

## Chapter 7 Overview of the Transportation Sector

---

### 7.1 Road Infrastructure Sector

#### 7.1.1 Road Network

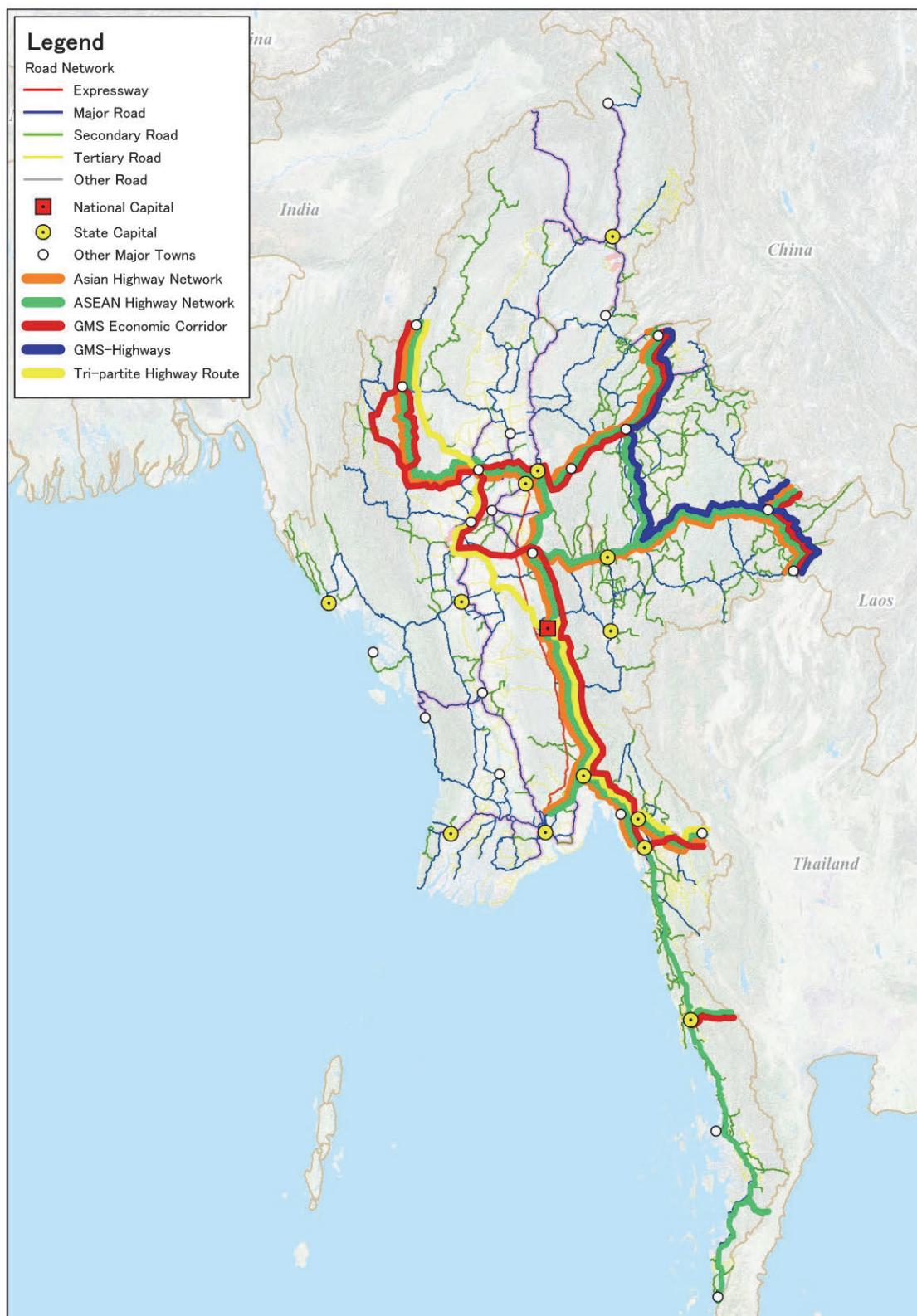
##### (1) Network of Corridors

The Department of Public Works (PW) in the Ministry of Construction (MOC) is the main implementation body for trunk road and bridge construction in Myanmar. PW has developed a 30-year highway development plan that includes six 5-year plans and explains the strategy and implementation activities for the future development of the highway network.

PW places a high priority on certain segments of the highway network that link into the regional network, namely, the Asian Highway, ASEAN Highway, GMS Economic Corridor, GMS Highway and Thai-Myanmar-India Tripartite highways. PW expects that further development of these network segments will accelerate the country's economic growth by encouraging international trade with neighboring countries.

Within Myanmar, the expressway connecting three major growth centers (Yangon, Nay Pyi Taw, and Mandalay) is not integrated into the regional road network, though it will play an important role in strengthening the Central North – South corridor.

As of 2013, the total road length in Myanmar reaches approximately 150,000 km, as shown in Figure 7.1.



Source: JICA Study Team

**Figure 7.1 Road Networks**

---

**Table 7.1 Length of Regional Highway Networks**

Asian Highway Network		
No.	Section	Length (km)
AH1	Myawaddy - Payagyi - Yangon - Meiktila - Mandalay – Tamu	1,665
AH2	Tachileik - Kengtung - Meiktila - Mandalay – Tamu	807
AH3	Mongla – Kengtung	93
AH14	Muse - Lashio - Mandalay	453
	Total	3,018
ASEAN Highway Network		
No.	Section	Length (km)
AH1	Myawaddy - Payagyi - Yangon - Meiktila - Mandalay – Tamu	1,665
AH2	Tachileik - Kengtung - Meiktila - Mandalay – Tamu	807
AH3	Mongla – Kengtung	93
AH14	Muse - Lashio - Mandalay	453
AH 111	Thibaw – Loilem	239
AH 112	Thaton – Mawlamyine - Thanbyuzayat – Ye – Dawei – Lehnya - Khamaukgyi, Lehnya - Khong Loy	1,145
AH 123	Dawei - Maesamee Pass	141
	Total	4,543
GMS Highway		
No.	Section	Length (km)
R3	Tachilek – Kengtung- Mailar (overlap with AH2 and AH3)	257
R4	Lashio – Muse (overlap with AH14)	176
R5	Kengtung – Loinlin –Thibaw- Lashio (overlap with AH2, AH14 and AH111)	666
	Total	1,099
Tri-Partite Highway Route		
No.	Section	Length (km)
	Tamu - Kalaywa - Chaungma - Lingadaw - Pakokku - Theegone - Naypyitaw - Payagyi - Thaton - Hpaan – Myawaddy	1,285

Source: Department of Public Works, Ministry of Construction (MOC)

**Table 7.2 GMS Economic Corridor**

GMS Economic Corridor		
Corridor Name	Section	Myanmar
North-South Corridor	Kunming – Bangkok	Yes
East-West Corridor	Mawlamyine – Danang	Yes
Southern Corridor	Dawei – Quy Nhan/Vung Tau	Yes
Northern Corridor	Gangheng – Tamu	Yes
Western Corridor	Tamu – Mawlamyine	Yes
Central Corridor	Kunming- Sihanoukville / Sattahip	No
Eastern Corridor	Kunming – Ho Chi Minh City	No
Southern Coastal Corridor	Bangkok – Nam Can	No
Northeastern Corridor	Nanning – Bangkok – Laem Chabang	No

Source: Asian Development Bank

### 7.1.2 Bridges

There are about 500 bridges in Myanmar that have lengths longer than 54m and a great many more shorter span bridges, according to information available as of July 2012. The exact number of bridges is unknown as there is currently no accurate government inventory of bridges or roads.

Myanmar's bridges are designed, constructed and maintained by PW directly, while private

companies under BOT schemes operate some trunk roads.

Regional technical and financial support for Myanmar's bridge infrastructure began with JICA's Bridge Engineering Training Center Project (BETC), implemented from 1969 to 1975. This support contributed to the technical capacity of PW staff and increased the number of bridge engineers in Myanmar. During the period of economic sanctions on Myanmar, several bridges, including the portable Bailey bridges, were constructed with Chinese and Indian technical and financial support.

**Table 7.3 Bridges on Major River**

No.	Name	Span (feet)	Type of Bridge
<b>River Ayeyarwady</b>			
1	Innwa Bridge (Sagaing)	3,960	Steel Truss
2	Nawaday Bridge	4,183	Steel Truss
3	Maubin Bridge	2,362	Steel Truss+ RCC
4	Bala Min Htin Bridge	2,688	Steel Truss
5	Bo Myat Htun Bridge	8,544	Steel Truss
6	Anawrahtar Bridge	5,192	Steel Truss
7	Ayeyarwady Bridge (Magway)	8,989	Steel Truss+ PC+RCC
8	Dadaye Bridge	4,088	Steel Truss+ RC
9	Ayeyarwady Bridge (Yadanarpon)	5,641	Steel Truss
10	Ayeyarwady Bridge (Nyaungdone)	7,402	Steel Truss
11	Ayeyarwady Bridge (Pakokku)	11,431	Steel Truss
12	Ayeyarwady Bridge (Sinkhan)	3,215	Steel Truss+ PC+RCC
<b>River Sittaung</b>			
13	Sittaung Bridge (Theinzayat)	2,320	Steel Truss
14	Sittaung Bridge (Taungngu-Mawchi-Loikaw)	680	CH Steel Girder
15	Sittaung Bridge (Shwe Kyin-Madauk)	1,500	PC+RCC
16	Sittaung Bridge (Mokepalin)	2,393	Steel Truss+ Plate Girder + RC
17	Sittaung Bridge (Natthankwin)	720	Steel Truss
<b>River Thanlwin</b>			
18	Kwan Lon Bridge	789	Steel Suspension
19	Tar Kaw Bridge	780	Steel Truss
20	Thanlwin Bridge (Hpa An)	2,252	Steel Truss
21	Thanlwin Bridge (Tarsan)	900	Suspension
22	Thanlwin Bridge (Mawlamyine)	11,575	Steel Truss+ PC+RCC
23	Thanlwin Bridge (Tarpar)	600	Steel Suspension
24	Thanlwin Bridge (Tarkaw At)	600	Bailey
<b>River Chindwin</b>			
25	Shinphyushin Bridge	4,957	Steel Truss
26	Chindwin Bridge (Monywa)	4,730	Steel Truss

Source: Department of Public Works, Ministry of Construction (MOC)

### 7.1.3 Sector Funding

#### (1) Road and Bridge Budgeting

Construction of the main roads and bridges in Myanmar is budgeted by the central government, based on the national annual budgetary plan, with funds generated from tax levies on fuel, vehicles, etc. Other countries, including Japan, allocate funding specifically for road and bridge construction.

The planned and actual expenditure for road and bridge construction and maintenance between 2005 and 2013 is shown in Table 7.4 and Table 7.5. Between 2005 and 2009, the level of infrastructure expenditure was approximately 100 billion Kyat, though after 2010 it increased sharply, reaching about 600 billion Kyat in 2012/2013 (Figure 7.2). Since then, it has decreased and the planned budget for 2013/14 is approximately 355 billion Kyat.

The planned road and bridge budget of 355 billion Kyat for 2013/14 is comprised of road construction (40%), bridge construction (25%), and infrastructure maintenance (35%).

**Table 7.4 Planned Budget for Road and Bridge Development (billion Kyat)**

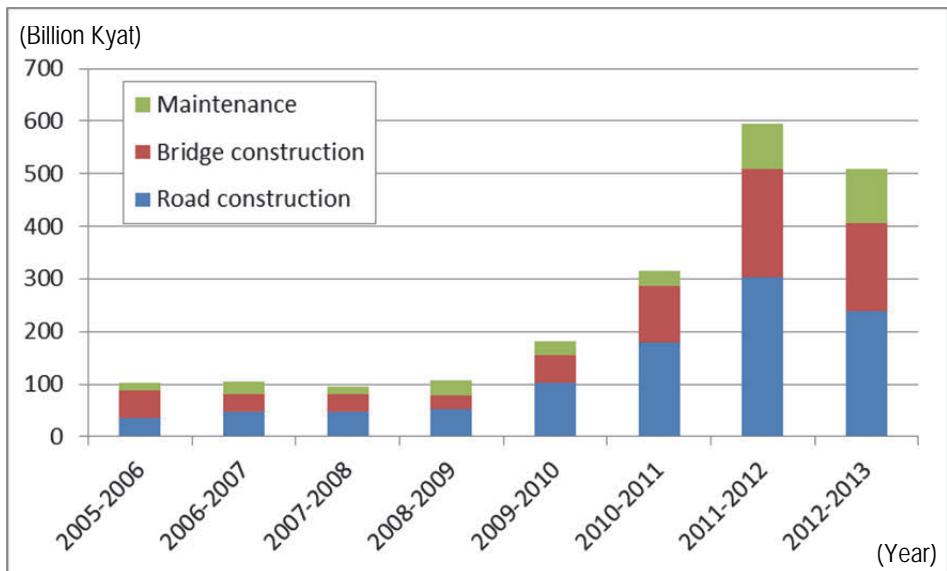
Plan	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010
Road construction	35.216	49.187	49.167	52.233	101.398
Bridge construction	52.625	32.772	35.446	27.248	54.154
Maintenance	21.359	34.813	24.413	35.115	56.139
Total	109.201	116.772	109.026	114.596	211.692
Plan	2010-2011	2011-2012	2012-2013	2013-2014	
Road construction	173.872	305.111	238.819	143.931	
Bridge construction	113.188	204.482	181.787	92.396	
Maintenance	42.296	87.154	103.292	118.243	
Total	329.355	596.748	523.899	354.570	

Source: Department of Public Works, Ministry of Construction (MOC)

**Table 7.5 Actual Budget for Road and Bridge Development (billion Kyat)**

Actual	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010
Road construction	35.164	48.430	47.030	51.546	101.615
Bridge construction	52.300	33.297	33.780	27.549	53.703
Maintenance	14.787	23.984	15.712	27.597	26.597
Total	102.252	105.712	96.521	106.692	181.915
Actual	2010-2011	2011-2012	2012-2013	2013-2014	
Road construction	173.872	179.175	303.907	238.701	
Bridge construction	113.188	107.802	205.110	168.077	
Maintenance	42.296	27.740	87.154	103.292	
Total	329.355	314.717	596.171	510.070	

Source: Department of Public Works, Ministry of Construction (MOC)



Source: Department of Public Works, Ministry of Construction (MOC)

**Figure 7.2 Actual Budget for Road and Bridge**

## (2) Private Sector Involvement

The private sector has been an active player in Myanmar's road and bridge sector and is an important source of financing. These businesses collect fees and conduct occasional maintenance work on nearly 400 tollgates on major roads and bridges. These toll fees are obtained through "auctions" (called laylan in the Myanmar language) or Build, Operation and Transfer (BOT) activities and are the main sources of financing for bridge and road operations.

Under the "auction" scheme, PW outsources toll fee collection to a company, but maintains responsibility for the maintenance work, which is financed by PW's budget. In the case of BOT, private companies are responsible for construction (or rehabilitation) of road and/or bridge sections with their own resources, and later recover this investment and generate profit from toll fees.

**Table 7.6 Type and Responsible Body for Operations and Maintenance**

Type of O&M	Responsible body		
	Toll collection	Maintenance	Operation
PW	PW	PW	PW
Auction	Private	PW	PW
BOT	Private	Private	Private

Source: Department of Public Works, Ministry of Construction (MOC)

### 7.1.4 Ongoing Projects and Actions

Myanmar's priority road, bridge and rehabilitation projects were presented by PW at the International Development Cooperation Forum in January 2013 and are summarized below.

#### (1) Priority Road Projects

Priority road projects include seven rehabilitation or new construction projects that share design features, such as a narrower cross section (12 feet) and bituminous treated surfaces. In addition, upgrading of the existing two-lane road network to PW's design standards is a key and urgent

priority. These projects are found mostly in suburban areas. (Table 7.7 and Figure 7.3)

## (2) Priority Bridge Projects

PW has presented a shortlist of priority bridge projects to international donors, seeking their partnership and technical and financial assistance. Some of the proposed bridges require urgent rehabilitation or replacement as they have outlived their designed lifespans and are likely to suffer damage. Many of these planned bridges are expected to improve connectivity between highways, including the high priority Hinthada Bridge, which will be one of the most used crossing points over the Ayeyarwady River. (Table 7.8 and Figure 7.4)

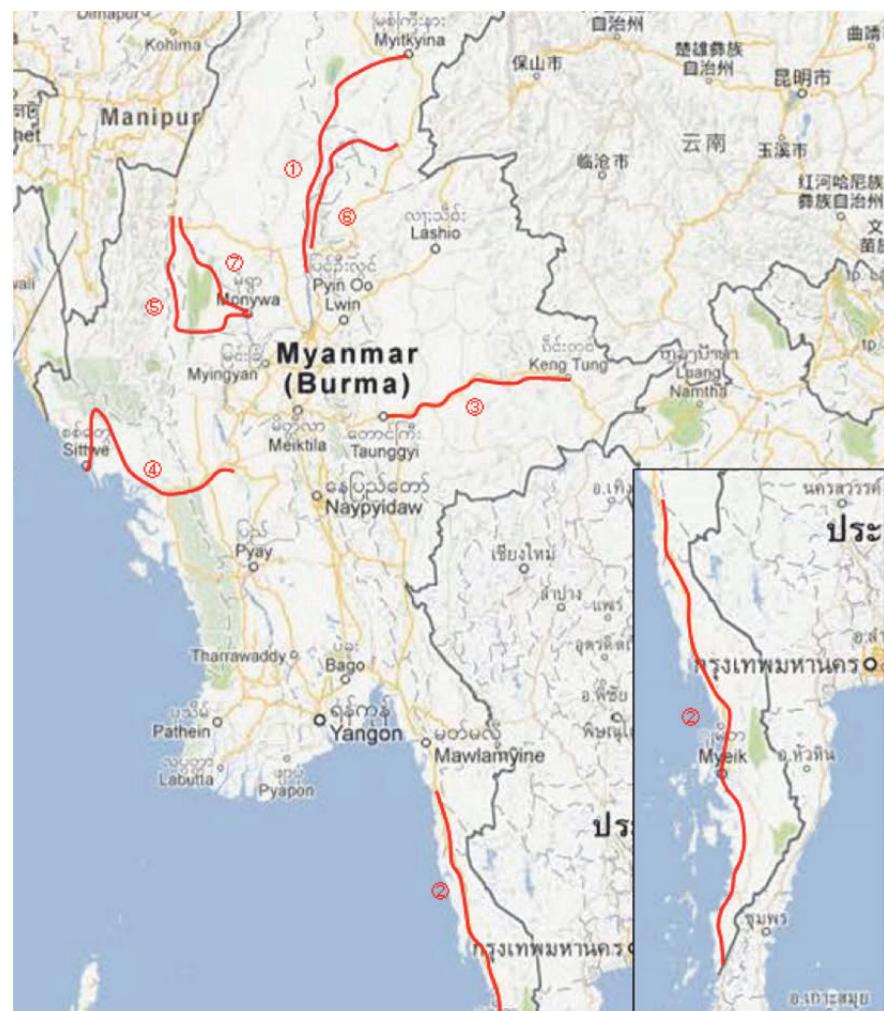
## (3) Priority Bridge Rehabilitation Projects

In terms of rehabilitation, a total of 20 existing bridges were prioritized by Myanmar for improvement and require urgent rehabilitation to maintain the reliability of the road network (Table 7.9 and Figure 7.5). These bridges are at a risk of severe damage due to years of accumulated corrosion to piers, abutments, decks and cable. The damage may be attributed, in part, to a lack of engineering skill during construction and corrosion by seawater, which is the main cause of damage in 14 of the 20 bridges located in Rakhine State.

**Table 7.7 Priority Road Projects**

	Road Section	Length (km)	Width of Paved Road (km)			Unpaved Road	Region/State
			12'	22'	24'		
1	Shwebo-Myitkyina	476	406	3	6	61	Kachin / Sagaing
2	Thanphyuzayat-Ye-Dawei-Myeik-Kawtaung	934	559	111	21	243	Mon / Tanintharyi
3	Meiktila-Taunggyi-Loilem-Kengtung	677	439	82	156	..	Mandalay / Shan(S) / Shan(N)
4	Minbu-Ann-Sittwe	477	367	5	6	99	Magway / Rakhine
5	Monywa-Pale-Gangaw-Kalaymyo	311	262	8.5	3	37.5	Sagaing / Magway
6	Mandalay-Thabeikkyin-Tagaung-Bhamo	282	13	13	..	56	Kachin / Sagaing / Mandalay
7	Monywa-Yargyi-Kalewa	186	186				Sagaing

Source: Department of Public Works, Ministry of Construction (MOC)



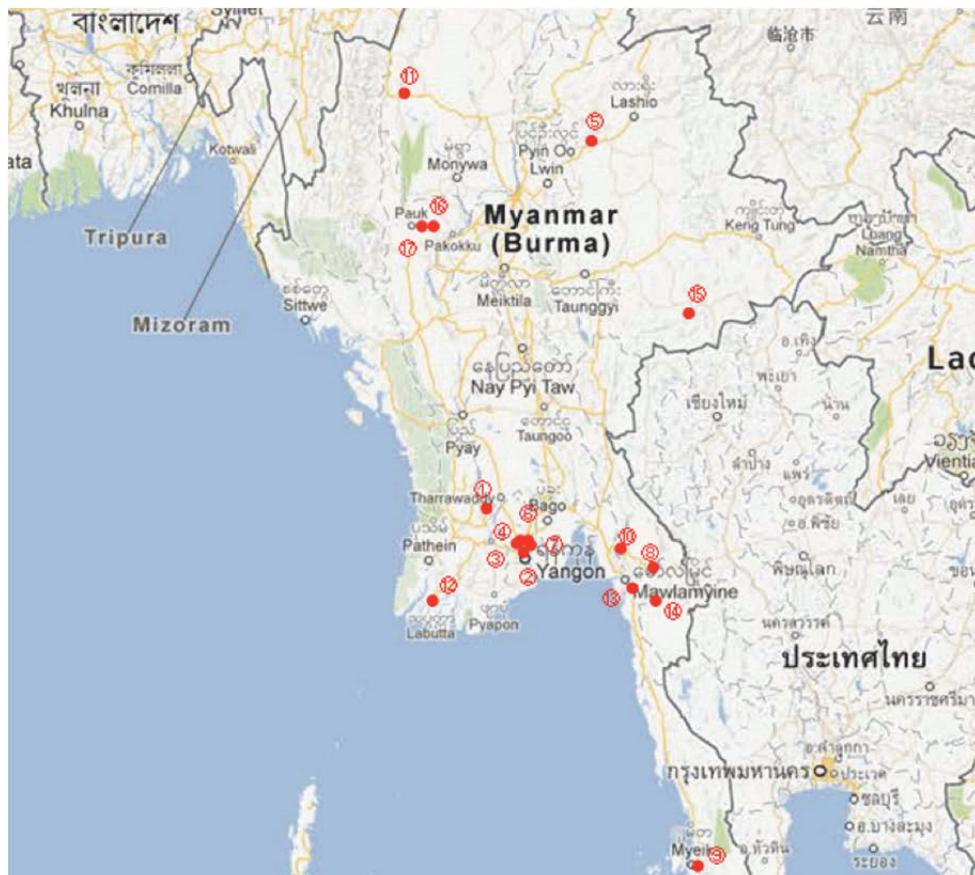
Source: Google Maps, JICA Study Team

**Figure 7.3 Locations of Priority Road Projects**

**Table 7.8 Priority Bridge Projects**

	Name of project	State / Region	Project Type	Length (m)
1	Hinthada Bridge	Ayeyarwady	New construction	3620
2	Dala Bridge	Yangon	New construction	1210
3	Hlaing River Bridge	Yangon	New construction	1200
4	Bayinanung Bridge No.2	Yangon	New construction	1200
5	New Goat twin Viaduct	North Shan	New construction	910
6	Wataya Bridge	Yangon	New construction	500
7	New Thakata Bridge	Yangon	Replacement	190
8	Gyaing (Kawkareik) Bridge	Kayin	Replacement	450
9	Tha Mouk Bridge	Tanintharyi	New construction	350
10	Don Tha Mi Bridge	Mon	Replacement	215
11	Chindwin (Kawlaywa) Bridge	Sagaing	New construction	600
12	Thetkal Thoung Bridge	Ayeyarwady	New construction	760
13	Thanlwin (Chaungsone) Bridge	Mon	New construction	600
14	Chaungnitkwa Bridge	Mon	New construction	360
15	Thanlwin (Tarsotpha) Bridge	Kachin	New construction	305
16	Yaw Chaung (Yepyar) Bridge	Magway	Replacement	1000
17	Yaw Chaung (Ohn Taw) Bridge	Magway	Replacement	760

Source: Department of Public Works, Ministry of Construction (MOC)



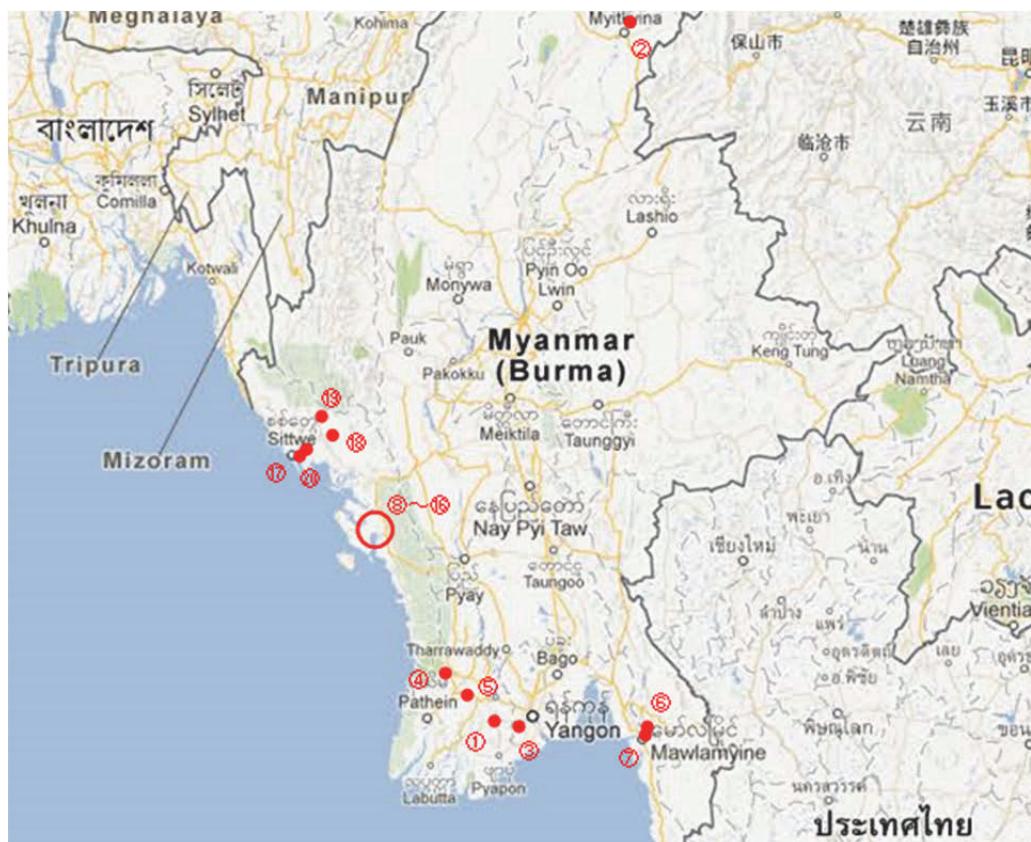
Source: Google Maps, JICA Study Team

**Figure 7.4 Locations of Priority Bridge Projects**

**Table 7.9 Priority Bridge Rehabilitation Projects**

	Bridge name	State/Region	Bridge type	Length (m)
1	Maubin	Ayeyarwady	Steel truss	709
2	Balaminhtin	Kachin	Steel truss	806
3	Twantay	Yangon	steel suspension	1071
4	Pathein	Ayeyarwady	steel suspension	633
5	Myaungmya	Ayeyarwady	Suspension	381
6	Gyaing ( Zarthapyin)	Mon	Suspension	870
7	Atran	Mon	Cable-stayed	426
8	Maei	Rakhine	RC	282
9	Kyaukkyipauk	Rakhine	Steel truss	90
10	Snarepauk	Rakhine	Steel truss	237
11	Lonetawpauk	Rakhine	Steel truss	347
12	Dedokepauk	Rakhine	Steel truss	178
13	Tanthamagyи	Rakhine	Steel truss	166
14	Thanthamachay	Rakhine	Steel truss	180
15	Thazintanpauk	Rakhine	Steel truss	178
16	Wanphite	Rakhine	Steel truss	248
17	Minkyuang	Rakhine	Steel truss	811
18	Yanmaung	Rakhine	Bailey	390
19	Kisspanaddy	Rakhine	Steel truss	754
20	Minchaung	Rakhine	Steel truss	601

Source: Department of Public Works, Ministry of Construction (MOC)



Source: Google Maps, JICA Study Team

**Figure 7.5 Locations of Priority Bridge Rehabilitation Projects**

### **7.1.5 Key Sector Issues**

While PW has made good progress with limited financing to extend the highway network across Myanmar, requirements for future development may exceed the capacity of PW, in a number of ways. For example, international freight forwarders are requiring increasingly higher standards for the transport sector and Myanmar's existing highways are below these design standards and must be upgraded to ensure safe, fast and smooth vehicle operation. In addition, other transport sectors also require accelerated investment in the next decades. PW understands this and is prioritizing improvements in administration, skills and knowledge, even though PW will be faced with budgetary constraints. To overcome this issue, PW should expand their analysis of how the private sector can participate and undertake legal and institutional improvements.

#### **(1) Planning and Coordination**

##### **1) Integrated Long-Term Plan**

The 30-year road development plan, prepared by the PW in 2000, includes six 5-year short-term development plans and informs individual project objectives and priority projects. The 30-year plan's policy, strategy and corresponding projects are limited to the road and bridge sector but must now be integrated with proposed corridor development and adjusted to maximize synergies with other transport sectors.

##### **2) BOT Contract Improvement**

In order to interest private companies in road and bridge construction, operation and management, the existing BOT scheme and the associated contracting models must be reviewed and improved. Current BOT schemes and contracts between PW and private companies are not clear and, at times, include unusual content for a legal document. In addition, some BOT contract documents do not include clear expressions of obligation or responsibility for business risks, others extend concession periods up to 40 years, which is much longer than comparable contracts in other countries.

##### **3) Road and Bridge Inventory Data**

Information about the existing road and bridge system has not been properly recorded in an integrated form or as a comprehensive inventory. Historically, information about road and bridge assets was recorded on a paper basis in the 1990s, and this information has not been digitized or kept current. Accordingly, PW engineers find it difficult and time consuming to understand and analyze the condition of these assets. These data quality challenges also make it difficult for PW to develop a proper investment plan for this infrastructure – road and bridge asset inventories would be improved with a classified road numbering system. However, PW has not yet developed a computer-based asset management system.

## **(2) Infrastructure**

PW places high priority on the improvement and construction of the union highway, as part of the regional (ASEAN) highway network. This commitment should be maintained so the ASEAN highway network can be completed. In addition, regional development can be accelerated with designated development corridors (particularly transport node developments such as Hanthawaddy International Airport, Thilawa SEZ) and should be integrated into union highway and motorway network planning. As well, the Master Plan should address issues related to the existing expressway, such as design and quality issues in comparison with international motorway standards and the expressway's restricted usage (e.g. trucks are not permitted).

## **(3) Safety, Security and Environment**

As traffic volumes increase, the rate of car accidents and fatalities likewise increases – this is a priority issue in Myanmar. On the existing Yangon–Mandalay Expressway, the number of fatal accidents is growing, mainly due to the expressway's poor physical condition and made worse by inadequate horizontal and vertical alignment, poor surface condition, and the shortage of road safety facilities such as guardrails, lighting and service areas.

In the case of union highways, most were not designed to accommodate paved shoulders or sidewalks (footpaths). In addition, highway design standards and supporting technical documents do not require road safety facilities. It is commonplace to see motorcycles and pedestrians sharing union highway carriageways and even expressways. Such behavior comes with a very high risk of injury and should be controlled as much and as soon as possible; these users require dedicated spaces, to ensure their safety.

In addition to the aforementioned weaknesses in infrastructure, right-hand drive vehicles may also pose risks. Myanmar's road network is design for left-hand driven vehicles. Many imported vehicles are of the right-hand variety and are used with no adjustment. For example, the driving lights for left-hand drive vehicles aim slightly leftward, to avoid blinding drivers of oncoming left-hand driven cars. However, this aiming can decrease visibility of drivers of oncoming right-hand drive vehicles.

## **(4) Human Resource, Institution and Regulation**

### **1) The Design Standard**

PW regulates road design standards for union highways and other roads of lower class (e.g. D1 to D6); these standards have been in place since 1969. However, the existing design standard does not cover roads of higher classes, such as motorways (full-access controlled highway), urban expressways (full-access controlled and semi-access controlled), high standard highways suggested by Asian Highway/ASEAN highway plans, or associated facilities such as interchanges. This Report urges PW to revise existing highway design standards urgently.

## **2) Decentralization**

PW has jurisdiction for roads of the D5 and D6 classes, which are mostly found in rural areas. Their work is challenged by the fact that it is quite difficult for a single agency (i.e. PW) to manage these minor roads with a limited staff contingent. This Report recommends that local governments (i.e. regions and states) take responsibility for the construction, operation and maintenance of the D5 and D6 class roads. In highly urbanized areas (e.g. Yangon and Mandalay), the urban expressway systems can be managed by the PW, if the Department is properly resourced. PW may also supervise union highway development, and R&D in the road and bridge sector. As with the D5 and D6 class road, responsibility for urban arterials roads and streets, including urban expressways can be borne by local governments or a specialized urban transport authority.

