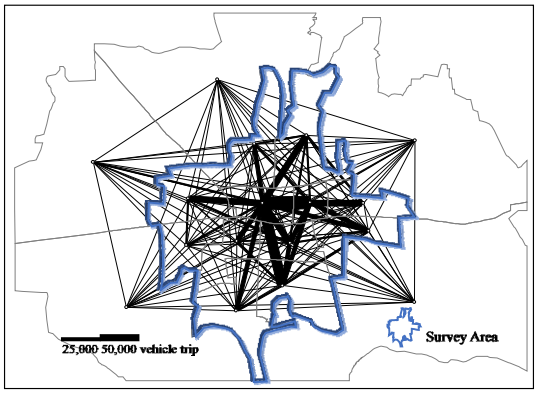


Figure 14.5-1 Trip Distribution Patterns by Desire Line (Year 2023)

14.6 Traffic Assignment

With the objective of effectively assessing the transportation policy and undertaking mitigation or solutions, traffic demand forecast was made for the years 2013, 2018 and 2023. It was initially assumed that no improvement would be achieved with the transportation supply. This was referred to as the "Do Nothing" scenario analysis. The other three scenarios are mention in **Chapter 17**.

(1) Daily Assignment Result

The VCR on a road network in 2011 shows desirable rate 1.0. However, the VCR at Chui / Fuchik intersection, Tolstoy / Molodaya Gvardiya intersection and near Dordoi market is more than 1.0. As a result, the daily average travel speed decreases from 35.6 km/hr in 2011 to 33.7 km/hr in 2023. **Table 14.6-1** to **Table 14.6-2** show the result of the traffic assignments in year 2011, 2013, 2018 and 2023 respectively.

Table 14.6-1 Summary of Vehicle Assignment Results by Daily Traffic

Average VCR (Volume Capacity Ratio)				Average Speed (km/hr)			
2011	2013	2018	2023	2011	2013	2018	2023
0.51	0.56	0.58	0.62	35.6	35.1	34.4	33.7

Table 14.6-2 Summary of CO_2 Emission Result in 2011 and 2023

2011 (ton)	2023 (ton)	2023-2011
330,360	416,231	+ 85,871

(2) Peak hour Assignment Result

The vehicle peak hour assignment results of the existing conditions in 2011 and future demand in 2013, 2018 and 2023 are summarized in **Table 14.6-3**. The average travel speed is decreased from 22.7 km/hr in 2011 to 15.1 km/hr in 2023 and VCR in 2023 reached to 0.77 which was 0.66 in 2011.

Table 14.6-3 Summary of Vehicle Assignment Results in Peak Hour

Average VCR (Volume Capacity Ratio)				Peak hour Speed (km/hr)			
2011	2013	2018	2023	2011	2013	2018	2023
0.66	0.69	0.73	0.77	22.7	22.0	18.9	15.1

CHAPTER 15 CONSIDERATION OF FUTURE TRAFFIC

Future traffic forecast was conducted based on the present situation analysis and socio-economic framework. The results of the future traffic forecast and expected problems and issues in the transportation system of Bishkek City are summarized below.

<table>
<tr><th>Category</th><th>Summary of Analysis</th><th>Problem and Issue</th></tr>
<tr><td colspan="3">Road Network and Traffic</td></tr>
<tr><td>VCR
(Volume Capacity Ratio)</td><td>1. Entire Road Network
Analysis Results show that VCR in the entire road network of the Study Area will be increased both in daily average traffic assignment and peak hour traffic assignment. Road capacity has sufficient service level as a entire network in 2023.

<table>
<tr><th rowspan="2">Year</th><th colspan="2">VCR</th></tr>
<tr><th>Daily Average Traffic Assignment</th><th>Peak Hour Traffic Assignment</th></tr>
<tr><td>2013</td><td>0.51</td><td>0.69</td></tr>
<tr><td>2018</td><td>0.56</td><td>0.73</td></tr>
<tr><td>2023</td><td>0.62</td><td>0.77</td></tr>
</table>

2. Bottleneck Point
Major Road Bottlenecks and Their Locations (Year 2023).

<table>
<tr><th rowspan="2">Road and location</th><th colspan="2">VCR</th></tr>
<tr><th>Daily Average Traffic Assignment</th><th>Peak Hour Traffic Assignment</th></tr>
<tr><td>Near Dordoi Market</td><td>1.34</td><td>2.11</td></tr>
<tr><td>Chui / Fuchik Intersection Chui ave. (East-West bound)</td><td>1.55</td><td>1.58</td></tr>
<tr><td>Tolstoy / Molodaya Gvardiya Boulevard</td><td>1.47</td><td>1.81</td></tr>
<tr><td>Chui / Alma Atinskaya str.</td><td>1.29</td><td>1.48</td></tr>
<tr><td>Jibelk-Jolu / Elebesov str.</td><td>1.24</td><td>1.46</td></tr>
<tr><td>Mir / Tolstoyt str.</td><td>1.24</td><td>1.55</td></tr>
<tr><td>Sovetskaya / Gorkey str.</td><td>1.24</td><td>1.48</td></tr>
</table>
</td><td>Problem:
1. More serious traffic congestion is expected during peak hours because traffic volume exceeds the road capacity.

Solutions to Issues
1. Preventive measures such as the traffic demand reduction are necessary in the entire network for eliminating future traffic congestion.
2. Traffic detours from the traffic congested areas or bottlenecks are necessary and traffic detours can be done by traffic management such as one-way traffic assignment and enforcement of traffic regulations.
3. Traffic capacity improvement in the bottleneck location and major roads for the resolution and mitigation.
4. Elimination of congestion at the bus stops and illegally parked vehicles are the hindrances to increasing traffic volume management.</td></tr>
</table>

<table>
<tr><th>Category</th><th>Summary of Analysis</th><th>Problem and Issue</th></tr>
<tr><td>Travel Speed</td><td>1. Entire Road Network
The analysis of results shows that Travel Speed in the entire road network of the Study area will be increased both in daily average traffic assignment and peak hour traffic assignment.

<table>
<tr><th rowspan="2">Year</th><th colspan="2">Travel Speed (km/hr)</th></tr>
<tr><th>Daily Average Traffic Assignment</th><th>Peak Hour Traffic Assignment</th></tr>
<tr><td>2013</td><td>35.1</td><td>22.0</td></tr>
<tr><td>2018</td><td>34.4</td><td>18.9</td></tr>
<tr><td>2023</td><td>33.7</td><td>15.1</td></tr>
</table>

2. Bottleneck Point
Major Road Bottleneck and Their Locations (Year 2023).

<table>
<tr><th rowspan="2">Road and Location</th><th colspan="2">Travel Speed (km/hr)</th></tr>
<tr><th>Daily Average Traffic Assignment</th><th>Peak Hour Traffic Assignment</th></tr>
<tr><td>Near Dordoi Market</td><td>32.7</td><td>5.0</td></tr>
<tr><td>Chui / Fuchik Intersection Chui ave. (East-West bound)</td><td>29.8</td><td>5.0</td></tr>
<tr><td>Tolstoy / Molodaya Gvardiya Boulevard</td><td>31.0</td><td>5.0</td></tr>
<tr><td>Chui / Alma Atinskaya str.</td><td>33.2</td><td>12.5</td></tr>
<tr><td>Jibelk-Jolu / Elebesov str.</td><td>33.8</td><td>13.0</td></tr>
<tr><td>Mir / Tolstoyt str.</td><td>33.8</td><td>5.0</td></tr>
<tr><td>Sovetskaya / Gorkey str.</td><td>33.9</td><td>12.6</td></tr>
</table></td><td>Problem:
1. Peak hour travel speed is reduced by 18.0 km in comparison with daily average speed in 2023.
2. Traffic congestion occurs in local areas by low speed.
3. Prolonged congestion during peak hours at the point of bottleneck in particular.

Solutions to the Issues:
1. Requirement to improve travel speed to eliminate traffic congestion.
2. Appropriate measures to avoid congestion during a peak hour is necessary.
3. Appropriate signal operation or control and repair of damaged roads can be reasonable measures.</td></tr>
<tr><td colspan="3">Traffic Environment</td></tr>
<tr><td>Road Improvement</td><td>1. CO_2 emission
CO_2 emissions increase due to an increase in traffic volume. The increase in emissions is due to low vehicle speed by congestions and lowering of vehicle speed by damaged road.

<table>
<tr><th rowspan="2">Year</th><th colspan="2">CO_2 Emission</th></tr>
<tr><th>ton / day</th><th>ton / year</th></tr>
<tr><td>2013</td><td>985.3</td><td>359,620</td></tr>
<tr><td>2018</td><td>1,050.0</td><td>383,238</td></tr>
<tr><td>2023</td><td>1,140.4</td><td>416,231</td></tr>
</table></td><td>Problem:
1. Since arterial, collector and distributor roads are damaged, vehicles cannot run in its normal speed and consequently CO_2 emission is increased.
2. Since vehicle operation cost increases due to low speed, economic efficiency is also affected.

Solutions to the Issues:
1. Political action and soft environmental measures (an emission gas burden charge, an ecology car and so on).
2. Road improvements and rehabilitations are necessary.</td></tr>
</table>

<table>
<tr><th>Category</th><th>Summary of Analysis</th><th>Problem and Issue</th></tr>
<tr><td colspan="3">Public Transportation</td></tr>
<tr><td>Public Transportation demand in 2023</td><td>The main bounds (axes) and facilities of the public transportation based on transportation demand in the future.

・East - West bound : Chui avenue / Kievskaya street
・North - South bound : Sovtsskaya street / Mir avenue / Manas avenue
・East Bus Terminal : Lenin street / Alma Atinskaya street
・West Bus Terminal : Makhatma Gandi street</td><td>Problem:
1. Bus terminals (east and west) are located in afar distance and the terminals are not connected by public transportation routes. Connection to the City center is also not good.
2. Route networks are not configured considering the mutual transfers.

Solutions to Issues:
1. Bus route network reformation on the basis of public transportation demand for the year 2023.
2. Strengthening of transfer function and provision of bus terminal is the base for development of public transportation network.
3. Improvement of East-West bus terminal.</td></tr>
<tr><td>Composition ratio of Bus and Passenger</td><td>・Share of trolleybus and midibus among public transportation modes is 10% whereas the share of minibus is 90%.
・Number of minibus in the Bishkek City is about 3,800.
・Present occupancy rates of the trolleybus and the midibus are less than 60% whereas that of the minibus exceeds 100%, which means over loading or over the limits of capacity.

<table>
<tr><th>Transportation Mode</th><th>Person Trip share (2011)</th><th>Number of Vehicle in Bishkek City (2011)</th><th>Daily Occupancy Ratio (2012)</th></tr>
<tr><td>1.Trolleybus</td><td>7.1%</td><td>87</td><td>46%</td></tr>
<tr><td>2.Midibus</td><td>2.5%</td><td>460</td><td>54%</td></tr>
<tr><td>3.Minibus</td><td>90.4%</td><td>About 3,800</td><td>117%</td></tr>
<tr><td>Total</td><td>100%</td><td></td><td></td></tr>
</table>
Note: Person trip share came out of the present OD.
Number of Vehilces in Bishkek City is infromed from UTD.
Daily Occupanccy Ratio is the results of the public transportation survey conducted in 2012. See Chapter 7.</td><td>Problem:
1. Minibus is crowded with the boarding rates more than a riding capacity.
2. Average rate of riding public transportation is less than 60%.
3. Number of minibus is one of the congestion factors.
4. Safety and comfort are spoiled by excess of a riding capacity.

Solutions to Issues:
1. Shifting from passenger car to trolleybus and midibus.
2. Road congestion can be minimized by enlarging of the minibus.
3. Adaptation of proper public transportation.</td></tr>
</table>

PART III: URBAN TRANSPORTATION IMPROVEMENT MASTER PLAN
CHAPTER 16 TRANSPORTATION IMPROVEMENT POLICY AND STRATEGY

16.1 Flow of Urban Transport Improvement Plan Formulation

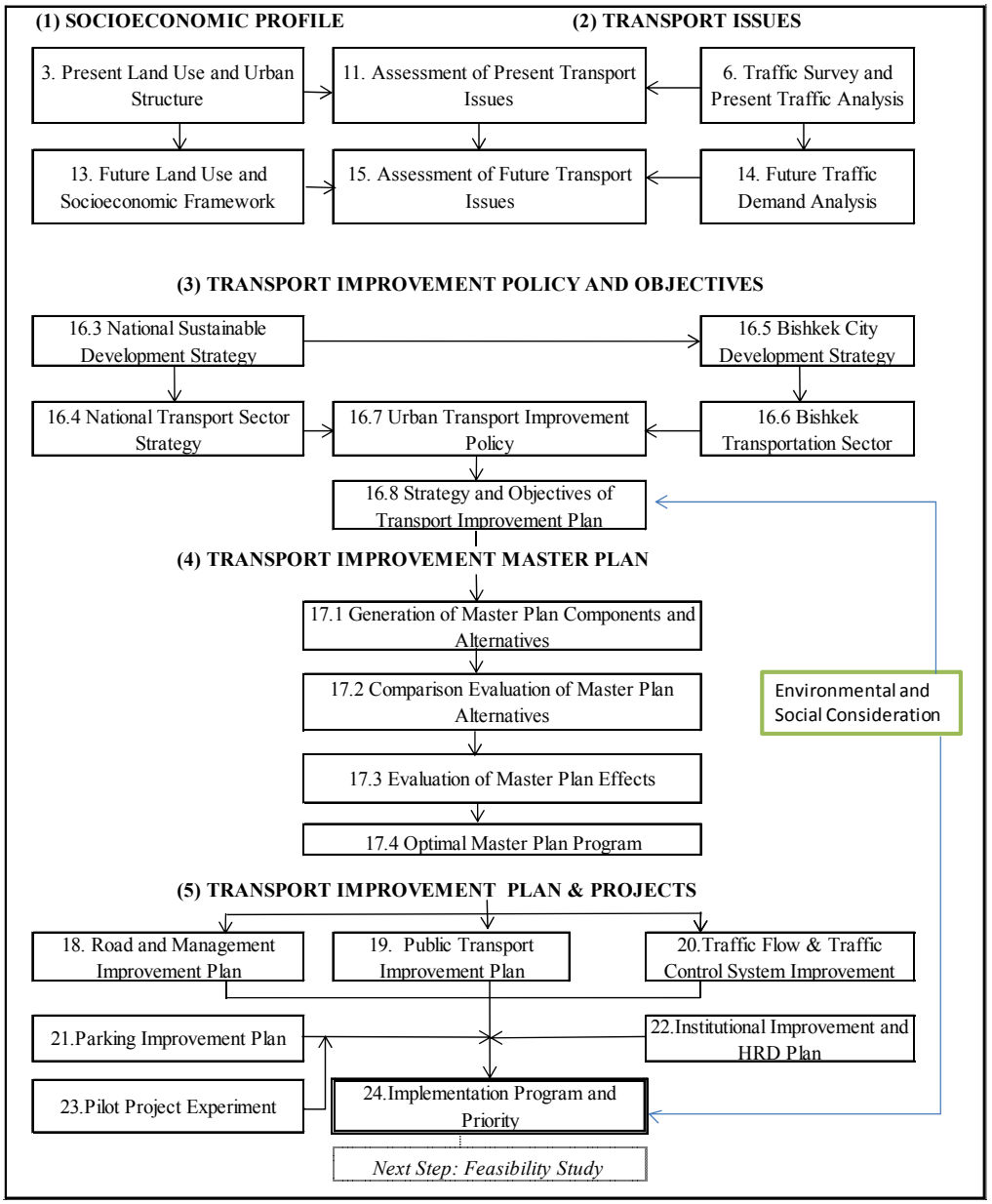
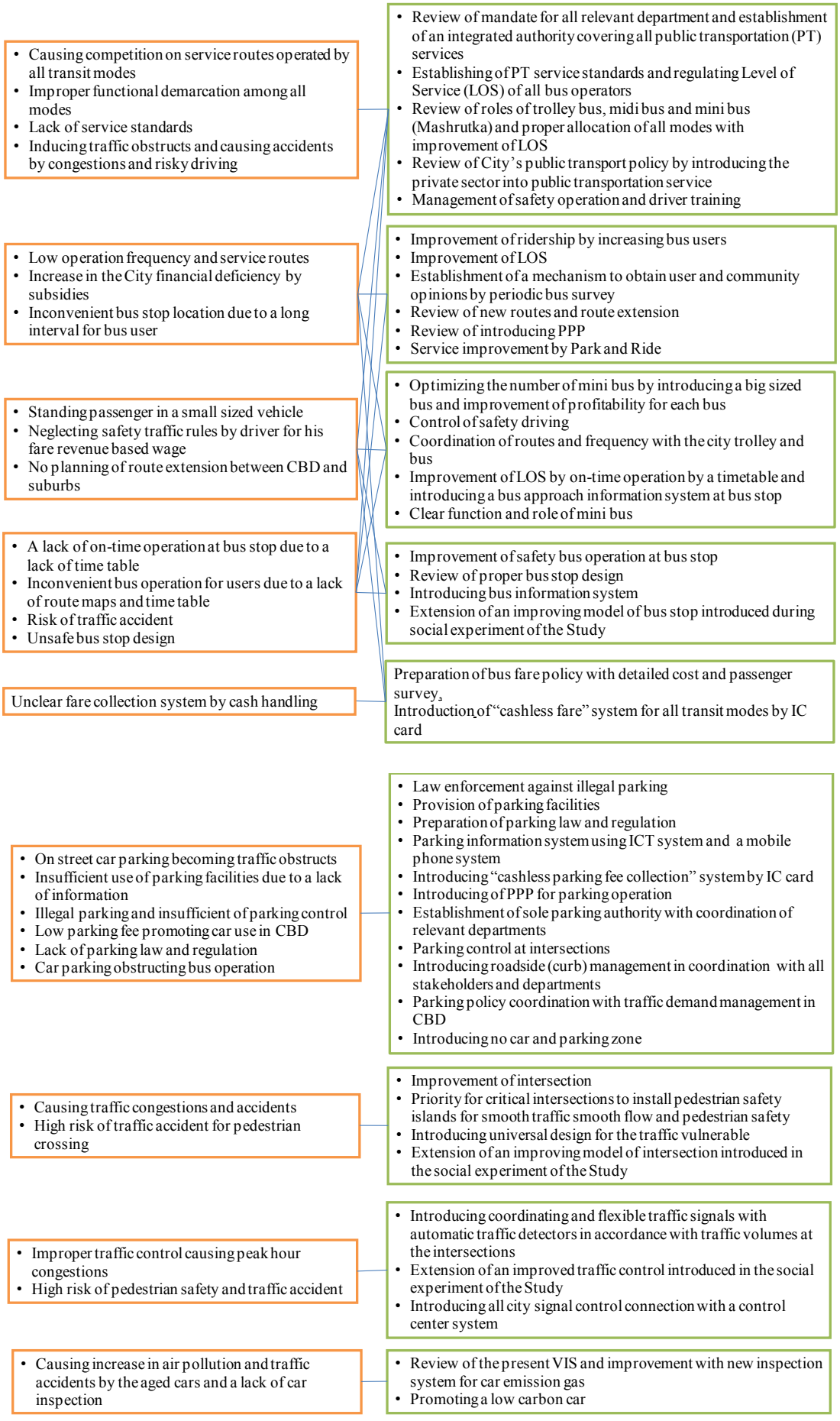


Figure 16.1-1 Flow of Urban Transport Improvement Plan Formulation

Based on the socio-economic framework and present and future traffic demands analyzed by survey results in the previous chapters, **Chapter 16** defined National Sustainable Development Strategy and Bishkek City Development Strategy and examined strategy and objectives for urban transport improvement plan. The following **Chapter 17** described transport improvement master plan and, **Chapter 18** to **Chapter 23** proposed improvement plans for each transport issue, and **Chapter 24** summarized an implementation program with priority.