## **(5) Finance**

A considerable influx of investment is needed in the road and bridge sector over the next two decades, if the Government is to achieve targets for social and economic growth. To achieve the required investment levels, the Government must identify sustainable funding mechanisms. In addition to already-mentioned PPPs, other possibilities include a special purpose tax (or earmarked tax) on fuel, vehicles for private use, and toll fees for exclusive use on highway construction and maintenance.

## 7.2 Road Transport Sector

### 7.2.1 Highway Bus Passenger Transport

#### (1) Bus Transport Network

Myanmar's bus transport business has increased rapidly in recent years. From 2008 to 2011, buses accounted for more than 90% of passenger trips (Table 7.10). Moreover, both the number of registered buses, bus operators and bus passengers has increased sharply, increasing by more than 10 times between 2008 and 2011 (Table 7.11). The increase of registered buses is not distributed evenly across the country, with more than half of registered in Yangon.

**Table 7.10 Number of Passengers by Transport Mode (million trips)**

Mode	2008		2009		2010		2011	
Road	1,632	94%	1,997	95%	1,294	93%	1,233	93%
Rail	75	4%	72	3%	69	5%	67	5%
River	27	2%	27	1%	28	2%	23	2%
Air	1	0%	1	0%	1	0%	1	0%
Total	1,735	100%	2,098	100%	1,391	100%	1,325	100%

Source: TPD/RTAD, MR, IWT, DCA (<http://www.ajtpweb.org/>)

**Table 7.11 Number of Fixed Route Bus Operators**

	2008	2009	2010	2011
Number of fixed route bus operators	1,582	1,129	13,873	16,044

Source: TPD (<http://www.ajtpweb.org/>)

The busiest bus routes are found on five intercity routes, namely: Yangon to/from Nay Pyi Taw (87 buses per day in both directions), Yangon to/from Mandalay (77 buses per day), Yangon to/from Mawlamyine (47 buses per day), Yangon to/from Hpa-an (45 buses per day) and Yangon to/from Hinthada (35 buses per day). Additionally, there are many buses that travel between other major cities.

The intercity buses travel to all capital cities in the 14 states and regions. These also travel to major cross border cities, including Myawaddy (6 buses per day to/from Yangon), Muse (4 buses to/from Yangon/Mandalay) and Tamu (5 buses to/from Yangon/Mandalay).

**Table 7.12 Daily Service Frequency of Intercity Buses by Distance Range**

Distance Range (miles)	Service Frequency per Day (no.)	Composition
0-100	220	18%
100-200	438	36%
200-300	211	17%
300-400	100	8%
400-500	162	13%
500-600	12	1%
600-700	28	2%
N/A	35	3%
Total	1,206	100%

Source: JICA Study Team, based on Myanmar Travels and Tours Directory 2013

## **(2) Registration and Regulation**

### **1) Bus Operation License**

Bus operators must hold an Operation B License, which is provided by the Transport Planning Department, MRT and is valid for only one year. MRT's Road Transport Administration Department inspects and registers these vehicles and bus operator's must submit their license applications at the central government or through one of the 48 region offices.

### **2) Bus Route and Services**

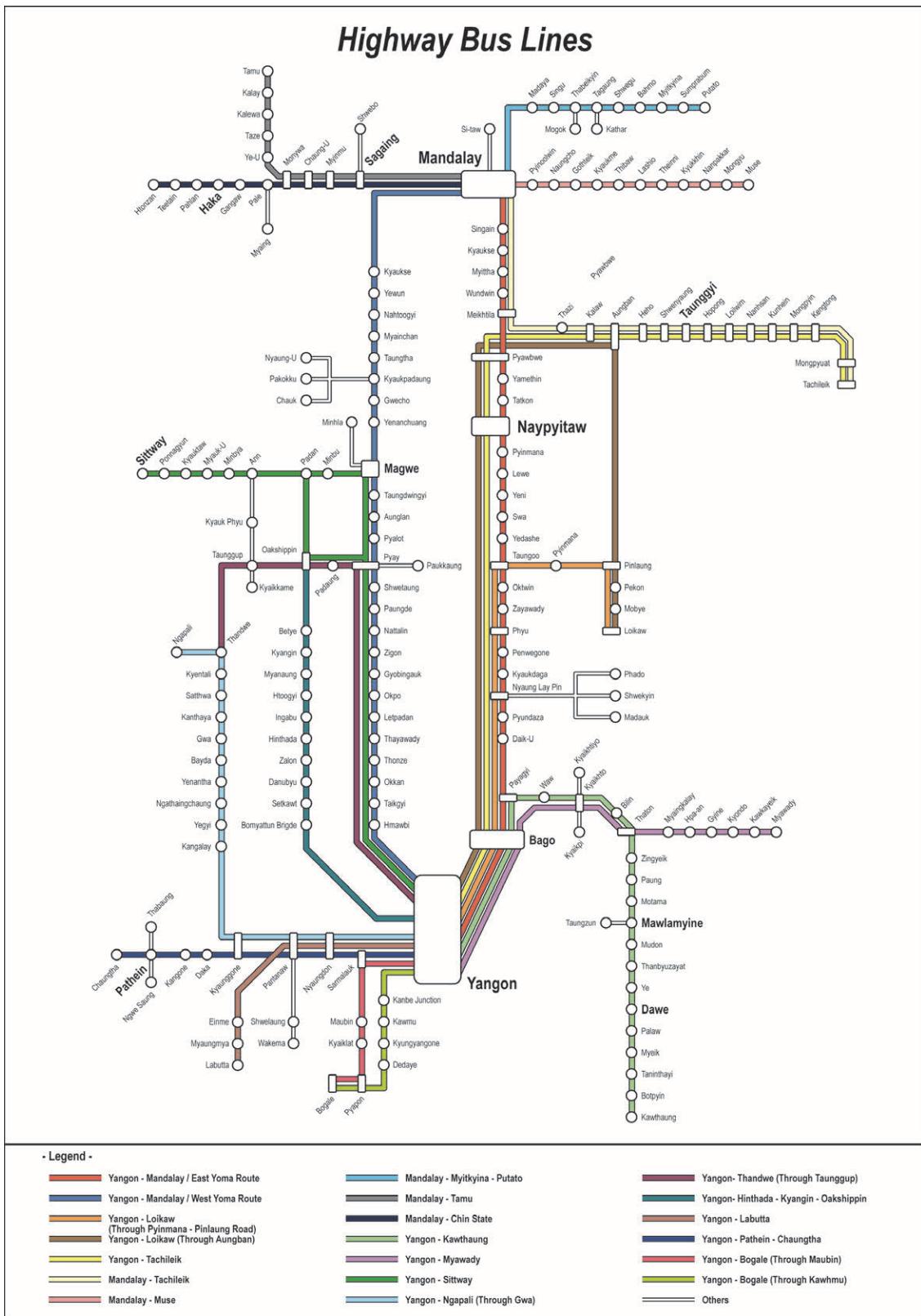
The regional authorities, in consultation with the Bus Control Committee, issue approvals to bus operators for routes and services. There is no restriction regarding trip limits on routes for intercity bus operation.

### **3) Bus Fares**

Intercity bus fares are strictly controlled by the central government. The distance-based fare is applied to all intercity bus services, which permits fares of 20 Kyats per mile for non-air conditioned bus and 24 Kyats for air-conditioned bus service. A different distance-based rate is charges for bus service in mountainous areas, which charges 40 Kyats per mile.

### **4) Control of Bus Services**

The intercity bus service is monitored by the Regional Bus Control Committee at the terminals in Yangon, Mandalay and Nay Pyi Taw. While the Committee monitors bus service frequency and inspects the condition of the bus, there is less control on the intercity bus service by the authorities/committees.



Source: JICA Study Team, based on Myanmar Travels and Tours Directory 2013

**Figure 7.6 Myanmar's Inter-city Bus Routes**

### 7.2.2 Highway Truck Transport

The truck transport business in Myanmar shares features with the bus transport business and has expanded rapidly in recent years. Both the number of registered trucks and their transported freight volumes are increasing. As Table 7.13 indicates, the number of trucking companies and domestic forwarders registered in Myanmar has increased 10 times between 2008 and 2011, now numbering more than 7,000 trucking companies and 9,000 forwarders. This increase of trucking companies contributes significantly to traffic congestion in major cities and warrants the construction of a full service and equipped truck terminal.

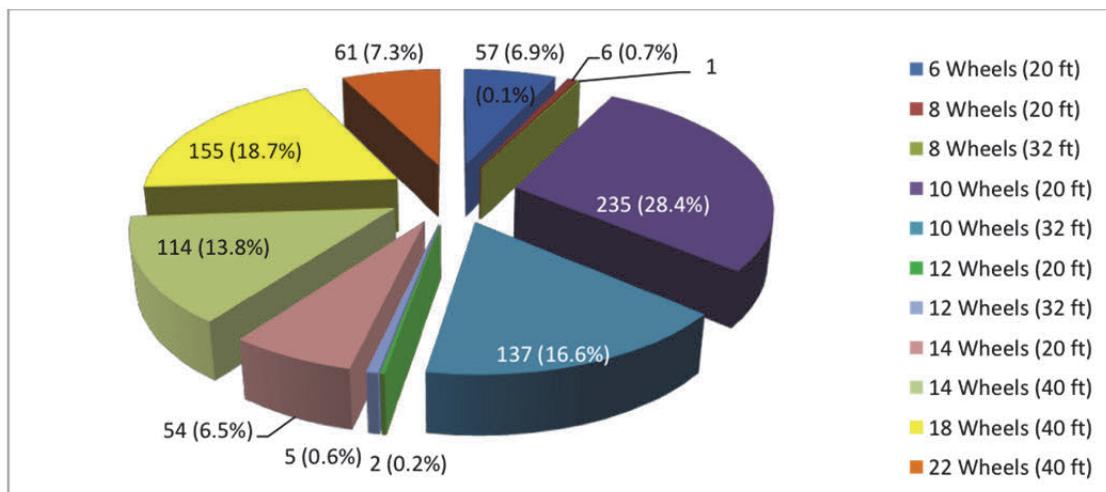
**Table 7.13 Number of Trucking Companies and Domestic Forwarders**

	2008	2009	2010	2011
Number of trucking companies	638	527	6,396	7,112
Number of domestic forwarders	644	716	8,664	9,363

Source: TPD (<http://www.ajtpweb.org/>)

Trucking companies in Myanmar are considered entrepreneurial small-scale enterprises (e.g. one owner/one truck) and those with more than 20 trucks are rare. The service areas for these companies are limited to local distribution centers within states and regions; there is no single trucking company that provides a regular, nationwide service.

The trucking companies registered in Myanmar with the Container Truck Association use various types of vehicles. The most common, used mainly to transport containers between Yangon Port and the industrial zones/warehouses/factories in and around Yangon, are 10-wheeler trucks (45% of the total trucks registered as of 2012), 14-wheeler trucks (20%), and 18-wheeler trucks (19%).



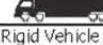
Source: Myanmar Container Trucks Association (2012)

**Figure 7.7 Type of Trucks Registered by the Container Truck Association**

The same 2012 study analyzes the trucking business operating cost structure. The analysis shows that the highest cost item of the transport business is fuel and lubricants, which accounts for 80% of total transport costs in Myanmar. By comparison, fuel accounts for just 50% of Thailand's transport cost for operators. This suggests that there are a number of issues, particular to Myanmar, that contribute to higher than average fleet operating costs, such as poor

road conditions, hilly and mountainous terrain, aging vehicles that require higher maintenance and emissions costs and equipment depreciation, which taken together, all contribute to higher operating costs.

The uneven enforcement of transport regulations is another contributor to operating inefficiencies. Axle load regulations, as shown in Figure 7.8, were strictly enforced from January to March 2011 and then again since November 2011. At the same time, the Government relaxed import license restrictions on new trucks. As a result, operators started purchasing cost-effective 22-wheeler trucks and freight charge decreased significantly.

Appendix V: The Current Weight Limits in Myanmar 2012					
Vehicle Type	Axle Configuration and Axle Weight			Total Weight (national)	Total Weight (ASEAN )
 Semi-Trailer (6 axles)	○	○○○	○○○○○	50	50.5
 Semi-Trailer (5 axles)	○	○○○	○○○○	41	46
 Semi-Trailer (4 axles)	○	○○	○○○○	33	34
 Single Rigid Vehicle (4 axles)	○	○○	○○○○	28	27
 Single Rigid Vehicle (3 axles)	○	○○○		23	23
 Single Rigid Vehicle (2 axles)	○	○○		15	15-16
Legend					
Single Wheel  Double Wheel 					

Source: Ksoll and Quarmby (2012)

**Figure 7.8 Current Axle Weight Limits in Myanmar**

### (3) Registration and Regulation

#### 1) Truck Operation License

Like bus operator licenses, the truck operator licenses (i.e. Operating License A) can be obtained at the Transport Planning Department (MRT). The trucking companies and bus operators follow similar procedures regarding licenses, and submit required documents together with negotiated truck routes and services, authorized by the Road Transport and Inland Water Transport Board.

#### 2) Trucking Routes and Services

In Myanmar, the trucking industry associations are a unique organization, called “Gates” which represent a large percentage of the operators. Gates exist in each major city and each Gate specializes in one trunk route. The Gate Manager negotiates rates on behalf of the operators. Generally, the operations of Gates, as well as the trucking companies within these Gates, function well below international standards and are subject to only informal agreement on how they operate.

### **3) Trucking Fares**

Trucking freight charges were once controlled by the regional authority and the standard distance-based charge was determined by the central government. However, authorities have not relaxed freight charges and companies now set these charges independent of the regulator.

### **4) Control of Trucking Services**

This Report finds that there is no authority or committee that monitors and controls the service of the trucking companies.

### **(4) Institutional Arrangement**

Most of Myanmar's transport sector is managed by three ministries and three city development committees. These include: (i) Ministry of Transport (MOT), (ii) Ministry of Rail Transportation (MRT), (iii) Ministry of Construction (MOC), and the Yangon, Mandalay and Nay Pyi Taw City Development Committees. The MRT and the MOC have a particularly important role in the road transport sector. The MRT and City Development Committees play vital roles in road transport sector as a policy maker and regulator, developing long-term policy and guidelines and regulating the road transport business and fares. The MOC is responsible for the developing policies and plans for development of roads, delivering technical training and conducting research for road development and maintenance.

#### **7.2.3 Container Truck Transport**

##### **(1) Container Truck Handling**

The Myanmar Container Trucks Association (MCTA) has approximately 827 container truck members in 2013, owned by 44 national companies. These container truck companies transport about 350 containers per day on average. Assuming one container truck handles 1.3 TEUs (30% for a 40 ft container or 70% for a 20 ft container), the maximum container carrying capacity by the existing trucks (MCTA) is 392,000 TEUs (1.3 TEUs x 827 vehicles x 365 days) per year, which is almost equal to the containers currently handled at the Yangon ports (about 380 thousand TEU per year).

**Table 7.14 Containers handled by the Container Trucks Association**

	Direction	For Export	Import from overseas	Total	Daily Average	40 feet container	20 feet container
November 2012	Within Yangon Downtown	2,581	5,489	8,070	269	80	189
	From Yangon to Nay Pyi Taw	-	103	103	3	1	2
	From Yangon to Mandalay	-	9	9	0	-	0
	Sub-total	2,581	5,601	8,182	273	81	192
December 2012	Within Yangon Downtown	3,041	6,759	9,800	316	94	222
	From Yangon to Nay Pyi Taw	-	79	79	3	1	2
	From Yangon to Mandalay	-	2	2	0	-	0
	From Yangon to Hlaingteti	-	1	1	0	-	0
	Sub-total	3,041	6,841	9,882	319	95	224
January 2013	Within Yangon Downtown	3,589	7,700	11,289	364	109	255
	From Yangon to Nay Pyi Taw	-	89	89	3	1	2
	From Yangon to Mandalay	-	20	20	1	-	1
	From Yangon to Pyin-oo-Lwin	-	2	2	0	-	0
	Sub-total	3,589	7,811	11,400	368	110	258
February 2013	Within Yangon Downtown	3,098	6,651	9,749	348	104	244
	From Yangon to Nay Pyi Taw	-	54	54	2	-	2
	From Yangon to Mandalay	-	13	13	0	-	0
	Sub-total	3,098	6,718	9,816	351	104	246

Note: Hlaingteti is between Meiktila and Kalaw

Pyinoolwin is between Mandalay and Lasho

Unit: The number of containers included 20 and 40 ft.

Empty containers are not included in the figures.

Yangon - Mandalay 40 ft : 20 ft ratio = 30 : 70

Other movement 40 ft : 20 ft ration = 40 : 60

Source: Container Truck Association, Myanmar

## (2) Diversity of Transportation

Many countries use the multimodal transport system, which includes modal transportation like railways, ships and trucks. This transportation system is adaptable and operators can determine optimal mixes of modes to increase efficiency. The system is flexible and operators are able to decrease the transportation time and cost. Some logistics companies in other countries believe multi-modal transportation may reduce CO<sub>2</sub> emissions, but improved efficiencies with this system require particular equipment to load and offload containers. In Myanmar, mechanical loading and unloading equipment is in short supply at truck terminals. As a result, goods must be transferred with manual labour.

### 7.2.4 Ongoing Projects and Actions

#### (1) Yangon City Public Transport Authority

Myanmar formed Yangon City Public Transport Authority in January 2013, involving 10 representatives from the transport sector agencies. The mission of the Authority is to provide convenient, smooth and efficient transport services to the people in Yangon. The Authority is responsible for coordinating the work of various transport-related agencies in the management of public transport modes in Yangon, and to reduce traffic congestion by drafting a public transport master plan, enforcing traffic measures, developing transport infrastructure and setting up organizations in management and funds with Yangon City Development Committee.

## (2) Tax Reduction

The Myanmar government is undertaking significant tax reforms for local transport operators. One of the outcomes of these reforms is the lowering of import tax for trucks, which was reduced from 30% to 5% (actual tax is 13%, including sales tax and registration tax). As well, the industry noted an increase in the number of registered transport vehicles in recent years. This lowering of duties on truck imports provided local transport operators with incentives to upgrade their trucks to international standards.

## (3) Brunei Action Plan

The Brunei Action Plan, which describes a list of priority actions to accelerate ASEAN Connectivity, was negotiated during an ASEAN Transport Ministries Meeting in 2010. This Action Plan includes clear targets, priority activities and timelines for physical infrastructure projects of all modes of transport and institutional development proposals for the transport sector. The following table summarizes actions for transport facilitation listed in the Brunei Action Plan.

Among these strategies and actions, enhancement of the transport facilitation and development of logistics industry are key policy directions, which Myanmar is adopting.

**Table 7.15 List of Actions Proposed for Transport Facilitation in Brunei Action Plan**

Strategies	Actions
1. Establish integrated and seamless multimodal transport system to make ASEAN the transport hub in the region	(1) Fully operationalize three ASEAN Framework Agreements on transport facilitation. (2) Implement initiatives to facilitate inter-state passenger land transportation. (3) Conduct studies on potential multimodal transport corridors to empower parts of ASEAN to function as land bridges in global supply routes. (4) Complete the East West Economic Corridor. (5) Promote the Mekong India Economic Corridor as a land bridge. (6) Comparative study between EU and ASEAN region for development of efficient transport system by 2013 and its adoption. (7) Promote the usage of transport terms and practices related to multimodal transport, including INCOTERMS (International Commercial Terms).
2. Enhance the competitiveness of ASEAN logistics industry	(8) Develop and upgrade skills and build capacity for MOTs (multimodal transport operators) and LSPs (logistics service providers) through joint training and workshops. (9) Establish national/regional centers of training centers, national skill certification systems and common core curriculum. (10) Identify and develop the ASEAN logistics network and formulate the necessary infrastructure development requirements.
3. Establish safe and secure inter-state transport system	(11) Share and apply appropriate technologies of information systems for promotion of supply chain security initiatives.
4. Develop environmental-friendly logistics	(12) Develop green logistics through increase in logistics management efficiency and utilization of environmentally -friendly transport modes, fuel, fleets, supporting logistics facilities.

Source: MLIT (2012) ASEAN No UNYUJIJO

### **7.2.5 Key Sector Issues**

#### **(1) Planning and Coordination**

##### **1) Transport Service Provider Development**

Recently, the number of road transport service providers has increased, year by year and despite competition among local operators and despite being regulated by the Government in terms of fares and services. The trend towards ASEAN and GMS regional integration will force the growing number of local transport providers into intense competition with the international market to support operations in an increasingly competitive environment. Transport services and infrastructure must be upgraded to achieve operational cost efficiencies and build capacity among the operators as they work to meet international standards in business and service.

#### **(2) Infrastructure**

##### **1) Lack of transport infrastructure and management/facility of the terminal:**

Urban transport issues, especially traffic congestion, seriously affect the road transport business. The traffic congestion in Yangon contributes to increases in the travel/lead times and transportation costs. While the Myanmar government is working hard to reduce traffic congestion, increasing demand has always outstripped the capacity of the traffic infrastructure.

Inadequate infrastructure is also problematic in the bus and truck terminals of Myanmar, which are poorly equipped. There is no cargo handling equipment to load or offload goods, instead goods are transferred with manual labor. This contributes to cargo damage, increased commodity cost as well as poor and unsafe working conditions. In addition, public truck terminals and access roads are always overcrowded during peak hours.

##### **2) Diversify in transport needs:**

Despite Myanmar using a multimodal transport system, it is not easily visible. There is no equipment for cargo/container handling, as such the railway and road networks are not integrated.

Moreover, logistics companies require a variety of transportation for their services, such as containerization and cold chain supply. These issues will soon become serious for Myanmar, especially when the ASEAN member countries are regionally integrated.

#### **(3) Safety, Security and the Environment**

##### **1) Poor traffic safety and environmental preservation practices:**

Traffic safety and environmental preservation are priority issues among the transport regulators and operators in developed countries. Some countries provide regulation/guidelines and subsidies to encourage safe and eco-friendly transport services. In Myanmar, traffic accidents are an increasingly worrying issue, though transport users appear ready to pay an additional cost for safer transportation.

#### **(4) Human Resources, Institutions and Regulations**

##### **1) Fragmented institutional structure:**

A number of Ministries and their executing agencies, the MOC, MOPBANRDA, and MOD, are mandated to develop and maintain the road transport infrastructure and services. Each Ministry sets up transportation committees to address overlap and lack of coordination between the concerned agencies.

**2) Lack of management/planning tool:**

Data required for planning is lacking in Myanmar (e.g. the last Population Census was conducted in 1989; no updated data is available since then) and this hinders forward planning.

**3) Absence policy/strategy:**

Though the MOT has adopted a long-term national transport policy and strategies and has committed itself to improving the transport network and service to international standards, Myanmar has no long-term road transport policy that includes bus or truck transport conforming to ASEAN transport agreements.

**4) Central control on transport business:**

The road transport business is controlled by the central government. For instance, the government and control committee determine the unit fare and the operators are allowed to charge a fixed rate by travel distance. While the operator licenses can be obtained, this is possible only when the control committee approves, though the process and conditions are not clearly stated.

**(5) Finance**

**1) Severe budget constraints:**

While the government finances the construction and management of the road side terminals, additional budget constraints mean that these terminals have not been upgraded or expanded, even though transport needs are diverse and demands are growing.

**2) Limited subsidy program:**

The Myanmar government is making significant efforts to encourage local transport operators to upgrade services to international standards. For instance, the aforementioned lowering of import tax for trucks and the regulation of the axle loads are examples. These policy reforms act as incentives for transport operators to upgrade truck equipment (e.g. especially 22 wheeled trucks) to reduce the transport costs.

## 7.3 Railway Sector

### 7.3.1 Railway Network

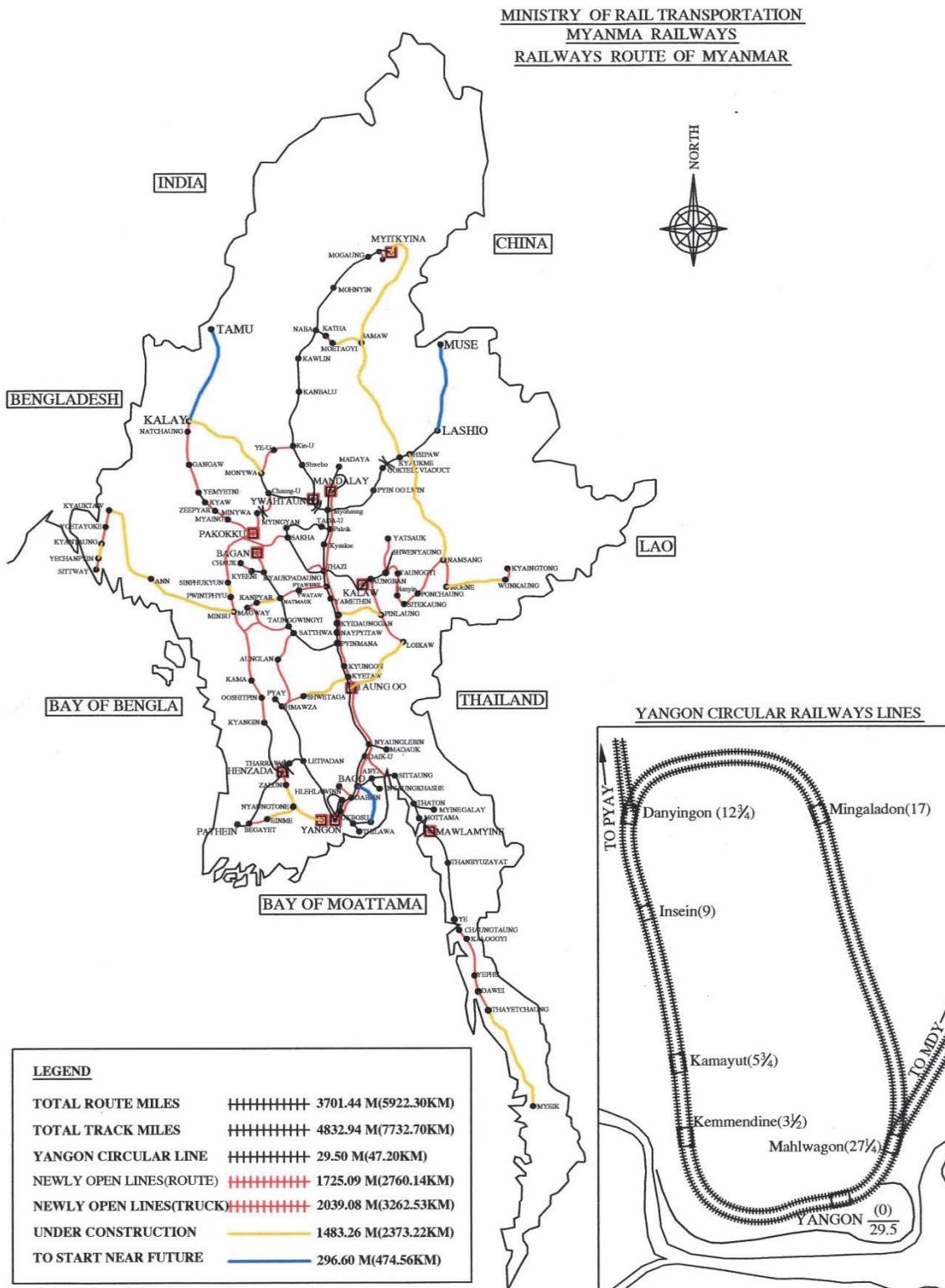
Myanmar has a rail network that spans the country with a total distance of 5,933.9 km, including 5,299.9 km of single-track sections and 704.76 km of double-track. Since 1988, Myanma Railways (MR) has expanded the railway network and has plans to add an additional 2,806.11 km and construct a new line of 477.23 km. The rail network includes a variety of facilities and infrastructure including 939 stations, 11,774 bridges, and 12 tunnels. The network operates 427 trains per day, with 200 trains on the Yangon circular and neighboring lines and 29 freight trains. In 2012, Myanmar's inventory of rail equipment included 35 steam locomotives, 405 diesel locomotives, 235 diesel railcars, 1,282 passenger cars, and 3,210 freight wagons. Among the 405 diesel locomotives, 268 locomotives are diesel electric locomotives (DEL) and 137 locomotives are diesel hydraulic locomotives (DHL). During the past five years, the number of diesel locomotives has increased by 18% (62 units). These additional locomotives were purchased with assistance from China, India and other countries.

**Table 7.16 The Number of Rolling Stocks by Type**

Type	FY2008	FY2009	FY2010	FY2011	FY2012
Steam Locomotive	37	37	37	37	35
Diesel Locomotive	343	352	387	394	405
(a) Diesel Electric	243	247	252	257	268
(b) Diesel Hydraulic	100	105	135	137	137
Diesel Car	159	182	182	189	235
Passenger Car	1,209	1,246	1,238	1,277	1,282
Freight Wagon	3,252	3,427	3,331	3,236	3,210

Source: The Facts about Myanma Railways 2012-2013

Final Report



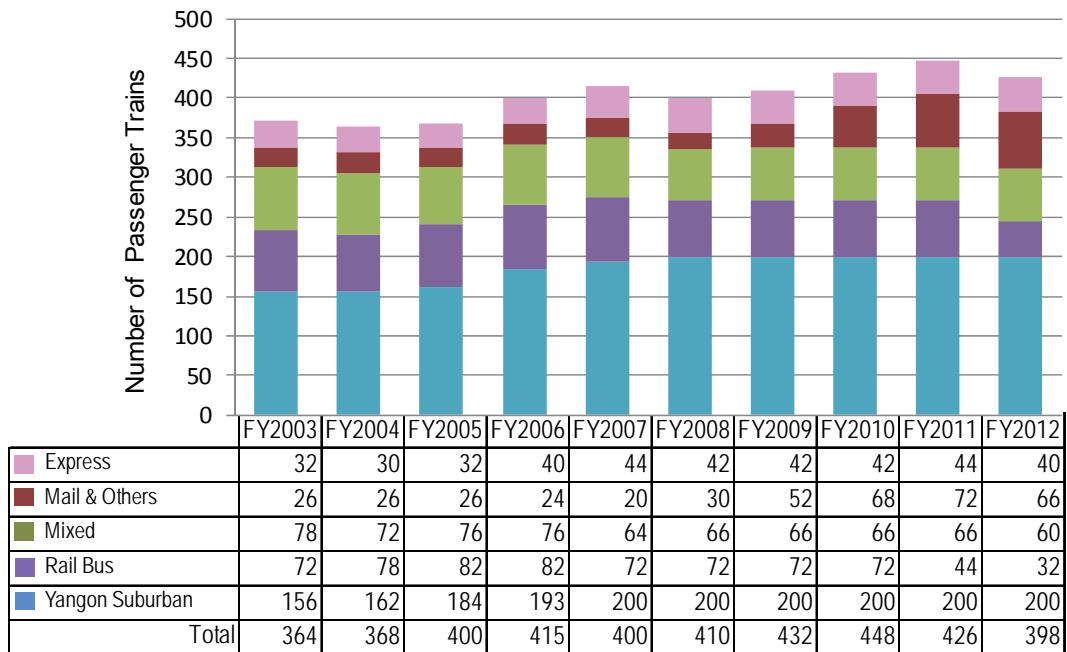
Source: MR

### **Figure 7.9 Existing Railway Network**

### 7.3.1 Rail Passenger Transport Services

#### (1) Passenger Train Operation

Figure 7.10 indicates the number of passenger trains in the 9-year period between 2003 and 2012. Apart from the normal significant traffic along the Yangon circular and suburban lines, there were 198 trains operating per day in 2012.



Source: Facts about Myanma Railways 2011-2012

**Figure 7.10 Number of Passenger Trains**

Table 7.17 indicates the travel time and the commercial speed of passenger express trains along the four main lines. Because there are so few trains, even express trains must make many stops and operate at night. The average commercial speed on the Yangon – Mandalay railway line is approximately 37.6 km/h.

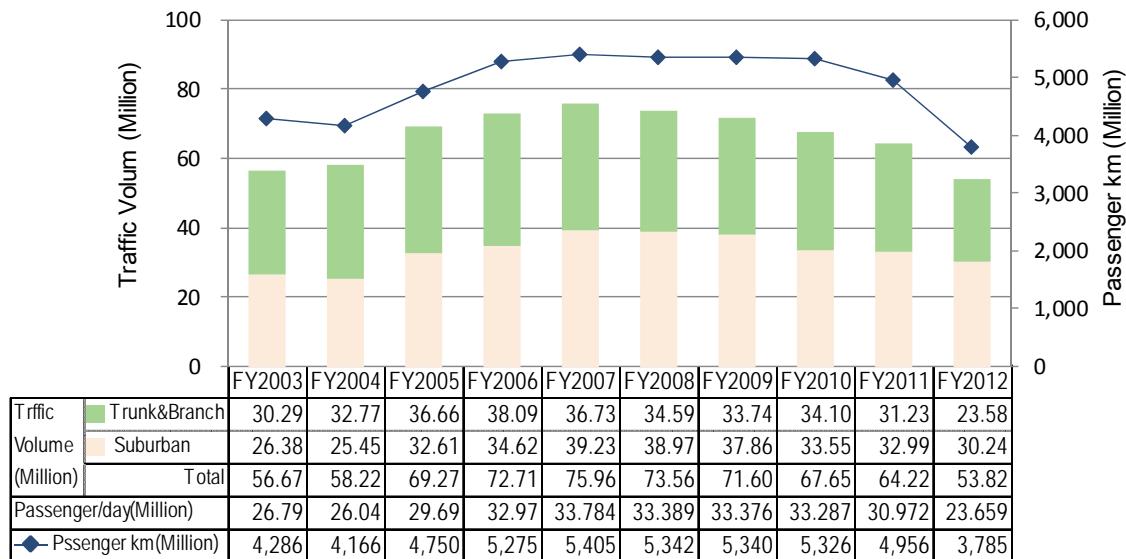
**Table 7.17 Traveling Time of Passenger Express Trains on Main Lines**

Line	Distance (km)	Train No.	Section		Traveling Time	Commercial speed
			From	To		
Yangon - Mandalay	620.3	11 Up	Yangon	Mandalay	16:30	37.6 km/h
Yangon - Pyay	259.0	71Up	Yangon	Pyay	8:30	30.5km/h
Yangon - Mawlamyine	293.2	89Dn	Yangon	Mawlamyine	9:35	30.6km/h
Manadalay- Myitkyina	551.5	55Up	Manadalay	Myitkyina	21:45	25.4km/h

Source: JICA Study team

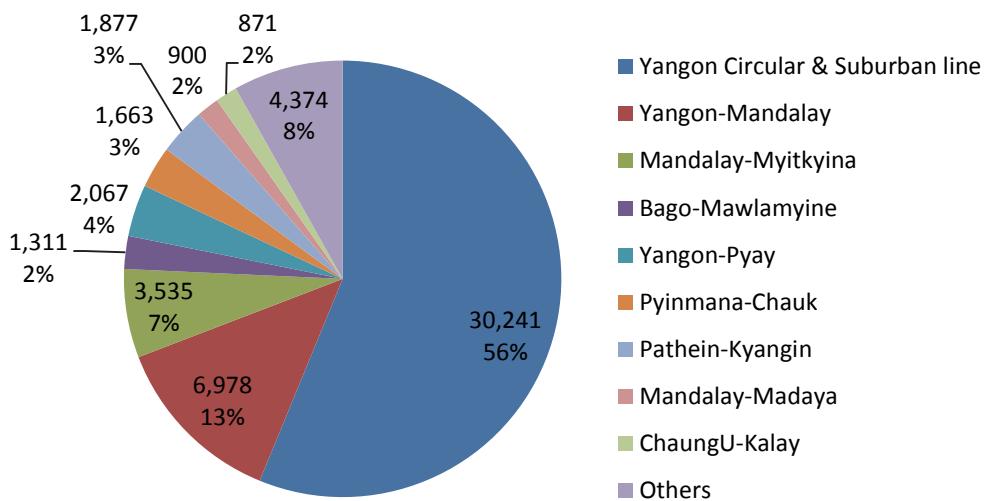
#### (2) Passenger Volume

Figure 7.11 shows the number of passengers during the 9-year period, between 2003 and 2012. Recently, the total number of passengers has decreased dramatically, with total railway passenger count reaching 53.28 million per year in 2012. Included in this total are the top three lines with Yangon circular (56%) and suburban lines of Yangon–Mandalay (13%) and Mandalay–Myitkyina (7%).



Source: Facts about Myanma Railways 2011-2012

Figure 7.11 Passenger Volume



Unit: Thousand Passengers / Year

Source: Facts about Myanma Railways 2012

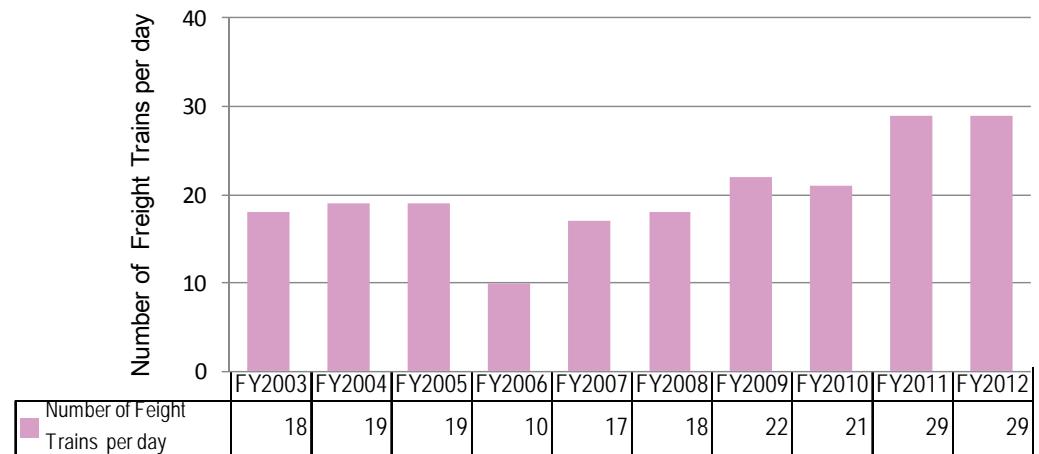
Figure 7.12 Passenger Volume by Railway Line

### 7.3.2 Rail Freight Transport Services

In terms of rail freight transport, MR provides two kinds of service, the freight train system and the parcel transportation system (e.g. goods wagons coupled to a passenger train).

#### (1) Freight Train Operation

Figure 7.13 shows the number of freight trains per day from 2003 to 2012. As of 2012, 29 freight trains per day were being operated. Among these, 16 trains (55.2%) were operated on the Yangon–Mandalay line and 6 trains (20.7%) were operated on the Mandalay–Myikyna line.

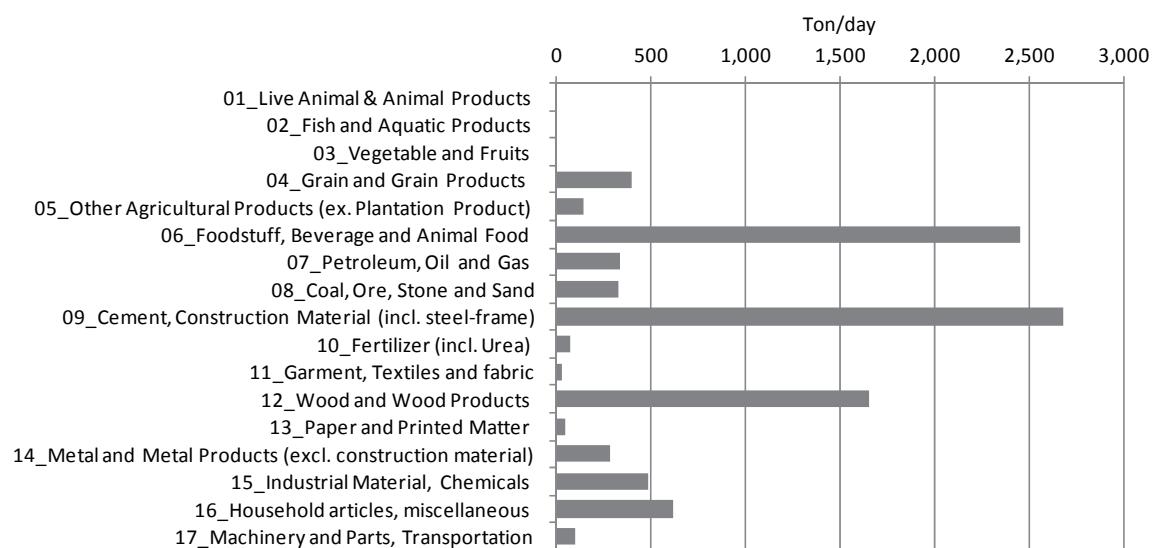


**Figure 7.13 Numbers of Freight Train**

## (2) Freight Volume

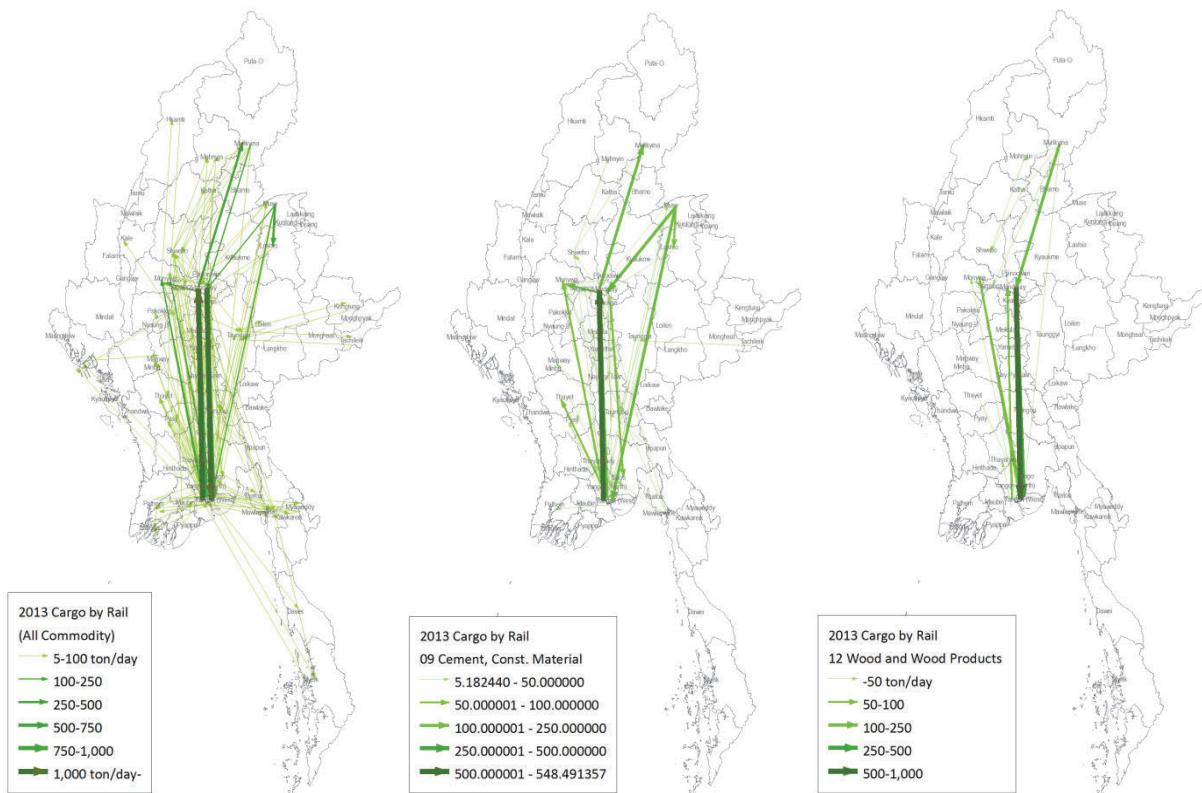
Based on a truck driver interview survey at railway stations and secondary data analysis, the MYT-Plan estimates current cargo flow transported by rail at approximately 9,600 tons per day, which consists of construction materials such as cement (28%), foodstuff and beverage (25%) and wood/wood product (17%), as shown in Figure 7.14.

Figure 7.15 shows the estimated current cargo flow of major commodities transported by rail. The Yangon-Mandalay-Myitkyina line is the backbone of Myanmar's freight transport system.



Source: JICA Study Team

**Figure 7.14 Estimated Current Cargo Volume by Railway**



### 7.3.3 Financial Performance and Sector Funding

#### (1) Revenue

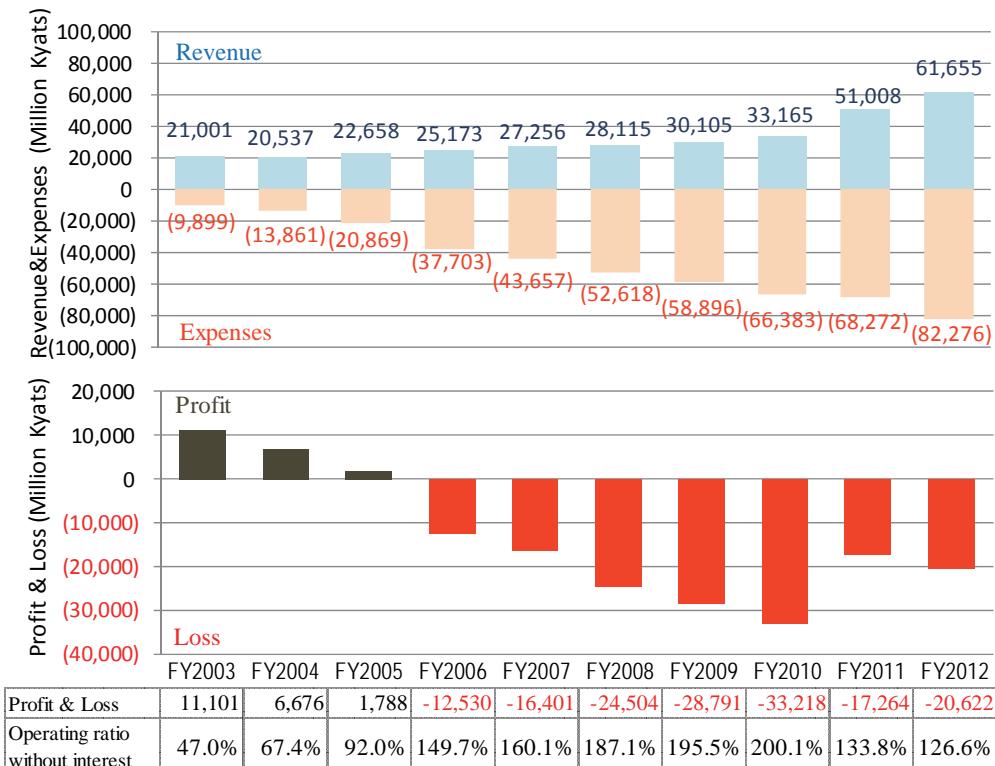
MR had total revenues in 2012 of 61,655 million kyat, which had grown in the two-year period 2011-2012. During this period, fare rates for passengers and cargo were raised. The share of passenger revenue and freight revenue against total revenue was 59% and 32%, respectively. The remaining 9% includes other revenue, such as leasing business of fiber optic cables on the Yangon-Mandalay line.

#### (2) Expenses

MR's expenses in 2012 totaled 82,276 million kyat, influenced by a particularly strong growth period between 2003 and 2012. During that time, MR staff salaries increasing sharply and in 2007, the price of light oil increased by 19 times compared to prices from 2005. These costs are the most significant expenditures for MR, with fuel cost capturing 40% of MR expenses and employees costing 31%. Furthermore, the foreign exchange rate had risen sharply in 2012, and the cost of equipment and foreign spare parts also increased, as much as 150 times in many cases.

### (3) Profit and Loss

Figure 7.16 summarizes the MR's profits and losses between 2003 and 2012. Prior to 2005, MR had been profitable, though since then the Railway's revenues have fallen below expenditures, leaving the MR in deficit by approximately 20,622 million kyats in 2012. The Myanmar government annually provides funds to cover MR losses, funding operating expenses, investment costs and funds reimbursement.

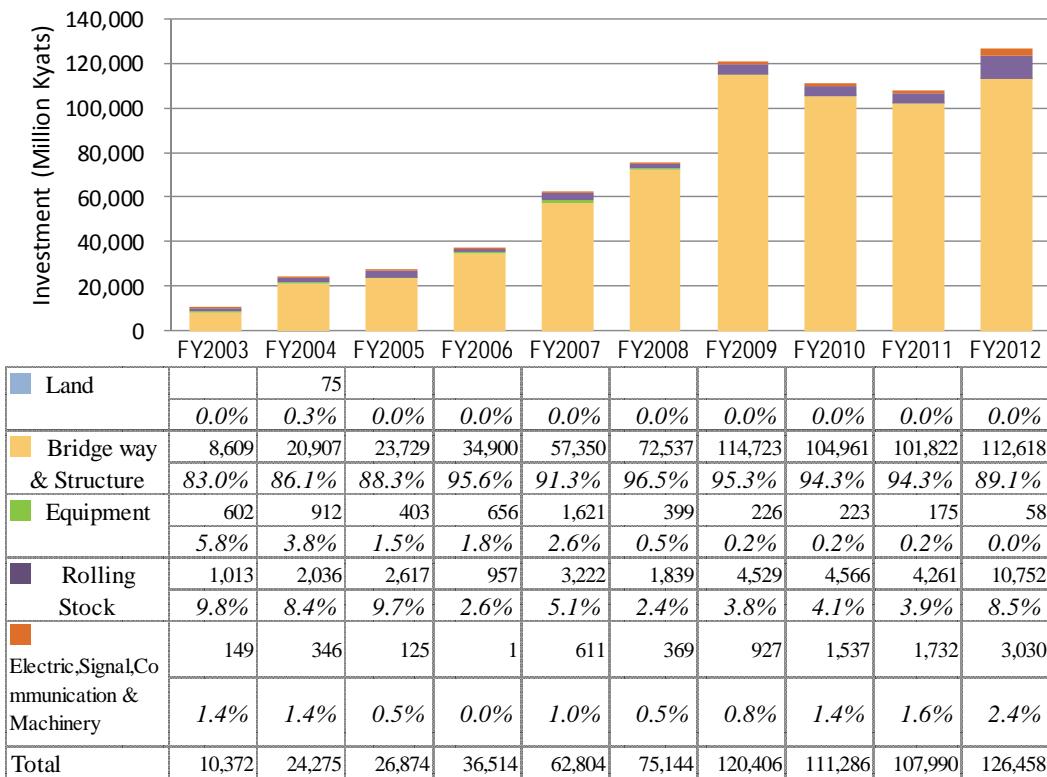


Source: JICA Study Team, Facts about Myanma Railways from 2003-2012

**Figure 7.16 Profit and Loss for MR**

### (4) Investment

Figure 7.17 shows MR's capital investment between 2003 and 2012 and highlights the significant increased investment and expansion of the rail network. Since FY 2007, annual investment has been more than double total revenues. During the last decade, 92.9% of MR's investments have been made in tracks, bridges and other structures while 6.4% has been invested in rolling stock, electrics, signals, communication and machinery.



Source: JICA Study Team, Facts about Myanma Railways from 2003-2012

**Figure 7.17 Capital Investment of MR**

### 7.3.4 On-going Projects and Actions

#### (1) Under Construction Railway Line Projects

While MR has expanded the railway network and has 13 lines under construction, many of these projects are currently suspended, due to recent changes of the development policy as well as the budget constraints.

**Table 7.18 Railway Lines under construction**

No.	Route	Mile	Remarks
1	Kyangin-Pakokku	22.73	Ongoing / Will be completed
2	Katha-Bhamo	78.19	Ongoing / Will be completed
3	Moene-Kyaingtong	220.4	Partially completed / Suspended
4	Pyawbwe-Nutmuk-Magway	64.91	Ongoing / Will be completed
5	Dawei-Myeik	113.19	Partially completed / Suspended
6	Minbu-Ann-Sittway	203	Ongoing / Will be completed
7	Pathein-Einme-Nyaungtong-Yangon	75.76	Ongoing / Will be completed
8	Pyay-Taungoo-Naypyitaw	100	Partially completed / Suspended
9	Hinthata-Zalun-Danuphyu-Setkauk	31.75	Ongoing/Will be completed
10	Nayoyitaw-Sinthe-Pinlong	120	Partially completed/ Suspended
11	Myitkyina-Bamaw-Moemmeik-Kyaukme-Thipaw-Lechar-Namsan	474.5	Suspended
12	Monywa-Kani-Miinking-Kalaywa-Kalay	125	Suspended
13	Taungoo-Yado-Loikaw	150	Suspended

Source: Myanmar Railway

## **(2) Future Development Plan of Myanma Railways**

During the Myanmar Development Cooperation Forum that took place on January 19 and 20, 2013, MRT proposed ten railway projects to rehabilitate and modernize the major trunk lines, which are the backbones of the north-south routes along the Myanmar and Yangon circular lines.

The proposed the ten railway projects include:

1. Yangon-Mandalay Track Rehabilitation and Modernization
2. Yangon City Urban Rail Line Modernization and Rehabilitation
3. Refurbishment of Locomotives (Repower of Locomotives)
4. Upgrading of a Railway Technical Training Center
5. A National Railway Strategic Plan
6. Mandalay-Myitkyina track and signaling Upgrading
7. Track upgrading Projects Bago-Dawei
8. Yangon- Pyay track upgrading Projects
9. Tamu-Kalay-Segyi-Monywa-Mandalay Rail connection line Project
10. Purchasing new passenger Coaches

## **(3) Railway links to neighboring countries**

### **1) Myanmar and Thailand Border**

In 2011, when officials from Myanmar and Thailand met in Nay Pyi Taw for the 13th Special Working Group Meeting for the Singapore-Kunming Rail Link Project, both countries agreed to suspend alignment of the Singapore-Kunming railway link. The following year, at the 14th Special Working Group Meeting, held in Vientiane, Laos PDR, representatives from Thailand proposed that a new rail line be constructed between Dawei and Kanchanaburi, replacing the Three Pagoda Pass–Namtok old line. In Dawei (Myanmar), there is an ongoing special economic zone project and the companies involved conducted a feasibility study to construct a Dawei–Kanchanaburi rail line. At the 22nd ASEAN Land Transport Working Group Meeting, Myanmar reported that increased freight and passenger transport between Dawei and Bangkok should be expected during the implementation stage for the Dawei–Kanchanaburi project.

### **2) Myanmar and China Border**

In April 2011, the Muse-Kyaukphyu rail transportation system project was launched through a Memorandum of Understanding (MoU) signed between China Railway Engineering Corporation (CREC) and Myanmar's Ministry of Rail Transportation. In May 2011, a supplementary MoU was signed in Beijing that created a Joint Coordinating Committee that conducted field surveys of the Muse–Kyaukphyu rail line. CREC submitted a feasibility study report for this project in April 2012 though the final alignment of the Muse-Kyaukphyu line is still in development and in July 2013, CREC was given a one-year extension to complete this work.

### **3) Myanmar and India Border**

Myanmar and India had planned a 135km railway line to run from Kalay (existing terminal

---

station) to Tamu (border town). A survey team from Rail India Technical and Economics Services (RITES) completed a feasibility study to link these lines in 2004. However, the construction plans for this line were suspended in 2013.

#### **(4) Dry Port Development Projects**

Myanmar has been party to an intergovernmental agreement on dry ports led by UNESCAP since 2010. Since then, Myanmar has proposed 8 possible dry port locations (Mandalay, Tamu, Muse, Mawlamyine, Bago, Monywa, Yangon, Pyay) and presented these at the Forum of Asian Ministers of Transport, held in Bangkok on 7th November 2013.

#### **(5) Project on Improvement of Service and Safety of Railway in Myanmar by JICA**

In October 2012, Myanmar requested Technical Assistance (TA) from the Government of Japan to support improvements to Myanma Railway's service and safety. Soon after, JICA dispatched a team to investigate existing service and safety conditions at MR; a scope of work for this TA was agreed to in March 2013. This TA started in the middle of 2013 and will be complete in 2015. Two major outputs are expected through this TA:

Output 1: enhanced service and safety in administration and maintenance processes and an improvement plan, informed by analysis of accidents.

Output 2: transfer of track maintenance technology to improve service and safety levels, through implementation of the pilot project.

#### **7.3.5 Key Sector Issues**

##### **(1) Planning and Coordination**

Since 1988, MR has expanded the railway network, based on a Government policy that calls for the railway to support the political, social and economic development of all regions. However, while the railway network contributes substantially to regional development in Myanmar, the MR was forced to suspend operations and construction on some lines due to decreasing demand for rail services in other areas. Myanmar has an opportunity to make better use of the railway network and this Report finds that the Government should issue a comprehensive transportation plan and coordinate its development with related agencies. One aspect of this plan should include integration with the feeder service as an integrated and smooth transit and feeder service will stimulate demand for railway services.

This transportation plan should also include sophisticated management and investment plans and a detailed database system for MR. This would include an analysis of existing traffic demand and statistical information such as daily passenger and cargo volumes by origin and destination. Furthermore, to evaluate risk and maintenance costs in future, inventory data systems for infrastructure will be required.

##### **(2) Infrastructure**

MR owns a well-developed railway network. However, most of its infrastructure (e.g. track, embankments, signals, bridges, tunnels, stations) as well as locomotives are seriously damaged and are in urgent need of rehabilitation. Furthermore, the containerization and service levels of competing transportation modes and existing railway infrastructure should be modernized. For example, the maximum authorized axle load is 12.5 tons on existing main lines in Myanmar. However, the maximum authorized axle load for the Trans Asia Railway (TAR) network is a minimum 15 tons for meter gauge track and 20 tones for standard or broad gauge track. Also,

high-feet containers of 8' 6" or more cannot pass under the some bridges. If the railway service levels are upgraded to meet international standards and the railway capacity is enhanced, traffic demand should grow as a result.

### **(3) Safety, Security and the Environment**

Railway infrastructure in Myanmar is heavily damaged due to weak maintenance regimes. In addition, Myanmar's climate, which includes heavy rain and high humidity, accelerates the deterioration of embankments and bridges. Existing signaling systems in MR rely on service peoples' attentiveness to railway performance. However, due to the railway's dependency on manual labor, the railway finds it difficult to manage high-speed train operations and the risk for human error is high. Furthermore, maintaining a standard maintenance regime and inventory of spare parts is made more difficult because there are many different types of rolling stock, due to the fact that much of this was donated from foreign countries, over a long period of time.

While MR's railway is in need of repair, the Railway plans to begin high-speed train operations in near future. This will require a social impact assessment along the railway line.

### **(4) Human Resources and Regulations**

Under Myanmar's Railways Act of 1890, MR carries out the inspection of railways (Railway Act No. 4, 5) and the approval of new railway lines (Railway Act No. 18, 19). MR also has the responsibility to monitor railway technical standards, which include mainly national regulations. The rail sector is organized to ensure that construction and operation of new railway lines is smooth and that the sector is able to expand the railway network rapidly. However, MR has reduced the number of employees while their jurisdiction has increased. This makes it difficult to maintain the railway systems. Furthermore, before a high-speed train is installed, MR will have to deliver more technical training for high-speed operation. This also places Myanmar's rail system in a hazardous position because the railway is less likely to adhere to administration market principles and this monopoly can hinder private sector participation. This is further complicated by MR's dominant position in the sector.

### **(5) Finance**

MR's revenues have surpassed expenditures after 2005 and the deficit in 2012 was approximately 20,622 million kyats. The Myanmar government subsidizes against these losses every year. To increase its revenues, MR must improve its service levels and strengthen its profitable new businesses like station real estate and goods forwarding operations.

## **7.4 Inland Waterway Sector**

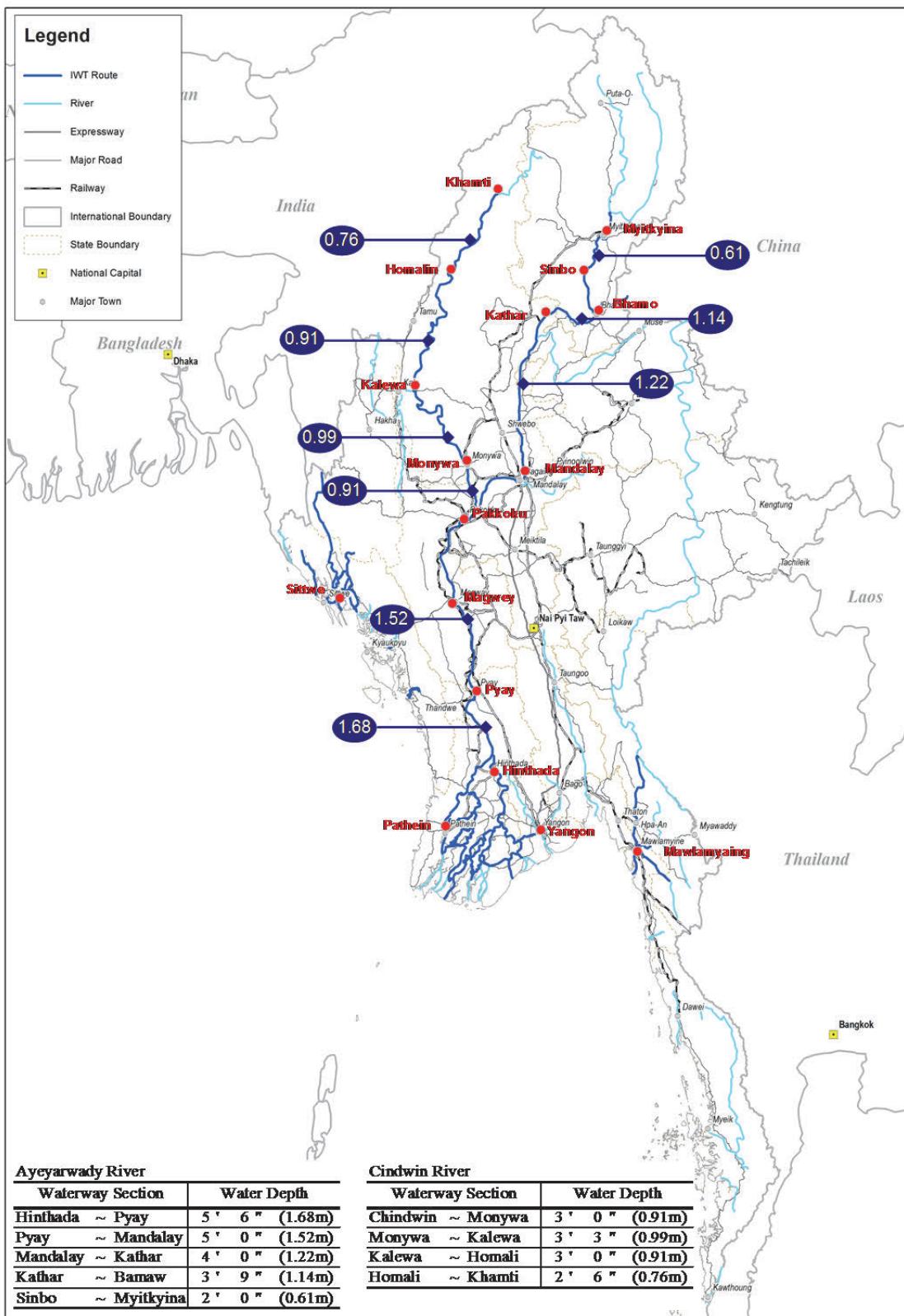
### **7.4.1 River, Port Facilities and Ships**

#### **(1) River and Port Facilities**

There are 6,650km of navigable waterways along major rivers in Myanmar. The longest of which is the Ayeyarwady River, which has a 2,170km long streamline and runs along a north-south direction through the middle of the country. The river's navigable channel length extends 3,938km and includes many branch flows in the delta area, which provides waterways for cargo and passenger ships. Figure 7.18 shows the navigable inland waterways in Myanmar, including the major river ports and the water depth during the dry season. Along the Ayeyarwady and Chindwin Rivers, which are the longest waterways in the country, variations in water depth between the dry and rainy seasons are very significant. For instance, water levels during the flooding season are 8m for Mandalay and 9m for Monywa. The water depth in the dry season is very shallow. For example, the water depth downstream from Mandalay is 1.5m and 1.1m upstream between Mandalay and Bhamo. The water depth of the Chindwin River becomes shallower during the dry season, where it is less than 1.0m. Some of inland water ports have old jetty facilities, however, most of the ports have no mechanical facilities for transfer and the ports rely on manual labor to handle goods.

#### **(2) Ships**

Inland Water Transport (IWT) is a public organization under Ministry of Transport (MOT) and operates ship transportation services using domestic river waterways. In 2013, IWT owned 413 ships including 255 powered vessels, 148 non-powered vessels and 39 stationed pontoons. Of the 225 powered vessels, 146 (65%) are “passenger-cum-cargo” ships, the rest are self-propelled barges and tug boats. The majority of IWT owned passenger-cum-cargo ships are very old, with only 31% (45) being under 20 years old, 22% of ships are between 20 and 50 years old, and 47 % of ships are older than 50 years old.



Source: MIMU, JICA Study Team

**Figure 7.18 Inland Waterway Network and Water Depth**

## 7.4.2 River Passenger Transport Services

### (1) IWT Network

Private companies, as well as the public organization IWT, provide river transport services. Table 7.19 shows the transportation fees applied by IWT for the Yangon, Mandalay, Monywa, Mawlamyaing and Sittwe hub ports. Currently, IWT is delivering regular service to 36 routes, as shown in Table 7.20. Fees for passengers are generally lower than those of private services. The cargo handling is carried out by hand as no equipment is available and cargo workers earn a daily wage of about 2,000 Kyat.