16.2 Assessment of Present and Future Transportation Issues

Problem	Issues
• Competitiveness loosing due to increase of transport cost for a landlocked country • Lowing the city status for a regional logistic terminal for ex-CIS countries	• More efficient transport by improving a freight transport network to smooth connection with international highways • Ensuring the city's regional advantages by the City as a regional and state transport hub, with substantial urban transport development. • Enhancement of present function as international logistic center (Dordoi Market) with improving transport access
• Low level of public service by the City • Lack of public projects for income and tax generation • Low payment by transport facility users (road, transit, and parking user)	• Review of transit fare, parking, etc. by beneficially- pay's principle • Privatization of public transport operation • Promotion of private sector involvement to new transport business • Revenue increase policy by activating urban economy through transport improvement
• Obstructs of smooth traffic flow by pavement damages occured in every winter • Financial burden for requirement of road maintenance works, patching and crack sealing • Insufficient repair of road and traffic facilities • Shorter life of road, pavement, and facilities	• Saving maintenance budgets by proper pavement materials and technical specification • Effective road maintenance system with proper inspection and repair • Review of cost saving method and new maintenance - free pavement (Concrete with asphalt) and supply of equipment to contractors • Review for proper traffic control signs • Clearing underground crossings at North and South Bus terminals
• Insufficient repair of irrigation facilities for road plants • Lacking of idea in use of water system cooling to mitigate summer heating • Insufficient preservation of the road green • Lack of comprehensive planning incorporating road green belts and parks	• Establishment of repair and maintenance management for road drainage, green belts, and parks • Promoting the road greening and reviewing high usage of the irrigation system with creating roadside waterfront environment • Using road spaces for preservation of urban ecosystem as "Green and Park City"
• Sufficient road capacity as a network; but insufficient use of network capacity due to unclear road function and hierarchy	• Separating through traffic and local traffic by clarifying the road hierarchy • Clear function for each road; transit priority, parking control, one-way, pedestrian first, etc.
• Sufficient road capacity as a network in 2023 • Travel speed is at 33.7km/h • Travel speed reducing at 15.0km/h in Peak hour	• Preventive measures for future traffic congestions by reducing traffic demand as network • On-way and traffic control for detouring from traffic congestions and bottleneck areas • Improvement of traffic obstructs including illegal parking and congestions at bus stop areas
	• Congestion mitigation measures by improvement of travel speed reducing at time and area control • Spreading traffic concentration in peak hour
• Congestions and bottlenecks at limited places; intersections and near the markets • Due to spreading the area where the traffic exceeding road, capacity, in future more worsen • Lowing travel speed at specific areas causing traffic continuous • At the bottleneck, chronicle congestions occurring	• Different Countermeasure at each bottleneck (parking control, traffic flow smoothness at intersection, traffic signal control, area traffic improvement, etc. • Improvement of road capacity aiming at mitigation of congestion at specific areas including trunk roads, zone, bottleneck • At bottleneck, preparing preventive measures; pavement repair, traffic signal control etc.


• Causing competition on service routes operated by all transit modes
• Improper functional demarcation among all modes
• Lack of service standards
• Inducing traffic obstructs and causing accidents by congestions and risky driving
• Review of mandate for all relevant department and establishment of an integrated authority covering all public transportation (PT) services
• Establishing of PT service standards and regulating Level of Service (LOS) of all bus operators
• Review of roles of trolley bus, midi bus and mini bus (Mashrutka) and proper allocation of all modes with improvement of LOS
• Review of City's public transport policy by introducing the private sector into public transportation service
• Management of safety operation and driver training
• Low operation frequency and service routes
• Increase in the City financial deficiency by subsidies
• Inconvenient bus stop location due to a long interval for bus user
• Improvement of ridership by increasing bus users
• Improvement of LOS
• Establishment of a mechanism to obtain user and community opinions by periodic bus survey
• Review of new routes and route extension
• Review of introducing PPP
• Service improvement by Park and Ride
• Standing passenger in a small sized vehicle
• Neglecting safety traffic rules by driver for his fare revenue based wage
• No planning of route extension between CBD and suburbs
• Optimizing the number of mini bus by introducing a big sized bus and improvement of profitability for each bus
• Control of safety driving
• Coordination of routes and frequency with the city trolley and bus
• Improvement of LOS by on-time operation by a timetable and introducing a bus approach information system at bus stop
• Clear function and role of mini bus
• A lack of on-time operation at bus stop due to a lack of time table
• Inconvenient bus operation for users due to a lack of route maps and time table
• Risk of traffic accident
• Unsafe bus stop design
• Improvement of safety bus operation at bus stop
• Review of proper bus stop design
• Introducing bus information system
• Extension of an improving model of bus stop introduced during social experiment of the Study
Unclear fare collection system by cash handling
Preparation of bus fare policy with detailed cost and passenger survey,
Introduction of "cashless fare" system for all transit modes by IC card
• On street car parking becoming traffic obstructs
• Insufficient use of parking facilities due to a lack of information
• Illegal parking and insufficient of parking control
• Low parking fee promoting car use in CBD
• Lack of parking law and regulation
• Car parking obstructing bus operation
• Law enforcement against illegal parking
• Provision of parking facilities
• Preparation of parking law and regulation
• Parking information system using ICT system and a mobile phone system
• Introducing "cashless parking fee collection" system by IC card
• Introducing of PPP for parking operation
• Establishment of sole parking authority with coordination of relevant departments
• Parking control at intersections
• Introducing roadside (curb) management in coordination with all stakeholders and departments
• Parking policy coordination with traffic demand management in CBD
• Introducing no car and parking zone
• Causing traffic congestions and accidents
• High risk of traffic accident for pedestrian crossing
• Improvement of intersection
• Priority for critical intersections to install pedestrian safety islands for smooth traffic smooth flow and pedestrian safety
• Introducing universal design for the traffic vulnerable
• Extension of an improving model of intersection introduced in the social experiment of the Study
• Improper traffic control causing peak hour congestions
• High risk of pedestrian safety and traffic accident
• Introducing coordinating and flexible traffic signals with automatic traffic detectors in accordance with traffic volumes at the intersections
• Extension of an improved traffic control introduced in the social experiment of the Study
• Introducing all city signal control connection with a control center system
• Causing increase in air pollution and traffic accidents by the aged cars and a lack of car inspection
• Review of the present VIS and improvement with new inspection system for car emission gas
• Promoting a low carbon car

16.3 National Sustainable Development Strategy

National Sustainable Development Strategy (NSDS) was formulated for a task of five-year (2013 to 2017) by the president office, in cooperation with international donors, and issued in March 2013. The Study considers NSD upper strategies of MP.

NATIONAL SUSTAINABLE DEVELOPMENT STRATEGY

1. Strategic vision of Kyrgyzstan in the long term

- a strong and independent country that is part of the developed countries
- a place that is comfortable for living
- a place where their rights, freedoms and security are ensured
- a multi-lingual and friendly domestic environment governed by the rule of law
- a country with high level of education, healthy natural environment, public stability, international image of state with stable background, robust economic growth and high attractiveness for investors

2. A task in the next five years (period of 2013 - 2017)

The Strategy is designed to ensure achievement of a task of succeeding as a democratic state with stable political system, dynamically growing economy and stable growth in the incomes of its citizen.

Local Self-Government Development Strategy

1. Improvement of organizational and legal framework
2. Separation of functions and authorities
3. Improvement on delivery of municipal services
4. Improvement of inter-budget relations, ensuring financial sustainability and effective management of resources
5. Increase in the accountability
6. Increase in professionalism and capacity building for the municipal service

Transportation Sector Strategy

1. Rehabilitation of five motorways of the Central Asian Regional Economic Cooperation (CAREC)
2. Preservation and improvement of the network of domestic paved roads
3. Ensuring transport independence to construct new bypass (detour) roads
4. Creation of an air transport hub

THREE MANDATORY CONDITIONS BY NSDS

1. Relying on own resources
2. Ensuring supremacy of law and rule of law
3. Ensuring unity

Figure 16.3-1 Scheme of National Sustainable Development Strategies

16.4 National Sustainable Development Strategy

The City Council expects to issue a Bishkek City Development Strategy in November 2013, by reviewing NSDS prepared by the president office and Bishkek City Development Concept (2009 - 2025) (BSDC) issued by the former City Council in 2009.

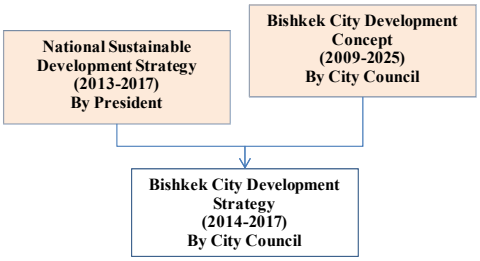


Figure 16.4-1 Relation of National and City Development Strategies

16.5 Bishkek City Development Strategy (Draft)

The Study prepared a draft of Bishkek City Development Strategy with a vision of Bishkek, based on NSDS and BCDC, aiming to enhance a capital function, as follows.

Vision
Green and Garden City

Objectives
- Capital playing a role of promoters for National Sustainable Development Strategy
- Capital improving social welfare and living standards of citizen
- Capital facilitating foreign direct investment(FDI) to meet global economy
- Capital strengthening hub functions of CIS & regional transportation and communication
- Capital promoting new urban industries such as tourism and Small & Medium enterprises
- Capital enhancing management capacity to maintain law and urban assets

Tasks
1. To promote NSDS through BSDS
2. To create a compact city with Transit Oriented Development (TOD)
3. To improve mobility and accessibility
4. To promote FDI in urban transportation sector
5. To promote transport hub facilities for passengers and freight
6. To promote Environmentally conscious (Green City)
7. To develop new industries with inteligent oriented and services including tourism
8. To promote "citizen participation"

16.6 Bishkek Transportation Improvement Policy

16.6.1 Adopted Principles

National Sustainable Development Strategy (NSDS) includes

i) Establishment of "law abiding country" governed by law,

ii) Environmental policy for sustainable development,

iii) Reduction of expenditure for financial reform,

iv) Investment for strategic sectors such as transport and tourism, and

v) Small government with deregulation and promotion of market economy.

Adopted principle for preparation of Bishkek Transportation Improvement Policy is summarized below, taking the above Bishkek City Development Strategy (Draft) into consideration.

NSDS Principles	Issue	Adopted Principle
1. Law	Transport law and institutional strengthening	・Urban Transport Related Law ・Institutional Strengthening &HRD
2. Environment	Environmentally Sustainable Transport (EST)	・Reduction of GHG ・Community unity ・Participation
3. Finance	・Economic promotion by transport ・Income generation in new transport sector	・International trade and transport hub function of state ・Private sector participation into creating income generating projects

NSDS Principles	Issue	Adopted Principle
4. Transport and Tourism	Coordination with tourism sector	・Road and transport facilities preservation ・Tourism promotion by transport
5. Small government & promotion of market economy	Policy review of subsidy	・Deregulation of transport sector ・Promotion of private involvement

16.6.2 Bishkek City Urban Transportation Improvement Policy

(1) Bishkek City Urban Transportation Improvement Policy

The policy of Bishkek City Urban Transportation is shown below, which is formulated based on the Bishkek City development concept, taking NSDS and City Development Strategy into consideration.

Bishkek Urban Transportation Improvement Policy

Goal and Strategy

I. To enhance the capita economic functions as driving force contributing national sustainable development;
II. To respond to environmental challenges such as global warming issues;
III. To apply aggressive deployment of world advanced transportation technology
IV. To ensure financial resources by the private sector for implementation
V. To make institutional strengthening and capacity development of human resources

Objectives

1. To promote NSDS through BSDS
2. To improve mobility and accessibility
3. To promote FDI in urban transportation sector
4. To create transportation hub facilities for passengers and freight
5. To promote EST for environmentally conscious as Green Park City
6. To facilitate urban tourism by "walking town"
7. To promote ITC technology
8. To promote citizen participation for law and plan
9. To provide institutional strengthening and capacity development of City and BCDA
10. To expand and firmly establish the results of social experiments in the Study

Approach

I-1: Assurance of effectiveness by strengthening the international and regional road networks by establishing transportation hub function;
I-2: Urban transport development for improvement of capital functions and revitalization of urban economy;
I-3: Promotion of tourism development by pedestrian malls and park roads;
I-4: Increase in tax revenue by activation of business at CBD;
II-1: Promotion of public transportation and traffic demand management;
II-2: Promotion of Environmentally Sustainable Transportation;
II-3: Efficient utilization of existing infrastructure through the introduction of new transportation technology;
III: Promotion of balanced privatization in public transportation;
IV-1: Introduction of private funds (DFI);
IV-2: Facilitation of Public and Private Partnership (PPP);
V-1: Development of technologies and measures that have been proven in social experiment during the Study; and
V-2: Implementation of human resource development and institutional improvement.

16.6.3 Approach of Transport Improvement Plan

The approach to formulate MP with projects is prepared based on the above policies, and the scope.

The study and planning scope is as follows.

Bishkek Urban Transportation Improvement Plan (2013 - 2023)

- ✓ Traffic bottlenecks solution with targeted year of 2018 and 2023 (every 5 year)
- ✓ Institutional capacity development of the City and BCDA through the Study
- ✓ Social experiments and pilot projects for traffic flow smoothness and traffic signal improvement, public transport, and pedestrian mall

Table 16.6-1 Objective and Approach for Plan

Objective	Approach	Plan
I. Transportation to enhance the capital economic functions as a driving force contributing national sustainable development	1: Strengthen a function of international transportation hub to assure the effects of improvement of regional roads	1. Traffic coordination between a national road network and urban trunk roads for traffic flow improvement 2. Solution of traffic congestions and securing traffic safety at the points where national and urban roads connect together 3. Resolution of traffic bottlenecks and traffic congestions on national trunk highway in the urban areas 4. Smooth flow of local public transportation into the urban area 5. Traffic improvement at logistic centers (Bazars) that use international highways
	2: Develop urban transport for improvement of capital functions and revitalization of urban economy	6. Resolution of traffic bottlenecks on urban road network 7. Ensuring smooth traffic flow by an integrated traffic signal control 8. Expansion of road capacity by curb management
	3: Promote Bishkek tourism resource development by transportation	9. Improvement of access to tourism sources by "walkable town". 10. Promotion of transport environment as "Environmentally Sustainable City"
	4: Increase urban economy and tax revenue by activation of commercial business at CBD;	11. Activation of Town by Transportation 12. Promotion of "people gathered" by pedestrian mall and fest 13. Creation of "a pedestrian reservoir" by improvement of pedestrian way
II. Transportation to respond to environmental challenges such as global warming issues;	5. Promotion of public transportation and traffic demand management; 6. Promote Environmentally Sustainable Transportation (EST) for reduction of CO_2	14. Improvement of public transportation service and promotion of PT use 15. Extension of environmental consciousness by introducing "Eco- Car" 16. Enhancing traffic safety 17. Improvement of pedestrian mobility
III. Transportation to do aggressive deployment of world advanced transportation technology	7. Do efficient utilization of existing infrastructure through the introduction of new modern technology	18. Improvement of maintenance technique of urban transport infrastructures and its asset management 19. Introductions of Intelligent Transport System (ITS) for efficient use and management 20. Introduction of modern transport ICT technology of Japan and developed countries 21. Introduction of environmental car (highbred car) for public use

Objective	Approach	Plan
IV. Securing financial resources to improve practicability	8. Promote balanced privatization in public transportation;	22. Review of comprehensive public transport preferential laws and policies 23. Creating an integrated institution for control of PT 24. Promoting PT management by service standards 25. Introduction of franchise system for 26. Remove of entry barriers for private enterprise
	9. Introduction of private funds (DFI)	27. Remove of entry barriers for private investment 28. Facilitation for entry of FDI to transport sector
	10. Facilitation of Public and Private Partnership (PPP)	29. Promotion of transport facilities having income generations 30. Introduction of facilities expanding PT services; like bus terminals 31. Applying "Park & Ride" facilities
V. Expand and establish outcomes of TIP	11. Develop technologies and measures that have been proven in social experiment during the Study	32. Extending design life of transport facilities by enhancement of road and transport maintenance management 33. Improvement of intersection for traffic flow improvement 34. Promoting pedestrian traffic safety policy 35. Curb management of bus stops and taxi parking 36. Activation of central business district by expanding pedestrian space
	12. Implement human resource development and institutional improvement.	37. Human capacity development of City. BCDA and traffic police 38. Institutional improvement and strengthen

CHAPTER 17 MASTER PLAN COMPONENTS AND ALTERNATIVE SCENARIOS EVALUATION

17.1 Generation of Master Plan Components and Alternatives

17.1.1 Approach

The study results show that the traffic capacity as road network is 1.0 or less even for traffic demand forecast in 2023. However, local and limited traffic congestions occur for certain time periods, in particular peak hours, and at specific bottleneck locations. Due to roadside conditions, it is difficult to increase the traffic volume through road development approach in road widening and elevated intersections, because they require new lands for expansion of the right of way.

In general, the road congestion and bottlenecks are caused by a various factors, hence transport planning has to consider multiple components for their solutions. In addition, the Study limits the aims to reducing traffic congestion and eliminating traffic flow bottleneck at the specific road and intersections.