**Table 7.19 Transportation Fee applied by IWT**

Division	Route	Distance (Mile)	Passenger Rate (Ordinary Class) (Kyat/Passenger/Mile)	Cargo Rate (Kyat/Ton/Mile)
Delta	Yangon-Phyapon	64	20.00	36.00
	Yangon-Mawlamyinekun	100	20.00	70.00
	Yangon-Latputta (Cargo)	171	20.50	60.00
	Yangon-Latputta (Inner Path)	171	20.83	50.00
	Yangon-Pathein	172	12.00	38.00
	Yangon-Myaung Mya	135	12.00	38.00
	Yangon-Bogalay(Cargo)	87	20.00	40.00
	Yangon-Pyay	263	20.00	36.00
Ayeyarwaddy	Mandalay-Katha(SE)	193	14.00	43.00
	Mandalay-Bammaw (R )	275	14.00	36.00
	Mandalay-Nyaung Oo	119	20.00	36.00
	Mandalay-Pyay	334	20.00	36.00
Chindwin	Monywa-Kalaywa	147	20.00	72.00
	Monywa-Homemalin	327	20.00	72.00
	Monywa-Khamti	454	20.00	72.00
Thanlwin	Mawlamyaing-Kalwi	7	60.00	44.44
	Mawlamyaing-Natmaw	9	51.00	34.56
Rakhine	Sittwe-Taungkyut	224	13.39	69.44
	Sittwe-Bothitaung	80	22.50	125.00
	Sittwe-Myauk OO	40	25.00	77.70

Source: IWT April 2013

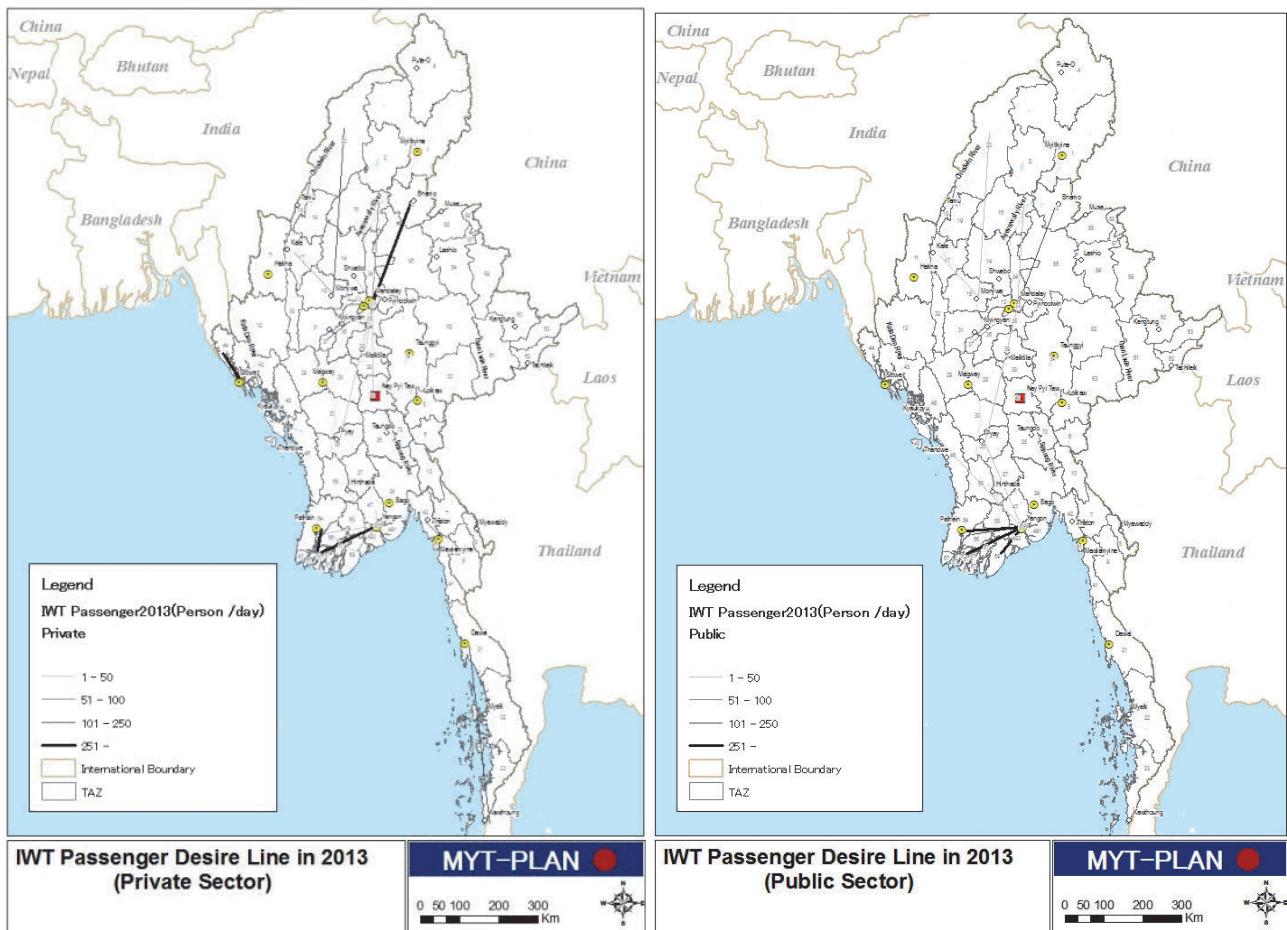
**Table 7.20 IWT Regular Services**

No	Division	Express	Ordinary	Ferry	Special	Total
1	Delta	5	2	5	6	18
2	Ayeyarwady	5	1	1	-	7
3	Chindwin	-	-	-	2	2
4	Thanlwin	-	3	1	-	4
5	Rakhine	-	-	-	4	4
6	Cargo	-	1	-	-	1
Total		10	7	7	12	36

Source: IWT

## (2) Passenger Volume

As of 2013, the number of inter-zonal IWT passengers<sup>1</sup> was estimated at 9,421 trips per day, including some 5,613 passengers who buy IWT service from a private operator. The private sector operators run a large number of inter-regional trips within the Mandalay and Ayeyarwady region. For the public sector, traffic volumes between Yangon and Ayeyarwadi region are high.



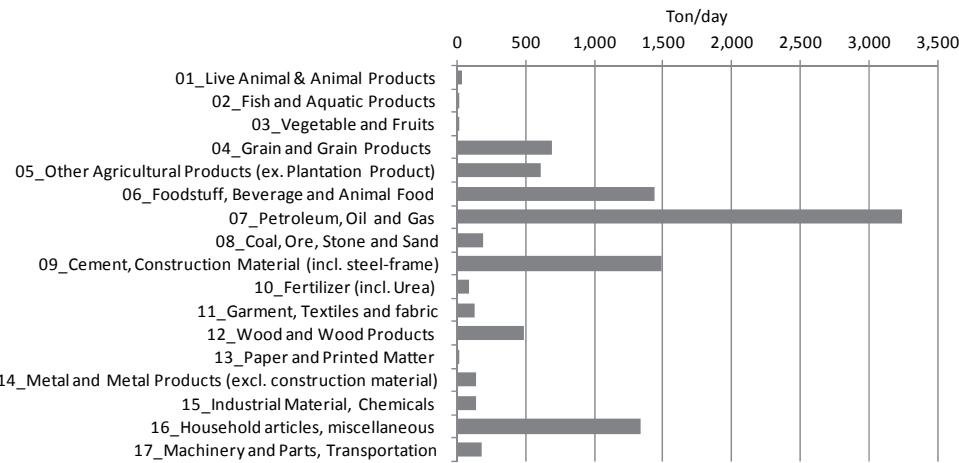
Source: Study Team estimated based on the statistics from IWT and DMA

**Figure 7.19 Estimated Desired Line for IWT Passenger in 2013  
(Private Sector: Left, Public Sector: Right)**

### 7.4.3 River Cargo Transport

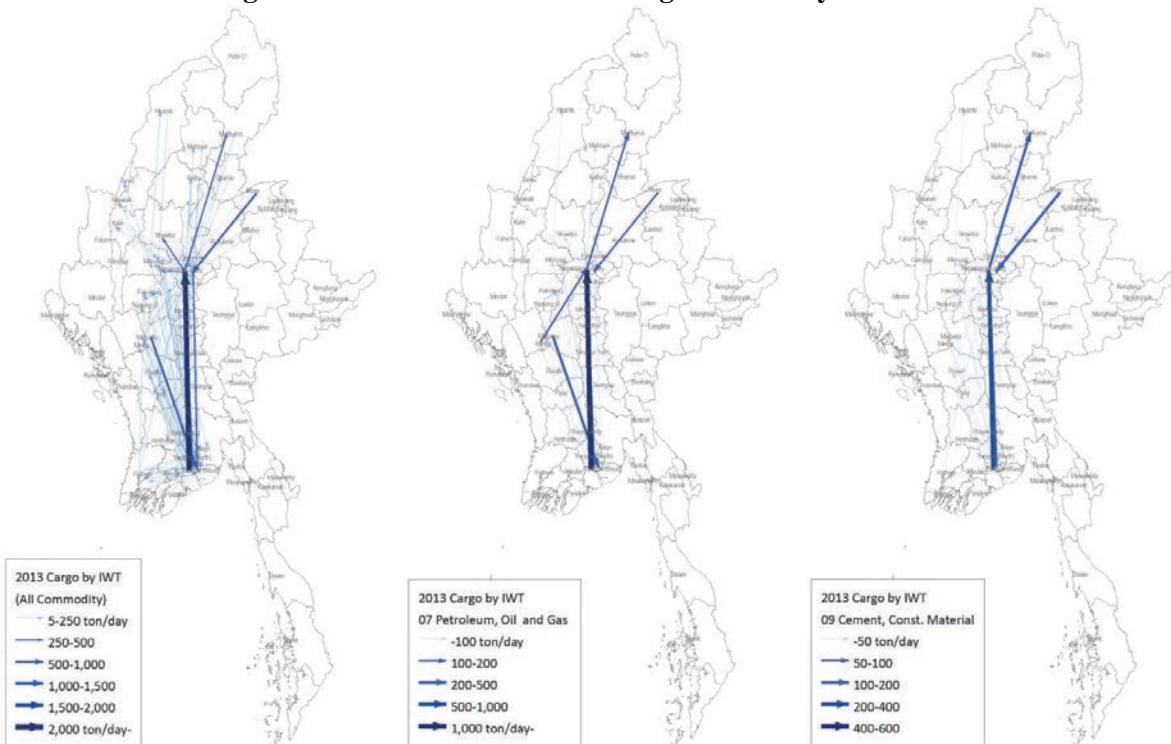
Estimated current cargo flows transported by inland water is about 10,200 tons per day and consists of petrol (32%), construction material (15%), foodstuff and beverage (14%) and miscellaneous (13%), as shown in following figure. Petrol is mainly transported from Yangon to Mandalay.

<sup>1</sup> The IWT passengers who pass through the boundary of traffic analysis zone (TAZ). It should be noted that the OD data from DMA includes many intra-zonal and short distance trips in Yangon and Pathein zones. However, the origin or destination of the trips are not clear.



Source: JICA Study Team

**Figure 7.20 Estimated Current Cargo Volume by Inland-Water<sup>2</sup>**



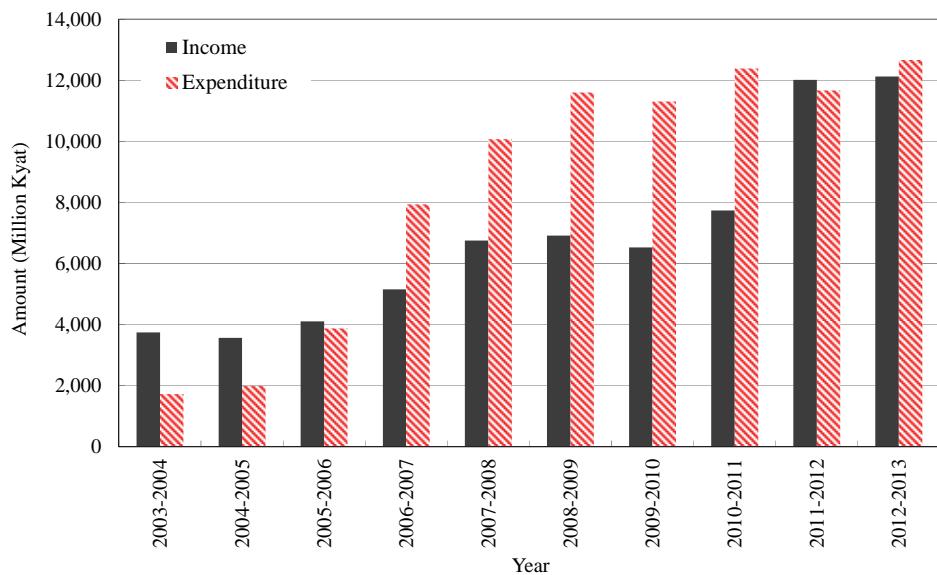
Source: JICA Study Team

**Figure 7.21 Desire Line of Current Inland-Water Cargo**

#### 7.4.4 Sector Funding

Figure 7.22 presents IWT profit and loss results since 2003. The revenues for 2012 were cargo charges (62% of revenues) and passenger charges of (29% of revenues). In terms of expenses, 52% of costs were spare parts and raw materials, such as petrol. The deficit in 2012 is approximately 594 million kyat.

<sup>2</sup> Total cargo volume was estimated based on the secondary data provided by DMA. The cargo volume by commodity was estimated based on the truck driver interview survey at major IWT ports.



Source: MR

**Figure 7.22 Profit and Loss for IWT**

#### 7.4.5 Ongoing Projects and Activities

##### (1) Upgrading of Dalla Dockyards

IWT owns 6 dockyard facilities in Myanmar, but all are very old and have not been renovated for more than 100 years. Recently, IWT has issued an official request to Japan for ODA assistance to rehabilitate and upgrade the Dalla Dockyards. The proposed project includes the construction of workshop buildings, procurement of ship repair equipment and technical training.

##### (2) New Ships Procurement for Inland Water Transport

Currently, IWT vessels are deteriorating. Their service is also suffering in comparison to private operators. IWT vessels' sailing speed is around 7 to 8 knots while that of private operators is around 15 knots. The poor condition of these vessels and their slow speed are chief causes for IWT's loss of competitiveness and its difficulty to provide reliable and convenient transport services.

As previously noted, IWT is planning to replace its old passenger-cum-cargo vessels with a speed ferry boat service for passenger transport and a shallow draft flat barge for cargo transport to help IWT be more competitive with private operators. Myanmar is also requesting Japan for an ODA loan to procure speed ferries and barges.

##### (3) Development of Regional Ports Plan by MOT

The Ministry of Transport (MOT) is planning to develop regional ports along the Ayeyarwady and Chindwin Rivers. This includes construction of river ports at Sinkhan, Mandalay, Pakokku, Magway on Ayeyarwady River, and Kalaywa and Monywa on Chindwin River as well as the procurement of cargo handling equipment and machinery. According to MOT, the objectives of this project are to: i) promote efficient cargo handling, ii) promote the containerization by using inland waterways, iii) support the facilitation of inland water transport, and iv) create job opportunities and develop the living standards of the people. The project costs for the

construction of river ports is estimated to be approximately ten (10) million USD per port, hence the total project cost of sixty (60) million USD.

#### (4) Total River Flow Management on Ayeyarwady River

Ayeyarwaddy River is braided at many locations and its flow is not stable and changes every year. From the viewpoint of a vessel operator, navigable conditions require Least Available Depth (LAD) and water levels to be maximized, for as long as possible. As such, navigation is most difficult during the dry season, when the draft is limited.

Navigability on the Irrawaddy and Lower Chindwin Rivers was studied in 1988 by UNDP, which investigated the technical and economic feasibility of improving navigation at critical points through the use of local materials. UNDP developed plans for such improvements and recommended riverbed regulation, which includes installation of wooden pile, steel cable and rock fill groynes. In the study, entitled the “Irrawaddy and Lower Chindwin Rivers Report” UNDP identified 46 constraints on Ayeyarwady River and 37 constraints on Chindwin River. Without external financial support, DWIR has been implementing river training work with groynes, funded by the state budget, according to UNDP’s development plan. Unfortunately, these efforts are not showing significant progress as yet and financial assistance from donors is again requested for the river training works, which is estimated to cost total approximately 109 million USD, according to MOT documents.

In addition, there is another method of river improvement under consideration, which can be described as a water level regulation method, achieved by constructing weirs and locks. The objectives of the project are to: i) maintain the level of draft for navigation and fresh water needs, ii) reduce the constraints sections and waterways, iii) prevent the flood and erosion, iv) conduct the water level regulation method, and v) strive for the multi-dimensional development. It is expected that this approach will enable smooth navigation throughout the year and mitigate the effects of flood, erosion and drought. It will also generate clean hydropower and promote industrial and passenger/freight transportation, which will lead to the reduction of poverty gaps between rural and urban communities. The construction of weirs is proposed at twelve locations between Bhamo in Kachin and Hinthada in Ayeyarwady region, as shown in below table. The estimated cost for the feasibility study of this project is 2 million EUROS and implementation is 400 million EUROS. MOT is also seeking financial assistance from foreign donors for this project.

**Table 7.21 Proposed Weirs**

ID	Township	Location	Width of River (meter)	Height of weir (Head) (meter)	Back water length (km)	Water surface area bet. Two weirs (sq. km)	No. of Turbine	Output Power (MW)
1	Hinthada	Kyaungkone	1,060	8.0	114	615	9	270
2	Pan taung	Htone Bo	700	9.9	100	265	10	300
3	Aung Lan	Yone Sate	1,310	8.7	92	176	10	300
4	Min Hla	Min Hla	1,170	9.0	142	582	9	270
5	chauk	Lan Ywar	1,050	10.5	124	476	10	300
6	Myingyan	Yantabo	760	8.5	94	240	6	180
7	Sitgaing	Wachat	1,340	8.5	113	244	6	180
8	Thabaitkyin	Shwe Kyin	700	8.0	71	81	6	180
9	Thabaitkyin	In Kone	950	8.9	86	170	6	180
10	Katha	Thapyaytha	1,750	6.6	58	48	4	120
11	Katha	Moe Ta	720	8.3	79	94	4	120
12	Ban Maw	Mya Lael	1,000	8.0	40	52	4	120

Source: MOT presentation material

## **(5) Pathein Port Development Plan by the Private Sector**

A local company has completed a feasibility study on the development of the Pathein jetty as an international port and has started planning its investment. When this project is complete, the new international port will transport rice produced on the western side of Ayeyarwady Region, which had previously travelled to Yangon by road. The new Pathein international port will reduce transportation costs, which will affect the price of rice. Pathein port is located 72 km from the sea and surveys conducted by a private investor in 2011 show that about 46 km would have to be dredged to accommodate vessels with a draft of up to 8 meters. The cost of dredging is estimated to be approximately USD\$ 4.5 million each year. The investor was also proposing to export dredged sand to the Maldives and Singapore. The proposed port would be able to handle containers as well. Further information and present status/progress of the project is to be confirmed during the study.

### **7.4.6 Key Sector Issues**

#### **(1) Planning and Coordination**

Generally, IWT transportation times are longer than those of other transportation modes, such as railway or road. However, IWT is less costly than alternatives and can even be appropriate for swamp areas during the rainy season. With these considerations in mind, heavy and regular cargo such as oil sand is suitable for IWT. For maximum efficiency, investments made in the transport sector should consider suitable role sharing among transportation modes.

#### **(2) Infrastructure**

Currently, the DWIR prohibits night sailings of cargo ships in the river channels for navigation safety reasons. The river channels are not stable and water levels fluctuate seasonally, every year. Although the river channel improvement project for the Ayeyarwady and Chindwin Rivers was recommended by the UNDP studies undertaken in 1988 and 1993, the survey records are now old and require updating. Progress in renewing surveys has been inhibited insufficient funds from the annual government budgets. River channel improvement is important to increase transportation efficiency and navigation safety; this should be carried out at the same time as port development and the installation of cargo equipment.

In Myanmar, a large amount of general cargo is handled manually on the natural riverbanks, but these sandy banks are inadequate as cargo yards. During the flood season, the riverbank cargo yards shrink, due to the rise of water levels. This causes congestion on the public roads around the port area. With economic development, labor costs will increase, this will weaken the competitiveness of IWT. The development and modernization of river ports is the most important and urgent subject for the government in terms of water transport.

#### **(3) Safety, Security and the Environment**

Most the IWT vessels are very old and in poor condition, posing significant risk of severe accident.

Waterway transportation is an environmental friendly shipping mode with low greenhouse gas emission volumes and CO<sub>2</sub>, as compared with other modes of transportation. This environmentally responsible mode is supported by policies within the European Commission, which aim to enhance modal shifts through a “Marco Polo Plan”. Under this plan, the EU government supports private sector proposals on transport modal shifts (from mainly road to waterway or railway) by paying 35% of the initial investment. For modern inland waterway

development plans, environmentally responsibly initiatives like the EU plan should be considered.

#### **(4) Human Resources and Regulations**

There are no port facilities at Myanmar's river ports and government authorities have little experience in port management. Though IWT operates ship services along the rivers, they have few port facilities, except for some small passenger floating pontoons. DWIR governs river channel maintenance, but it does not manage the river port operations. In line with the planned port development project, the government's capacity for port management should be substantially improved.

Though the IWT is a publicly operated waterway transport service, private shipping operators are also operating on IWT routes. Despite this competition, publicly operated transportation still has an important role in the Ayeyarwady Delta and upstream from the Chindwin, as these areas do not have sufficient road infrastructure meaning that these waterway channels are peoples' lifeline. It is important for the government to have a clear policy for improving public services along the waterways, while ensuring that these policies do not disturb or influence the efficient and positive growth rate of the private business market.

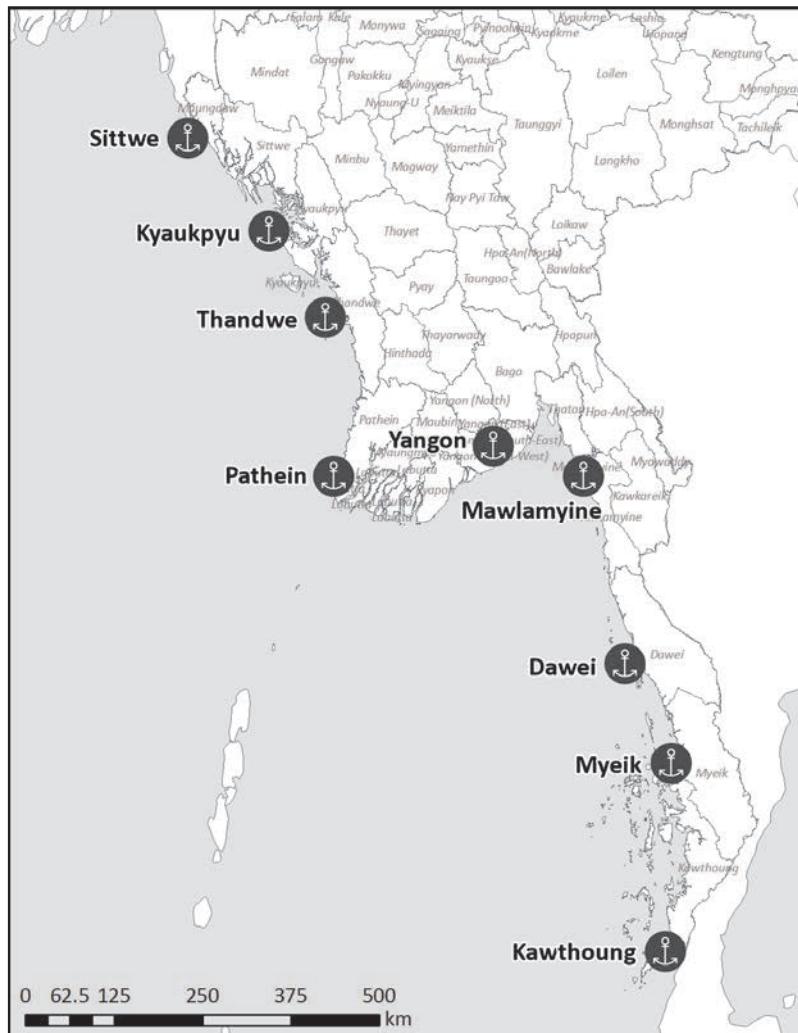
#### **(5) Finance**

As of 2012, IWT's deficit was approximately 594 million kyat. Given IWT's weak fiscal condition, the purchase of new vessels may not be possible. This may lead to increased chance of accidents, due to the continued use of old and weak vessels. As such, public financing may be required to allow IWT to purchase adequate and safe equipment.

## 7.5 Maritime Sector

### 7.5.1 Port Facilities

As shown in Figure 7.23, Myanmar has nine ports in operation, with most coastal freight trips running between Yangon-Dawei, Yangon-Kawthoung, Yangon-Myeik and Yangon-Sittway, according to the MPA.



Source: Myanmar Port Authority

**Figure 7.23 Ports in Myanmar**

#### (1) Yangon Ports (including port in Thilawa area)

The Yangon port (excluding the port in Thilawa area) is Myanmar's largest international gateway port and is located about 32km upstream from the mouth of the Yangon River. This port manages most of Myanmar's international cargo and can accommodate ships of 15,000 DWT and a draft of 9m. Naung Thor Company is developing a new terminal on the upstream side of MIP.

**Table 7.22 Wharves in Yangon Port**

Name of Wharves	Length (m)	Apron Width (m)	Storage Area		Owner	Remarks
			Yard (m <sup>2</sup> )	Shed (m <sup>2</sup> )		
Hteedan Berth	180	21	21738.6	-	MEC	General Cargo
Hteedan Rice Berth	139	12.5	-	6688.8	MPA	Rice & Rice Products
Ahlon Wharves						
No.1	198	30.5	43630	2675.5	AWPM	Container & G.C
No.2	156	19.5	3483	1895	AWPM	Container & G.C
No.3	260	30.5	7928	1859	AWPM	Container & G.C
Myanmar Industrial Port Wharves	310	18	102385	6140	MIP	Container & G.C
Sule Pagoda Wharves						
No.1	137	12.2	6967.5	5016.6	MPA	General Cargo
No.2	137	12.2	5574	5202.4	MPA	General Cargo
No.3	137	12.2	10683.5	3855.35	MPA	General Cargo
No.4	137	12.2	3251.5	6688.8	MPA	General Cargo
No.5	160	15.2	6038.5	17595.26	MPA	General Cargo
No.6	160	15.2	3251.5	16062.41	MPA	General Cargo
No.7	158.5	15.2	1042.3	13098.9	MPA	General Cargo
Bo Aung Gyaw Wharves						
No.1	137	15.2			UMEHL	Container & G.C
No.2	137	15.2	48000	400	UMEHL	Container & G.C
No.3	183	30			UMEHL	Container

Legend: MEC: Myanmar Economic Cooperation (MPA leased the operation in 2010),

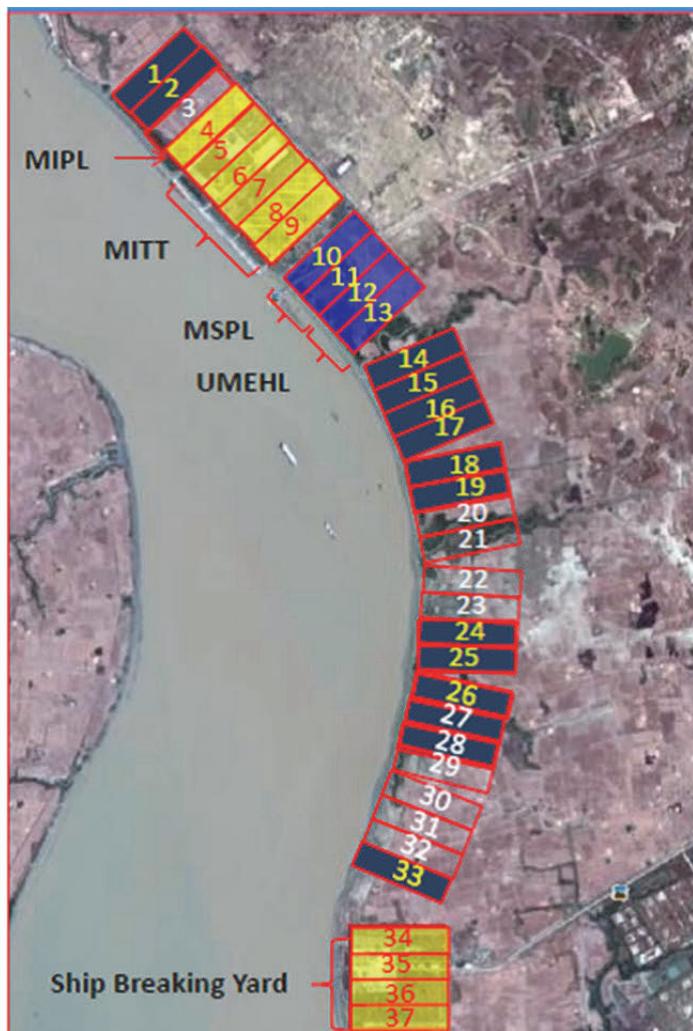
AWPM: Asia World Port management Co., Ltd.:

UMEHL: LANN PYI MARINE CO., LTD. Under Union of Myanmar Economic Holding Limited.

(Note: MPA leased the operation in 2010.)

Source: MPA

Yangon Port in Thilawa Area (hereinafter referred to as Thilawa Port) is designed to accommodate ships of 20,000 DWT and drafts of 9 m. The port has 37 plots, some of which are already in operation. The Myanmar Integrated Port Limited (MIPL) operates lot No.4, established on a BOT basis in 1998. Lot No. 5 to 9 are operated by the Myanmar International Terminal Thilawa (MITT), located 25 km from the Yangon River mouth. These lots include five berths and were developed under a BOT project in 1997.



**Figure 7.24 Allocated Lots in Thilawa Port**

### **(2) Sittwe Port**

Sittwe port is located approximately 90 km south from the Bangladesh border and about 3 km on the upper streamside of the Kaladan River. MPA owns two jetties at this location and rely on manual labor for loading and unloading cargo. The first jetty, which is located near Sittwe market, is classified as an international port. However, presently only coastal ships traveling from Yangon (sometimes from Pathein) to Bangladesh call at this port.

### **(3) Kyaukphu Port**

In 2010, the Korean company DAEWOO constructed a jetty near the Kyaukphu town area to provide equipment/material to their offshore gas platform. The facility is a T-type jetty with steel pipe pile structure and a berth length of 80 m with +7.00 m height. MPA uses approximately 20 m of this DAEWOO jetty for their cargo, however, the height of the jetty is too high for the MPA ship and MPA has requested DAEWOO to construct a local jetty. In response to MPA's request, DAEWOO has donated a lower-height jetty to the region and a local company is now constructing this jetty. MPA has floating jetties for inland water transport; they have no cargo cranes and are located 2.5 km south of Kyaukphu town.

---

#### (4) Pathein Port

Pathein port is located 110km upstream from the river mouth and has only CD of -4 to -5 m depth, on average. The river tide levels change by approximately 3.5 m, as such, this port cannot accommodate larger ships, unless the riverbed is dredged. The river depth is shallow but port activities for inland water transport are vital, especially for private operators, compared to Sittwe & Kyaukphu. Most of the jetties in Myanmar are of the old England floating type, with manual loading and unloading.

#### (5) Mawlamyine Port

There are 6 floating jetties and 1 RC jetty along the lower Thanlwin River, on west side of the town center and another floating jetty on the east side. All floating jetties are of the old England type. The RC jetty is partly sloped for easier manual loading and unloading and a flat area for general use.

#### 7.5.2 International Cargo Transport

In 2011, the Yangon ports handled approximately 380,000 TUE containers, of which 67 percent (approximately 260,000 containers) were managed through the Asian World Port; the primary destination for these containers were the industrial zones in the west bank area of the Yangon River (Hlaing industrial area).

**Table 7.23 Container Transport at Ports in Yangon**

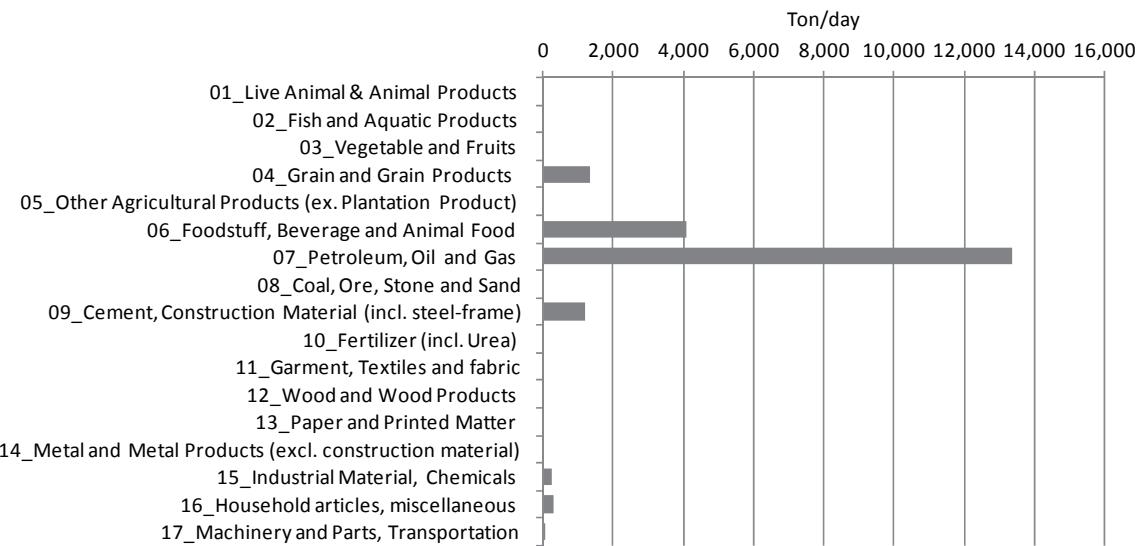
(Unit: TEU)

Wharf name	Owner	Year	2010	2011	2010	2011
Ahlone Wharves	AWPM	Import	108,135	131,644	62.4%	66.8%
		Export	100,128	124,775		
		Sub-total	208,263	256,419		
Myanmar Industrial Port	MIP	Import	25,770	46,899	16.8%	24.8%
		Export	30,203	48,473		
		Sub-total	55,973	95,372		
Bo Aung Gyaw Wharves	UMEHL	Import	28,173	14,772	16.9%	7.8%
		Export	28,361	15,188		
		Sub-total	56,534	29,960		
Myanmar International Terminals Thilawa	MITT	Import	5,943	1,067	3.9%	0.6%
		Export	7,200	1,172		
		Sub-total	13,143	2,239		
<b>Yangon Total</b>			<b>333,913</b>	<b>383,990</b>	<b>100.0%</b>	<b>100.0%</b>

Source: Myanmar Port Authority

#### 7.5.3 Coastal Shipping

The cargo OD, by commodity type, is estimated by re-classifying the commodity and converting it to a weight-value factor, which is calculated by dividing the export value by the import value and volume. The estimated current cargo flow transported by coastal trade is approximately 20,600 tons per day, consisting of petrol (65%), foodstuffs and beverages (20%), grain (6%) and construction material (6%), as shown in Figure 7.25.



Source: JICA Study Team

**Figure 7.25 Estimated Current Cargo Volume by Coastal Shipping**

**Table 7.24 Coastal Freight Transportation**

From	To	Ave. ton/month (Apr. - Dec. 2012)	Ave. ton/day
Yangon	Dawei	3,592	120
Dawei	Yangon	219	7
Yangon	Kawthoung	2,254	75
Kawthoung	Yangon	5,024	167
Yangon	Myeik	2,149	72
Myeik	Yangon	2,151	72
Yangon	Sittway	4,836	161
Sittway	Yangon	456	15

Source: MPA

The following tables indicate the domestic coastal cargo between Yangon and other domestic seaports. The cargo transported by sea are primarily consumer goods, such as fuel and foodstuffs.

**Table 7.25 Coastal Trade between Yangon and other Domestic Seaports by Type of Commodity (In-Shipment 2012)**

(Unit: million Kyat)

		Sittwe	Myeik	Mawla-myine	Thandwe	Dawei	Kawthaung	Total
Food, Drink and Edible Oil	Food, Drink and Edible Oil	210	2,172	0	0	5	2,637	5,024
	Textiles	0	0	0	0	0	4	4
	Medicine	0	0	0	0	0	0	0
	Fuel	0	151	0	0	0	4	155
	Materials Raw and Semi-Manufactured	193	1	0	0	0	253	447
	Others (Including Tires and Tubes)	27	119	0	0	13	1,847	2,005
	Sub Total (Consumer Goods)	430	2,443	0		17	4,745	7,636
Building Materials	Building Materials	240	2	0	0	0	168	410
	Machinery, Appliance and Apparatus	1	0	0	0	0	49	50
	Private Motorcars	13	6	0	0	0	48	67
	Bicycle and Parts	0	0	0	0	0	0	0
	Other Transport Equipment	0	0	0	0	0	15	15
	Others (Including Tires and Tubes)	5	8	0	0	0	149	163
	Sub Total (Capital Goods)	259	16	0	0	0	429	705
Total		689	2,459	0	0	18	5,174	8,341

Source: MPA

#### 7.5.4 Ongoing Projects and Actions

##### (1) Yangon and Thilawa Area

###### 1) Asia World Port Management Co., Ltd. (AWPM)

In 1996, AWPM constructed the Ahlone wharf, which is located about 2 km upstream from MIP and is the first private international wharf in Myanmar. Currently, AWPM is expanding the port with a new 238 m wharf, named No.4 Ahlone Wharf. After this wharf is complete, the total length of the Ahlone wharves will be 852 m.

###### 2) Myanmar Industrial Port (MIP)

MIP is located about 2 km upstream from the Sule Pagoda Wharves and includes two wharves, with a combined length of 310 m and no cargo crane equipment. MIP's No. 2 berth is under construction and MIP has plans to construct a No. 3 berth in the future.

###### 3) Hteedan Wharves

The renovation and development of Hteedan's two wharves began in 2010. One of these is already complete, the other is still under construction. Shwe Nar Wah Company Limited, which is a subsidiary of Asia World Co. Ltd and AWPM, is managing the terminal.

###### 4) New Terminal Development

Naung Thor Company is developing a new terminal on the upstream side of MIP and piling

works are ongoing.

#### **5) Agricultural Terminals in Thilawa Area**

Lots No. 10 and 11 in Figure 7.24 will be completed by Maritime Services Pvt. Ltd and 12 and 13 will be completed by UMEHL. No. 20 and 21 are now undergoing a feasible study to serve agricultural uses by WILMAR in Singapore. Lot No. 29 is operated by Myanmar Agricultural Company and No. 30 is operated by Diamond Star Company.

#### **6) Yangon Port in Thilawa Area (Thilawa Port) Development by Japanese ODA Loan**

Presently, a feasibility study for Thilawa Port Development is underway. The planned area from Lot No. 23 to 26 has two berths. The recommended berth structure is a jacket type, which is advanced technology in Japan procured for Haneda International Airport in Tokyo. This technology would dramatically shorten the construction period.

#### **(2) Kaladan Multi-Modal Transit Transport Project**

In 2008, the Indian government signed an agreement with the Myanmar government to construct the Kaladan Multi-Modal Transit Transport Project. This project will connect the Kolkata port in India with Sittway port in Myanmar. It can then link Sittway to Mizaram in India via river and road transport. The project is divided into three phases, namely the Sittway port redevelopment, the dredging of the Kaladan River for 158 km between Sittway and Paletwa in Chin State and the construction of a 129 km highway between Paletwa and the Mizoram border. The total project budget is US 140 million. Phases 1 and 2 are almost complete though road construction is delayed, due to EIA procedures. The planned depth of berths at Sittway is -7 meters.

#### **(3) Kyaukphu Deep Sea Port & Pipe Line Project, and Local Jetty Construction**

The Kyaukphu deep-sea port project with an oil tank farm on Madera Island (near China) is almost complete. The port has a depth of -28 m and it can accommodate a 300,000 DWT oil tanker. The main purpose of the port is to function as a gateway port for oil from the Middle East and as a port for natural gas from Bengal Bay, extracted by DAEWOO. These petroleum products are conveyed through pipelines to Kunming in Yunnan province, Luzho, and Guiyang, China, according to China's overall plan for the pipeline project.

In 2009, another development plan called the "Kyaukphu Economic and technological Development project" is a large-scale and complex project containing industrial, agricultural and residential areas and multi modal development including SEZ; this project was agreed-to by the Myanmar and Chinese governments.

#### **(4) Mawlamyine**

Mawlamyine is a proposed candidate for a deep-sea port and a gateway for an east/west corridor in Myanmar. However, the existing shallow riverbed is just 3 to 4 meters in depth in the dry season.

#### **(5) Yangon Offshore Terminal**

Normally, national gateway ports are constructed near the main city, for Myanmar the city is Yangon. Other candidate locations are quite far from Yangon (e.g. Mawlamyine is 300km from Yangon, and the road network is still vulnerable.)

## **(6) Dawei Deep Sea Port and Industrial Estate Project**

This project was being implemented by the Italian-Thai Development (ITD) Public Company Ltd. and includes a deep-sea port with a -20 m access channel and -12 to -16 m berths. The total number of berths number 58, and some are to be artificially excavated. The port is planned as an industrial estate with a power plant and water supply, which are connected to transportation network by rail and road. This port and related facilities are expected to be the gateway of the Southern Economic Corridor of the Greater Mekong Sub region (GMS) and the project is a high priority for the government.

### **7.5.5 Key Sector Issues**

#### **(1) Planning and Coordination**

Considering Myanmar's geographic features, ports are essential transportation facilities. However, ports cannot function without access to transportation infrastructure like roads or railways and a smooth and comprehensive feeder network. In cases of new port development, these access networks are crucial. To avoid mixing cargo traffic with local traffic, the routes for heavy trucks are prescribed for certain areas in Yangon and Mandalay. However, these roads are chronically congested especially in the highly urbanized areas near ports. Furthermore, it is forecasted that the cargo handling volume will increase with economic growth. Considering the future demand for cargo transport, the improvement of feeder infrastructure and industrial areas as well as the port itself is required and coordinating with relevant agencies like MOC, MR and private investors.

The existing inland water transportation services that connect Yangon and Mandalay national growth centers are expected to be further strengthened through future modernization and improvements to carrying capacity. In this regard, modern transshipment facilities in Yangon Port (including Thilawa area) and improvements to the navigation channel of the Ayarwaddy River should be developed in parallel.

#### **(2) Infrastructure**

Thilawa port was constructed as a result of growing cargo demand in Yangon area. However, both Thilawa port and Yangon port are river ports and their maximum water depth is limited. The approach route from Yangon port is approximately 46 km and has two shallows. MPA has conducted dredging work, however, the maximum water depths cannot be modified significantly. If large vessels approach to the Yangon in future, an additional deep-sea port may be necessary.

#### **(3) Safety, Security and Environment**

When large vessels proceed through the approach on Yangon River, a pilot must guide the vessel and navigate the route. To ensure the safety and security of ships entering port at Yangon, advanced navigation system should be installed, such as a Vessel Traffic Service (VTS), which is based on industry standards for navigation safety including regular updates of nautical charts, publications, notices to mariners, reliable tide table, etc. Such information must be updated regularly to provide operators with current conditions for sea and navigable route(s).

## 7.6 Civil Aviation Sector

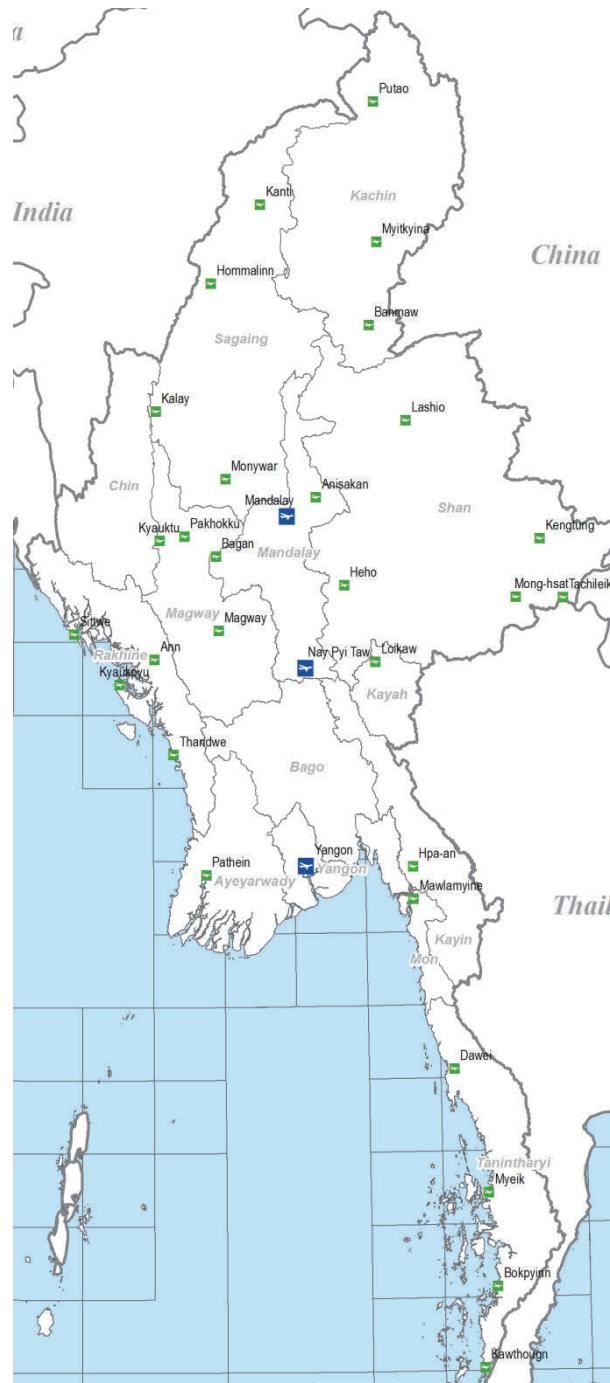
### 7.6.1 Airport Infrastructure

There are 33 airports in Myanmar and scheduled flights are operated at 27 airports of these. At the other 6 airports, only non-scheduled flights are operated. Yangon, Mandalay and Nay Pyi Taw airports are Myanmar's international airports.

The design capacity of the Yangon International Airport (YIA) is approximately 2.7 Million Passengers Per Annum (MPPA)<sup>3</sup> and is expected to reach passenger capacity within the next few years. The other two international airports are rated at 3 MPPA (Mandalay) and 5 MPPA (Nay Pyi Taw) and have not yet reach capacity.

Many of the domestic airports in Myanmar do not fulfill the requisite ICAO standards or recommendations and several lack, even the Precision Approach Path Indicator (PAPI), a critical visual guidance system for approaching aircraft. These deficiencies can both directly and indirectly influence the safety of aircraft operations at the airports, or downgrade the airport serviceability in terms of flight delays and cancellations.

Table 7.26 provides some detail of airport characteristics in Myanmar.



Source: JICA Study Team

**Figure 7.26 Location of Airports in Myanmar**

<sup>3</sup> This is for only the international terminal.

**Table 7.26 Summary List of Airports in Myanmar<sup>4</sup>**

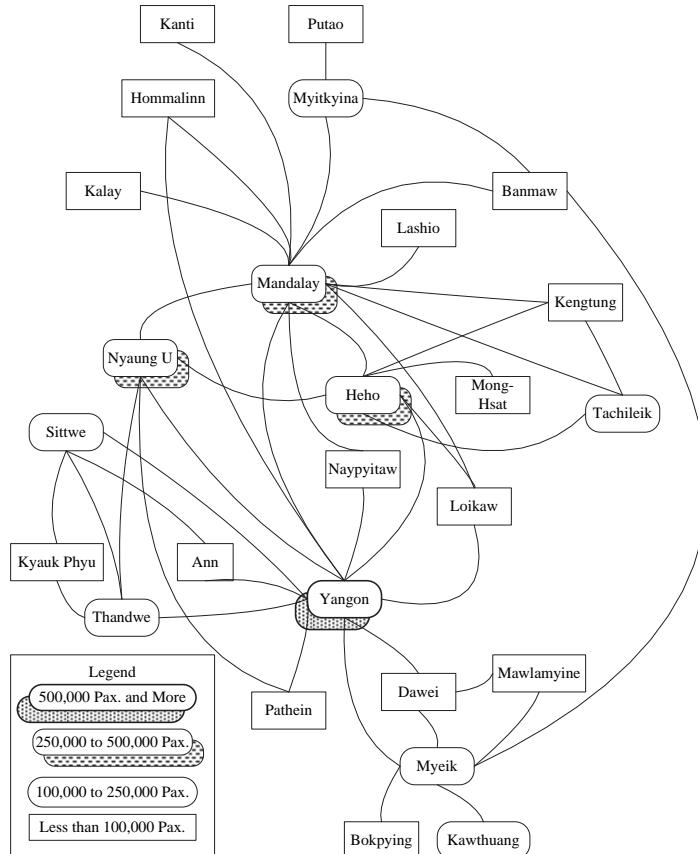
No.	Name	Intl'l Pax. (2012)	Dom. Pax. (2012)	RWY (m)	RWY Strength	RWY Strip (m)	Sched. Max. Aircraft	Approach Category	ILS	DVOR/ DME	NDB	VHF	Approach Light	PAPI <sup>1</sup>	RWY Lights	AWOS <sup>*3</sup>	RFF <sup>*2</sup> Category
1	Yangon	1,929,404	1,157,565	3,414 x 61	PCN56/R/C/X/T	4,023 x 150	A330	Precision	✓	✓	✓	✓	3	PA/LS/SALS	✓	✓	9
2	Mandalay	77,995	496,007	4,267 x 61	PCN55/R/A/W	4,572 x 305	B737	Precision	✓	✓	✓	✓	3	PA/LS/SALS	✓	✓	7
3	Naypyitaw	-	40,423	3,657 x 61	PCN56/R/A/W	4,267 x 305	ATR72	Precision	✓	✓	✓	✓	2	PA/LS/SALS	✓	✓	5
4	Heho	-	377,838	2,591 x 30	68,039 kg	2,895 x 150	F100	Non-precision	((✓))	✓	✓	✓	2	SALS	PA/PI(2)	((✓))	4
5	Nyaung U	-	255,046	2,591 x 30	68,039 kg	2,865 x 150	F100	Non-precision	((✓))	✓	✓	✓	2	((SALS))	((PAPI)2))	((✓))	4
6	Tachileik	-	217,309	2,149 x 30	33,112 kg	2,301 x 150	E190	Non-precision	✓	✓	✓	✓	2	SALS	PAPI2	✓	2
7	Kawthoung	-	146,867	1,829 x 46	60,781 kg	2,133 x 91	E190	Non-precision	✓	✓	✓	✓	2	SALS	PAPI2	✓	3
8	Myithyina	-	137,569	1,829 x 46	33,112 kg	1,981 x 150	E190	Non-precision	((✓))	✓	✓	✓	2	✓	✓	✓	3
9	Myeik	-	118,110	2,743 x 61	60,781 kg	2,956 x 150	E190	Non-precision	((✓))	✓	✓	✓	2	SALS	PAPI2	✓	3
10	Sittwe	-	114,187	1,829 x 46	33,112 kg	2,438 x 150	E190	Non-precision	✓	✓	✓	✓	2	SALS	PAPI2	✓	3
11	Dawei	-	108,909	3,657 x 30	395,987 kg	3,870 x 150	ATR72	Non-precision	✓((✓))	✓	✓	✓	2	((SALS))	((PAPI)2))	((✓))	3
12	Thanawwe	-	76,882	2,438 x 30	33,112 kg	Width 150	ATR72	Non-precision	((✓))	✓	✓	✓	2	SALS	PAPI2	✓	3
13	Kengtung	-	53,446	2,438 x 46	60,781 kg	2,895 x 150	E190	Non-precision	✓	✓	✓	✓	2	SALS	PAPI2	✓	2
14	Lashio	-	45,692	1,600 x 30	20,412 kg	1,874 x 150	ATR72	Non-precision	✓	✓	✓	✓	1	SALS	PAPI2	✓	2
15	Putao	-	31,462	2,133 x 30	60,781 kg	2,285 x 150	ATR72	Non-precision	✓	✓	✓	✓	2	SALS	PAPI2	✓	3
16	Bamnaw	-	28,704	2,286 x 30	33,112 kg	2,438 x 122	ATR72	Non-precision	✓	✓	✓	✓	2	SALS	PAPI2	✓	2
17	Kalay	-	25,376	1,676 x 30	1,829 x 150	ATR72	Non-precision	✓	✓	✓	✓	2	PAPI2	✓	✓	2	
18	Ann	-	24,093	2,591 x 30	60,781 kg	2,865 x 150	E190	Non-precision	✓	✓	✓	✓	1	SALS	PAPI2	✓	2
19	Kyaikphyu	-	22,005	1,408 x 30	20,412 kg	1,560 x 150	ATR72	Non-precision	✓	✓	✓	✓	2				2
20	Monywar	-	16,440	2,591 x 30	68,039 kg	2,895 x 150	E190	Non instrument	✓	✓	✓	✓	2				3
21	Hommalin	-	16,072	3,657 x 61	395,987 kg	3,932 x 150	E190	Non-precision	✓	✓	✓	✓	2				3
22	Bokpyinn	-	12,120	3,048 x 30	395,987 kg	3,332 x 150	F28	Non instrument	✓	✓	✓	✓	1			-	-
23	Loikaw	-	10,819	1,585 x 23	20,412 kg	1,859 x 150	ATR72	Non-precision	✓	✓	✓	✓	2		✓	✓	3
24	Kanti	-	10,034	1,829 x 30	20,412 kg	1,950 x 152	ATR72	Non-precision	✓	✓	✓	✓	2				2
25	Mawlamyine	-	9,369	1,646 x 46	20,412 kg	1,798 x 150	ATR72	Non-precision	✓	✓	✓	✓	2	SALS	PAPI2	✓	3
26	Mong Hsat	-	6,336	1,524 x 30	20,412 kg	1,798 x 150	ATR72	Non-precision	✓	✓	✓	✓	2				2
27	Pathen	-	778	2,835 x 61	165,000 kg	3,048 x 150		Non-precision	✓	✓	✓	✓	2	SALS	PAPI2	✓	3
28	Magway	-	-	2,591 x 61	165,000 kg	2,895 x 150	No	Non-precision	✓	✓	✓	✓	1	SALS	PAPI2	✓	2
29	Kyaiktu	-	-	3,048 x 30	395,987 kg	3,332 x 150	No	Non-precision	✓	✓	✓	✓	2				2
30	Hpa-an	-	-	-	1,371 x 30	20,412 kg	No data	Non-precision	✓	✓	✓	✓	1				2
31	Pakokku	-	-	2,591 x 30	68,039 kg	2,895 x 150	No	Non instrument	✓	✓	✓	✓	1				1
32	Anisakan	-	-	3,048 x 61	395,987 kg	3,333 x 150	No	Non-precision	✓	✓	✓	✓	1	SALS	PAPI2	✓	-
33	Coco Island	-	-	1,524 x 30**	20,412 kg	1,644 x 150	No	Non instrument									

<sup>4</sup> PAPI<sup>1</sup>: Precision Approach Path Indicator, RFF<sup>2</sup>: Rescue and Fire Fighting, AWOS<sup>3</sup>: Automated Weather Observation System, EQ shown in ( ) were already installed by DCA but yet to be commissioned. EQ shown in (( )) will be installed under JICA grand assistance project. \*\*: The runway at Coco Island Airport is being extended by 300 m.

## 7.6.2 Air Transport Services

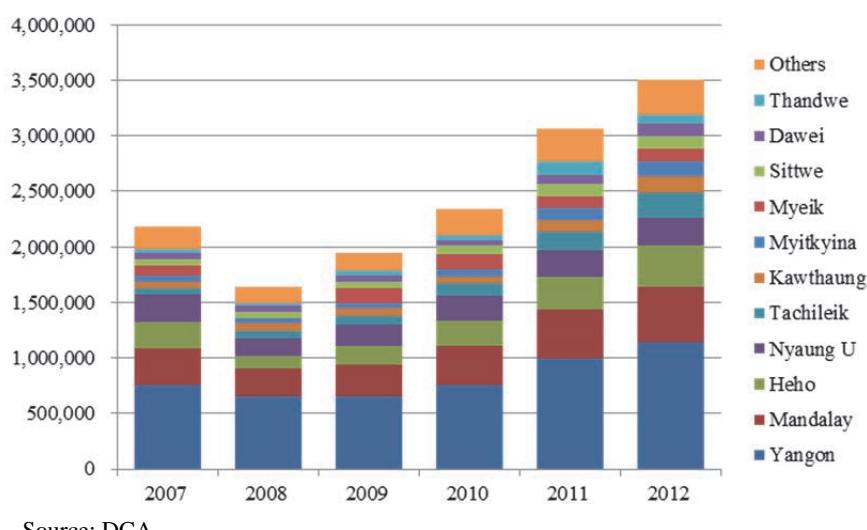
### (1) Domestic Services

There are seven domestic airlines in Myanmar operating from 27 airports. Yangon and Mandalay Airports are function as domestic hubs. In 2012, the total number of domestic departure/arrival passengers was 3,492,400, of which 32.6% (1,139,654) flew from Yangon International Airport. The balance (65.2%) flew from Yangon and 34.8% flew from other airports. The top five domestic airports in Myanmar are Mandalay, Heho, Nyaung U and Tachileik airports, where more than 200,000 passengers flew during 2012, representing 71.1% of domestic passenger travel.



Source: JICA Study Team

**Figure 7.27 Current Domestic Air Services Network**



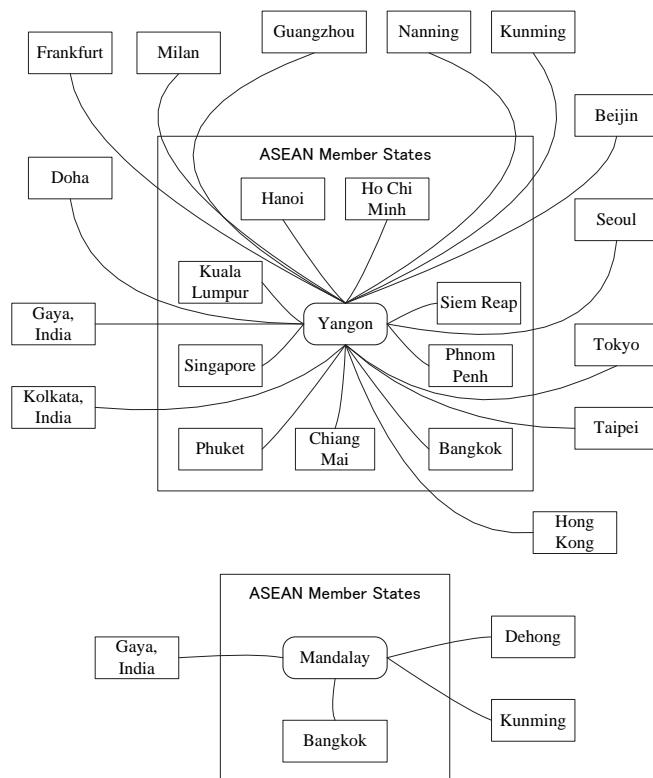
Source: DCA

**Figure 7.28 Domestic Passenger Traffic Record**

## (2) International Services

Myanmar's international airline is Myanmar Airways International, a joint venture between Myanmar Airways (state enterprise under MOT) and a local investor. In addition, 21 foreign airlines fly into Myanmar. The air service network is shown in Figure 7.29.

Table 7.27 describes international passenger movement to and from Myanmar, indicating marked increases in 2012 movement with an increase of 33.2% at Yangon and 76.3% at Mandalay. Passenger movement at Yangon airport accounts for 96% to 99% of total international passenger movements, which, although historically strong, now shows a slight decrease.



Source: JICA Study Team

**Figure 7.29 Current International Air Services Network at Yangon and Mandalay**

**Table 7.27 International Passenger Movements Record**

Airport	Description	2007	2008	2009	2010	2011	2012
Yangon Int'l	Passengers	867,853	824,595	967,622	1,211,372	1,448,729	1,929,404
	Change	-	-5.0%	17.3%	25.2%	19.6%	33.2%
	Share	-	98.5%	98.0%	97.6%	97.0%	96.1%
	Passengers	10,102	12,232	20,246	30,261	44,234	77,995
Mandalay Int'l	Change	-	21.1%	65.5%	49.5%	46.2%	76.3%
	Share		1.5%	2.0%	2.4%	3.0%	3.9%
	Passengers	877,955	836,827	987,868	1,241,633	1,492,963	2,007,399
Total	Change	-	-4.7%	18.0%	25.7%	20.2%	34.5%

Source: DCA

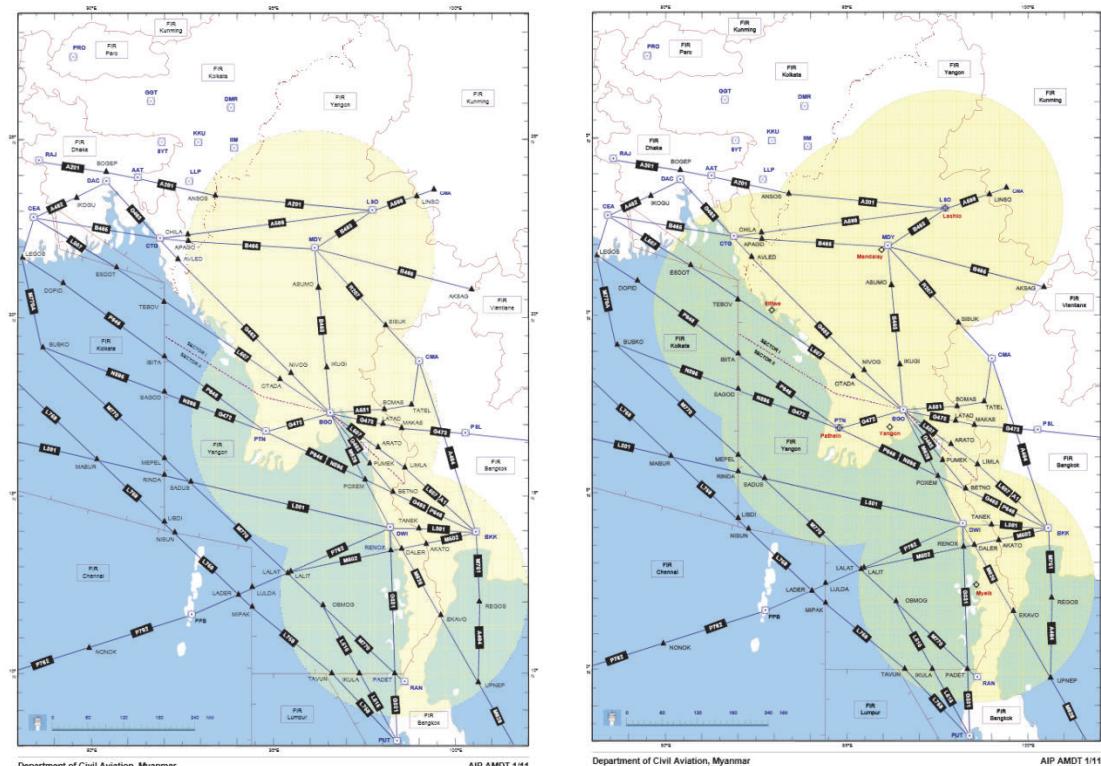
### 7.6.3 Air Traffic Services

Myanmar's Air Traffic Services (ATS) are provided by air traffic control units such as the Area Control Center, Approach Control Units and Aerodrome Control Towers. Table 7.28 summarizes the air traffic control services being provided within Myanmar's defined airspace.

**Table 7.28 Air Traffic Control Services**

ATC Services	Control Area	ATC Facility
Area Control	Yangon FIR (2 sectors)	Yangon ACC
Approach Control	Mingaladon (Yangon) Terminal Control Area	Mingaladon APP
	Mandalay Terminal Control Area	Mandalay APP
Aerodrome Control	32 airports	Control Tower

Yangon Area Control Center (ACC) provides ATC services for aircraft at the Yangon FIR airport and utilizes Monopulse Secondary Surveillance Radar (MSSR) (in Yangon, Mandalay and Myeik) and six Very High Frequency (VHF) Remote Control Air Ground (RCAG) stations (Yangon, Mandalay, Lashio, Sittwe, Pathein and Myeik), which are connected by Very Small Aperture Terminal (VSAT) channel between ACC and each facility. MSSR coverage and VHF RCAG coverage are shown in the Figure 7.30. This equipment monitors almost all of the two sectors within the Yangon FIR, though MSSR and communication coverage gaps still exist in the Bay of Bengal airspace.



**Figure 7.30 MSSR and VHF RCAG Coverage (Line of Sight)**

### 7.6.5 Sector Funding

#### (1) Budget of DCA

Table 7.29 and Table 7.30 indicate the annual DCA budgets since 2011 for capital expenditures (including repair) and current expenditures (including equipment maintenance costs). The DCA budget for current expenditures was increased significantly in Fiscal Year 2012-2013, due to the increase of pay allowances, etc., which are a major cost item and accounted for 53% of the total current expenditures in FY 2012/2013.

**Table 7.29 DCA Budget for Capital Expenditures**

(million Kyats)

Category	FY 2010-2011	FY 2011-2012	FY 2012-2013
On-Going Construction	12,486.141	13,136.425	16,411.546
New Construction	7,829.095	2,790.374	4,256.157
Machinery & Equipment	9,382.215	1,096.673	351.107
Installation	309.882	184.177	213.156
Total	30,007.332	17,207.649	21,231.967

Source: DCA

**Table 7.30 DCA Budget for Current Expenditures**

(million Kyats)

Category	FY 2010-2011	FY 2011-2012	FY 2012-2013
Pay, Allowances, Honoraria, etc.	1,033.862	1,025.123	1,637.033
Travelling Allowances	19.994	35.936	109.304
Goods, Labor, Servicing	875.875	970.797	1,233.037
Maintenance Charges	175.718	215.856	421.712
Transfer Payment	0	0	10.505
Entertainment	0.893	1.199	1.389
Total	2,106.342	2,248.910	3,412.980

Source: DCA

#### (2) Revenues from DCA's Activities

Table 7.31 reports revenues earned from DCA activities during the last 3 years. In FY 2012/2013, revenues grew significantly because: (i) currency exchange rates increased; (ii) aeronautical charge increased for domestic flights; and (iii) the DCA introduced service charges for domestic passengers. Total revenues in this fiscal year were more than twice the current and capital expenditures.

**Table 7.31 Revenues from DCA's Activities**

(million Kyats)

Category	FY 2010-2011	FY 2011-2012	FY 2012-2013
Earning from Services	789.493	1,024.162	62,506.414
Earning from Rents	232.357	342.355	2,052.555
Earning from Rents & Taxes	46.674	500.291	967.763
Miscellaneous	6.283	20.289	323.407
Other	33.512	51.147	133.204
Total	1,108.319	1,938.244	65,983.343

Source: DCA

Table 7.32 describes air navigation facility charges collected in FY 2012/2013, when international over-flying aircraft provided the majority of the revenue.

**Table 7.32 Air Navigation Facility Charges Collected in FY 2012/2013**

Type of Flight	Amount
Domestic Flight (including Landing Charge)	K 52.829 million
International Flight (Incoming & Outgoing, including Landing Charge)	US\$ 1.68130 million
International Flights (Over Flight)	US\$ 67.885 million

Source: DCA

Facility charges for international passengers cost US\$10 and domestic passengers are charged Ks1,000. It should be noted that while tariffs on domestic flights increased 100 fold in July 2012, this is still only about 1/4 the industry average charge for international flights, at the current exchange rate.

Compared with neighboring countries such as Vietnam and Thailand, the landing charges in Myanmar are among the lowest in ASEAN. The air navigation facility charge for landing an Airbus A320 (MTOW 73,500kg) is US\$ 99 in Myanmar and US\$ 210 or 255 in Vietnam, depending on the controlled flown distance. The Boeing B767 (MOTW 186,900kg) landing charge is US\$ 304 in Myanmar and US\$ 310 or 390 in Vietnam.

## 7.6.6 Ongoing Projects and Actions

### (1) Yangon International Airport Development Project

The Yangon International Airport Development Project is a 30-year BOT and will expand terminal capacity to 6 MPPA. The DCA invited private investors through tender and a contract was announced on 10 August 2013. The total investment proposed by the successful applicant was US\$ 199.5 million, of which US\$ 169 million is to be a loan with 6.30% interest rate.