Under these conditions, MP will consider, as components for solutions on demands, promotion of utilization of public transportation and traffic management in order to reduce the traffic volumes and vehicle trips. As for solutions on supply, in order to recover road traffic capacity, the hindering factors in reducing road traffic volumes are examined, including repair of damage and conservation of road pavement and transportation facilities, improvement of bottleneck at intersection, and control of illegal road-side parking so on.

As shown in Figure below, MP will formulate alternative scenarios with high feasible components in the time frame and financial affordability of the City.

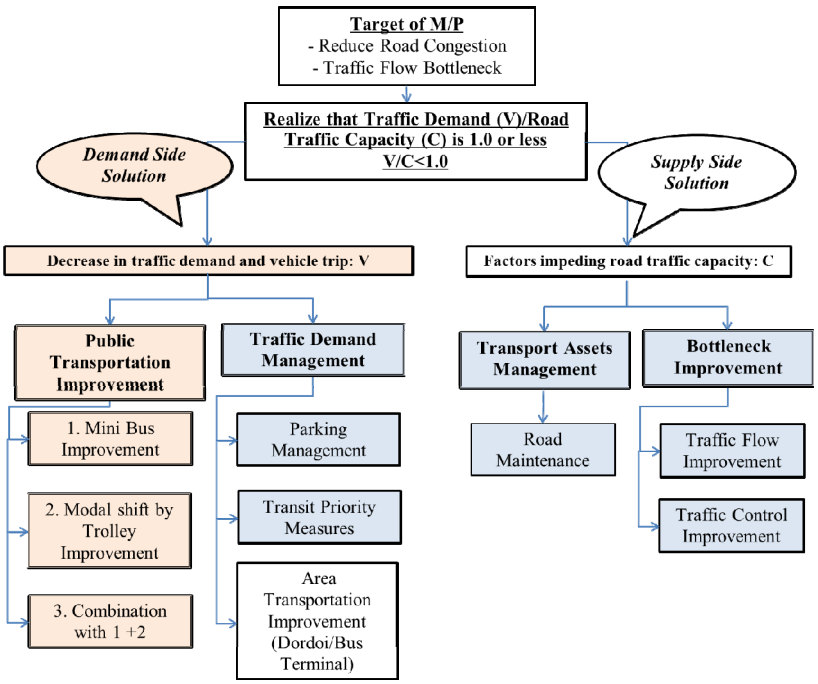


Figure 17.1-1 Approach of Generation of Master Plan Components

17.1.2 Basic Conditions of Traffic Share (Do-Nothing Case)

The basic conditions in compiling the scenario are shown below. Regarding Person Trips (PT), passenger cars account for 87 percent of the total number of vehicles when the PT rate is 25 percent. In comparison with the PT and the number of passenger cars, the passenger car transportation seems inefficient. The PT rate of minibuses is high at 42 percent and accounts for 98 percent by vehicle of the mode of public transportation. This shows that vehicle congestion is mainly caused by passenger cars. The trolleybuses account for only three percent of the PT and below one percent of the number of vehicles. Thus, reduction of the number of trips of passenger cars and conversion to public transport are examined. Regarding public transportation, as the minibuses cause traffic congestions at bus stops and on specified roads (overlapping route), countermeasures for minibus operation need to be taken.

Table 17.1-1 Trip Share by Mode in 2013 (Do-noting)

Mode	Passenger / Vehicle	Person trip/day (Bishkek City Zone 1-61)			Vehicle trip/day (All Zones 1-98)	
	(Passenger)	(Trip)	Share	PT Share	(Trip)	Vehcl.%
1.Trolleybus	28.2	72,181	3.2%	7.0%	3,194	0.3%
2.Midibus	27.0	27,750	1.2%	2.6%	8,619	0.9%
3.Minibus	17.0	934,832	42.0%	90.4%	94,119	9.8%
Total (Public Transport : PT)		1,034,763	46.5%	100.0%		
4.Truck	1.3	3,171	0.1%	-	12,966	1.4%
5.Passenger Car	1.5	560,234	25.2%	-	839,550	87.6%
6.Walk	-	629,316	28.3%	-		
Total		2,227,484	100.0%	-	958,448	100.0%

Source : JICA Study Team

17.1.3 Generation of Alternative Scenarios

One alternative scenario is the modal shift from utilization of passenger cars to public transportation utilization, with a study of policies. Initially, the small minibuses operated by the private companies will be changed to larger ones, thereby reducing the number of vehicles and its trips, then mitigating congestion on the minibus routes. It takes a big slice of budget and time until full-scale operation of new trolleybuses can be put into consideration. In addition, the minibus currently loads its passengers over the nominal passenger numbers and some passengers are forced to stand. Hence, increasing in numbers of minibuses would contribute to better service and passenger safety. In this Scenario 1, the City only needs to set regulations and does not need additional expenditure.

Scenario 2 is to improve the efficiency of operation of new trolleybuses with repair and extension of its operation routes. Modal shift from passenger cars to trolleybuses is to be promoted by improving the level of service, such as the evaluation of optimum distance between bus stops, propmpt operation using the timetables, an information system of approaching buses and a park-and-ride scheme. The use of passenger cars must be limited with parking lot management, prompt time, zone and road management must be established.

If passenger car control can be carried out simultaneously with the improvement of public

transportation capacity and service, there will be a need to consult with citizens. The city government should decide whether they persuade people based on the guidance policies or enforce regulations, or both.

Scenario 3 would be as follows. If trolleybus operations improve and the limitations on use of passenger cars can be implemented, an integrated operational management of public transportation will be needed. It is necessary to clarify the functions and role of each mode, to establish an integrated management organization, to create a fare system with common IC card under the organization, and to guarantee the convenience of bus transfers in terms of improvement of service for users.

The table below shows a summary of scenarios in consideration of the issues described above.

Table 17.1-2 Summary of Alterative Scenarios

Scenario	Objective	Measures	Effects
Scenario 0	Do-nothing	No	No
Scenario 1	Using high occupancy bus for small minibus	25% of small minibus trip share to big ones	Reduce the number of minibus trips
Scenario 2	Modal shift to trolley bus	10% in vehicle trip share of trolleybus	Increase trolleybus users
		10% reduction of passenger car trip	Decrease the number of car use along PT corridor
Scenario 3	Scenario 1 + Scenario 2	Combination of Scenario 1 and 2 ・Measures to improve services ・Establishment of integrated management organization ・IC card introduction, etc.	Combination of effects of Scenario 1 and 2 ・Improvement of convenience ・Increase in users ・Improvement of profitability

Source : JICA Study Team

(1) Scenario 1

Scenario 1 assumed that 25 percent of minibus trips of small-sized vehicles will be replaced with vehicles double their size (twice the seating capacity) to reduce the number of trips of minibuses.

Table 17.1-3 Minibus Vehicle Trip Decrease in Scenario 1

Unit : PCU x trip

Year	Do Nothing (a)	Scenario 1 (b)	Decrease (a)-(b)	Do Nothing	Target share
2013	94,119	70,766	23,353 (-10%)	9.8%	7.3%
2018	98,381	73,970	24,411 (-10%)	9.7%	7.1%
2023	103,642	77,926	25,716 (-10%)	9.5%	7.3%

Source : JICA Study Team

(2) Scenario 2

Scenario 2 assumed that modal shift will be promoted from use of passenger cars to use of trolleybuses, for the same purpose, that is, to increase trolleybus use and reduce car use.

Table 17.1-4 Trolleybus Vehicle Trip Increase in Scenario 2

Unit : PCU x trip

Year	Do Nothing (a)	Scenario 2 (b)	Increase (b-a)	Do Nothing	Target share
2013	3,194	6,388	3,194 (+50%)	0.3%	0.7%
2018	3,371	6,742	3,371 (+50%)	0.3%	0.7%
2023	3,650	7,300	3,650 (+50%)	0.3%	0.7%

Source : JICA Study Team

Table 17.1-5 Passenger Car Vehicle Trip Decrease in Scenario 2

Unit : PCU x trip

Year	Do Nothing (a)	Scenario 2 (b)	Increase (b-a)	Do Nothing	Target share
2013	839,550	763,227	76,323(-10%)	87.6%	86.2%
2018	890,714	809,740	80,974 (-10%)	87.7%	86.3%
2023	957,456	870,414	87,015(-10%)	87.8%	86.4%

Source : JICA Study Team

(3) Scenario 3

Scenario 3 assumed the case in which a combination of Scenario 1 with Scenario 2 is applied, with measures to improve services, establish integrated management organization and IC card introduction, etc.

17.2 Comparison Evaluation of Master Plan Alternatives

Table 17.2-1 Summary of VCR and Average Speed by Daily Traffic

	Average VCR (Volume Capacity Ratio)				Average Speed (km/hr)			
Case	2011	2013	2018	2023	2011	2013	2018	2023
Scenario 0	0.51	0.56	0.58	0.62	35.6	35.1	34.4	33.7
Scenario 1	-	0.54	0.57	0.61	-	35.3	34.6	33.8
Scenario 2	-	0.52	0.53	0.58	-	35.4	34.7	34.0
Scenario 3	-	0.50	0.52	0.56	-	35.5	34.8	34.2

Source : JICA Study Team

Table 17.2-2 Summary of Vehicle-km and Vehicle Hour by Daily Traffic

	PCU Vehicle-km ('x 1,000)				PCU Vehicle-hour ('x 1,000)			
Case	2011	2013	2018	2023	2011	2013	2018	2023
Scenario 0	7,216	7,752	8,182	8,818	202	220	238	261
Scenario 1	-	7,481	7,899	8,515	-	212	228	251
Scenario 2	-	7,220	7,624	8,216	-	204	219	241
Scenario 3	-	6,946	7,339	7,910	-	195	210	231

Source : JICA Study Team

Table 17.2-3 Summary of CO_2 Emission Result in 2023

Case	Reduction /(t/day)	Reduction /(t/year)	Reduction volume (t/year)
Scenario 0	1,140.4	416,231	-
Scenario 1	1,137.0	414,995	-1,236
Scenario 2	1,030.6	376,160	-40,071
Scenario 3	1,026.7	374,758	-41,473

Source : JICA Study Team

17.2.1 Additional Evaluation by Peak - Hour Traffic

Table 17.2-4 Summary of VCR and Average Speed by Peak Hour Traffic

	Average VCR (Volume Capacity Ratio)				Average Speed (km/hr)			
Case	2011	2013	2018	2023	2011	2013	2018	2023
Scenario 0	0.66	0.69	0.73	0.77	22.7	22.0	18.9	15.1
Scenario 1	-	0.66	0.70	0.74	-	23.2	21.4	17.6
Scenario 2	-	0.65	0.68	0.73	-	23.2	21.9	18.0
Scenario 3	-	0.62	0.66	0.70	-	24.6	23.1	20.4

Source : JICA Study Team

The impacts of the three scenarios are shown in comparison with daily traffic volume in Do-nothing cases in 2023 and peak-time congestion rate and speed. It shows reduction of congestion in road networks. The congestion rate improves from 0.77 to 0.70 and average speed improves from 15.1 to 20.4 km/hr. The public transportation and the modal shift must be promoted further.

17.2.2 Results of Evaluation of Alternative Scenarios

Item	Do-nothing	Scenario 1	Scenario 2	Scenario 3
1.Average VCR	0.62	0.61	0.58	0.56
	-	(a)	(aa)	(aaa)
2.Travel time (km/h)	33.7	33.8	34.0	34.2
	-	(a)	(aa)	(aaa)
3.Traffic Efficiency (vehicle- km)	8,182,000	8,515,000	8,216,000	7,910,000
	-	(a)	(aa)	(aaa)
4.Time saving (vehicle- time)	261,000	251,000	241,000	231,000
	-	(a)	(aa)	(aaa)
5.CO_2 (t/year)	416,231	414,995	376,160	374,758
	-	(a)	(aa)	(aaa)
6. Funding Scheme	-	Private-oriented	Public	PPP
		(aaa)	(a)	(aa)
7. PT Promotion	-	Low	Medium	High
		(a)	(aa)	(aaa)
8. Civil work	No	Less	Medium	Medium
		(aaa)	(a)	(a)
9. Institutional Reform	-	No	Less	Required
		(aaa)	(aa)	(a)
10. Social Impact	-	Medium	High	High
		(aa)	(a)	(a)
11. EIA	-	Not required	Not required	Not required
		(aaa)	(aaa)	(aaa)
12. Practicability	-	High	Medium	Low
		(bbb)	(bb)	(b)
Total Evaluation	-	17a+3b	20a+2b	26a+b
Priority		Second	Second	First

17.2.3 Optional Master Plan Program

Year	Scenario 0	Scenario 1	Scenario 2	Scenario 3
2013	-	Full Scale	Preparation	Scenario 1
2018	○	Full Scale	Full Scale	Scenario 1+2
2023	○	Full Scale	Full Scale	Full Scale MP

Source : JICA Study Team

17.2.4 Peak Hour Solution in 2023

(a) Public Transport Priority measures

(b) Control passenger car use in peak hour

(c) Solution of Bottleneck at intersections and along corridors

(d) Roadside (curb) management for bus and taxi

(e) Parking system improvement at critical section of roads

17.3 Evaluation of Master Plan Effects of Scenario 3 in 2023

(1) Daily Traffic

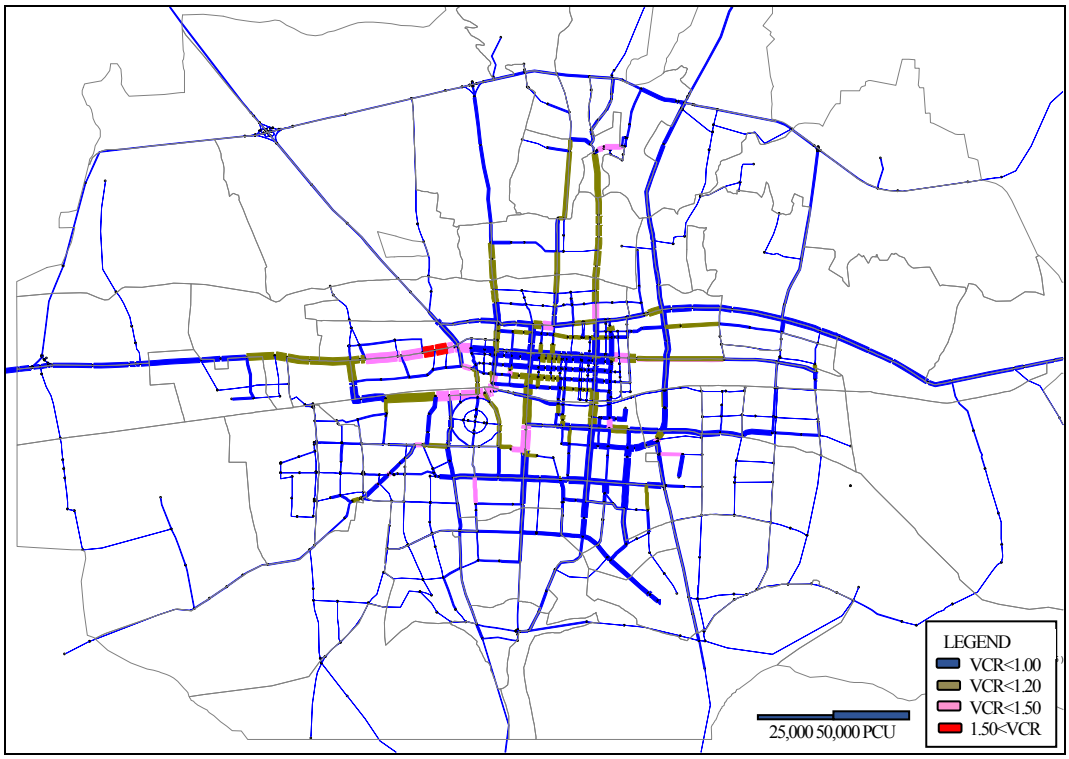


Figure 17.3-1 Daily Traffic Assignment in 2023 (Scenario 3)

(2) Peak Hour Traffic in Scenario 3 in 2023

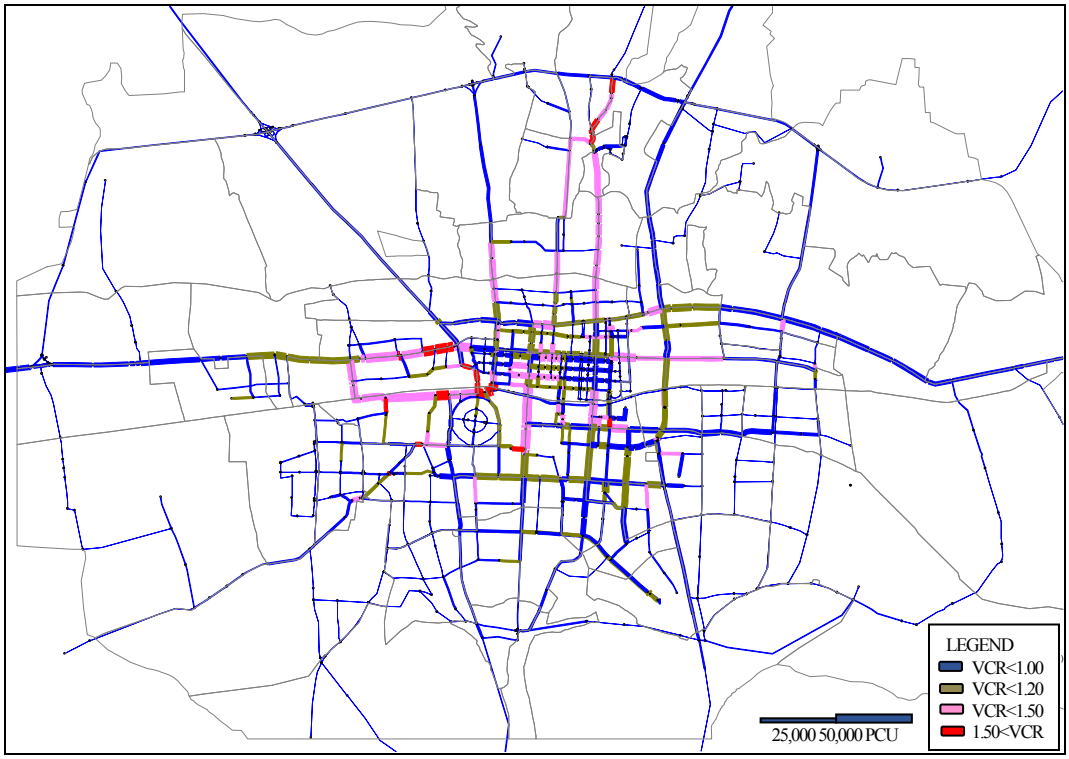


Figure 17.3-2 Peak Hour Traffic Assignment in 2023 (Scenario 3)

CHAPTER 18 ROAD AND MAINTENACE IMPROVEMENT PLAN

18.1 Policy Background

18.1.1 Deterioration of Road Pavement and Every-Year Repair Work

While trunk roads in Bishkek City have good pavement conditions and provide high travel speed, other road types, including distributor types, collector types and streets, need repairs for damages on asphalt surfaces each year. Due to low temperatures in winter, small cracks expand to traverse and longitudinal cracks, thereby causing huge pot holes. The city is forced to provide a huge slice of its budget for repair work every year. These damages decrease vehicle mobility, resulting in traffic congestion and accidents. Traffic control signage to ensure smooth traffic flow such as traffic signals and road markings, are broken, damaged and decayed. Roads and traffic facilities are very important to urban transport infrastructure. Damages and aging or wear and tear aversely affect urban economic activities. In particular, asphalt concrete (AC) pavements are easily damaged by temperature change. The existing road management system repeats expensive repair work on damages annually. This work becomes a big burden on the city budget. To solve these problems, the Study proposes as major solutions the promotion of privatization, reviewing concrete pavements from AC, advancement of private construction companies, and application of new pavement technology. There are private contractors for road maintenance in Bishkek. Through promotion of privatization, preventive maintenance methods will be recommended.