### (2) Hanthawaddy International Airport Project

Hanthawaddy International Airport is a planned as a new international airport, located 77 km northeast of downtown Yangon. On 09 July 2012, the DCA issued an “Invitation to Prequalification” for this project and a successful tender was announced on 10 August 2013. DCA estimates the capacity limit of Yangon International Airport is 6 MPPA and has noted the following points:

- The existing airport is suitable for short-range flights and propeller or small jet aircraft and can accommodate domestic flights.
- Hanthawaddy airport will be suitable for international flight operation.
- If operating conditions such as aircraft and number of movements can be achieved, national airlines may be able to operate regional routes at the existing airport.

**Table 7.33 Outline of Facility Requirements (Hanthawaddy International Airport)**

		Phase 1	Phase 2
Operation Start		Year 2018	Year 2028
Annual Passengers	International	12 MPPA	24 MPPA
	Domestic	-	6 MPPA
	Total	12 MPPA	30 MPPA
Runway Length		3,600m x 1	3,600m x 2
Apron	Code E	15	26
	Code C	21	51
	Total	36	77
Passenger Terminal Building (floor space)	International	192,000m <sup>2</sup>	256,200m <sup>2</sup>
	Domestic	-	24,000m <sup>2</sup>
	Total	192,000m <sup>2</sup>	280,200m <sup>2</sup>

Source: JICA Study Team

While the Hanthawaddy International Airport project moves forward, it has not yet secured all of its financing and the role of the existing Yangon International Airport, once the HIA is complete, remains unclear. As well, there are no firm plans to build access transport, such as an expressway, union highway or airport rail link.

### **(3) Mandalay International Airport Project**

DCA issued an Invitation to Prequalification for “Private Sector Participation in the Development of Mandalay International Airport” on 12 September 2012. The project is 30-year BOT and DCA expects the airport to handle 2 MPPA (0.6 MPPA international and 1.4 MPPA domestic) by 2023 and 5 MPPA (1.5 MPPA international and 3.5 MPPA domestic) by 2033. A successful tender was announced on 10 August 2013 and the total investment proposed by the successful bid was US\$22.1 million, all covered by equity.

### **(4) Development Plan for Domestic Airports**

DCA has a plan to improve many airports in Myanmar, namely: Heho, Nyaung U, Tachileik, Kawthoung, Myitkyina, Myeik, Dawei, Thandwe, Kengtung, Kyaukphyu, Mong-Hsat and Coco Island. Heno and Nyaung O airports are planned to function as international airports<sup>5</sup>.

### **(5) Development of CNS/ATM Systems**

DCA established the Air Traffic Management Modernization Plan but have no plans in the medium term (2013-2016) to implement ICAO preferred or accepted performance based navigation systems, such as RNAV 5 or RNP 4 for route operation and Expand RNAV 1 or RNP 1 for TMA. TA on CNS/ATM sponsored by JICA is scheduled from the middle of 2014.

### **(6) Project for the Improvement of Nationwide Airport Safety and Security Equipment**

Japan International Cooperation Agency (JICA) is providing grant aid for the Project for the Improvement of Nationwide Airport Safety and security equipment such as x-ray equipment and an approach lighting system.

<sup>5</sup> DCA announced in November 2013 that it was planning to invite private investors to upgrade 30 domestic airports, mainly due to government budget constraints; many of Myanmar's local airports also need urgent improvement.

**Table 7.34 Project for the Improvement of Nationwide Airport Safety and Security Equipment**

Unit: No.	Yangon	Mandalay	Heho	Nyaung U	Thandwe	Dawei
Major Fire Fighting	1	-	-	-	1	1
Rapid Intervention Vehicle	1	-	1	1	-	-
Friction Testing Vehicle	1	-	-	-	-	-
X-Ray Equipment (Hold Baggage)	2	1	1	2	1	-
X-Ray Equipment (Cabin Baggage)	2	-	1	2	-	1
Doppler Type VHF Omnidirectional Range / Distance Measuring Equipment	-	-	1	1	1	-
Simple Approach Lighting System	-	-	-	1	-	1
Runway Threshold Identification Lights	-	-	-	1	-	1
Precision Approach Path Indicator	-	-	-	2	-	2
Runway Edge/Threshold/End Lights	-	-	-	-	-	1
Automatic Meteorological Observation System	-	-	1	1	1	1
Explosive Trace Detecting System	3	2	-	-	-	-
Voice Communication Control System	1	-	-	-	-	-
Flight Procedure Design System	2	-	-	-	-	-

Source: Study Team

## **(7) Reorganization of DCA**

DCA is contemplating organizational changes to separate internal service functions from regulatory functions. To achieve this, DCA plans to create an “Airport Authority”, which will provide airport services and create the “Air Navigation Services of Myanmar”. This new entity will provide communications, navigation and surveillance, air traffic management and aeronautical information services.

### **7.6.7 Key Sector Issues**

#### **(1) Planning and Coordination**

DCA is planning to develop a new airport, Hanthawaddy International Airport, to address growing traffic demands and stretched capacity of the existing YIA, as well as to expand YIA via a PPP scheme.

Other efforts that address increased traffic demands, such as enforcement of specific traffic distribution rules, do not appear to be of interest to the Government. As a result, both international and domestic passenger traffic must be accommodated at YIA and HIA, though the private sector will be an important partner to ensure profitability. Furthermore, this two-airport solution will require complex processes and additional investment for airlines and airport services and may result in inconveniences for users and transit passengers. Finally, efficient and reliable airport access will be important for success. HIA is approximately 80 km from Yangon city center, and the construction of rapid road and rail access for HIA will require significant investment, not currently under the control/responsibility of DCA.

## **(2) Infrastructure (Air Traffic Modernization Plan) and Capability Improvement**

DCA has developed an Air Traffic Management Modernization Plan that includes the implementation of Performance Based Navigation (PBN), which will include RNAV 10 for en-route, Basic Required Navigation Performance 1 (RNP) for the terminal and Lateral Navigation (LNAV) / Vertical Navigation (VNAV) Global Navigation Satellite System (GNSS) for approach. However, the plan does not include ICAO preferred or acceptable navigation specifications, such as the RNAV 1, RNP 2, RNAV 2, RNAV for continental en-route, RNP 2, or RNP 4 for oceanic operations. For the seamless and efficient operations of international flights, DCA should implement PBN and modernize CNS/ATM systems in line with ICAO's Global Air Navigation Plan (GANP).

The Mandalay International Airport (MIA) has a runway of more than 4,000 m and passenger terminal capacity of 3.0 MPPA. However, the existing facilities at MIA will not be fully utilized until 2025. Similarly, the facilities at Nay Pyi Taw International Airport (NIA) have a design capacity to accommodate 5.0 MPPA, though this will not be utilized throughout the planning horizon (up to year 2030).

Myanmar's domestic airports are also not compliant with ICAO standards or recommendations. Several of these domestic airports lack even Precision Approach Path Indicator (PAPI), the critical visual guidance system for approaching aircraft. These deficiencies can both directly and indirectly influence the safety of aircraft operations at the airports, or downgrade the airport serviceability in terms of flight delays and cancellations. The lack of night operation facilities at most of domestic airports impose additional limitations on hours of operation and the lack of an aircraft fuel supply facility at many domestic airports require airlines to arrange to carry additional fuel or conduct technical stops during flights.

## **(3) Safety, Security and Environment**

ICAO Annex 11 requires "States shall establish a State safety program, in order to achieve an acceptable level of safety in civil aviation" and "States shall require, as part of their State safety program, that an air traffic services provider implement a safety management system acceptable to the State". For airports, ICAO Annex 14 requires "As part of the certification process, States shall ensure that an aerodrome manual which will include all pertinent information on the aerodrome site, facilities, services, equipment, operating procedures, organization and management including a safety management system, is submitted by the applicant for approval/acceptance prior to granting the aerodrome certificate." Annex 6 requires "States shall require, as part of their State safety program, that an operator implement a safety management system acceptable to the State of the Operator".

## **(4) Human Resource, Institution and Regular**

### **a) Separation of the Regulatory and Service Functions within DCA**

The separation of air traffic regulatory and service functions has not been made. The change of organization structure in legislation may take time, but it shall be rectified, in practice (de facto), as soon as possible for improvement of safety of civil aviation.

### **b) Enhancement of Myanmar Accident/Incident Investigation Bureau**

The Myanmar Accident/Incident Investigation Bureau is headed by an Investigator-in-Charge who presently has just two Investigators from the Airworthiness Division. Aircraft accident investigation is a highly specialized task that should only be

undertaken by trained personnel. Depending on the types of accident/incident, various specialists are required for a thorough investigation. DCA officers, who have a good and sound working knowledge of aircraft operations and air traffic services, should be trained as Investigators, though foreign technical assistance would be required for training of this type. These staff may work as investigators on-call basis for efficient use of human resources in DCA.

## **(5) Finance**

Successful PPP projects require that public and private partners are equipped with clear and well-planned roles and responsibilities and that they understand their obligations and the potential risks during project preparation stages. These requirements, while important to be set early in the project planning stage, may be adjusted during the tender process through a pre-bid conference, clarification on bid documents, bid document consultation and/or two-stage bidding.

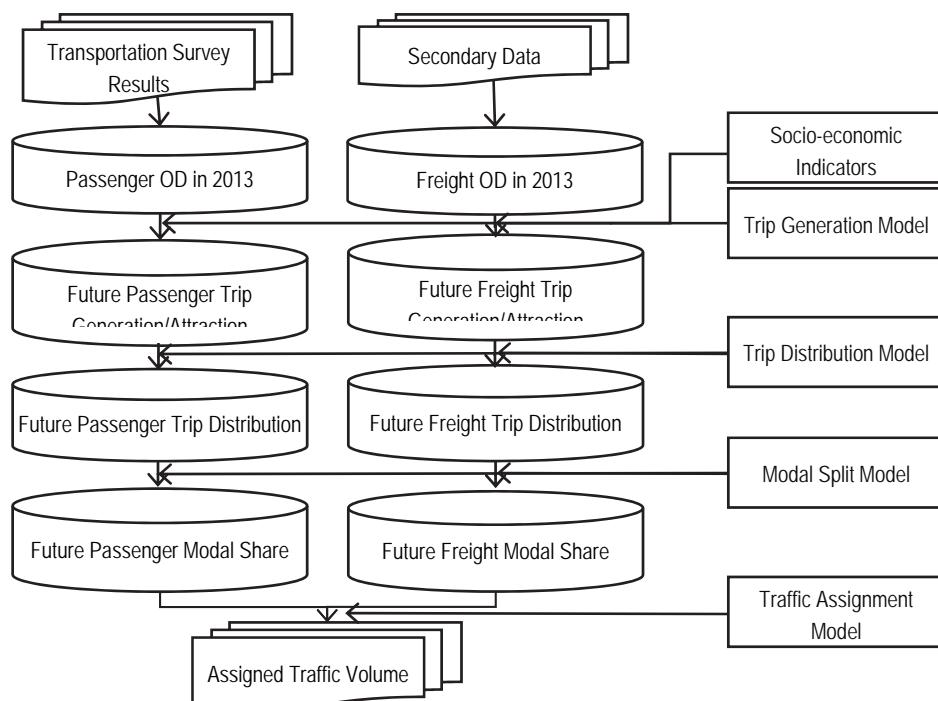
The development of a new international airport requires very substantial funding to construct the runway, taxiway system, apron, CNS/ATM facilities and equipment, passenger and cargo terminal facilities, road and car park, etc. These are partially offset by the passenger terminal facilities, which can generate significant revenues if passenger demand is significant. If this is not the case, the private investor who participated in development of HIA, may require the HIA operator to raise airport tariffs, resulting in the loss of competitive edge.

## Chapter 8 Demand Forecast

### 8.1 Introduction

The MYT-Plan traffic demand forecast models have been developed to simulate inter-city passenger and freight movement in the country. The year 2013 base-year inter-zonal Origin-Destination (OD) matrices are estimated, based on the traffic surveys conducted by the JICA Study Team during the first and second quarter of 2013 and secondary transport statistics provided by the transport related agencies.

Figure 8.1 summarizes the work flow of the MYT-Plan model building. Each of the passenger OD matrices is developed according to the most significant mode of transport (e.g. private vehicle, highway bus, railway, inland water transport and air). Additionally, the freight OD matrices are further broken down by type of cargo (e.g. 17 commodity types such as rice, wood, steel, etc.). A series of conventional four step procedure models are then developed based on existing network attributes, such as distance, travel time, travel speed, etc. Future zonal parameters are estimated separately, based on the given socio-economic framework. By incorporating those future parameters, then future OD matrices are estimated.



Source: JICA Study Team

**Figure 8.1 Demand Forecast Work Flow**

## 8.2 Existing Traffic Demand

### 8.2.1 Passenger Transport

The year 2013 daily passenger travel demand in Myanmar in terms of inter-zonal movement is summarized as follows:

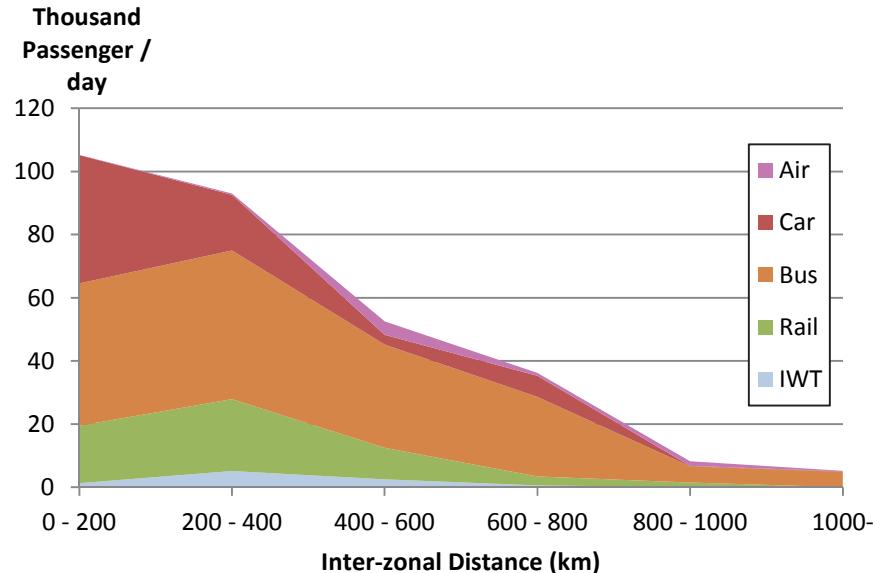
- Total trip generation: approximately 300 thousand trips per day
- Total passenger kilometres: 102 million passenger kilometres per day
- Average travel distance: 340 kilometres per person for a continuous travel

In terms of modal share, bus transportation is dominant, reaching at about 53% of the total, followed by car 23%, railway 18%, IWT 3% and Air 2%. Figure 8.2 illustrates modal share by travel distance.

**Table 8.1 Observed Current Passenger Movement in Myanmar**

Transportation Mode	Inter-zonal Trips (Trips / day)	Modal Share (%)	Passenger * km (thousand)	Average Distance (km/Trips)
Air	7,282	2	4,559	626
Car	68,414	23	14,479	212
Bus	160,042	53	62,689	392
Rail	55,286	18	16,985	307
IWT	9,421	3	3,470	368
Total	300,445	100	102,182	340

Source: JICA Study Team



Source: JICA Study Team

**Figure 8.2 Passenger travel demand by mode of transport and by travel distance**

### 8.2.2 Freight Transport

In 2013, Myanmar's inter-zonal daily freight movement is summarized as follows:

- Total freight traffic generation: 208.9 thousand tons per day
- Mode of transport: truck (81%), followed by coastal shipping (20.6%), inland waterway (10.2%) and railway (9.6%)

**Table 8.2 Current Freight Volume by Mode and Commodity**

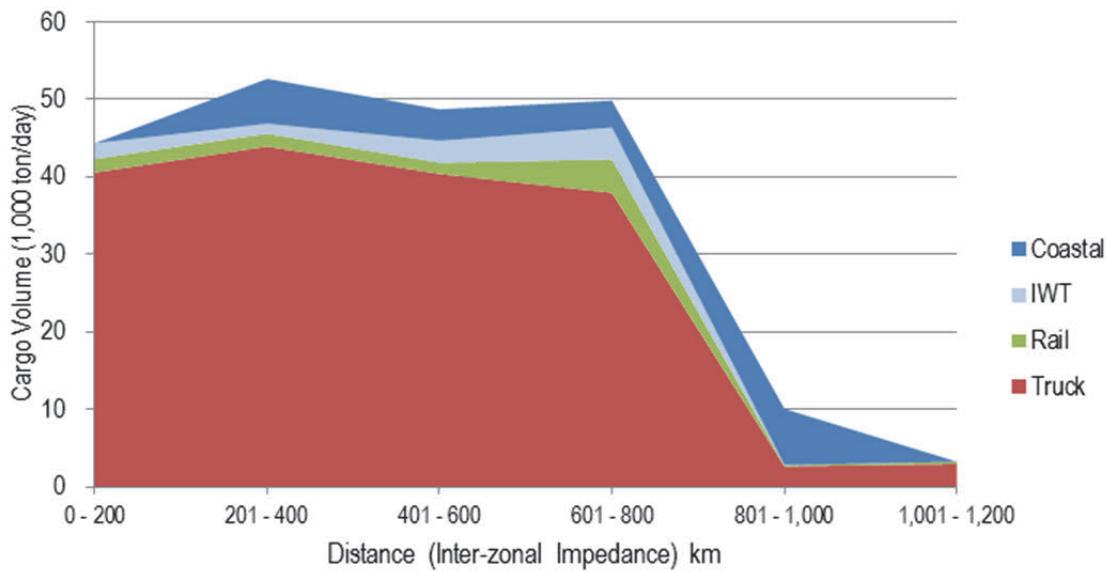
(Unit: thousand ton / day)

Commodity	Truck	IWT	Railway	Coastal	Total
1_Live Animal & Animal Products	1.6	0.0	0.0	0.0	1.6
2_Fish and Aquatic Products	2.6	0.0	0.0	0.0	2.7
3_Vegetable and Fruits	6.0	0.0	0.0	0.0	6.0
4_Grain and Grain Products	31.9	0.7	0.4	1.3	34.3
5_Other Agricultural Products (ex. Plantation Product)	14.2	0.6	0.1	0.0	15.0
6_Foodstuff, Beverage and Animal Food	17.6	1.4	2.5	4.1	25.6
7_Petroleum, Oil and Gas	4.8	3.2	0.3	13.4	21.8
8_Coal, Ore, Stone and Sand	7.9	0.2	0.3	0.0	8.4
9_Cement, Construction Material (incl. steel - frame)	22.7	1.5	2.7	1.2	28.0
10_Fertilizer (incl. Urea)	14.0	0.1	0.1	0.0	14.2
11_Garment, Textiles and fabric	3.3	0.1	0.0	0.0	3.5
12_Wood and Wood Products	3.6	0.5	1.7	0.0	5.8
13_Paper and Printed Matter	1.4	0.0	0.1	0.0	1.5
14_Metal and Metal Products (excl. construction material)	1.9	0.1	0.3	0.0	2.3
15_Industrial Material, Chemicals	6.5	0.1	0.5	0.3	7.4
16_Household articles, miscellaneous	20.3	1.3	0.6	0.3	22.5
17_Machinery and Parts, Transportation	8.1	0.2	0.1	0.0	8.4
Total	168.4	10.2	9.6	20.6	208.9
Share	81%	5%	5%	10%	100%

Source: JICA Study Team

As shown in Figure 8.3, the volume of cargo for which travel distance is longer than 800 km is small (about 6%), in other words, the travel distance of most of the cargo movement falls in within 800km.

Truck transport is a dominant form for cargo transport for distances up to 800 km. The railway and inland waterway seem to be relatively competitive for distance over 400 km.



Source: JICA Study Team

**Figure 8.3 Cargo Trip Distribution by Mode**

### 8.3 Transport Modelling

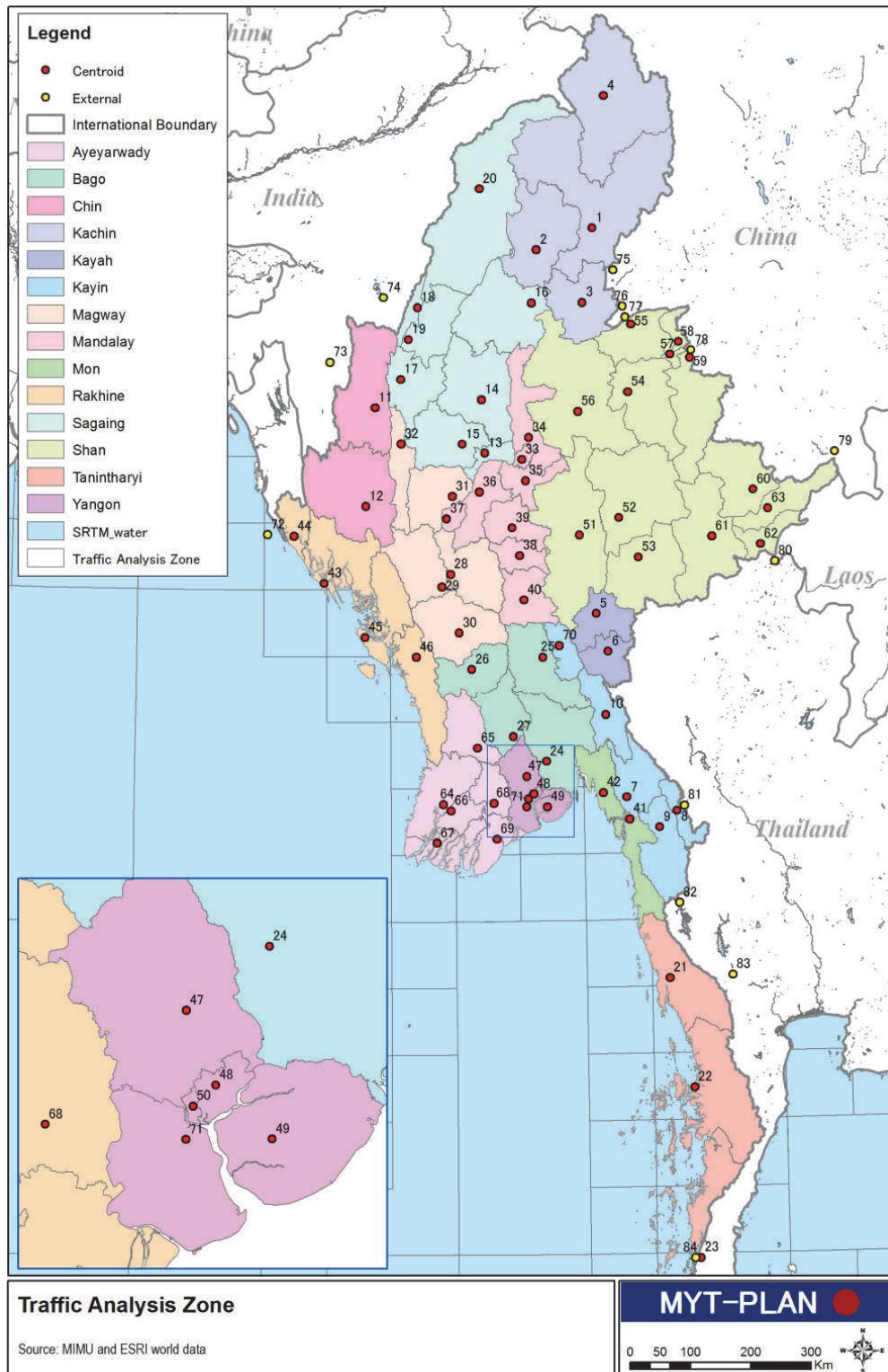
#### 8.3.1 Zoning System and Transportation Network

##### (1) Zoning System

Myanmar is divided into 71 Traffic Analysis Zones (TAZ), based on administrative boundaries and geographic features, which are used as a reference for traffic data collection, analysis, and transport modelling.

The Yangon Region is divided into five TAZs in order to capture traffic demand in a more detailed manner, that is, traffic generation from the western bank of the Yangon River, downtown area including the Yangon Ports, Thilawa SEZ, etc. Similarly, Hpa-an district is divided into two zones because it includes two segregated areas.

In addition to the 71 intra zone system, external zones (zone no. 72 to 84) are identified in order to capture the traffic movement between Myanmar and neighboring countries.



Source: MIMU, ESRI world data, JICA Study Team

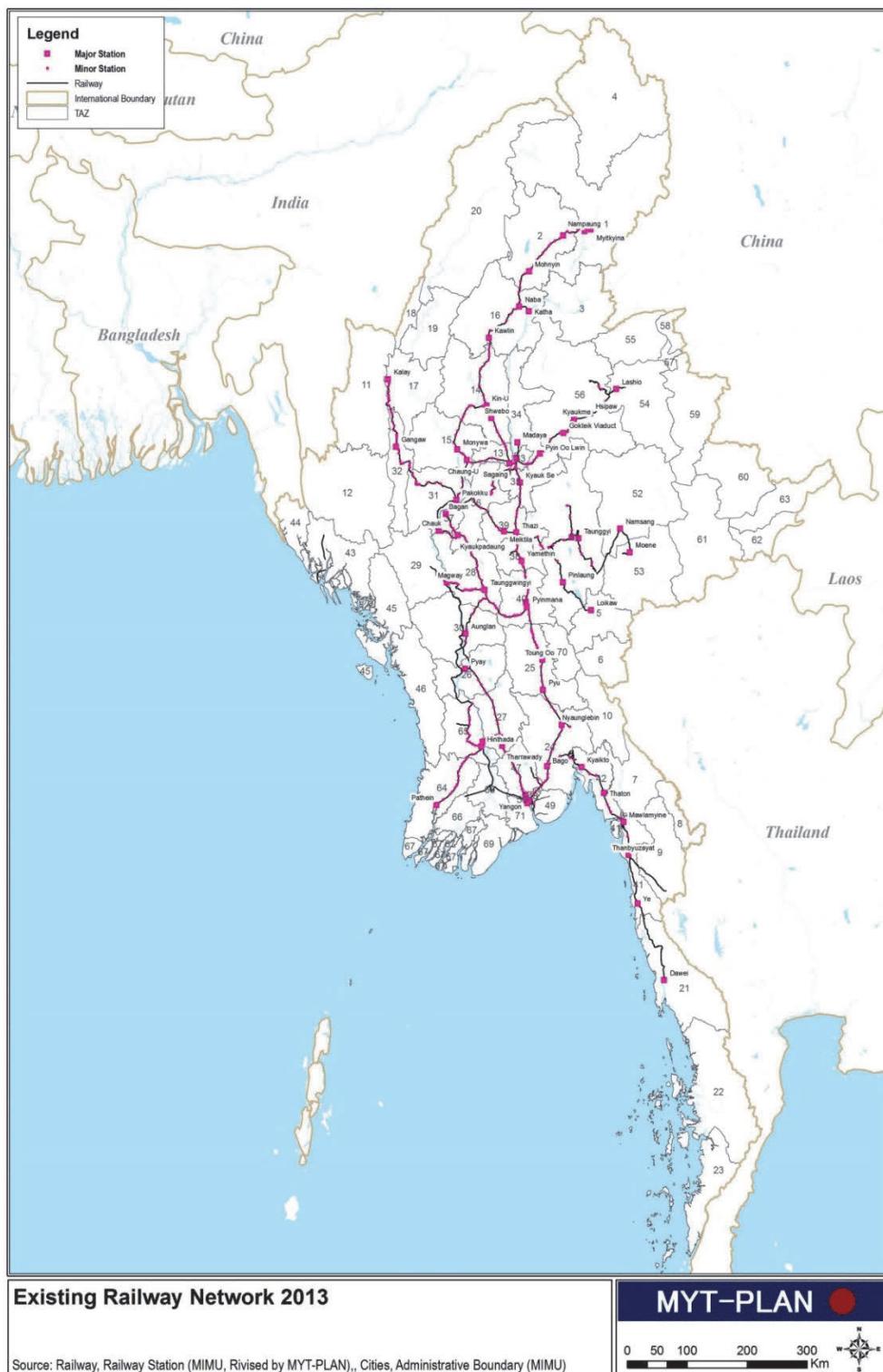
**Figure 8.4 Traffic Analysis Zone**

## **(2) Transport Network**

### **1) The Base Year Transport Network**

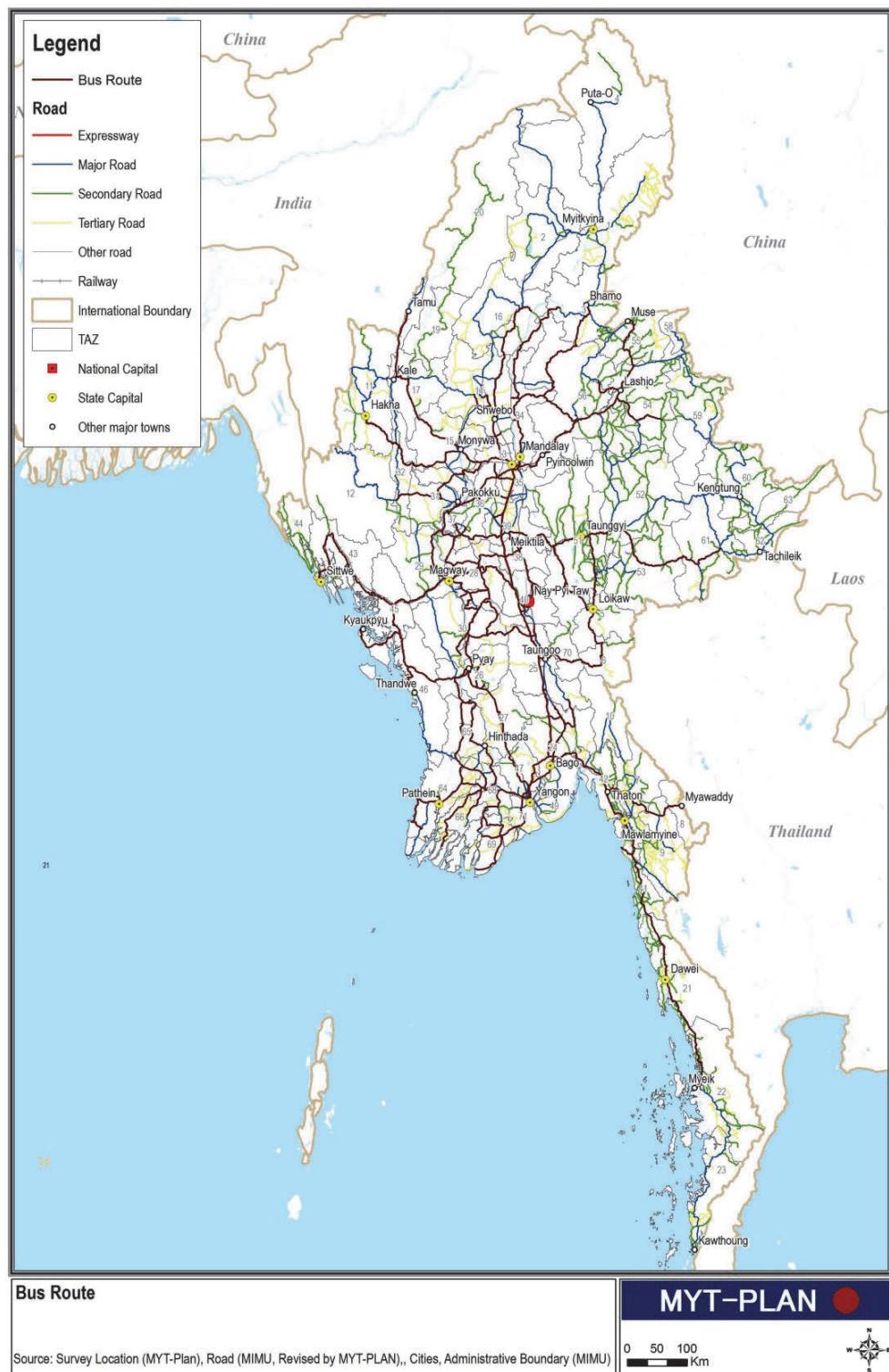
The 2013 base year transport network (trunk transport system) was developed based on geographical information from the Myanmar Information Management Unit (MIMU). The data from MIMU was reviewed and updated based on advice from experts of Public Works, Myanma Railway, Inland Water Transport and a site investigation by the JICA Study Team.

The union highway information was used to develop the computerized road network, while information of regional roads and other roads of lower classes was not updated nor cleaned in terms of GIS.