18.1.2 Privatization of Road Maintenance and Situation of Private Construction Company

The JICA Study Team proposes promotion of the private road contractors with the equipment rental market and financial support system, and the differentiation between construction work and supervision. This policy also follows the promotion of privatization of road maintenance and management.

The contractors in Bishkek have the following issues, compared to ones in developed countries.

(a) Lack of equipment rental market

(b) Lack of financial support to Small and Medium Enterprise (SME)

(c) Lack of proper supervision of quality control

(d) Lack of time for work, only six months from April to October

(e) Lack of tax preference in donors project

18.2 The Project of Enhancement of Road and Maintenance Capacity

18.2.1 Project Purpose

The project's purpose is to develop and facilitate the private contractor's capacity for road maintenance and

management using several measures to overcome the above problems, and to reduce the cost of work and reduce the burden on the city's maintenance budget, together with ensuring quality of the work. The Study proposes the following measures:

(a) Equipment supply contract

(b) Facilitation of general fund

(c) Introduction of equipment- intensive and labor- intensive pavement design and method

(d) Enhancement of quality control with proper test equipment and Human Resource Development (HRD)

18.2.2 Equipment and Plant Supply for Road Pavement Improvement

Table 18.2-1 shows comparison for two plans in terms of privatization of road improvement. **Table 18.2-2** shows urban road management by privatization.

Table 18.2-1 Comparison of Asphalt and Concrete Plans and Pavement

	Asphalt Plant	Concrete Plant
Main Market	Road pavement	Private sector for building
Road market	-Ditto-	Concrete pavement
Ownership	City own	Private
Privatization	PPP	Private
Contract method	Material supply by the City	Material purchase
Pavement life	AC: 3-5 year design life	CC: 5- to 10 year design life
Maintenance cost	High maintenance cost	Low maintenance cost

Source : JICA Study Team

Table 18.2-2 Urban Road Management by Privatization

Item	Periodic (by 3-5 year)	Routine (every year)	Urgent/Special
Repair Work	Overlay Reconstruction	Potholes/Crack Canal repairs	Damage/Snow remove
Contractor	Contract with Big and Midium Enterprises	Contract with SME Force-account	Force-account Outsourcing
Supervision			
1) Laboratory Test	The City	The City	The City
2) Site Supervision	Consultant	The City/Consultant	The City

Source : JICA Study Team

18.2.3 Role of the City

(a) Provision of equipment and materials for road maintenance

(b) Private contractor supporting policy

(c) Preventive maintenance plan preparation

(d) Contract Management

18.2.4 Project Components

To fulfill the above-mentioned tasks , the proposed project includes the following components:

(a) Equipment Procurement: 10 million USD

(b) Pilot project for equipment-supply contract

(c) Pilot Project for new pavement of Roller Compacted Concrete Pavement (RCCP) by concrete

(d) Pilot Project for preparation of preventive maintenance program by VIMS[1] survey

(e) Institutional strengthening and HRD

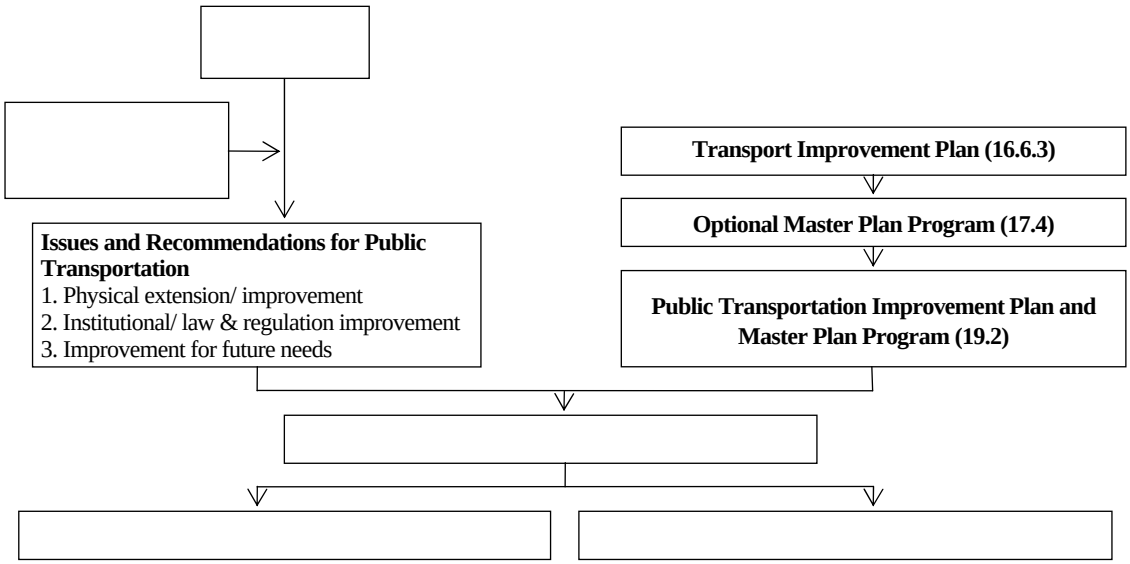
[1] VIMS means for Vehicle Intelligent Monitoring System. JICA has provided "VIMS", measurement equipment of road surface roughness (IRI) under the technical assistance project to MOTC, 2008-2011.

CHAPTER 19 URBAN PUBLIC TRANSPORTATION IMPROVEMENT PLAN

19.1 General

(1) Flow of Urban Public Transportation Improvement Plan

As shown in **Figure 19.1-1** a Flow of Urban Public Transportation Plan, **Chapter 19** summarized the present and future issues in **Chapter 7** and **Chapter 15**, and the public transportation concerning plans and programs from the transportation improvement plan and master plan program in **Chapter 16** and **Chapter 17**. Projects are then proposed to solve the present and future issues in complying with the public transportation improvement plan and programs. A case study, the trolleybus route operating plan is conducted to introduce the methodology and a study of ICT fare collection system



to public transportation in Bishkek City is discussed.

Figure 19.1-1 Flow of Urban Public Transportation Plan

19.2 Issues and Recommendations for Public Transportation

Table 19.2-1 Issues and Recommendation for Public Transportation in Bishkek City

Issues	Recommendation		Measures
➢ Physical Extension/ Improvement			
1. Bus routes are duplicated and excessive competition between public and private sectors, even between private companies is occurring.	Reform public transportation network to be more efficient and smooth	⇨	1. Bus Route Network Reformation 2. BRT Introduction Plan 3. ICT Ticket for All Transit Modes 4. Bus information system 5. Bus Lanes for Peak Hours 6. Bus Priority Signal Installation 7. Bus Operation Monitoring System
2. Entire bus route information and bus operation frequency are not sufficiently provided to citizens.	Provide an entire bus route information to the public		
3. Fare collection system is inefficient due to manual collection method.	Revise fare and ticketing system with design of e-ticketing system		
4. Transportation terminals are not well	Improve bus terminals to		

Issues	Recommendation		Measures
designed with the view of connectivity to the City Center, neither their facilities are not well designed to transfer.	provide one-stop service		8. Bus Approach Information System 9. Public Bus Enhancement 10. Improve Terminals at East and West Bus Terminals
5. It is required to improve bus service speed.	Improve bus service speed		
➢ Institutional/ Law & Regulation Improvement			
1. Minibus driver has an incentive to catch passengers as much as possible rather than obeying traffic rules and working rules.	Monitor public transportation service	⇨	11. Curb management 12. Public Transportation Management and Service Level Improvement 13. Public Transport Priority System
2. Minibus operation is controlled by planned vehicle numbers and reported actual operated vehicle numbers from private companies, thus, actual operation records, such as frequencies, are not reported to UTD.	Evaluate public service level on a regular basis in the view of users and the view of service provider		
3. Financial conditions of BTD and BPTE are in continuously deficit.	Balance revenue and expenditure of BTD and BPTE		
4. Revision of tariffs of public transportation, which came into force on 1st of May, 2012, caused decline of trolleybus users.	Formulate comprehensive public transportation policies		
5. Cheap fare rate and fare exemption affect profitability on public transportation revenue.			
➢ Capacity Development			
1. UTD is designed to have right to form urban transportation network in Bishkek City, however, UTD is parallel to two other public companies and does not work as a comprehensive transportation planning bureau.	Reform urban transportation sector in Bishkek City	⇨	14. Capacity Development on Public Transportation Management in Bishkek City
Peak Hour Solution in 2023			
1. Increase bus at the peak hours.	Develop exclusive bus lanes	⇨	15. Bus Lanes for Peak Hours (repeated)

Source : JICA Study Team

19.3 Public Transportation Improvement Plan

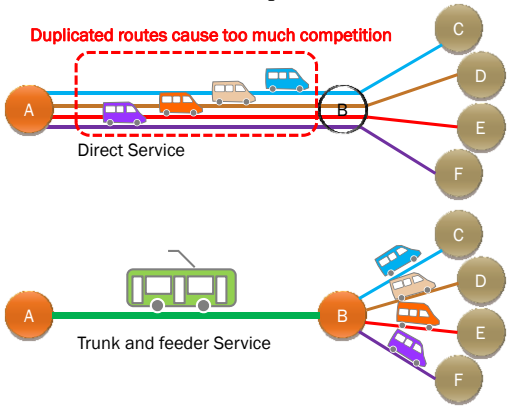
Plan	Recommendation
Utilizing High Occupancy Vehicle in Minibus	・Larger vehicles such as trolleybus and/ or midibus replacing present minibus vehicles will reduce the total number of vehicles on the road and relieve traffic congestions. ・An operation monitoring system is to be installed to public bus services to improve bus services. ・To enhance present encouragement policy of using a rather bigger bus by private minibus companies, even though expand to much bigger bus for example 30 seats buses. ・To facilitate investment to bus fleets, it is necessary to establish some financial methods for bus fleet procurement, such as lease system of bus fleets. At the same time, the JICA Study Team recommends to enhance the corporate responsibilities to establish robust public transportation.
Monitor Public Transportation Service and Evaluate Public Service Level	・It is required to enhance monitoring function of UTD ・To install the service quality cycle for evaluation and improving public transportation service.
Reformation of Public Transportation Network 	・To reform public transpiration network as a trunk-feeder system should be considered. Advantages and disadvantages of stakeholders are summarized in **Table 19.3-1**. ・Major routes shall be appointed to operate bigger bus vehicles for more efficient transportation in Bishkek city. ・Proposed network structure is set on Chui Avenue and Kievskaya Street as the “primary bus trunk”, and Manas Avenue, Mir Avenue and Sovetsukaya Street as the “secondary bus trunk”. It can replace about 3,000 minibus trip by 74 bigger bus concentrating operation. ・To apply BRT system. ・To provide one-stop service at interchange bus stations. ・To introduce transfer ticket system with E-ticketing system. ・To provide comprehensive information to the users.
Restructure of the Urban Public Transportation Sector	・To create a new department which has jurisdiction over comprehensive public transportation policies. The proposed structure is that under the new organization, present three organizations are arrayed managing and operating the trolleybus, the midibus, the minibus and taxi in an integrated manner.
Taxi Services	・To provide supplemental public transportation service, taxi stands shall be developed.

Table 19.3-1 Advantages and Disadvantages of Trunk-feeder System

	Advantages	Disadvantages
For Passengers	- Increase travel speed of bus. - Increase capacity of vehicles and frequency of bus service on trunk routes. - Public transportation network would be simpler and a passenger can select bus routes easily for a travel to an unfamiliar destination.	- Times of transfer for a long travel will increase. - Interchange stations would hinder a travel if they would not provide sufficient information of bus operation, such as a route map and time tables. - Using both trunk and feeder routes would hike the total fare for a travel under the present fare system.
For Operators	- Excessive competitions would be reduced. - Operators can appoint bus vehicles to proper routes by size in accordance with demands.	- Coordination between trunk operation and feeder operation is required especially between different firms. - Working conditions and opportunity revenue of drivers will be more variable.
For Administrators	- Easy to monitor actual operation due to simplified public transportation network and operators.	- Stronger enforcement of keeping a time table for operators is required to ensure the system consistency. - Under the present fare exemption system, the total amount of subsidy of the City to BTD would increase if fare exempted passengers increased.
For Government	- Road congestion would be relieved.	- Without understanding of passengers, criticize on changing the system would be raised.
For Road Users	- Road congestion would be relieved.	

To avoid or alleviate disadvantages, following issues shall be considered;

- ✓ Enhance attractions of interchange stations,
- ✓ Revise fare and ticketing system,
- ✓ An organization which has overall coordination functions on public transportation shall be established,
- ✓ Consider new working regulation or contract for drivers,
- ✓ Enhance the governance of public transportation operation, and
- ✓ Implement new service with public involvement.

19.4 Tentative Proposal of Trunk-feeder System in Bishkek City

The following paths are specified as bus trunk routes considering heavy duplicated bus routes and volume of passengers and set requirements to operate vehicles bigger than minibuses.

- ✓ Primary Bus Trunk : Chui Avenue and Kievskaya Street
- ✓ Secondary Bus Trunk : Manas Avenue, Mir Avenue and Sovetsukaya Street

・This tentative proposal is based on many assumptions stated in main report, however, it is estimated that 74 midibuses can replace 3,000 minibus operations.

・Bus trunks require two-minute interval operation for trolleybuses and 30-second intervals for midibuses. To realize this complex operation, Bus Rapid Transit (BRT) system should be considered.

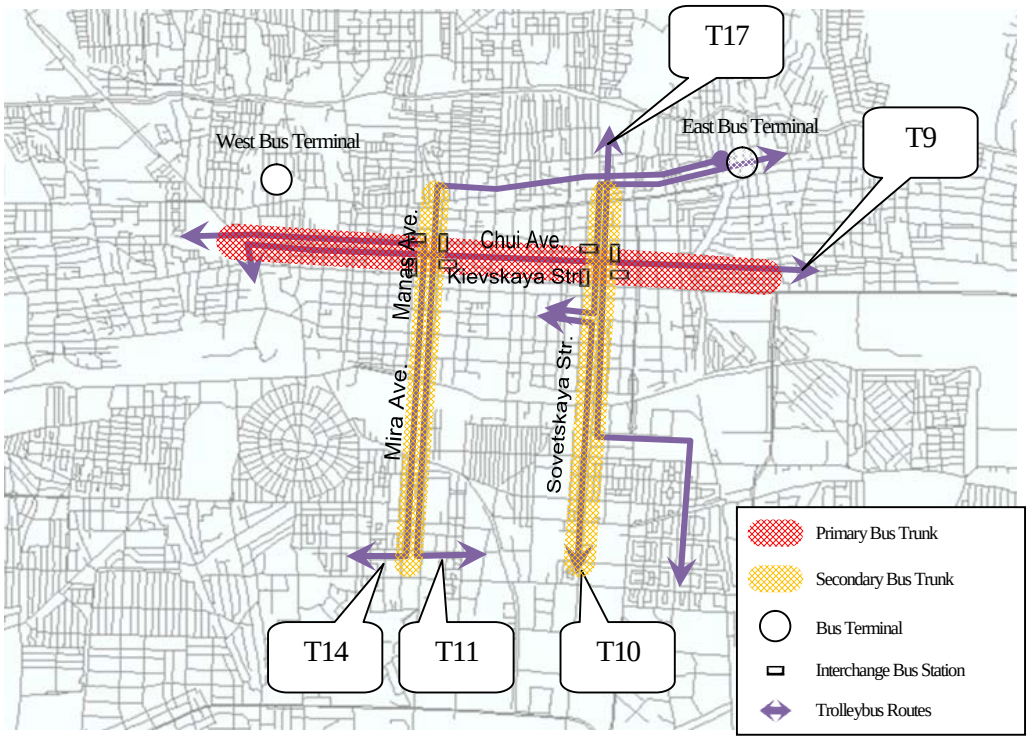
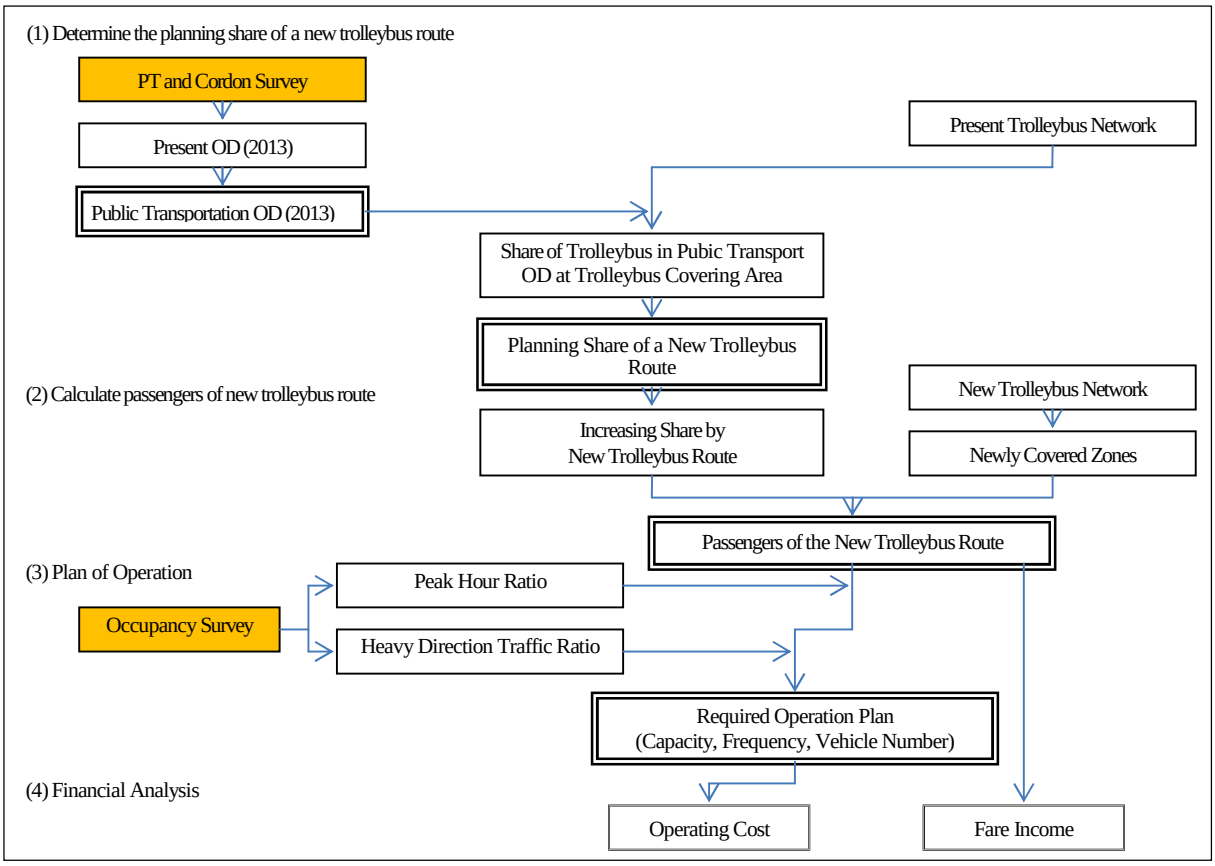


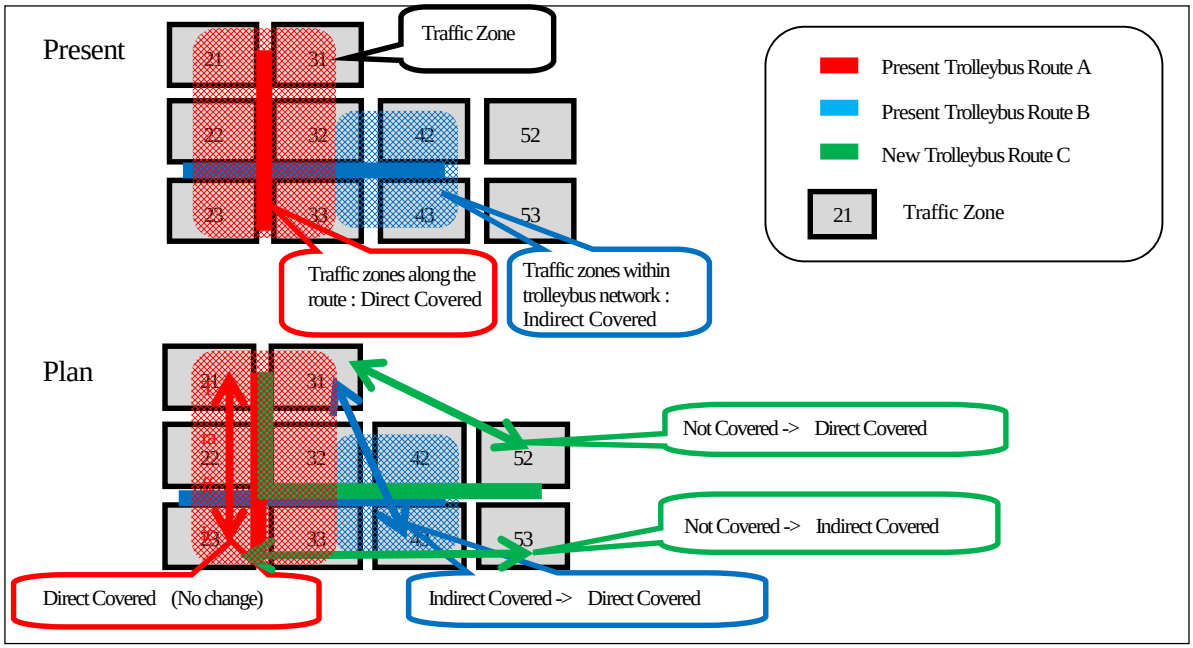
Figure 19.4-1 Primary Secondary Network for Public Transportation

19.5 Case Study : Trolleybus Route Operating Plan



Source : JICA Study Team

Figure 19.5-1 Planning Flow of a New Trolleybus Route



Source : JICA Study Team

Figure 19.5-2 Two Types of Traffic Zone Pairs and Their Changes by a New Route

(1) New Trolleybus Network

The new trolleybus route to be planned is TR 16 and its passing zones are shown in **Table 19.5-1**.

Table 19.5-1 Traffic Zones Passed by TR 16

Route No.	Traffic Zones Passed by Trolleybus Route
TR 16	3, 1/4, 1/5, 2/5, 2, 6, 10/11, 8/10, 32, 32/44, 33/51, 51/44, 51

Note : Traffic zone numbers written in the form of (" / ") are the zones where the trolleybus route passes through the border between these two zones

Source : JICA Study Team

(2) Newly Covered Zones

To compare existing trolleybus routes covering zones and the new trolleybus route covering zones, zones were changed in service condition as shown in **Table 19.5-2**.

Table 19.5-2 Traffic Zones to be Changed Passing by TR 16

Service Condition	Zone Pairs
"Not Covered" to "Direct Covered"	1-3,1-4,2-3,2-4,3-3,3-4,3-5,3-6,3-8,3-10,3-11,3-32,3-33,3-44,3-51,4-4,4-5,4-6,4-8,4-10,4-11,4-21,4-33,4-44,4-51
"Not Covered" to "Indirect Covered"	3 to each covered zone, and 4 to each covered zone
"Indirect Covered" to "Direct Covered"	1-5, 2-5,5-33,3-44,5-51

Source : JICA Study Team

(3) Estimation Results

Based on the assumptions, roughly estimated profits by operating TR 16 is shown in **Table 19.5-3**.

Table 19.5-3 Estimated Profits of TR 16 in 2013, 2018 and 2023

Year	Yearly Operation Cost (1,000 SOMS/year)	Yearly Fare Income (1,000 SOMS/year)	Profit (1,000 SOMS/year)
	(1)	(2)	(3) = (2) - (1)
2013	12,045	17,851	5,806
2018	11,498	17,543	6,045
2023	12,045	17,817	5,772

Source : JICA Study Team

19.6 Consideration of ICT Fare Collection Introduction to Public Transportation in Bishkek City

19.6.1 Background

The current public transportation fare collection system in Bishkek City adopts a basic system collecting coins from a passenger upon alighting by a bus driver. Therefore, the management of fare collection is vulnerable and no passenger data is accumulated by the bus enterprise which can be vital to consider adequate bus time table, and route setting based on actual demand.

Automated, safe and accurate fare collection | No need to prepare small coins | Smooth boarding and alighting | Accumulate users' data for demand analysis and marketing

The JICA Study Team raises the issues necessary to be discussed in the future for the introduction of ICT fare collection system to Bishkek City public transportation in this report.

19.6.2 ICT Card System Mechanism

The flow of ICT card use mechanism which is in use internationally in general is described in **Figure 19.6-1**. The optimum ICT system for the public transportation in Bishkek City should be considered during the feasibility study or social experiment stages of ICT fare collection system.

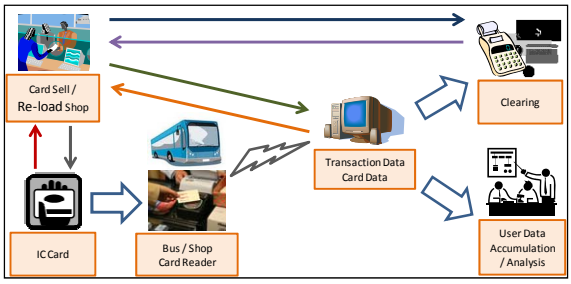


Table 19.6-1 Criteria for Priorities IC Fare Collection System Introduction Social Experiment by Transportation Mode in Bishkek

	Transportation	Practicability	Cost	Sustainability
1	Trolleybus (Support from EBRD)	Good Flat fare / Fixed route / fewest operation routes. easy to monitor	Good Limited route so that easy to control but limited passenger.	Good EBRD is supposed to implement E-ticket system to trolleybus.
2	Midibus	Good Flat fare / Fixed route / Limited operation routes	Fair Limited routes so that easy to control large number of user will be expected if the government expand midibus route in future.	Fair It is preferable to consider the introduction in future in terms of user's convenience and OD data accumulation.
3	Marshrutka (Minibus)	Poor Two types of fare (Private Own / Largest) and complicated operation routes	Poor Potential ICT card user number is the highest. But introduction is difficult because of the vehicle operation system.	Poor Marshrutka adopts franchise system and drivers are working independently so that it is difficult to introduce the system by international aid scheme. However, it is preferable to consider the introduction in terms of user's convenience since Marshrutka plays significant role for public transportation in Bishkek City.

Table 19.6-2 Items to be Considered for ICT Fare Collection System Introduction

Institution and Law, Regulation, Guideline			
	Item	**Detail to be discussed**	**Note**
1	Administration organization	Responsible agency of ICT card system for public transportation.	Urban Transportation Department of Bishkek City mayor's office (UTD) is candidate as existing governmental agency considering their role for public transportation in Bishkek.
2	Clearing house	If ICT card system will cover all public transportation modes and the number of the ICT card exceed a certain amount in future, clearing house need to be set up under ICT card authority.	- Need to consider if it uses as e-money for shopping purpose as well. - Mobile Company or Bank in Bishkek would be the candidate for clearing house setting. Mobile company might be suitable considering mobile use expansion in Kyrgyzstan while fewer rate of bank account holder in Kyrgyzstan.
3	Card issuer	Operation and management method of ICT system in Bishkek City.	The issuer would be expanding the card business operation for other fields.
4	Radio wave law	Relevant for sending data from card reader to server.	Need to confirm if there is relevant law for radio wave use.
5	E-money governing law	Relevant to ICT card use for bus fare payment and e-money use.	Need to confirm if there is relevant law for e-money commerce.
6	Account and auditing regulations governing	Relevant to ICT card clearing house control.	Need to confirm if there is relevant law for clearing house account and auditing e-money.

Institution and Law, Regulation, Guideline			
	Item	**Detail to be discussed**	**Note**
	e-money		
7	Privacy protection law	Relevant to ICT card user information registration.	Need to confirm if there is relevant law for privacy protection.
8	Company law	In case of PPP establishment for ICT card fare collection system operation.	Need to confirm if there is relevant law for PPP.
9	Drivers' wage system	Informed consent among bus drivers and financial division of bus enterprise about new ICT fare collection system.	Need to consider adequate salary for drivers to sustain ICT card fare collection system.

System Setup			
	Item	**Detail to be discussed**	**Note**
1	Software Development	- ICT card function setting and operation management method. - Necessary data items for OD data. - Necessary function for reload, withdraw, card information display. - Data protection	Need to discuss future potential use for additional functions such as e-money from the development stage.
2	Operation cost estimation	Running cost of ICT fare collection system.	Method of introduction and operation contract.
3	Fare collection management system and work flow	- On line or off line setting during transportation operation. - Device data transmission system and its work method.	Online is required if the system covers card lost and refund system.
4	Selection of the equipment (IC Type / Card Type / Kinds of cards)	Security level, transaction speed, cost, single use or multipurpose use, support system, type of function, maintenance cost, etc.	Consider future expansion use (ex. ICT card use, coverage area and function).

ICT Card and Fare Setting			
	Item	**Detail to be discussed**	**Note**
1	Fare collection and reload setting	- Flat rate / Distance based fare - ID registration / No registration - Setting of card reload amount - Bus stop setting	Current fare system is a flat fare rate. However need to consider future possibilities of fare system change at the programming stage for ICT card system setting.
2	Card refund, damage and loss	Refund system, in case of card damage or loss.	ID registration is required if the systems include refund, damage and loss service.
3	Items to be legislated on display / receipt	- Boarding / alighting point - Amount of fare / deposit - Date - Language (ex. Russian, Kyrgyz, English)	Receipts will be issued at card shops. Displays will be installed at ticket shops / inside of public buses.
4	Process of card use	- How to withdraw / reload fare - Location of card reader setting	Relevant facilities setting needs to consider together with the method.
5	Method of card sales and reload	- Set up ticket sell and reload shop - Incentive for ICT card use - Set up amount of card reload (maximum / medium / minimum)	Consider based on average monthly expense for public transportation users for commuting.
6	Card function setting (Present / Future)	Expansion of use (ex; E-money, public utility reloads payment)	Need to discuss future potential use additional functions such as e-money from the development stage.
7	Registration of card	Registration of personal data / no registration	It is related to card refund, damage, loss service

ICT Card and Fare Setting			
	Item	**Detail to be discussed**	**Note**
	holder information	type	and monthly pass card system.
8	Balance check	- Card reader device - Device setting place to check the balance - Possibility to use internet website (WS) access	Balance check through WS will be required ID registration system setup.

Social Experiment Preparation			
	Item	**Detail to be discussed**	**Note**
1	Method of fare withdraw, reload, data accumulation	- Role of ICT card use for the public transportation. - Reload location and amount.	For operation staff and ICT card users.
2	Prepare training manuals for the social experiment	Manuals for the devise use, guidance to users, data management, clearing system.	For operation relevant staff.
3	Training of ICT card fare collection system operation	Staff training (Bus driver, ticket shop, data management, clearing and users).	Efficient information of ICT card fare collection system needs to be well explained and discussed among relevant officers and drivers.
4	Publicity of the social experiment	- Usage of ICT card information - Publicity means - Duration of the publicity	For public transportation users.
5	Evaluation survey (Before, During and after the experiment)	- Monitoring of the operation - Financial Analysis - Data collection - Interview survey from operation staff and card users.	Both technical and social impact survey is required.

19.6.3 Recommendation for Public Transportation ICT Card Fare Collection System Introduction in Bishkek City in Future

✓ Although the ICT card system was supposed to be introduced to the trolleybuses by EBRD, other public transportations also need the ICT to effect viable card use from the standpoint of users' convenience, and to be able to collect public transportation utilization data (OD data) for public transportation operations analysis. Additionally, from the standpoint of sustaining the ICT card system operation business, it is necessary to increase both card users and card utilizations in order to cover operation costs, and also by expanding public transportation area of coverage.

✓ To boost ICT card utilization, introduction of incentives by providing discounts or point system through reload amount or withdrawn amount is in effect. In Kyrgyzstan, a shopping point card system has been introduced in some stores through ICT card use, to attract customers and as marketing strategy. If the public transportation ICT card can introduce discount or point system just for using the ICT card, it would become popular among citizens.

✓ Since bank account holders and credit card users in Kyrgyzstan are few, potential prepaid card

(e-money) system utilization (as used in the USA and the Philippines[1]) might increase, due to clear account records, easy reload or payment method and limited amount of reload cash. It would particularly target small scale businesses with bus fares and supermarket shopping. Therefore, the ICT card's utilization and card business would be sustained and expand with the combined functions as public transportation ICT card and as multipurpose ICT card (e-money with user's incentives). Additionally, mobile companies can be potential significant actors for ICT card business by introducing mobile-based payment and reload systems to public transportation in Bishkek City.

- ✓ There are some rejections of ICT fare collection system by drivers in other countries due to decrease of drivers' wages with the introduction of the system. It is advisable to take into consideration adequate wage levels and introduce performance evaluation system based on driving manners and safe driving, together with the ICT fare collection system in order to maintain ICT card system and improvement of bus service quality.

[1] Wal-Mart Stores Inc. and American Express Co. form a team on a reloadable prepaid card for shoppers in USA. PVB Card Corporation (PVBCC) and JCB International Co, Ltd., in partnership with the City Government of Bacoor of Philippine issued the first prepaid card combined with City identification card. Both of the prepaid cards are targeted on non bank account holder group.

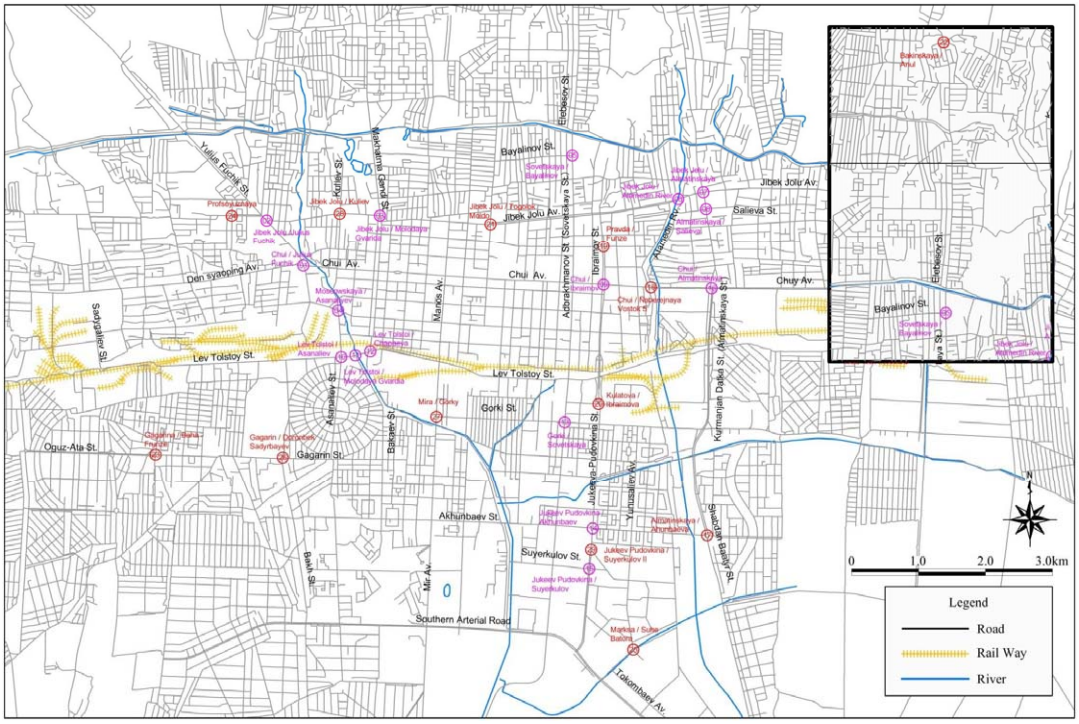
CHAPTER 20 TRAFFIC FLOW AND CONTROL SYSTEM IMPROVEMENT PLAN

20.1 Traffic Flow Improvement Plan at Intersection

A total of 29 intersections were taken up as candidate intersections where traffic management issues exist and traffic improvement measures are required. Subject locations for traffic flow improvement were listed based on the information provided by Bishkek City. In the first year, 16 bottleneck intersections were provided. Chui-Fuchik intersection was selected from among 16 candidate intersections with nine criteria such as location, area, traffic signal, number of entering lanes, number of public transport lines, bus stop, parking spaces, road condition and land use. In the second year, 13 bottleneck intersections were added by Traffic Police. Site visits were then conducted to observe general traffic and physical conditions of the candidate sites, and identify type and extent of traffic management issues. The location of candidate intersections are shown in **Figure 20.1-1**.