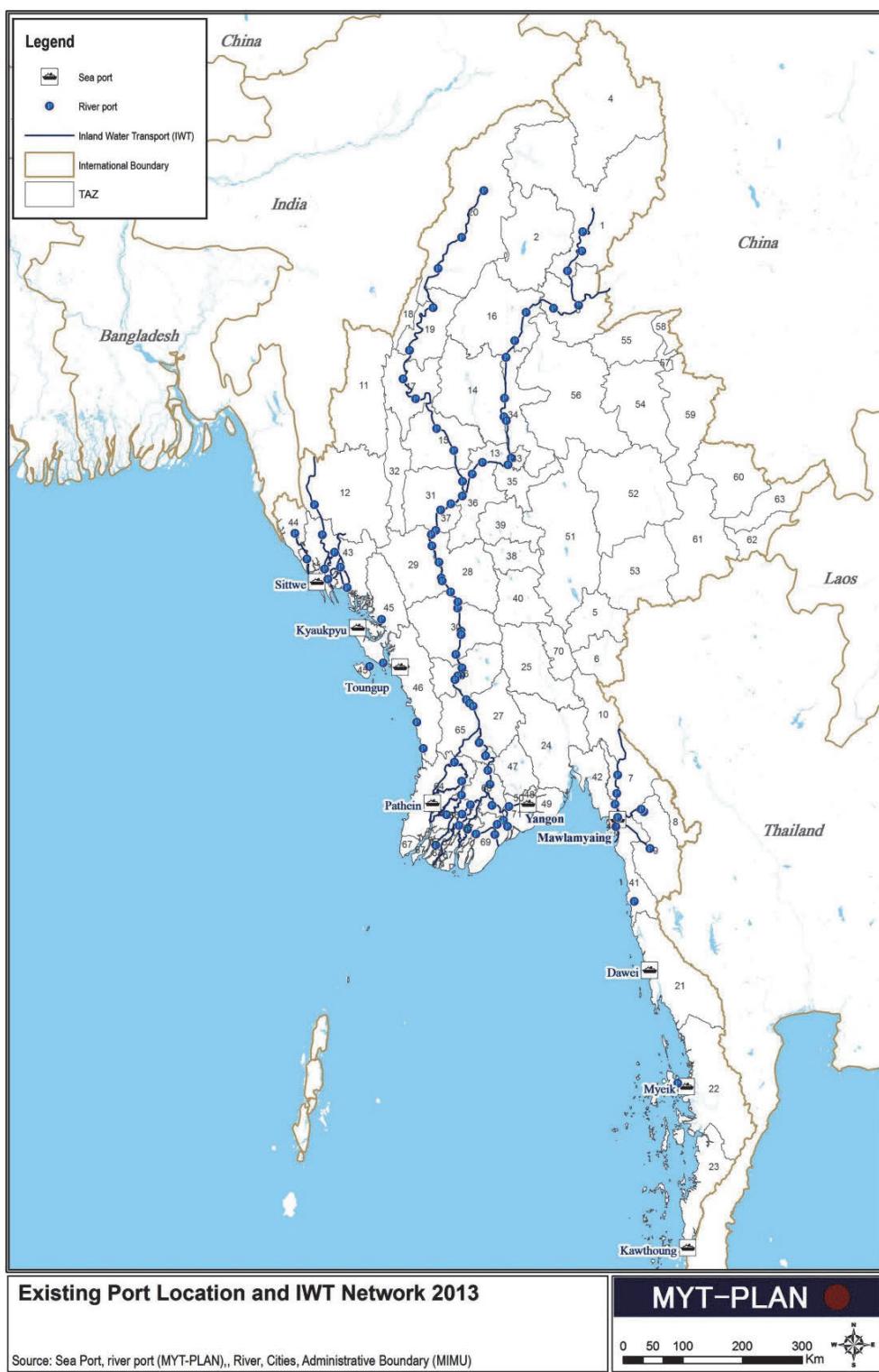
Source: JICA Study Team and MR

**Figure 8.5 Existing Railway Network**



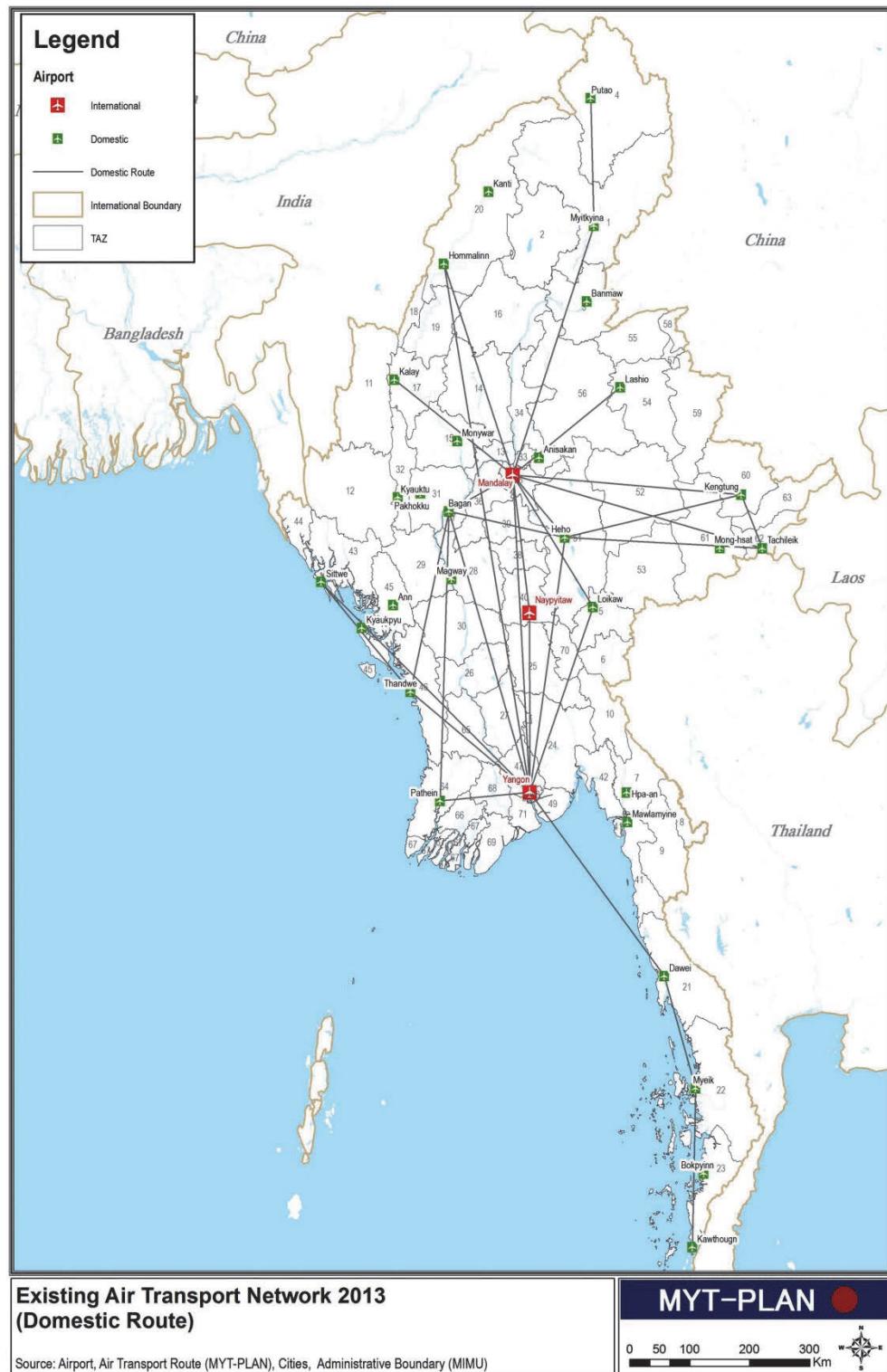
Source: JICA Study Team, PW and Ma Hta Tha

**Figure 8.6 Existing Road and Bus Network**



Source: JICA Study Team and IWT

**Figure 8.7 Existing IWT Network**



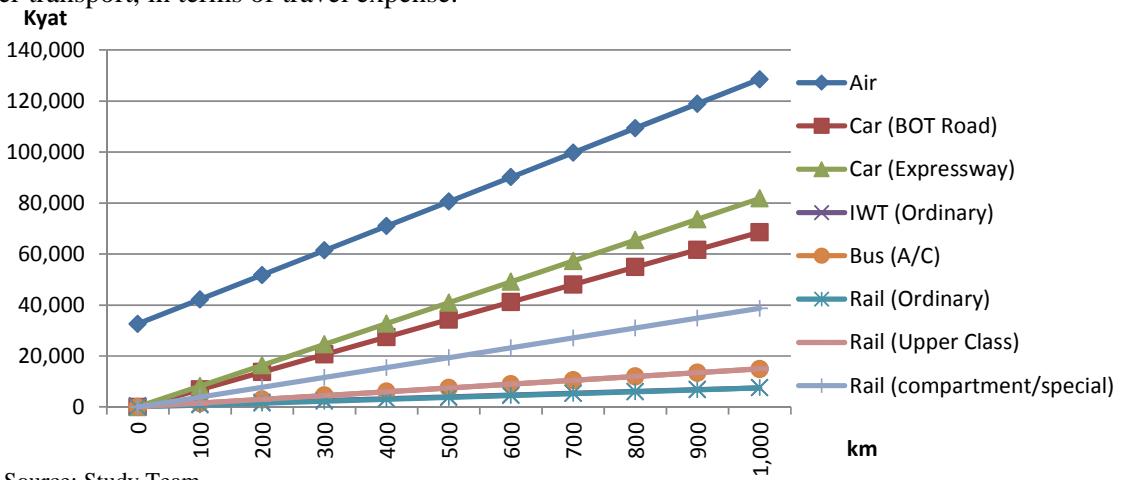
Source: JICA Study Team, Myanmar Travels & Tours Directory 2013

**Figure 8.8 Air Transport Network**

## 2) Network impedance

### a) Passenger

Figure 8.9 summarises passenger travel fares for each mode. Obviously, air travel has the highest fares, followed by fares of cars using the expressway. There is no significant difference between fares for highway bus and rail (upper class) and between rail (ordinary) and inland water transport, in terms of travel expense.



**Figure 8.9 Passenger Travel Cost Comparison by Transportation Mode<sup>1</sup>**

### b) Freight

Travel time and transport cost of each transport mode are calculated as follows,

- Coastal shipping

Coastal shipping travel times and transport costs include vessel and truck for access/egress to the port. These are calculated by estimating the average speed of bulk/general cargo vessel 20.37 km/h (11 kt) and distance between the ports by “cargo transported by coastal trade” prepared by MOT, which includes inbound/outbound freight by ton and ton-mile. Transport cost (Kyat/ton) by vessel are prepared by conducting analysis on “coastal freight transport, other than Myanmar five star line in Yangon region (MPA)”. Travel times of access/egress truck to/from coastal ports (18 km each) are calculated by accounting for median travel distance and speed (21.6 km/h), based on truck driver interview survey at river ports. Truck transport costs are calculated using a distance proportional model, estimated with a regression model and based on roadside interview surveys.

- Inland waterways

Inland waterway travel times and transport costs also include vessel and truck modes as factors. Vessel travel times between representative river ports for each zone, defined by handling cargo volume, are calculated by travel distances shown in “cargo transported by inland waterways cargo vessels (MPA)” and average travel speeds (5.07 km/h), based on the

<sup>1</sup> Travel Cost for car includes toll and gasoline cost.

---

actual operation schedule. Transport costs of vessels an average (15 Kyat/ton/km) of the dry and rainy season rates between Yangon and Mandalay, based on interview survey with forwarders. Travel times and costs of truck access/egress to river ports are calculated by road distances between zone centroids and the nearest river ports, and median travel speeds (21.6 km/h) and the estimated distance proportional fare systems of truck.

- Railway

Railway travel times and transport costs consists of railway and truck factors. Railway travel times are calculated by average travel speed (16.7 km/h) based on actual performance in “Strategic Plan (MR)” and distance between representative railway station in each zone selected by handling cargo volume. Transport cost of railway is defined as 36.5 Kyat/ton/km based on freight tariff of express freight train for plain section. Travel time and cost of access/egress truck is calculated by average truck travel speed, distance proportional fare system and average access/egress distance (14.4 km each) based on the results of truck driver interview survey at railway stations.

- Truck

Truck travel times are calculated by the median travel speed (21.6 km/h), based on the results of the roadside interview survey and distance by OD pair computed by road network. Truck transport costs are estimated by the following distance proportional fare system, based on the roadside interview survey.

$$\text{Kyat/ton by truck} = 41.7 * \text{distance (km)} + 5,339 \quad (R^2=0.724)$$

### 3) Future Transport Network

The future transport network, for the year 2013, is developed based on the proposed component projects for each corridor (refer to Chapter 3 of this Final Report).

#### 8.3.2 Socio-economic Framework

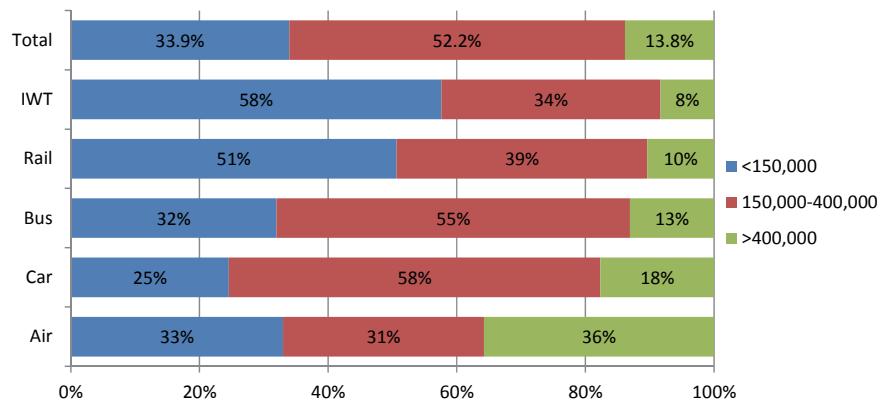
##### (1) Household Income

Figure 8.10 indicates the household income distribution of travellers, derived from the JICA Study Team’s transportation survey in 2013. Overall, one third of travellers were higher income earners while slightly more than half were middle income earners.

The relationship between household income level and choice of transport mode is clearly indicated in Figure 8.10. That is, a majority of travellers using rail and inland water transport are from lower income households, while the majority of highway bus and car users are from middle income households. In the case of civil aviation, higher income households account for nearly 40% of travellers and 30% are from lower income households.

Figure 8.11 indicates future income distribution, estimated based on the growth ratio of future GDP per capita and highlighting an important change in terms of peoples’ preference in future modal choice.

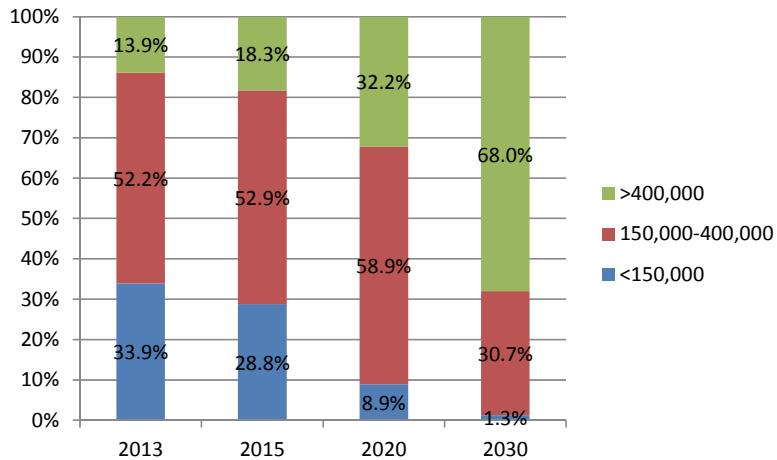
(Unit: Kyat / Month)



Source: Study Team

**Figure 8.10 Household Income Distribution by Mode**

(Unit: Kyat / Month)



Source: Study Team

**Figure 8.11 Forecasts of Household Income Distribution**

## (2) Value of Time

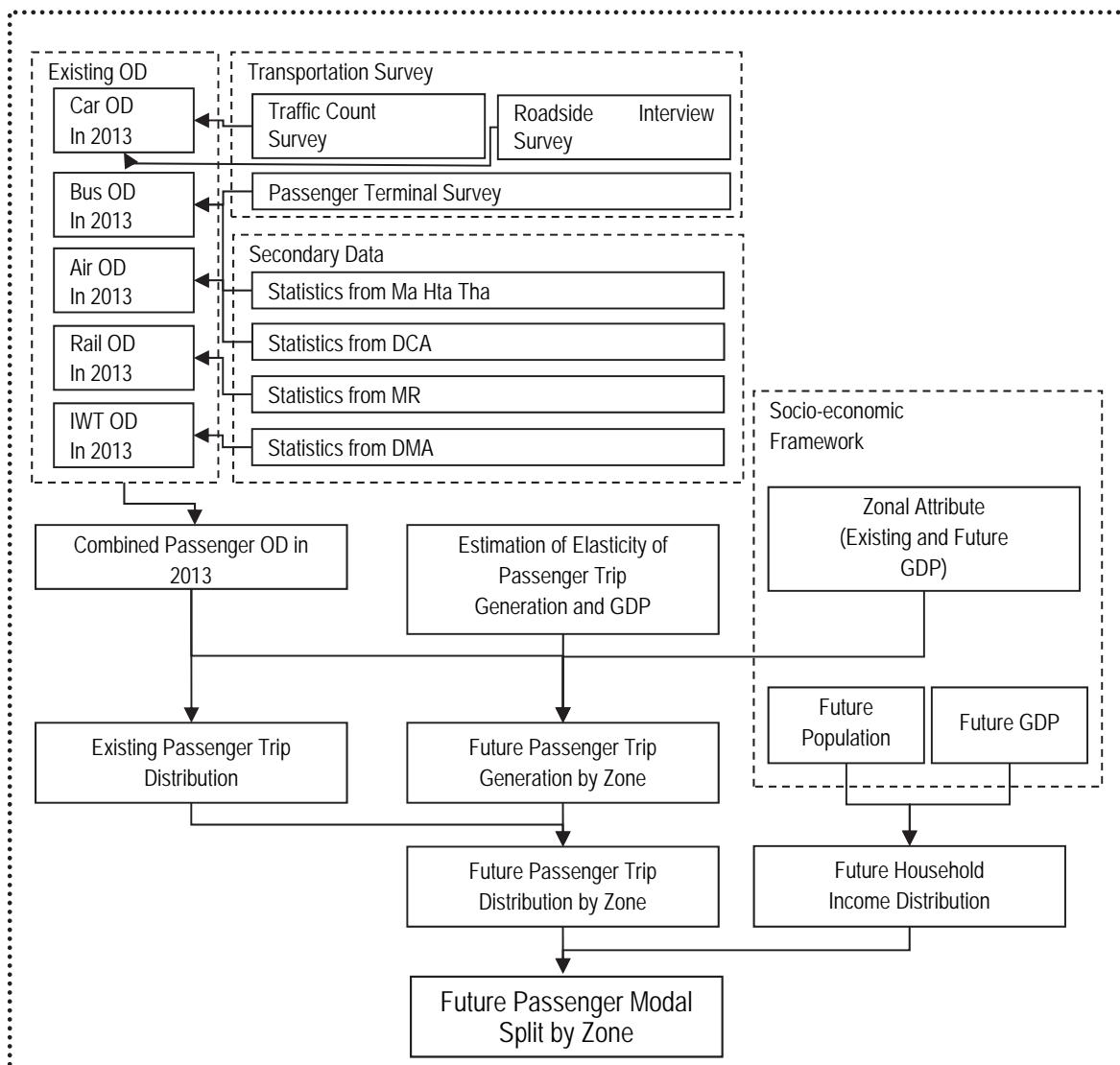
The interview survey findings illustrate respondents' assessment of "value of time"<sup>2</sup>, which is an influential factor in the modal split model. The value of time is determined at 562 Kyat per hour, 1,253 Kyat per hour and 3,636 Kyat per hour respectively, for each of the three economic activity classes (low, mid, and high) in the year 2013 constant prices.

<sup>2</sup> "value of time" is an estimated amount of money, based on monthly household income and average monthly working hour.

### 8.3.3 Passenger Transport

#### (1) Methodology

Figure 8.12 forecasts the flow of passenger demand, based on the conventional four-step method. Based on statistical information and the traffic survey, existing inter-zonal traffic volume was estimated. Trip generation is estimated as a function of the future socio-economic indicator of each zone. Furthermore, modal share of each transportation mode is estimated, comparing travel time and cost of each mode between each zone.



Source: JICA Study Team

**Figure 8.12 Flow of Passenger Demand Forecast**

## (2) Trip Generation

Population growth, economic development and income level improvement will increase the trip generation volume. Considering examples of economic development and traffic growth in neighboring countries, the GDP elasticity of trip generation from each zone, from 2013 to 2015 and from 2015 to 2030, are defined as 1.0 and 1.2 respectively.

## (3) Trip Distribution

The person trip distribution for inter-zone travel is estimated using the Frater method, as shown in following formula.

$$T_{ij} = t_{ij} \cdot \frac{G_i}{g_i} \cdot \frac{A_j}{a_j} \cdot \frac{1}{2} \left( \frac{\sum_j g_i}{\sum_j t_{ij} \cdot A_j / a_j} + \frac{\sum_i a_j}{\sum_i t_{ij} \cdot G_i / g_i} \right)$$

where,  $T_{ij}$ : Future trip distribution at zone i to j,

$G_i$ : Future trip production at zone i,

$A_j$ : Future trip attraction at zone j,

$t_{ij}$ : Current trip distribution at zone i to j

$g_i$ : Current trip production at zone i, and

$a_j$ : Current trip attraction at zone j

## (4) Modal Split

The modal structure, or hierarchies of person trip types in terms of person model, is depicted in Figure 8.13. Person trips are distributed between five modes (air, private car, IWT, rail and bus) via a hierarchy of binary logit mode splits. The proportion of trips between any two zones (i and j) that identify ‘choice one’ from the subset of two choices, is calculated as follows:

$$\frac{1}{1 + \exp(-\lambda(C_{ij}^2 - C_{ij}^1))}$$

Where:

$\lambda$  is the scale parameter and is defined in Figure 8.13;

$C_{ij}^1$  is the generalized cost of travel for hierarchical choice 1 between any two zones i and j; and

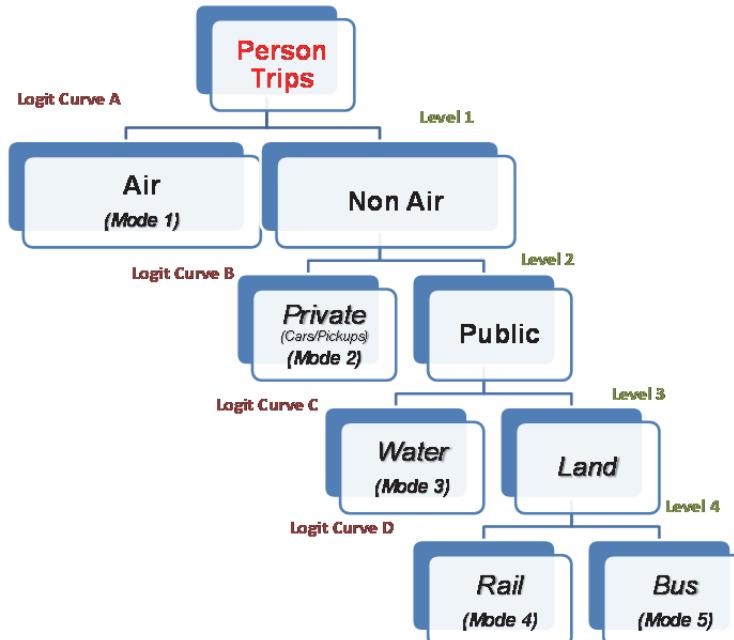
$C_{ij}^2$  is the generalized cost of travel for hierarchical choice 2 between any two zones i and j.

The generalized cost of travel<sup>3</sup> is defined to include all of the perceived travelling costs between any origin and destination. In the case of travel by car, this cost will include time, any tolls and the perceived fuel costs. In the case of non-car travel, the generalized cost includes

<sup>3</sup> This perceived cost is in the form of equivalent minutes.

*Final Report*

fare, travel time and waiting time. The scale parameter is estimated by income class based on the stated preference survey. Table 8.3 illustrates a comparison of the observed modal share and the estimated modal share.



Source: Study Team

**Figure 8.13 Modal Split Hierarchy**

**Table 8.3 Modal Choice Scale Parameters**

Mode Split Equation Level	Economic Activity Class s <sup>4</sup>	Choice 1	Choice 2	Scale Parameter
A	1	Air	Non-Air	0.0046
B	1	Car	Public	0.0033
C	1	IWT	Land Public	0.0072
D	1	Rail	Bus	0.0134
A	2	Air	Non-Air	0.0046
B	2	Car	Public	0.0033
C	2	IWT	Land Public	0.0092
D	2	Rail	Bus	0.0191
A	3	Air	Non-Air	0.0073
B	3	Car	Public	0.0082
C	3	IWT	Land Public	0.011
D	3	Rail	Bus	0.0237

Source: Study Team

**Table 8.4 Comparison of Observed and Estimated Modal Share**

(Unit: Person / day)

Transportation Mode		Air	Car	Bus	Rail	IWT
Estimated	Passenger	9,241	64,501	158,196	57,723	10,785
	Share	3%	21%	53%	19%	4%
Observed	Passenger	7,282	68,414	160,042	55,286	9,421
	Share	2%	23%	53%	18%	3%

Source: JICA Study Team

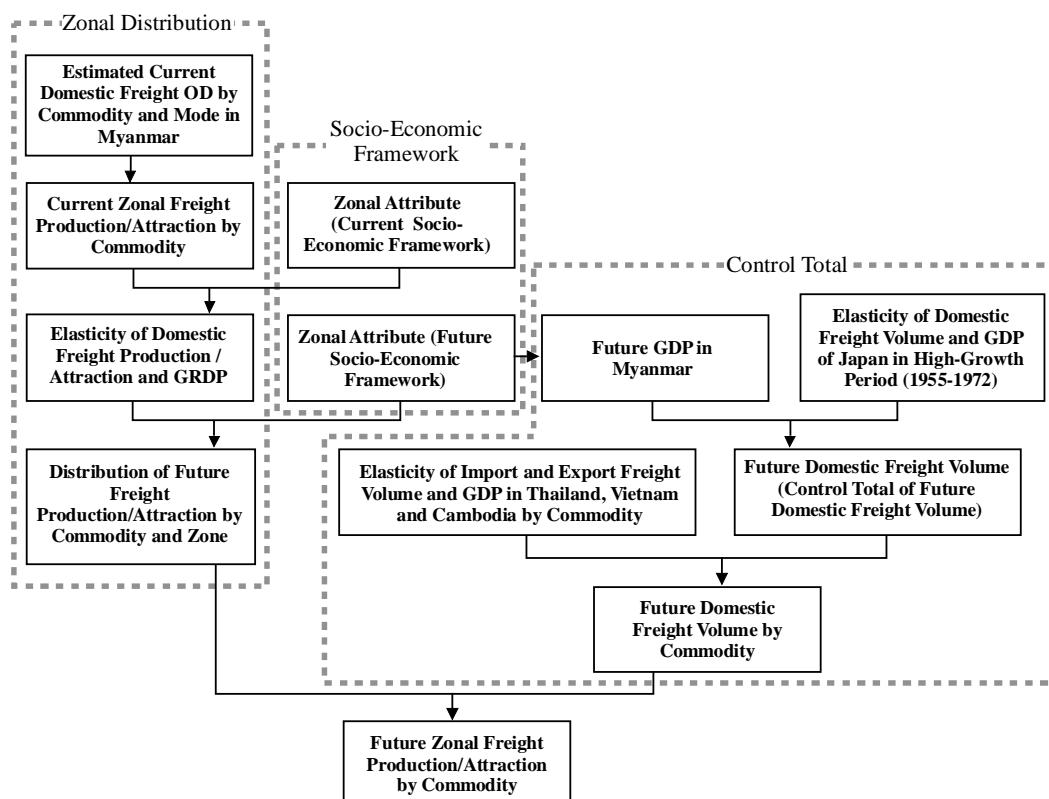
<sup>4</sup>

Household Income Category:  
Class 1  $\leq$  150,000 Kyat/ month, 150,000 < Class 2  $\leq$  400,000, Class3 < 400,000

### 8.3.4 Freight Transport

#### (1) Trip Generation

Future cargo generation in the study area is estimated as shown in Figure 8.15. Future cargo generation modelling consists of two steps, namely: (i) estimation of a control total, which is the total domestic cargo generation of the entire study area by type of commodity; and (ii) zonal distribution, which is the cargo production and attraction by type of commodity and traffic analysis zone.



Source: JICA Study Team

**Figure 8.14 Workflow of Future Zonal Cargo Generation**

#### 1) Control Total

Control total is the total domestic cargo flow volume (between TAZs) of all transport modes and of all commodity types. This is estimated with existing total domestic cargo flow volumes and an expansion factor, calculated by future GDP growth rate and elasticity of domestic cargo volume to GDP.

The elasticity of domestic cargo volume to GDP is calculated by a regression model in Japan, during high-economic growth periods (1960 - 1972), which is 1.342 ( $R^2 = 0.993$ ).

Control total by type of commodity is also estimated by the elasticity of import/export volumes to GDP in Thailand, Vietnam and Cambodia. Defined elasticity is indicated in following table.

**Table 8.5 Elasticity of EXIM Volume by Type Commodities**

Commodity	Elasticity to GDP
1 Live Animal & Animal Products	1.22
2 Fish and Aquatic Products	1.76
3 Vegetable and Fruits	1.18
4 Grain and Grain Products	1.74
5 Other Agricultural Products (ex. Plantation Product)	2.13
6 Foodstuff, Beverage and Animal Food	1.30
7 Petroleum, Oil and Gas	1.84
8 Coal, Ore, Stone and Sand	2.21
9 Cement, Construction Material (incl. steel - frame)	1.93
10 Fertilizer (incl. Urea)	1.09
11 Garment, Textiles and fabric	1.24
12 Wood and Wood Products	1.14
13 Paper and Printed Matter	1.05
14 Metal and Metal Products (excl. construction material)	1.29
15 Industrial Material, Chemicals	1.33
16 Household articles, miscellaneous	1.80
17 Machinery and Parts, Transportation	1.40

Source: JICA Study Team

## **2) Zonal Distribution**

The elasticity of cargo production/attraction by commodity to GRDP is shown in Table 8.6, based on the estimated current total cargo production/attraction and zonal attributes.

Future cargo production and attraction by zone is adjusted to control the total, after being computed by current cargo production and attraction, future GRDP by zone, elasticity of cargo production and attraction to GRDP.

**Table 8.6 Elasticity of Domestic Cargo Production and Attraction to GRDP**

Commodity	Cargo Production	Cargo Attraction
1 Live Animal & Animal Products	0.315	1.560
2 Fish and Aquatic Products	0.554	2.552
3 Vegetable and Fruits	0.803	0.819
4 Grain and Grain Products	1.274	0.771
5 Other Agricultural Products (ex. Plantation Product)	1.304	0.988
6 Foodstuff, Beverage and Animal Food	0.942	0.961
7 Petroleum, Oil and Gas	1.178	1.170
8 Coal, Ore, Stone and Sand	0.400	1.512
9 Cement, Construction Material (incl. steel - frame)	1.024	1.663
10 Fertilizer (incl. Urea)	1.663	1.831
11 Garment, Textiles and fabric	0.850	1.644
12 Wood and Wood Products	0.462	1.757
13 Paper and Printed Matter	0.858	0.579
14 Metal and Metal Products (excl. construction material)	1.621	0.384
15 Industrial Material, Chemicals	1.698	0.685
16 Household articles, miscellaneous	1.252	1.030
17 Machinery and Parts, Transportation	0.950	1.013

Source: JICA Study Team

## (2) Trip Distribution

The following formula uses the Fratar growth factor method to forecast future cargo OD by type of commodity.

$$T_{ij} = t_{ij} \cdot \frac{G_i}{g_i} \frac{A_j}{a_j} \cdot \frac{1}{2} \left( \frac{g_i}{\sum_j t_{ij} \cdot A_j / a_j} + \frac{a_j}{\sum_i t_{ij} \cdot G_i / g_i} \right)$$

where,  $T_{ij}$ : Future cargo distribution at zone i to j,

$G_i$ : Future cargo production at zone i,

$A_j$ : Future cargo attraction at zone j,

$t_{ij}$ : Current cargo distribution at zone i to j,

$g_i$ : Current cargo production at zone i, and

$a_j$ : Current cargo attraction at zone j.

## (3) Modal Split

The following logic model forecasts future cargo by type of commodity, and is divided into each transport mode, namely, costal, inland water transport, railway and truck.

$$P_i = \frac{\exp(U_i)}{\exp(U_i) + \exp(U_j)}$$

where,  $U_i = a \cdot \text{time}_i + b \cdot \text{cost}_i$   
 $U_j = a \cdot \text{time}_j + b \cdot \text{cost}_j$

$U_i$ : Utility of mode i,

$\text{time}_i$ : Travel time of mode i,

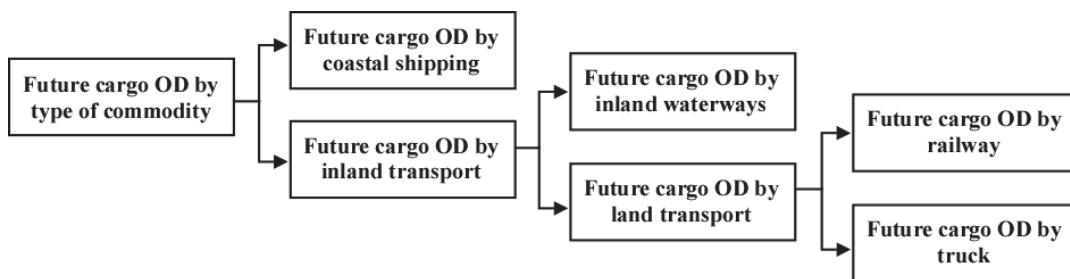
$\text{cost}_i$ : Cost of mode i,

$U_j$ : Utility of mode j,

$\text{time}_j$ : Travel time of mode j, and

$\text{cost}_j$ : Cost of mode j,

The modal split model is estimated by type of commodity and the following binary choice type, (i) coastal shipping - inland transport, (ii) inland waterways and land transport, and (iii) railway and truck.



Source: JICA Study Team

**Figure 8.15 Binary Choice Type Modal Split Model**

The following tables indicate estimated parameters for the modal split model, computed by current cargo OD, by commodity and by transport mode.