The typical problems found by the site observation are presented below.

- ✓ Inadequate intersection geometry resulting in underutilization of intersection capacity
- ✓ Inadequate traffic signal operation that does not match traffic demand
- ✓ Lane assignment not meeting traffic demand
- ✓ Lack of pavement marking to guide traffic
- ✓ Deteriorated pavement reducing traffic capacity rate
- ✓ Obstruction caused by roadside parking near intersection



Source : JICA Study Team

Figure 20.1-1 Candidate Locations for Traffic Flow Improvement

To alleviate the issues, countermeasures were prepared for each intersection. Normally several improvement measures will be selected and applied to a bottleneck location. The measures include the following.

- ✓ Modification of intersection geometry to increase intersection capacity and enhance traffic safety
- ✓ Modification of signal phase and timing plans to handle traffic demand more efficiently
- ✓ Provision of left turn lane at intersection where left turn volume is high
- ✓ Application of pavement marking near intersection

The total cost for intersection improvement including survey, analysis, design and construction was estimated at 10,166 USD, 143 for the 29 intersections.

The intersection improvement implementation is divided into three phases in three years. In phase I, the baseline survey will be carried out at all candidate intersections to set priority and to prepare an improvement plan to be implemented during phase II and III.

20.2 Traffic Control System Improvement Plan

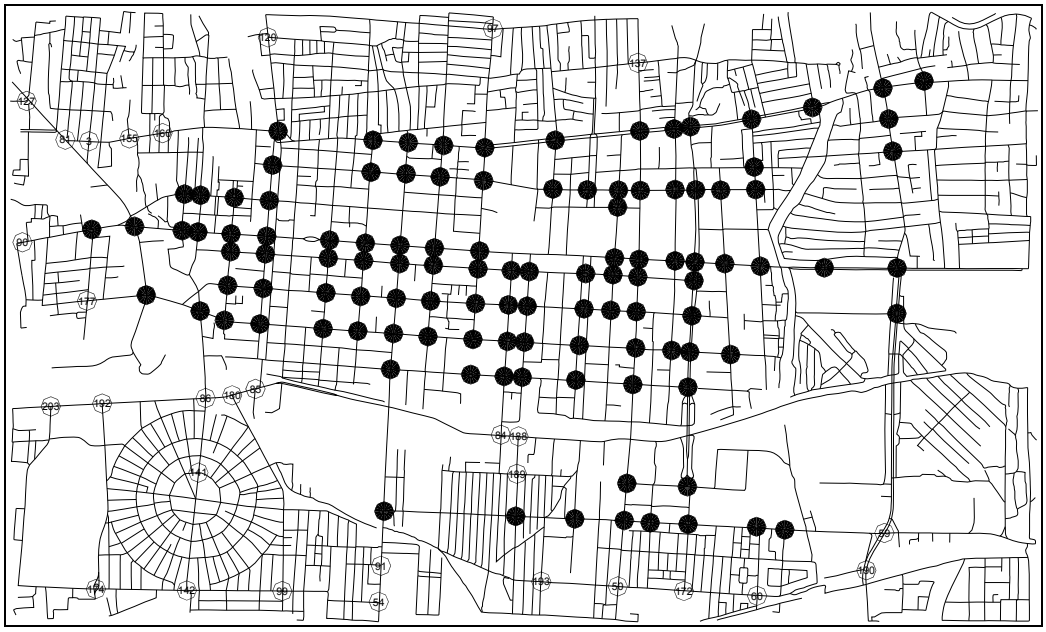
The introduction of area traffic control system is proposed, which controls traffic signals with timing parameters best suited to the prevailing traffic condition, in order to manage the traffic efficiently and minimize the delays. In the project, the existing Traffic Control Center will be rehabilitated in order to accommodate center system and equipment. A new traffic signal controller with remote control function will be installed at the selected intersections, vehicle detectors will be installed at strategic locations and communication network using the fiber optical cable will be established to connect traffic signal controllers with the control center.

Benefits to be brought about by ATC system are generally recognized as follows:

- ✓ Efficient traffic operation (less number of stops, shorter delays and higher travel speed).
- ✓ Safer traffic (less number of accidents).
- ✓ Reduction of fuel consumption resulting in less emission of CO_2 and other pollutants.

The initial system will cover the traffic signals in the City Center totaling 113 signals as shown in **Figure 20.2-1** below. The selection criteria adopted for selection of ATC signal are as follows:

- ✓ Signals at critical intersections where volume/capacity ratio is high during peak hours and an efficient signal control system that considers the traffic condition is required.
- ✓ Signals located along arterial streets, coordination of which is effective and required for better signal performance and shorter delays.
- ✓ Signal located in the vicinity of other signals and coordinated operation is required.

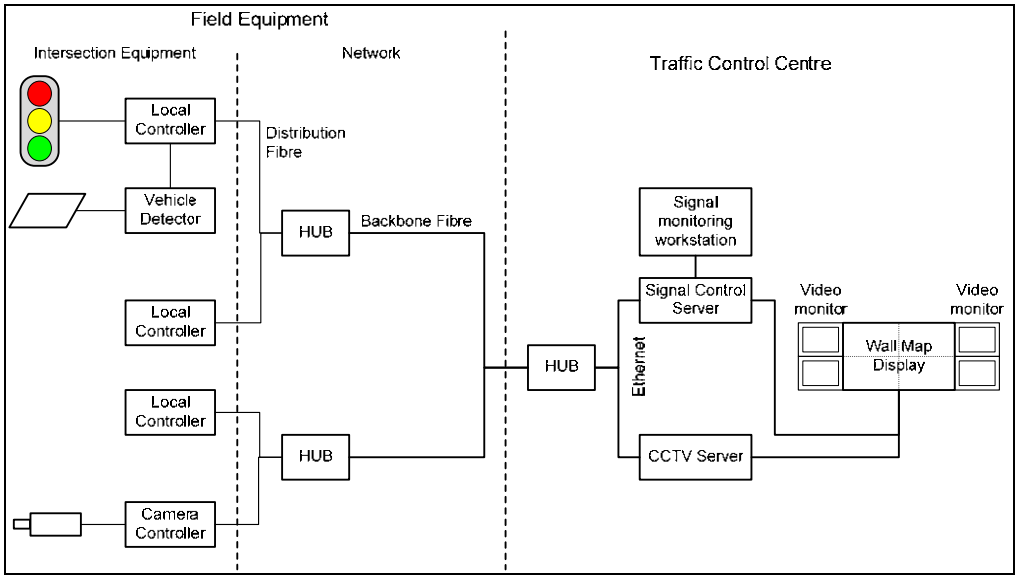


Source : JICA Study Team

Figure 20.2-1 Location of ATC Signals (Tentative)

In addition CCTV camera will be installed at 18 intersections for traffic monitoring purpose.

Conceptual system configuration of the proposed area traffic control system is shown in **Figure 20.2-2**.



Source : JICA Study Team

Figure 20.2-2 System Configuration

The system construction cost is estimated at 10,354,286 USD.

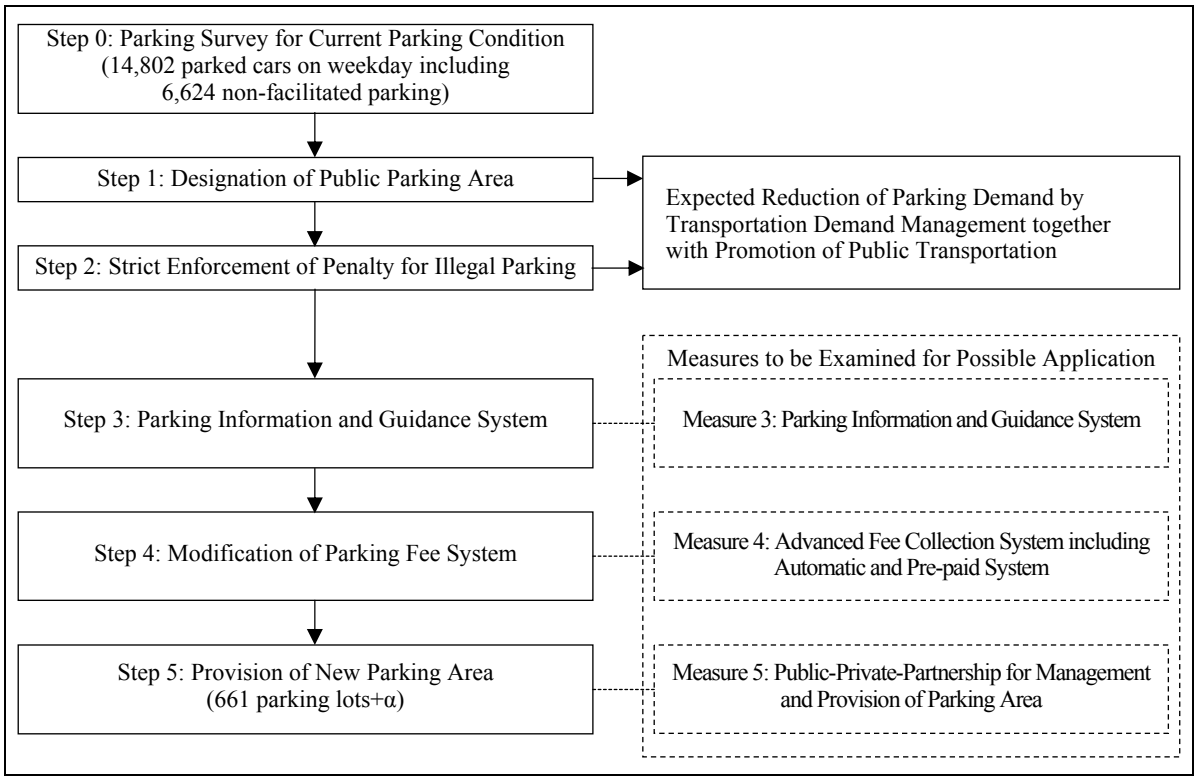
The project is expected to take three years to complete. During the first year, system design and tender documents will be prepared. The contractor will be selected during the first half of the second year. Manufacturing, installation and system commissioning is expected to take one and half year to complete.

CHAPTER 21 CITY PARKING IMPROVEMENT PLAN

21.1 Improvement of Parking in the City Center

21.1.1 Improvement of Current Parking Condition

The necessary measures to improve the parking conditions were examined by using the parking survey data. These measures consisted of six steps as shown in **Figure 21.1-1**. The following sub-clauses describe the contents of the necessary measures in each step.



Source : JICA Study Team

Figure 21.1-1 Steps and Measures to Improve Existing Parking Condition

21.1.2 Future Parking Demand

In addition to the improving existing parking conditions, further measures will be needed to prepare for future parking demands. It should be noted that providing a new parking area would boost further parking demands. Taking the nature of the parking demands and the social equity into account, providing parking areas should not be set at the same level as the current parking demand. From the standpoint of transportation demand, the provision of parking areas should be set at a level lower than the parking demand.

(1) Updating of Technical Standard for Obligatory Parking Lot by Type of Building

The existing technical standard for a mandatory parking lot was outdated and unable to meet the current parking demand. The provision for a minimum number of parking lots need to be modified.

(2) Formulation of Plan of Parking Area in Specific Area

The additional parking demand was estimated at 3,465 cars on weekdays and 1,614 cars on weekends. Since the parking demand on weekends would be largely covered by the mandatory parking lots for housing, the incremental parking demand will be 1,851 cars. This incremental parking demand has to be controlled with the mandatory parking lot, type of building, the provision of new municipal parking, and traffic demand management.

21.2 Improvement Policy for Parking

The study team formulated the improvement policy for parking based on **Chapter 21.1**. There is a significant number of vacant parking lots in the City center, but many cars are parked on the street. Since the existing fee collection system allows non-payment, parking fee is not strictly collected. Since traffic volume will increase with economic development of Kyrgyz Republic, traffic from outside of the City center should be controlled or managed to prevent traffic congestion. To solve these issues the Study Team formulated following policy.

- ✓ To promote the use of parking in order to reduce on-street parking
- ✓ To establish a parking fee collection system from all users
- ✓ To introduce a new parking operation system to control traffic flow in the City center

21.3 Improvement Measures for Parking

The Study Team proposes following measures for improvement of parking.

Table 21.3-1 Improvement Measures for Parking

Operation	Facility	Legislation
・Parking information and guidance system ・Parking fee collection system ・Parking fee system (pay-for-use by time, different unit price by location) ・Time limits parking	・Construction of parking in the City Center ・Construction of parking outside of the City Center (Fringe Parking, Park & Ride Parking)	・Parking rule campaign ・Modification of parking operation / fee regulation ・Strict enforcement of penalty for illegal parking ・Modification of technical standard for mandatory parking ・Parking space around car owner house

Source : JICA Study Team

21.4 Improvement Project for Parking

Improvement measures for parking are shown in following.

(i) Illegal Parking Prevention at Specific Areas

(ii) Introduction of Parking Fee Payment Card

(iii) Integrated Parking Law and Management

(iv) Parking Facility Construction

(v) Parking Information System

(vi) Promotion of Park and Ride Parking

CHAPTER 22 INSTITUTIONAL IMPROVEMENT PLAN

22.1 Institutional Strengthening and Management Enhancement

For the Bishkek City to implement the MP effectively, the key is to improve each department capability as well as to develop staffing functions of BCDA, through institutional strengthening and human resource development, for coordination with each agency. The institutional strengthening and human resource development of BCDA consist of enhancing project management, identification, and implementation. It is necessary to provide technical assistance as stated in subsequent sections.

22.2 Bishkek City Urban Transport Management Capacity Development

To develop the management capability of each department related to urban transportation, technical assistance will be provided to BCDA with institutional strengthening of coordinating and training functions among the city departments. The Project Design Matrix is shown below.

<table>
<tr><th>Project Description</th><th>Indicator</th><th>Source</th><th>Externality</th></tr>
<tr><td>Overall Goal:</td><td colspan="3" rowspan="5">(Performance Indicators, its source and each externalities to be worked out)</td></tr>
<tr><td>1. The MP is implemented by the City</td></tr>
<tr><td>2. Project Purpose
Priority projects are implemented.</td></tr>
<tr><td>3. Output:
(1) BCDA improved operational capacity,</td></tr>
<tr><td>(2) BCDA prepared a draft policy and implemented the related project.
(3) BCDA trained the City departments and other relevant staffs</td></tr>
<tr><td>4. Activities:</td><td colspan="3">Input:</td></tr>
<tr><td>1.1 To coordinate with international donors
1.2 To manage the projects
1.3 To review the progress of the donor’s assisting projects
1.4 To coordinate among the line department of the City
2.1 To prepare a draft policy and ordinances
2.2 To grasp peoples’ needs
2.3 To plan the related projects
2.4 To plan and implement pilot projects
2.5 To plan and implement pilot projects
2.6 To monitor the pilot project
2.7 To prepare the project report
3.1 To prepare HRD and training program
3.2 To conduct workshops for MP project implementation
3.3 To conduct seminars of GIS training and traffic analysis software “JICA STRADA” etc.
3.4 To evaluate training results
3.5 To prepare the report of the training results</td><td colspan="3">Experts
a) Transport policy/plan
b) Pilot project plan
c) Human resource development plan
d) Public Participation
e) Training of GIS
f) Training of JICA STRDA
g) Public transportation
h) Parking
i) ITS
Pilot Project
a) Parking system with ITS
b) Pedestrian mall event extension</td></tr>
</table>

22.3 Management Capacity Enhancement for Public Transport Enterprises

It is proposed to establish one organization that will supervise and regulate all transit enterprises. This organization will assume responsibility for introduction of the new system into public transportation, service improvement planning, and implementation of future comprehensive improvement policies including establishing the functions of survey, analysis, planning, implementation and monitoring.

CHAPTER 23 PILOT PROJECT AND CAPACITY DEVELOPMENT

23.1 Pilot Projects

The main purpose of the pilot project is to examine new methods for improving transportation conditions in Bishkek City. It is then expected to subsequently utilize proven methods in order to solve similar issues in the future.

Four Pilot Projects were selected. Three projects were determined in line with the Transportation MP targets, Traffic Flow Improvement, Traffic Control system Improvement and Public Transport Facility Improvement. Those were conducted at Chui-Fuchik Intersection and nearby. The other project was Pedestrian Mall, which was the first pedestrian mall in Bishkek City. The contents of the pilot projects are summarized in **Table 23.1-1**.

Through the WorkGroup Meetings for the pilot projects, all necessary works were conducted by counterparts with assistance of the JICA Study Team. Counterparts recognized that the necessity of preliminary modelling and simulation on proposed improvement to decide proper measures to be taken. BCDA performed as a focal point of coordination between practical implementing organizations such as the Capital Construction Department and Traffic Police Safety Department.

The Pedestrian Mall is a first experience in Kyrgyz and successfully organized by BCDA with many participants who appreciated it. Bishkek City succeeded in getting sponsors for donations to activate the event and compensate the event expenses as some of the sponsors offered sponsorship for similar events. In the standpoint of traffic safety, it is effective to insist pedestrian prioritized traffic manner by implementing enjoyable event and the traffic safety awareness activity targeted on “children first”, because it is expected to spillover effect on their parents, some of them are drivers as well. The event contributed to change the behavior through publicity and education.

Table 23.1-1 Summary of Pilot Projects

Pilot Project Type	Main Task	Picture	Outcome
Traffic Flow Improvement (Pilot Project I) September 2011 to October 2011	Improvement of Intersection by Installation of New Road Markings (About 600 square meter) and Road Signs (36 sets).		Traffic flow at the intersection have been smoothed after delineating the left turn lane, straight lane and right turn lane by installing new road marking and road signs. The stop lines shifted to minimize the size of intersection so that the time and distance of crossing at the intersection have been shortened. In addition to these, vehicle detector and local controller were installed and the phase sequence has been changed by taking account of the volume/capacity ratio to improve the traffic control system. By implementing these improvements, the residural queue
Traffic Flow Improvement (Pilot Project II) Janauary to October, 2012	Construction of Traffic Island at Intersection (About 65 square meter), Improvement of Side Walk (About 145 square meter), and Reline Road Markings (About 360		

Pilot Project Type	Main Task	Picture	Outcome
	square meter).		length has been shortened from about 20 m to zero in all approaches (i.e. directions). The average travel speed has also been improved from 24.8 to 31.0 km/h in the north-south approach and from 22.7 to 24.6 km/h in the east-west approach. The traffic island can improve the safety of pedestrians and reduce the number of unreasonable crossing.
Traffic Control System Improvement August 2012 to October 2012	Installation of V Lanterns (14 sets), Vehicle Detector and Local Controller (each 1 set)		
Public Transport Facility Improvement Janauary to October 2012	Improvement of Bus Stop and Approach Area (35 m), Installation of New Design Bus Shelter, Improvement of Pedestrian Underpass (About 45 m)		The terrace type busbay has improved the convenience to ride on and alight from the buses. However, roadside management is required for smooth utilization of the bus stop. Regarding the pedestrian underpass, most of pedestrians had not passed through the pedestrian underpass before improvement of the underpass but after the implementation of pilot project, the 650 pedestrians per day (during monitoring period) were used the underpass to cross the intersection.
Pedestrian Mall September 16, 2012	Event for Traffic Safety Awareness and Pedestrian Rights		BCDA implemented the event of Pedestrian Mall to promote the traffic safety awareness with assistance of JICA Study Team. An average of 2,600 persons/hr participanted the event. The result of questionnaire survey reveals that the participants would like to hold a similar event in the future also.

23.2 Capacity Development

23.2.1 Activities

(1) Seminar and Training in Kyrgyz

The JICA Study Team held Work Shops fifteen times over to confirm the pilot projects, to exhibit the progress of the Study and to explain methodologies of specific subjects. From first and fifth and tenth workgroups concerning the pilot projects.

To formulate the master plan with a scientific approach, the Geographic Information System (GIS) and the Transportation Demand Forecast are currently indispensable tools. Hence, the JICA Study Team conducted two trainings for GIS and JICA STRADA.

Table 23.2-1 The List of Conducted Main Meeting, Work Shop, Seminar and Training

Activity and Title	Date	Venue	Contents	Number of Participants
1st WG Workshop	3 August 2011	Architecture and Construction Department	Explanation of the JICA Study Activities	18
1st Steering committee	5 August 2011	Bishkek City Mayor's Office	Explanation of the JICA Study Activities	12
2nd WG Workshop	17 August 2011	BCDA	Intersection Improvement Plan, Simulation of output samples	13
3rd WG Workshop	16 September 2011	BCDA	Introduction of Traffic Survey and Progress of Pilot Project	15
Seminar in University	19 September 2011	Kyrgyz state University of Construction, transport and Communication	Explanation of the JICA Study, EIA in Japan	120
4th WG Workshop	13 October 2011	BCDA	Intersection Improvement Plan, progress of Pilot Project	13
5th WG Workshop	30 November 2011	BCDA	Signal Control and Results of Intersection	11
6th WG Workshop	12 December 2011	BCDA	Explanation of Work Progress of Urban Planning and GIS Related Activities	8
7th WG Workshop	16 December 2011	BCDA	Explanation of Traffic Survey	12
8th WG Workshop	16 December 2011	BCDA	Progress of Urban Planning	9
9th WG Workshop	16 December 2011	BCDA	Overview of GIS	9
2nd Steering committee	16 February 2012	Bishkek City Mayor's Office	Explanation of Urban Plan, Public Transportation Survey, Pedestrian Mall.	12
10th WG Workshop	4 May, 2012	BCDA	Pilot Project III- Traffic Signal System Improvement Work	7
11th WG Workshop	5th of June, 2012	BCDA	Environmental and Social Considerations	9
12th WG Workshop	28 August 2012	BCDA	Parking Survey Analysis and Public Transportation Survey Results	11
1st training	29 August 2012	BCDA	GIS software operation training	14
13th WG Workshop	6 September 2012	BCDA	Approach of Environment Improvement regarding Traffic on the JICA Study	6
2nd training	1st of November	BCDA	Traffic Demand Forecast using JICA STRADA	6
14th WG Workshop	18 April 2013	BCDA	Evaluation of intersection improvement social experiment.	11
15th WG Workshop	30 April, 2013	BCDA	Land Use Management and Public Transportation Improvement Plan	13

(2) Training in Japan

Two training groups were organized to visit Japan to study Japanese urban transportation systems. Each training group consisted of seven to eight members, headed by a Vice -Mayor.

The first training in Japan was conducted for two weeks during 29 January to 11 February 2012 in order to obtain knowledge and information on traffic planning related situations in Japan. In addition to Japan, the training group visited Istanbul, Turkey to review the JICA project on Istanbul Historic District Traffic Demand Management.

The second training in Japan was conducted from 11 to 24 May 2013. The main objective was traffic demand control and discussion on Bishkek Sustainable Development Strategy.

Table 23.2-2 Outline of the Training in Japan

Period	Organizations of Participants	Main Topics	Visited Sites
1st: From 29 January to 11 February, 2012	・First Vice mayor ・Life Infrastructure Department ・Urban Transport Department ・Traffic Safety Department ・Bishkek City Main Department of Architecture & Construction ・BCDA (2 persons)	Citizen's participatory in Urban Planning, Traffic System in Japan, Site visit of Traffic Control Center, Road maintenance in snow, Person Trip Survey, Site Visit of LRT, Urban Transportation Plan in Hiroshima, BRT, Istanbul municipal office traffic control division	Tokyo, Sapporo, Hiroshima, Kyoto, Istanbul
2nd: From 11 to 24 May, 2013	・Second First Vice Mayor ・Financial Department ・Urban Transport Department ・Capital Construction ・Traffic Safety Department ・BCDA (2 persons)	Urban planning, Participation of citizen for Urban Planning, Traffic System in Japan, Consideration of ideal urban transportation form the cases of overseas, Discussion on Kyrgyz National sustainable development strategy, TDM in Kanazawa city, Smart city in Toyama, Site Visit of Bus System in Nagoya	Tokyo, Kanazawa, Toyama, Nagoya

23.2.2 Conclusion

Through the Study and Trainings, Bishkek City recognized the necessity of upgrading GIS data and OD data for traffic forecast provided by the JICA Study Team, utilizing them for urban city or transportation development. Bishkek City requests further trainings of GIS and Traffic Demand Forecast.

CHAPTER 24 IMPLEMENTATION PROGRAM AND PRIORITY

24.1 Projects

The JICA Study Team summarized the projects on the improvement plans for roads and maintenance, in **Chapter 18**, public transportation in **Chapter 19**, traffic flow and control system in **Chapter 20**, city parking in **Chapter 21**. **Table 24.1-1** summarized the proposed projects in addition to the projects elaborated from BSDS and the results of the pilot projects.

Table 24.1-1 Summary of Project by the Scope of the Study

Unit : million USD

Improvement plan	Project	Cost
I. Road and maintenance	1. Enhancement of road maintenance and improvement capacity	10.0
	2. Local Road and Pavement Improvement in the Poor Area	15.0
II. Public transportation	3. High occupancy vehicle for minibus	-
	4. Roadside management for bus stops with tax /car parking	0.5
	5. Public transportation management and service improvement	0.9
	6. Bus route network reformation (TA)	0.3
	7. BRT introduction plan	0.5
	8. ICT ticket for trolleybus (on-going with EBRD)	1.0
	9. ICT ticket for all transit modes	1.0
	10. Public transport priority system	1.0
	11. Bus lane for peak hour	0.8
	12. Bus priority signal installation	0.8
	13. Bus operation monitoring system (FS)	0.8
	14. Bus approach information system (FS)	1.0
	15. East and west bus terminal improvement (FS)	1.0
II. Traffic flow improvement	16. Traffic flow improvement at bottleneck intersection	15
IV. Traffic signal control	17. Traffic signal control improvement	15
V. City Parking	18. Illegal parking control at specific areas	0.8
	19. Introduction of parking fee payment card (PPP)	1.0
	20. Integrated parking law and management (TA)	0.3
	21. Parking facility construction (PPP by ADB)	0.6
	22. Parking information system (PPP)	1.0
	23. Promotion of parking and ride (PPP)	1.0
VI. Economic Vitalization	24. Pedestrian mall for vitalization of town's economy	-
	25. Introduction of area traffic management at Dordoi market	2.0
	26.Pilot Project for transit corridor improvement	1.0
	27. Urban section of Bishkek-Osh road improvement	50.0
	28. Police community post for tourism promotion	0.1
VII EST and Smart City	29. Introduction of bicycle lane for NMT promotion	0.2
	30. Eco-car promotion	1.0
	31. Pedestrian way rehabilitation	1.0
	32. Traffic safety promotion for accident reduction program	1.0
	33. Driving manner improvement program	0.1
	34. "No car day for commuting" program	0.1
	35. Staggered office hours campaign	0.1
VII. Institutional and Capacity Development	36. Capacity Development of BCDA	1.0

24.2 Approach of the Project Formulation

The JICA Study Team considers that budget or finance constraint and implementing capacity are very important issues in examining the practical and immediate solutions to traffic problems within 5 to 10 years. EST and preservation of roads and transport facilities are added. In particular, EST is the principal objective of the National Sustainable Development Strategy (NSDS). The following are principles to be applied for the project examination.

(a) Finance constraint

(b) Environmentally Sustainable Transportation (EST)

(c) Preventive maintenance of infrastructure of transport

(d) Institutional strengthening and implementing capacity

24.3 Examination of the Priority

24.3.1 Examination Criteria

Table 24.3-1 summarized the examination criteria consisting of finance, capacity, EST, effectiveness, efficiency and impact. Each criterion has three levels of points and weight by total practicability and importance of NSDS. All projects are examined using these criteria, thereby summing the points for judging its priority.

Table 24.3-1 Examination Criteria

	Weight	Performance Indicators						
Criteria	Max pts.	Indicator	Item	Pts.	Item	Pts.	Item	Pts.
1. Finance	30%	Amount of investment	Low	3	Medium	2	High	1
	1.8	Funding scheme	Private	3	PPP	2	Public	1
2. Capacity	20%	Ability of implementation	High	3	Medium	2	Low	1
	1.2	Institutional preparedness	No	3	Less	2	Reform	1
3. EST	20%	CO_2 reduction	High	3	Medium	2	Low	1
	1.2	Reduction amount	High	3	Medium	2	Low	1
4. Effective	10%	Direction of NSBS/BSDC	High	3	Medium	2	Low	1
	0.6	Master plan direction	High	3	Medium	2	Low	1
5. Efficiency	10%	Output/input	High	3	Medium	2	Low	1
	0.6	Outcome/input	High	3	Medium	2	Low	1
6. Impact	10%	EIA requirement	No	3	IEE	2	Yes	1
	0.6	-	-	-	-	-	-	-
Total	100%	-	-	-	-	-	-	-
	6.0	-	-	-	-	-	-	-

Note: IEE: Initial Environment Examination
Source: JICA Team Study

24.3.2 Overall Implementation Program

Table 24.3-2 shows an overall implementing program (I/P) with budget allocation for 2013 to 2023, divided into emergency, short-term, and medium-term, with their priority and finance affordability of the City[1].

[1] 7.7 million USD is required (8% of 135 million USD of the total budget in 2013.)

Table 24.3-2 Implementation Program for 2014 to 2023

Unit: million USD

Priority	Proposed Project (Project type)	Cost	Urgent	Short	Mid.
			2014-6	2017-9	2020-23
1	3. High occupancy vehicle for minibus: (private)	-	0.0		
2	1. Enhancement of road maintenance and improvement capacity: (equipment procurement + technical assistance (TA))	10.0	10.0		
2	24. Pedestrian mall for vitalization of town economy: (private)	-	0.0		
2	30. Eco-car promotion: (pilot project (PP))	1.0	1.0		
5	31. Pedestrian way rehabilitation: (FS + PP)	1.0	1.0		
6	34. "No car day for commuting" program: (PP)	0.1	0.1		
7	15. East and west bus terminal improvement: (FS + PP)	1.0	1.0		
7	36. Capacity Development of BCDA: (technical assistance (TA))	1.0	1.0		
9	10. Public transport priority system: (FS + PP)	1.0	1.0		
9	11. Bus lane for peak hour: (FS + PP)	0.8	0.8		
11	4. Roadside management for bus stops with tax and car parking (PP + TA)	0.5	0.5		
11	16. Traffic flow improvement at bottleneck intersection: (design (DD) + construction (CW))	15.0	5.0	5.0	5.0
11	17. Traffic signal control improvement: (DD + CW)	15.0	3.0	12.0	
14	12. Bus priority signal installation: (FS + PP)	0.8	0.8		
14	26. Pilot Project for transit corridors improvement: (FS + PP)	1.0		1.0	
14	28. Police community post for tourism promotion: (PP)	0.1		0.1	
14	33. Driving manner improvement program: (PP + traffic police human resources development (HRD))	0.1		0.1	
14	35. Staggered office hours campaign: (PP)	0.1		0.1	
19	6. Bus route network reformation: (PP + TA)	0.3		0.3	
19	7. BRT introduction plan: (PP + TA)	0.5		0.5	
21	13. Bus operation monitoring system: (FS)	0.8		0.8	
21	14. Bus approach information system: (FS + PP)	1.0		1.0	
21	25. Introduction of area traffic management at Dordoi market: (FS + PP)	2.0		2.0	
24	22. Parking information system (PPP): (FS + PP)	1.0			1.0
25	2. Local Road and Pavement Improvement in the Poor Area: (DD + CW)	15.0			15.0
25	23. Promotion of parking and ride (PPP): (FS + PP)	1.0			1.0
25	27. Urban Section of Bishkek-Osh Road improvement (national budget)*: (FS + CW)	(50.0)			(50.0)
25	32. Traffic safety promotion for accident reduction program: (PP + HRD)	1.0			1.0
29	8. ICT ticket for trolleybus (on-going with EBRD)	1.0		1.0	
29	9. ICT ticket for all transit modes: (FS + PP)	1.0		1.0	
31	5. Public transportation management and service improvement: (FS + PP)	0.9		0.9	
31	29. Introduction of bicycle lane for NMT promotion: (PP)	0.2			0.2
33	19. Introduction of parking fee payment card (PPP): (FS + PP)	1.0			1.0
33	21. Parking facility construction (PPP by ADB): (FS)	0.6			0.6
35	18. Illegal parking control at specific areas: (FS + PP)	0.8			0.8
35	20. Integrated parking law and management: (PP)	0.3			0.3
	Total Cost	**76.9**	**25.2**	**25.8**	**25.9**

Note: * The MOTC is in charge of the project for the zone outside Bishkek area. However, the national budget (NB) that is included as it is in the affected area is not included in the total cost of the city budget.

: City revenue increase project

Source: JICA Study Team.

CHAPTER 25 CONCLUSION AND RECOMMENDATION

25.1 Purpose and Scope of the Study

The purpose of the Study is to limit the targets of the master plan (MP) to be formulated as follows:

- public transport plan,
- traffic control system plan
- traffic flow improvement plan
- set the target year as 2023
- tackle short and mid-term challenges on which urgent action needs to be taken

The parking is also a serious issue and the "parking improvement plan" is included to examine traffic improvement comprehensively.

JICA dispatched a study team jointly formed by Katahira & Engineers International (organizer) and Recs International Inc. The study began in July 2011 and was completed in October 2013 with objectives as follows:

(a) To formulate a simple[1] urban traffic MP of Bishkek, with the target year of 2023

(b) To implement technical transfer for enhancing the executing structure and capacity development related to urban traffic in the city

25.2 Study Approach and Outcomes

25.2.1 Scientific Approach

The Study is the first MP of Bishkek based on scientific approach. It differs significantly from conventional survey in three aspects: (i) scientific approach, (ii) demonstration based on pilot projects, and (iii) human resources development (including training in Japan).

The analysis method based on primary information (that includes current detailed facts and measured data in traffic survey and land use survey) is used. Scientific approach was new to Kyrgyz and Bishkek city. The Study consists of the socioeconomic frame of traffic survey and land use or population survey. Traffic survey consists of person trip survey based on traffic interview with approx. 4,000 sample households (1.7% of population) and road traffic survey to obtain traffic data at extensive points. Obtained measured data is compiled as the current OD table (Origin/Destination table) of traffic in Bishkek. In addition to the survey, public transport survey that includes boarding survey, bus stop survey, interview with passengers and drivers, parking demand and supply capacity survey (based on interview with parking facility), roadside parking, and parking users, and a survey to

[1] The target plan is limited to the three sub-sectors and the target year is set as 2023, 10 years from now, and short- and mid-term challenges on which action needs to be taken urgently are tackled. The land use is the current city structure in principle.

improve intersections, were conducted separately to examine challenges and provide possible solutions.

In the socioeconomic frame survey, such statistical data as various GDP and population census were analyzed and latest satellite photographs and GIS (geographical information system) were used to estimate current land use and population distribution, to identify population characteristics of each traffic area unit. Based on the trend of population growth rate, and city development based on the results, future traffic demand of 2023 was estimated. The analytical estimation method uses a general four-step method to estimate occurrence or concentration of traffic, distributed traffic volume, sharing of means of transportation, and assigned traffic volume to estimate the 2023 traffic demand as "Do-nothing" and congested road and bottlenecks are shown. The MP proposes a traffic improvement plan based on the scenario, based on public transport, in addition to other traffic improvement measures. The results are summarized in a project implementation plan.

As a result of the traffic demand estimation and survey of current situations based on scientific approach, the traffic congestion and bottleneck in Bishkek is not so serious as to leave some allowance in traffic management. Thus, it is determined that a certain level of traffic flow can be utilized with planning and execution of efficient investment albeit financial limitations. This shows that the city planning and public transport policy have been relevant. However, because traffic congestion and bottlenecks will happen across the city due to traffic volume increase in the near future, preventive measures need to be taken before the problem becomes serious. It is necessary to take comprehensive measures of "traffic and city development", which includes elimination of traffic bottlenecks, efficient use of traffic network, conservation of street landscape and conservation and use of existing roads and transportation facilities. The current compact city based on the city planning should be reevaluated in terms of a low carbon city and environmentally sustainable transport (EST) and examine development into a bold smart city concept.

25.2.2 Demonstration through Pilot Projects

Pedestrian Mall method, smooth traffic through improvement of intersections, traffic light control, and improvement of bus stops have been carried out as pilot projects and they have already had impacts. The pedestrian mall method was particularly appreciated by citizens and the approach is used in other sectors (educational events). The pilot projects have yielded positive results by utilizing very limited budget effectively and is an example that creative ideas have good results even in financial constraints. The pilot projects are listed in the table below.

No.	Pilot Project	Project Site	Implementation Schedule
1	Traffic Flow Improvement (I)	Chui-Fuchika intersection	Sep.-Oct. 2011
2	Traffic Flow Improvement (II)	Chui-Fuchika Intersection	Jan.-Oct. 2012
3	Traffic Control System	Chui-Fuchika Siaopina Intersection	Aug.-Oct. 2012
4	Public Transport Facility Improvement	Chui-Fuchika Intersection / Chui Avenue	Jan.- Oct. 2012
5	Pedestrian Mall	Kiyevskaya Street, Bishkek City	Sep. 16, 2012

25.2.3 Outcomes of Human Resources Development and Training in Japan

The scientific approach and pilot projects described above were used as means of human resources development. Various workshop programs were provided mainly by BCDA for human resources development of city employees and organizational capacity improvement of BCDA. BCDA and the city government experienced the Pedestrian Mall in planning, implementation and evaluation stages and their capacity improvement is remarkable. JICA provided hardware and software for the GIS seminar and their use and education is expected to be in continuity. Training in Japan was provided in two sessions. Trainees learned examples of Japanese cities and city development approach and this led to the decision of the introduction of a compact city development, bus location system and bus-only lanes. The implementation of the Pedestrian Mall scheme is also one of the outcomes of the training.

25.2.4 Conclusion of the Study

The study can be concluded as follows:

(a) Bishkek can avoid traffic congestion that currently paralyzes the city functions by executing investment in the chronological order proposed in the report as planned, albeit financial constraints.

(b) It is important to utilize the time allowance and implement small-scale projects and pilot projects proposed herein before the traffic problems become serious, and conduct various surveys for the future.

25.3 Generation of Master Plan Components and Alternatives

25.3.1 Approach

The study results show that the traffic capacity as road network is 1.0 or less even in terms of traffic demand in 2023. However, local and limited traffic congestion occurs for certain time periods and at certain locations. Due to roadside conditions, it is difficult to increase the traffic capacity by means of road development of widening of roads and building of raised intersections as they require land. Since road congestions and bottlenecks are caused by various factors, a MP needs to be formulated by combining multiple components for their solutions. Thus, the MP aims to reduce traffic congestion and eliminate traffic flow bottlenecks in limited road sections, points and areas, and study the promotion of use of public transportation, traffic demand management, reducing the traffic demand and number of vehicle trips, as components for solutions on demand.

Currently, repair of damage roads, conservation of road pavement and transportation facilities, improvement of bottlenecks at intersection, and control of illegal road-side parking are factors impeding and reducing road traffic capacity, which are studied as components or solutions for supply, in order to recover road traffic capacity. The scenarios of the MP will be compiled as highly feasible components in the chronological order and based on financial capacity.

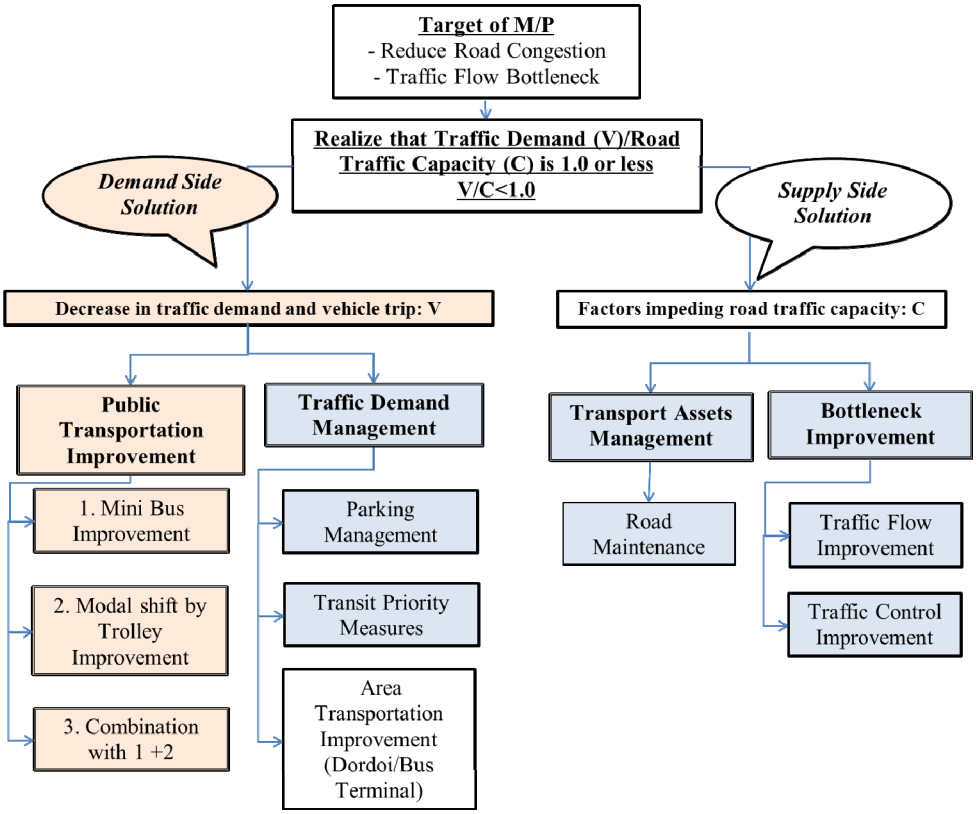


Figure 25.3-1 Approach to Generation of Master Plan Components and Alternatives

25.3.2 Basic Traffic Conditions (Do-Nothing Case)

The basic traffic conditions for compiling the scenario are shown below. Regarding the person trip (PT), passenger cars account for 87 percent of the total number of vehicles when the use rate is 25 percent. In comparison with the use trip, the number of vehicles in use is big and causing insufficient transport. The utilization rate of minibuses is high at 42 percent and accounts for 9.8 percent of vehicles. This shows that vehicle congestion is mainly caused by passenger cars. The trolleybuses account for only three percent of the PT and below one percent of the number of vehicles. Thus, reduction of the number of trip of passenger cars and conversion to public transport are examined. Regarding public transport, minibuses stopping at bus stops and specified roads (overlapping routes) are causing traffic congestion and preventive measures need to be taken.

Table 25.3-1 Trip Share by Mode in 2013 (Do-nothing)

Mode	Passenger / Vehicle	Person trip/day (Bishkek City Zone 1-61)			Vehicle trip/day (All Zones 1-98)	
	Passenger	Trip No.	Share	PT Share	Trip No.	(%)
1. Trolleybus	28.2	72,181	3.2%	7.0%	3,194	0.3%
2. Midibus	27	27,750	1.2%	2.6%	8,619	0.9%
3. Minibus	17	934,832	42.0%	90.4%	94,119	9.8%
Total (Public Transport: PT)			46.5%	100.0%		
4. Truck	1.3	3,171	0.1%	-	12,966	1.4%
5. Passenger Car	1.5	560,234	25.2%	-	839,550	87.6%
6. Walk	-	629,316	28.3%	-		
Total			100.0%	-	958,448	100.0%

Source : JICA Study Team

25.3.3 Alternative Scenarios

As basic alternative scenario policy, feasibility of modal shift from passenger cars to public transport is studied. The larger minibuses will be introduced, to reduce the number of vehicle trips, in consideration of financial constraints of the city, until the time of full-scale operation of new trolleybuses, and to reduce the traffic congestion in the minibus route. The minibuses currently transport passengers over the specified capacity and some people are standing. The change to larger minibuses contributes to better service and traffic safety. The city government only needs to set regulations without need for any additional expenditures. (Scenario 1)

As Scenario 2, efforts will be made to improve the efficiency of operation of new trolleybuses. It will repair and extend routes while promoting modal shift from passenger cars. For this purpose, the convenience of trolleybuses will be improved. The distance between bus stops will be reviewed and efforts will be made to carry out on-time operation in accordance with the timetable, and introduce the system to inform that a bus is approaching and the park-and-ride scheme. The use of passenger cars will be regulated. Parking lots will be regulated on accordance with time and time zones will be established. The passenger car regulation will be carried out with the improvement of public transport capacity and service. There is a need to consult with citizens to decide whether these are carried out based on the guidance policies or enforced as regulations.

Integrated operation management of public transport is needed as the trolleybus operation capacity improves and the passenger car regulation is agreed on. Thus, it is necessary to clarify the function and role of each mode in terms of improvement of service for users, establish an integrated management organization, create a fare system with common IC card under the new organization, and guarantee the convenience of transit. This is Scenario 3. The table below shows a summary of scenarios in consideration of the issues described above.

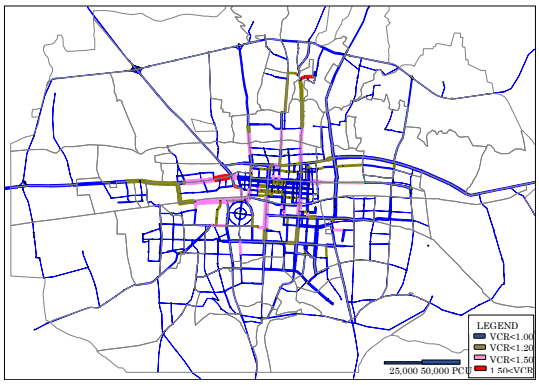
Table 25.3-2 Summary of Alterative Scenarios

Description	Objective	Measures	Effects
Scenario 0	Do-nothing	No	No
Scenario 1	Using high occupancy bus for small minibus	25% of small minibus trip share to big ones	Reduce the number of minibus trips
Scenario 2	Modal shift to trolleybus	10% in vehicle trip share of trolleybus	Increase trolleybus users
		10% reduction of passenger car trip	Decrease the number of car use along PT corridor
Scenario 3	Scenario 1 + Scenario 2	Combination of Scenario 1 and 2 ・Measures to improve services ・Establishment of integrated management organization ・IC card introduction, etc.	Combination of effects of Scenario 1 and 2 ・Improvement of convenience ・Increase in users ・Improvement of profitability

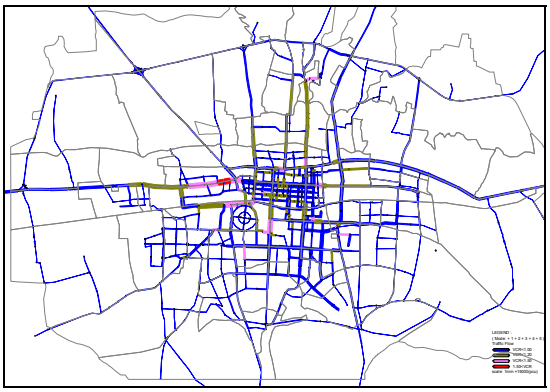
Source: JICA Study Team

25.3.4 Impacts of Scenarios

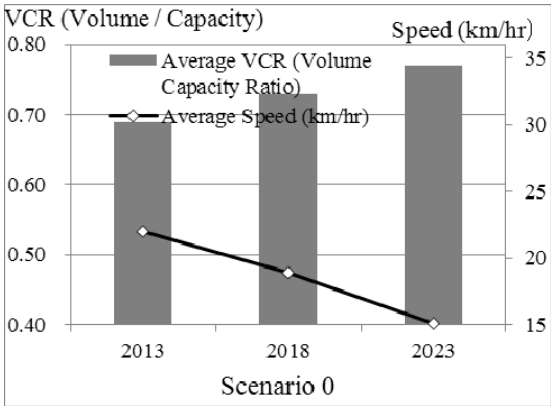
The impacts of the three scenarios above are shown in comparison of daily traffic volume in Do-nothing case in 2023 and peak-time congestion rate and speed. It shows reduction of congestion in road network. The congestion rate improves from 0.77 to 0.70 and average speed improves from 15.1 to 20.4 km/hr. Public transport and modal shift need to be promoted further.



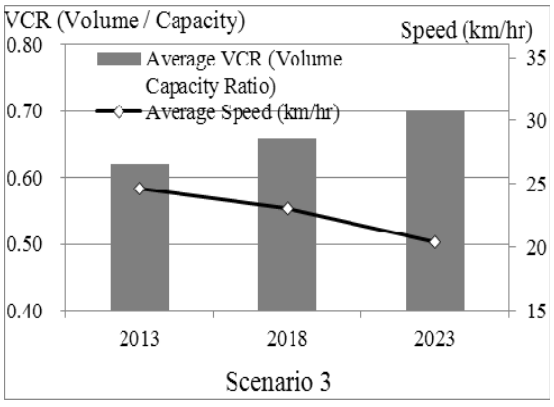
Daily Traffic Assignment in 2023
(Do-nothing)



Daily Traffic Assignment in 2023
(Scenario 3)



VCR and Travel Speed (Peak) in 2023 (Do-nothing)



VCR and Travel Speed (Peak) in 2023
(Scenario 3)

25.4 Project Implementation Plan

The project implementation period is divided as shown below in consideration of the priority order and financial constraints of the city government.[2]

Table 25.4-1 Implementation Program

Unit: million USD

Priority	Proposed Project (Project type)	Cost	Urgent	Short	Mid.
			2014-6	2017-9	2020-23
1	3. High occupancy vehicle for minibus: (private)	-	0.0		
2	1. Enhancement of road maintenance and improvement capacity: (equipment procurement + technical assistance (TA))	10.0	10.0		
2	24. Pedestrian mall for vitalization of town economy: (private)	-	0.0		
2	30. Eco-car promotion: (pilot project (PP))	1.0	1.0		
5	31. Pedestrian way rehabilitation: (FS + PP)	1.0	1.0		
6	34. "No car day for commuting" program: (PP)	0.1	0.1		
7	15. East and west bus terminal improvement: (FS + PP)	1.0	1.0		
7	36. Capacity Development of BCDA: (technical assistance (TA))	1.0	1.0		
9	10. Public transport priority system: (FS + PP)	1.0	1.0		
9	11. Bus lane for peak hour: (FS + PP)	0.8	0.8		
11	4. Roadside management for bus stops with tax and car parking: (PP + TA)	0.5	0.5		
11	16. Traffic flow improvement at bottleneck intersection: (design (DD) + construction (CW))	15.0	5.0	5.0	5.0
11	17. Traffic signal control improvement: (DD + CW)	15.0	3.0	12.0	
14	12. Bus priority signal installation: (FS + PP)	0.8	0.8		
14	26. Pilot Project for transit corridors improvement: (FS + PP)	1.0		1.0	
14	28. Police community post for tourism promotion: (PP)	0.1		0.1	
14	33. Driving manner improvement program: (PP + traffic police human resources development (HRD))	0.1		0.1	
14	35. Staggered office hours campaign: (PP)	0.1		0.1	
19	6. Bus route network reformation: (PP + TA)	0.3		0.3	
19	7. BRT introduction plan: (PP + TA)	0.5		0.5	
21	13. Bus operation monitoring system: (FS)	0.8		0.8	
21	14. Bus approach information system: (FS + PP)	1.0		1.0	
21	25. Introduction of area traffic management at Dordoi market: (FS + PP)	2.0		2.0	
24	22. Parking information system (PPP): (FS + PP)	1.0			1.0
25	2. Local Road and Pavement Improvement in the Poor Area: (DD + CW)	15.0			15.0
25	23. Promotion of parking and ride (PPP): (FS + PP)	1.0			1.0
25	27. Urban Section of Bishkek-Osh Road improvement (national budget)*: (FS + CW)	(50.0)			(50.0)
25	32. Traffic safety promotion for accident reduction program: (PP + HRD)	1.0			1.0
29	8. ICT ticket for trolleybus (on-going with EBRD)	1.0		1.0	
29	9. ICT ticket for all transit modes: (FS + PP)	1.0		1.0	
31	5. Public transportation management and service improvement: (FS + PP)	0.9		0.9	
31	29. Introduction of bicycle lane for NMT promotion: (PP)	0.2			0.2

[2] 7.7 million USD that accounts for 8% of 135 million USD of the total budget is required based on the development budget of the city finance in 2013.

Priority	Proposed Project (Project type)	Cost	Urgent	Short	Mid.
			2014-6	2017-9	2020-23
33	19. Introduction of parking fee payment card (PPP): (FS + PP)	1.0			1.0
33	21. Parking facility construction (PPP by ADB): (FS)	0.6			0.6
35	18. Illegal parking control at specific areas: (FS + PP)	0.8			0.8
35	20. Integrated parking law and management: (PP)	0.3			0.3
	Total Cost	**76.9**	**25.2**	**25.8**	**25.9**

Note: * The MPWT is in charge of the project for the zone outside Bishkek area. However, the national budget (NB) that is included as it is in the affected area is not included in the total cost of the city budget.

: Project increases City revenue

Source : JICA Study Team

25.5 Recommendations

Recommendations for Bishkek City

(a) The city government should approve the MP and implement it according to as implementation program.

(b) The city government should organize the utilization of Pedestrian Mall method as there is popular demand from citizens.

(c) The city government should establish an integrated management organization for all public transportation modes.

(d) The city government should introduce funding schemes to involve the private sector in public transport operation.

(e) The city government should establish a new public parking management authority to alleviate the issue of parking.

(f) The city government should promote Compact City and future Smart City concepts as its vision, aiming to develop a Low-Carbon City.

Recommendation of enhancement of BCDA functions

(a) BCDA should improve the functions in planning and implement a city or urban planning and a transportation planning.

(b) BCDA should enhance the coordinating function with the donors and the private investors.

(c) BCDA should independently assume the responsibility for new mandate (i.e. Public-Private Partnership), in which other city departments or agencies will not be involved.

(d) BCDA should improve education and training functions for technical competence of the City staff.

Recommendation of continuation and extension of the social experiments and pilot projects

(a) Development of Pedestrian Mall scheme for the vitalization of the City center and tourism promotion

(b) Expansion of intersection improvement in consideration of traffic safety of pedestrians and universal design

(c) Expansion of outcomes of traffic light improvement

(d) Expansion of outcomes of bus-stop improvement

Urgent policy recommendation for aid or support agencies

(a) Aid or support agencies should establish and promote results, or aid assets, from past technical cooperation.

(b) Government and aid or support agencies should recognize the strategic importance of Urban Development.

(c) Government and aid or support agencies should recognize the importance of technical assistance and ensure continuity.

(d) Government and aid or support agencies should exchange views on aid policies and strategies in urban transport and city development.

Recommendations for urgent action

(a) The city government should act to implement urgent projects based on the MP.

(b) The city government should act to implement the projects that expect to increase city revenues, by utilizing the private sector.

(c) The city government should act to implement the capacity improvement of BCDA including the PPP as city think-tank.