**Table 8.7 Parameters for Modal Split Model 1 (Coastal - Land Transport)**

Commodity	Intercept	(Time_Land) -(Time_Coastal)	(Cost_Land) -(Cost_Coastal)	R <sup>2</sup>
1 Live Animals & Animal Products	-	-	-	-
2 Fish and Aquatic Products	-	-	-	-
3 Vegetables and Fruits	-	-	-	-
4 Grains and Grain Products	-4.5860	-0.2244	-0.0001	0.8504
5 Other Agricultural Products (ex. Plantation Product)	-	-	-	-
6 Foodstuffs, Beverages and Animal Food	0.8766	-0.0004	-0.0004	0.7852
7 Petroleum, Oil and Gas	-	-	-	-
8 Coal, Ore, Stone and Sand	-	-	-	-
9 Cement, Construction Material (incl. Steel - frame)	-10.842 8	-0.2622	-0.0002	0.8223
10 Fertilizer (incl. Urea)	-	-	-	-
11 Garments, Textiles and fabric	-	-	-	-
12 Wood and Wood Products	-	-	-	-
13 Paper and Printed Matter	-	-	-	-
14 Metal and Metal Products (excl. Construction Material)	-	-	-	-
15 Industrial Material, Chemicals	-1.4294	-0.0858	-0.0004	0.5360
16 Household articles, miscellaneous	1.4364	-0.0355	-0.0004	0.5738
17 Machinery and Parts, Transportation	-9.1314	-0.0847	-0.0001	0.9584

Source: JICA Study Team

**Table 8.8 Parameters for Modal Split Model 2 (IWT - Land Transport)**

Commodity	Intercept	(Time_Land) -(Time_River)	(Cost_Land) -(Cost_River)	R <sup>2</sup>
1 Live Animals & Animal Products	1.2754	-0.0314	0.0000	0.5787
2 Fish and Aquatic Products	2.3079	-0.0601	-0.0001	0.6536
3 Vegetables and Fruits	3.7516	-0.0142	0.0000	0.4659
4 Grains and Grain Products	1.6748	-0.0194	-0.0001	0.4280
5 Other Agricultural Products (ex. Plantation Product)	0.7821	-0.0158	-0.0001	0.6127
6 Foodstuffs, Beverages and Animal Food	-0.4133	-0.0387	-0.0004	0.6713
7 Petroleum, Oil and Gas	-1.2808	-0.0386	-0.0008	0.6969
8 Coal, Ore, Stone and Sand	0.5921	-0.0741	-0.0006	0.9647
9 Cement, Construction Material (incl. Steel - frame)	1.6728	-0.0087	-0.0003	0.5192
10 Fertilizer (incl. Urea)	2.9320	-0.0283	-0.0003	0.4003
11 Garments, Textiles and fabric	1.6906	-0.0219	-0.0004	0.5049
12 Wood and Wood Products	2.0427	-0.0169	-0.0004	0.9789
13 Paper and Printed Matter	3.9057	-0.0172	-0.0003	0.6502
14 Metal and Metal Products (excl. Construction Material)	-1.1756	-0.0412	-0.0001	0.5042
15 Industrial Material, Chemicals	-0.6727	-0.0732	-0.0006	0.7014
16 Household articles, miscellaneous	0.6300	-0.0173	-0.0001	0.5060
17 Machinery and Parts, Transportation	-0.1859	-0.0628	-0.0006	0.6602

Source: JICA Study Team

**Table 8.9 Parameters for Modal Split Model 3 (Railway - Truck)**

Commodity	intercept	(Time_Truck) -(Time_Rail)	(Cost_Truck) -(Cost_Rail)	R <sup>2</sup>
1 Live Animals & Animal Products	-	-	-	-
2 Fish and Aquatic Products	-	-	-	-
3 Vegetables and Fruits	-	-	-	-
4 Grains and Grain Products	-0.8966	-0.3892	-0.0008	0.5338
5 Other Agricultural Products (ex. Plantation Product)	-4.7785	-0.6994	-0.0015	0.5116
6 Foodstuffs, Beverages and Animal Food	-0.7408	-0.2078	-0.0003	0.6553
7 Petroleum, Oil and Gas	-14.4599	-1.2397	-0.0026	0.6679
8 Coal, Ore, Stone and Sand	2.8238	-0.0121	-0.0001	0.5394
9 Cement, Construction Material (incl. Steel - frame)	-3.0991	-0.1828	-0.0010	0.5839
10 Fertilizer (incl. Urea)	1.4067	-0.1803	-0.0006	0.5132
11 Garments, Textiles and fabric	-0.2128	-0.1772	-0.0010	0.5916
12 Wood and Wood Products	-16.5696	-0.5941	-0.0034	0.7840
13 Paper and Printed Matter	-1.3076	-0.1718	-0.0012	0.5996
14 Metal and Metal Products (excl. Construction Material)	-9.2513	-0.6487	-0.0022	0.5597
15 Industrial Material, Chemicals	-1.5760	-0.1760	-0.0008	0.5230
16 Household articles, miscellaneous	-1.9646	-0.5891	-0.0006	0.6127
17 Machinery and Parts, Transportation	2.5323	-0.0287	-0.0004	0.7430

Source: JICA Study Team

## 8.4 Demand Forecast

### 8.4.1 Passenger Transport

#### (1) Trip Generation

The Total Trip generation in 2013 is approximately 300 thousand persons per day. Trip generation in 2020 and 2030 is estimated at 0.55 million persons and 1.4 million persons, respectively.

**Table 8.10 Total Trip Generation, GDP and GDP Growth Ratio**

	Y2013	Y2015	Y2020	Y2030
Total Trip Generation (1,000 Persons / day)	300	347	555	1,397
GDP (Billion Kyat)	49,901	56,567	80,078	160,500
Annual Average GDP Growth Ratio (%)		6.5%	7.2%	7.2%

Source: JICA Study Team

**Table 8.11 Trip Generation by States / Region**

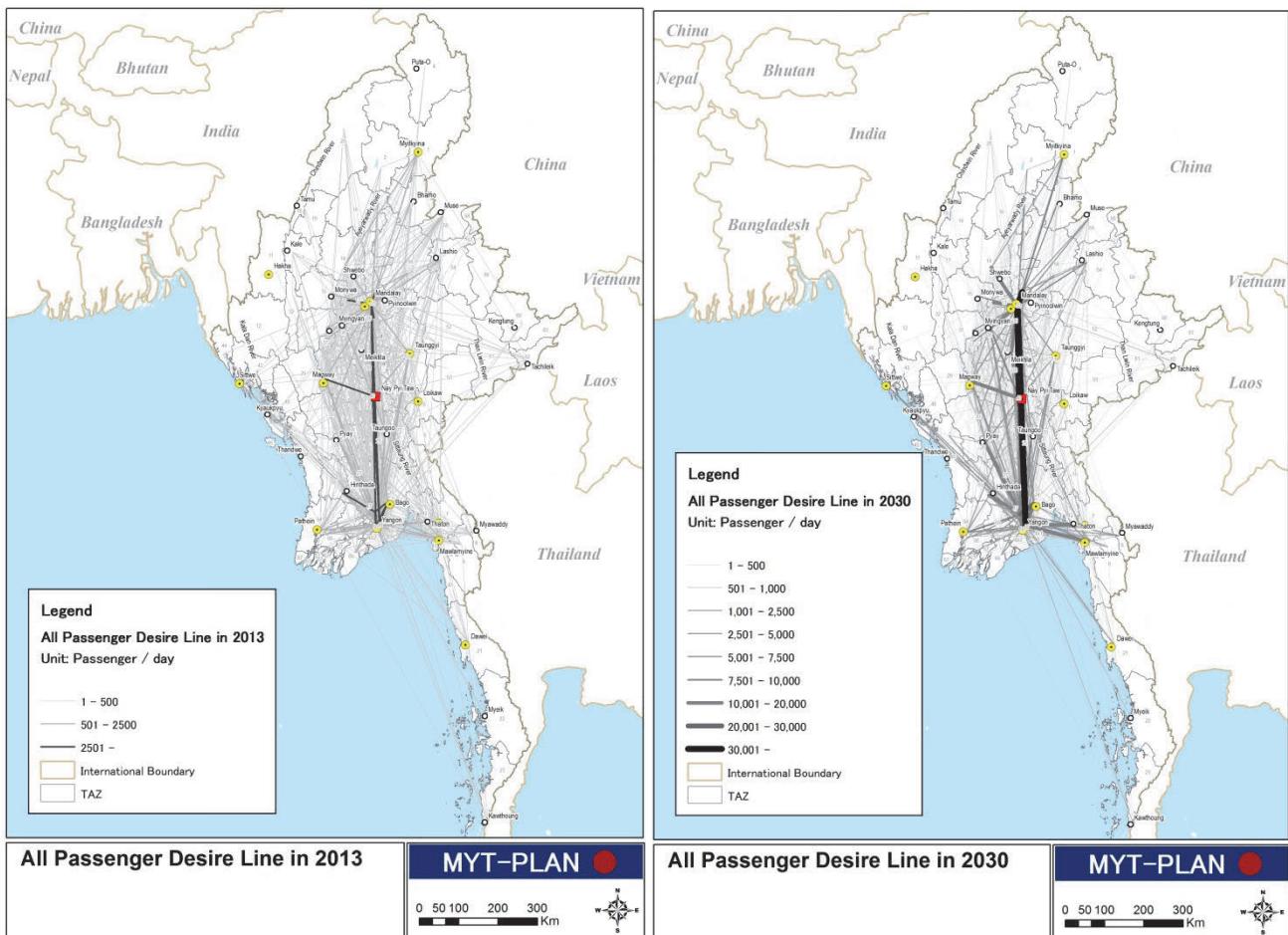
(Unit: Trip / day)

ST_CODE_rev	ST_NAME	2013	2015	2020	2030
1	Kachin	6,218	7,063	10,676	23,253
2	Kayah	544	656	1,110	2,572
3	Kayin	2,156	2,417	4,275	14,878
4	Chin	71	79	112	242
5	Sagaing	17,696	19,351	24,833	45,378
6	Tanintharyi	2,068	2,251	3,036	7,391
7	Bago	29,998	33,357	50,316	127,431
8	Magway	18,163	19,574	26,988	45,087
9	Mandalay	65,930	76,571	134,512	376,000
10	Nay Pyi Taw	21,546	26,898	46,344	142,404
11	Mon	11,933	13,575	20,674	50,944
12	Rakhine	3,587	4,079	6,727	17,950
13	Yangon	83,723	101,101	171,971	435,975
14	Shan	13,701	14,787	20,721	48,285
15	Ayeyarwady	23,110	25,365	33,012	59,909
	Total	300,445	347,125	555,308	1,397,700

Source: JICA Study Team

## **(2) Trip Distribution**

Future trip distribution patterns are estimated using the Frater method. Figure 8.16 indicates the Desire Lines as of 2013 and 2030. Table 8.12 and Table 8.13 show estimated inter-state passenger OD in 2013 and 2030, respectively. As shown in the inter-state passenger tables, a significant increase of inner-state passenger trips in Mandalay region and Yangon region is estimated. The Tables show how both inter-state trips between National Growth Centers (i.e., Mandalay, Yangon, and Nay Pyi Taw) and trip volume between Mandalay region and Bago region increase dramatically.



Source: JICA Study Team

**Figure 8.16 Passenger Desired Line for All Transportation Modes (Left:2013, Right 2030)**

**Table 8.12 Estimated Inter-state Passenger OD in 2013**

(Unit: Person/day)

State Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	698				1,363		108	769	2,988	52			143	24		6,145
2					82		19	12	90	72			242	15	12	544
3						12	268	1	23	56	304	21	1,232	42	197	2,156
4													71			71
5	1,363	82			3,657		90	706	9,214	394	2	72	1,484	566	56	17,686
6			12			206	74		26		222	21	1,489		18	2,068
7	108	19	268		90	74	3,558	1,086	2,143	2,055	1,093	209	18,120	506	656	29,985
8	769	12	1		706		1,086	3,634	3,662	3,358	9	49	3,911	845	121	18,163
9	3,133	90	23		9,229	26	2,165	3,662	25,471	5,935	287	81	10,228	5,583	110	66,023
10	52	72	56		394		2,055	3,358	5,935		466	12	7,479	1,082	585	21,546
11			304		2	222	1,093	9	287	466	1,978		7,015	193	364	11,933
12			21		72	21	209	49	81	12		729	2,106	280	6	3,586
13	143	242	1,232	71	1,484	1,489	18,123	3,911	10,228	7,479	7,015	2,106	8,329	3,649	18,304	83,805
14	24	15	42		566		506	845	5,583	1,082	193	280	3,649	888	28	13,701
15		12	197		56	18	656	121	110	585	364	6	18,152	28	2,728	23,033
Total	6,290	544	2,156	71	17,701	2,068	30,010	18,163	65,841	21,546	11,933	3,586	83,650	13,701	23,185	300,445

Source: JICA Study Team

**Table 8.13 Estimated Inter-state Passenger OD in 2030**

(Unit: Person/day)

State Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	1,471				2,169		256	939	17,568	237			543	70		23,253
2			3		165		37	38	510	448			1,299	38	34	2,572
3		3				45	1,291	4	290	417	1,323	181	10,674	171	479	14,878
4													242			242
5	2,169	165			2,962		157	612	32,963	1,204	5	134	4,016	935	56	45,378
6			45			408	107		70		804	39	5,889		29	7,391
7	256	37	1,291		157	107	8,104	2,201	11,296	10,278	3,384	794	87,015	1,293	1,218	127,431
8	940	38	4		612		2,201	3,050	12,061	12,673	13	86	11,980	1,263	166	45,087
9	17,568	510	290		32,963	70	11,296	12,061	142,628	50,589	1,760	502	81,323	24,158	282	376,000
10	237	448	417		1,205		10,278	12,673	50,589		2,321	90	57,598	4,668	1,880	142,404
11			1,324		5	804	3,384	13	1,760	2,321	6,638		33,689	420	586	50,944
12			182		134	39	794	86	502	90		2,696	12,535	879	13	17,950
13	543	1,299	10,670	242	4,016	5,890	87,014	11,980	81,322	57,598	33,689	12,535	65,272	12,721	51,184	435,975
14	70	38	171		935		1,293	1,263	24,158	4,668	420	879	12,721	1,630	39	48,285
15		34	479		56	29	1,218	166	281	1,880	586	13	51,183	39	3,945	59,909
Total	23,254	2,572	14,876	242	45,379	7,392	127,430	45,086	375,998	142,403	50,943	17,949	435,979	48,285	59,911	1,397,700

Remarks: State Code in above tables is as follows:

1:Kachin, 2: Kayah, 3: Kayin, 4: Chin, 5: Sagaing, 6: Tanintharyi, 7: Bago, 8: Magway,

9:Mandalay, 10: Nay Pyi Taw, 11: Mon, 12: Rakhine, 13: Yangon, 14: Shan, 15: Ayeyarwady

Source: JICA Study Team

### (3) Modal Split

The following tables show the results of forecasted passenger ODs, in instances with no projects implemented and instances with all proposed projects implemented. In the case with all proposed projects, the modal share of railway will increase to 30 %.

**Table 8.14 Forecasted Modal Share (Without Case)**

	Number of Trip (1,000 Trip / day)						Share (%)					
	Air	Car	Bus	Rail	IWT	Total	Air	Car	Bus	Rail	IWT	
Y2015	11	78	182	64	11	347	3	23	53	18	3	100
Y2020	23	148	2833	89	12	555	4	27	51	16	2	100
Y2030	113	429	677	162	17	1,398	8	31	48	12	1	100

Source: JICA Study Team

**Table 8.15 Forecasted Modal Share (With Case)**

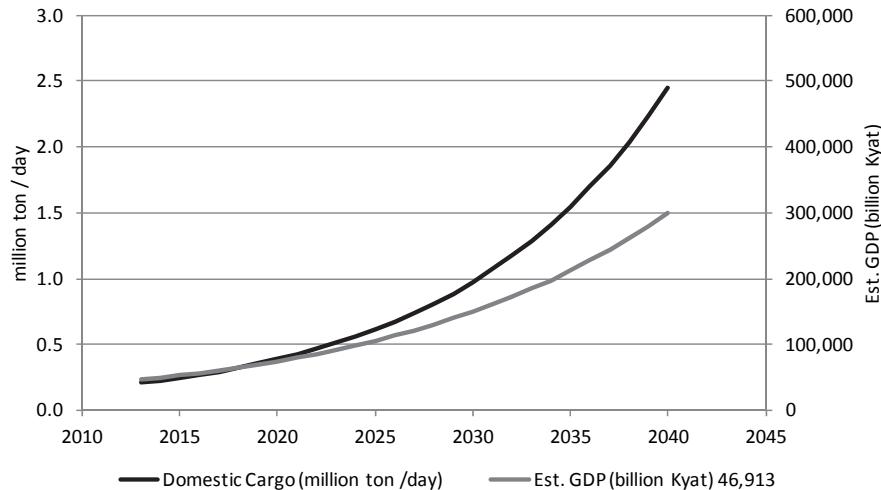
	Number of Trip (1,000 Trip / day)						Share (%)					
	Air	Car	Bus	Rail	IWT	Total	Air	Car	Bus	Rail	IWT	
Y2020	21	147	286	89	13	555	4	26	51	16	2	100
Y2030	87	374	499	423	15	1,398	6	27	36	30	1	100

Source: JICA Study Team

## 8.4.2 Freight Transport

### (1) Trip Generation

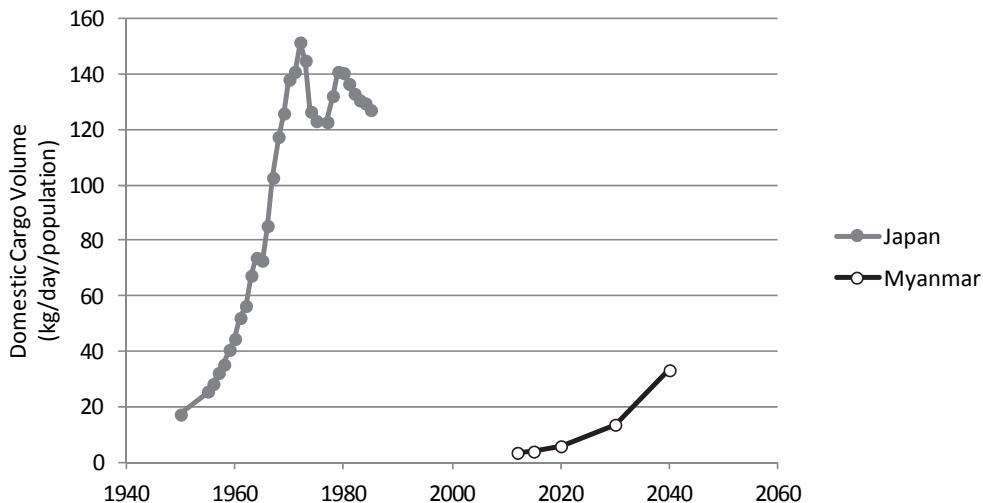
Based on forecasted future GDP and elastic factor of domestic cargo flow, future domestic cargo flow in Myanmar is forecast as shown in Table 8.17. In 2040, the total domestic cargo flow in Myanmar is expected to 11.7 times that of domestic cargo in 2013.



Source: JICA Study Team

**Figure 8.17 Estimated Future Domestics Cargo Flow in Myanmar**

Figure 8.18 indicates the average domestic cargo flow volume per population in Japan and in Myanmar. In 2040, Myanmar's average domestic cargo flow per capita is expected to be 33kg/day/population, which is almost equal to what Japan's flow per capita was in 1957.



Source: JICA Study Team

**Figure 8.18 Forecasted Domestics Cargo Volume per Population in Myanmar**

Based on the calculated control total of future domestic cargo flow volume and elasticity of each commodity, future domestic cargo flow volume by commodity is forecast in Table 8.16.

**Table 8.16 Forecasted Future Domestic Cargo Flow in Myanmar**

(Unit: 1,000 ton/day)

Commodity	2013	2015	2020	2030	2040
1 Live Animal & Animal Products	3.6	1.8	2.4	4.4	7.7
2 Fish and Aquatic Products	7.6	3.2	5.1	13.2	32.6
3 Vegetable and Fruits	14.5	6.7	8.9	15.7	26.5
4 Grain and Grain Products	84.1	41.0	65.7	167.0	408.1
5 Other Agricultural Products (ex. Plantation Product)	40.0	18.7	33.9	110.0	343.6
6 Foodstuff, Beverage and Animal Food	51.7	28.9	40.1	76.3	139.3
7 Petroleum, Oil and Gas	14.4	26.2	43.4	117.3	304.6
8 Coal, Ore, Stone and Sand	18.0	10.6	19.7	67.1	219.7
9 Cement, Construction Material (incl. steel - frame)	55.8	34.2	58.2	166.8	459.7
10 Fertilizer (incl. Urea)	41.1	15.6	20.3	33.7	53.9
11 Garment, Textiles and fabric	10.2	3.9	5.4	9.9	17.4
12 Wood and Wood Products	11.2	6.4	8.4	14.5	24.0
13 Paper and Printed Matter	4.5	1.6	2.1	3.3	5.2
14 Metal and Metal Products (excl. construction material)	5.0	2.6	3.7	7.0	12.7
15 Industrial Material, Chemicals	19.8	8.4	11.8	22.9	42.9
16 Household articles, miscellaneous	62.1	27.0	44.3	116.9	296.9
17 Machinery and Parts, Transportation	25.9	9.7	13.9	28.4	55.7
Total	208.9	246.5	387.3	974.2	2,450.4

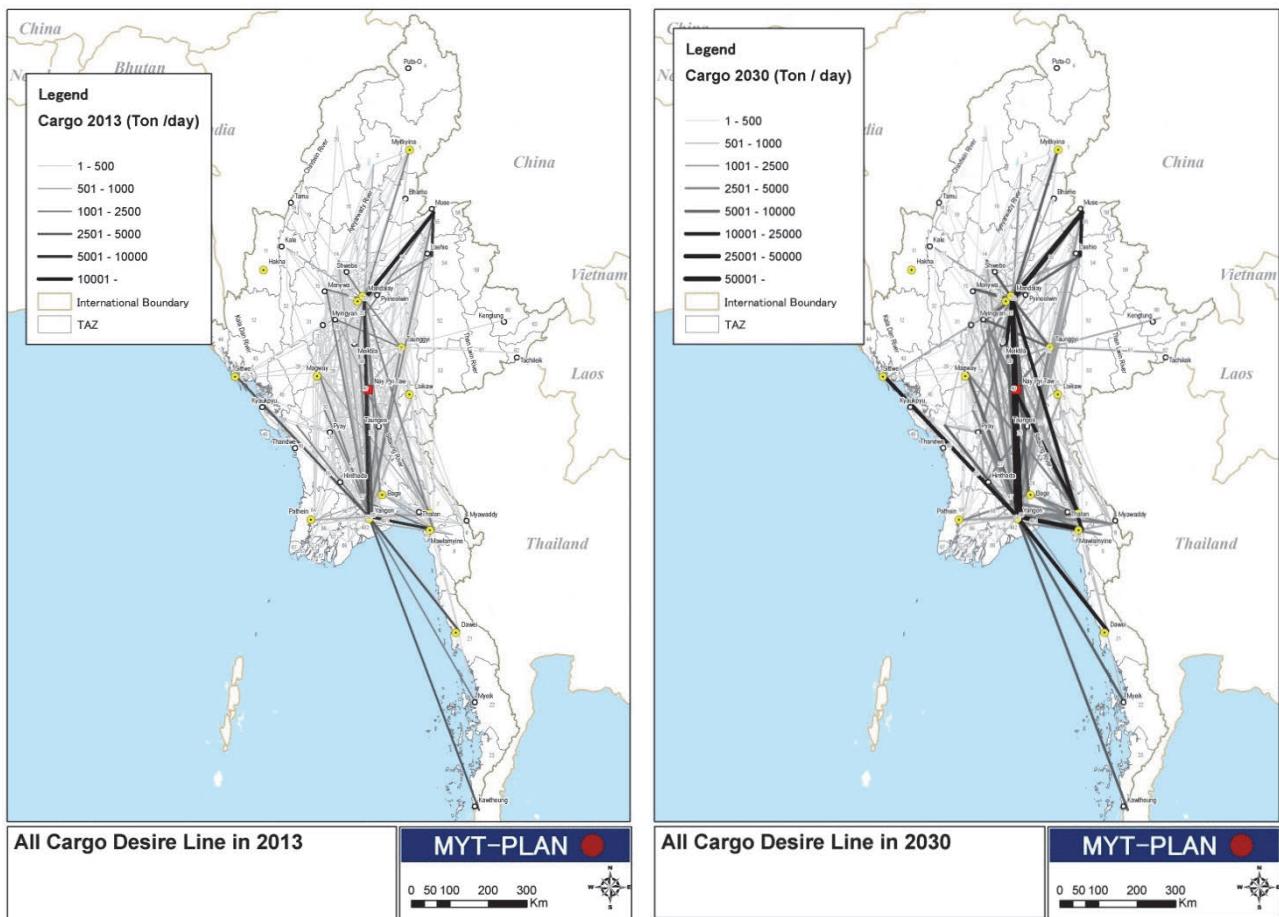
Source: JICA Study Team

## (2) Trip Distribution

Future trip distribution patterns are estimated using the Frater method. Figure 8.19 indicates the Desire Lines as of 2013 and 2030. Table 8.17 and Table 8.18 show estimated inter-state cargo OD in 2013 and 2030, respectively. The inter-state passenger tables indicate a significant increase of inner-state cargo flows in Mandalay region and Yangon region. In addition, the

Final Report

inter-state trips between National Growth Centers (i.e., Mandalay, Yangon, and Nay Pyi Taw) increase greatly.



Study Team

**Table 8.17 Estimated Inter-state Cargo OD in 2013**

(Unit: Ton/day)

State Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	126	0	0	0	98	0	0	6	2,238	0	0	0	39	0	0	2,507
2	0	0	39	0	0	0	0	0	294	0	0	0	10	16	0	359
3	0	0	0	0	63	0	727	842	624	1,392	198	0	2,271	177	266	6,560
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	276	0	0	0	1,067	0	82	98	3,893	275	103	0	2,805	543	1	9,141
6	0	0	0	0	0	0	0	0	0	0	214	0	5,352	0	0	5,566
7	0	0	28	0	307	0	541	469	3,825	361	1,005	358	4,475	907	328	12,603
8	0	0	0	0	8	0	435	633	1,750	58	359	55	5,385	35	95	8,813
9	1,832	485	145	0	5,311	122	2,354	1,151	8,231	2,010	1,943	70	12,298	9,442	207	45,603
10	0	0	1,045	0	98	0	692	8	1,383	0	80	0	1,494	612	41	5,453
11	0	0	195	0	65	294	1,419	30	1,933	47	170	0	1,826	192	0	6,171
12	0	0	0	0	107	0	322	18	362	38	0	53	1,308	0	0	2,208
13	0	1,114	2,301	0	3,102	6,667	5,229	2,819	20,475	2,605	8,281	4,045	2,698	4,300	3,297	66,931
14	0	7	0	0	361	0	623	106	18,481	45	377	22	3,829	7,921	14	31,785
15	0	0	0	0	102	0	963	53	174	217	0	0	3,428	0	247	5,183
Total	2,234	1,606	3,753	0	10,690	7,082	13,387	6,233	63,662	7,047	12,728	4,602	47,218	24,143	4,496	208,884

Source: JICA Study Team

**Table 8.18 Estimated Inter-state Cargo OD in 2030**

(Unit: Ton/day)

State Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	216	0	0	0	142	0	0	3	8,615	0	0	0	51	0	0	9,027
2	0	0	335	0	0	0	0	0	1,591	0	0	0	31	27	0	1,984
3	0	0	0	0	596	0	4,114	3,643	5,049	12,211	1,435	0	16,817	414	1,089	45,368
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	880	0	0	0	1,597	0	354	20	16,213	1,066	213	0	6,073	1,802	0	28,218
6	0	0	0	0	0	0	0	0	0	0	1,293	0	16,157	0	0	17,450
7	0	0	235	0	860	0	1,843	1,294	27,591	1,320	5,239	1,977	21,407	3,963	1,442	67,171
8	0	0	0	0	7	0	1,779	1,127	6,633	235	940	71	17,122	83	338	28,335
9	7,755	2,354	1,800	0	17,927	672	15,004	3,613	51,036	19,790	10,311	457	73,214	42,109	875	246,917
10	0	0	6,903	0	225	0	2,395	33	16,864	0	237	0	9,380	3,123	170	39,330
11	0	0	947	0	90	1,551	7,442	85	14,931	168	445	0	6,886	393	0	32,938
12	0	0	0	0	738	0	1,656	80	1,732	237	0	252	8,085	0	0	12,780
13	0	3,249	10,126	0	6,628	27,449	16,684	5,662	134,096	13,223	31,152	22,084	15,218	10,184	7,298	303,053
14	0	19	0	0	690	0	1,300	250	82,180	173	803	144	9,356	26,188	25	121,128
15	0	0	0	0	223	0	4,802	259	961	1,118	0	0	10,277	0	725	18,365
Total	8,851	5,622	20,346	0	29,723	29,672	57,373	16,069	367,492	49,541	52,068	24,985	210,074	88,286	11,962	972,064

Remarks: State Code in above tables is as follows;

1:Kachin, 2: Kayah, 3: Kayin, 4: Chin, 5: Sagaing, 6: Tanintharyi, 7: Bago, 8: Magway,  
9:Mandalay, 10: Nay Pyi Taw, 11: Mon, 12: Rakhine, 13: Yangon, 14: Shan, 15: Ayeyarwady

Source: JICA Study Team

### (3) Modal Split

The following tables indicate the results of forecasted future domestic cargo OD, with no projects implemented. The modal share is determined by transport time and cost between different modes. Therefore, modal share and OD by mode will change, depending on future transport network improvements.

**Table 8.19 Forecasted Future Cargo Volume in 2015**

(Unit: 1,000 ton/day)

Commodity	Truck	IWT	Railway	Coastal	Total
1 Live Animal & Animal Products	1.7	0.0	0.0	0.0	1.8
2 Fish and Aquatic Products	3.1	0.0	0.0	0.0	3.1
3 Vegetable and Fruits	6.6	0.0	0.0	0.0	6.6
4 Grain and Grain Products	38.7	0.5	0.2	1.5	40.9
5 Other Agricultural Products (ex. Plantation Product)	18.0	0.6	0.0	0.0	18.6
6 Foodstuff, Beverage and Animal Food	22.0	0.5	2.1	4.4	28.9
7 Petroleum, Oil and Gas	8.8	1.7	0.0	15.8	26.2
8 Coal, Ore, Stone and Sand	10.1	0.1	0.4	0.0	10.6
9 Cement, Construction Material (incl. Steel - frame)	30.9	0.7	1.1	1.4	34.1
10 Fertilizer (incl. Urea)	15.5	0.0	0.0	0.0	15.6
11 Garment, Textiles and fabric	3.9	0.0	0.0	0.0	3.9
12 Wood and Wood Products	5.9	0.2	0.2	0.0	6.3
13 Paper and Printed Matter	1.6	0.0	0.0	0.0	1.6
14 Metal and Metal Products (excl. Construction Material)	2.5	0.1	0.1	0.0	2.6
15 Industrial Material, Chemicals	7.6	0.3	0.1	0.4	8.4
16 Household articles, miscellaneous	25.3	1.0	0.4	0.3	27.0
17 Machinery and Parts, Transportation	9.5	0.0	0.1	0.0	9.7
Total	211.7	5.7	4.7	23.8	246.0
Share	86%	2%	2%	10%	100%

Source: JICA Study Team

**Table 8.20 Forecasted Future Cargo Volume in 2020**

(Unit: 1,000 ton/day)

Commodity	Truck	IWT	Railway	Coastal	Total
1 Live Animal & Animal Products	2.3	0.0	0.0	0.0	2.4
2 Fish and Aquatic Products	5.0	0.0	0.0	0.0	5.1
3 Vegetable and Fruits	8.8	0.0	0.0	0.0	8.9
4 Grain and Grain Products	62.7	0.6	0.3	2.1	65.7
5 Other Agricultural Products (ex. Plantation Product)	32.8	1.0	0.0	0.0	33.8
6 Foodstuff, Beverage and Animal Food	31.7	0.3	2.9	5.2	40.1
7 Petroleum, Oil and Gas	15.6	3.0	0.0	24.7	43.3
8 Coal, Ore, Stone and Sand	18.7	0.2	0.7	0.0	19.6
9 Cement, Construction Material (incl. Steel - frame)	53.5	0.7	2.0	2.0	58.2
10 Fertilizer (incl. Urea)	20.2	0.0	0.0	0.0	20.2
11 Garment, Textiles and fabric	5.3	0.0	0.0	0.0	5.3
12 Wood and Wood Products	7.9	0.3	0.2	0.0	8.4
13 Paper and Printed Matter	2.0	0.0	0.0	0.0	2.0
14 Metal and Metal Products (excl. Construction Material)	3.4	0.1	0.1	0.0	3.6
15 Industrial Material, Chemicals	10.4	0.1	0.2	0.5	11.2
16 Household articles, miscellaneous	41.9	1.3	0.6	0.4	44.2
17 Machinery and Parts, Transportation	13.7	0.0	0.1	0.1	13.9
Total	336.0	7.7	7.3	34.9	386.0
Share	87%	2%	2%	9%	100%

Source: JICA Study Team

**Table 8.21 Forecasted Future Cargo Volume in 2030**

(Unit: 1,000 ton/day)

Commodity	Truck	IWT	Railway	Coastal	Total
1 Live Animal & Animal Products	4.3	0.1	0.0	0.0	4.3
2 Fish and Aquatic Products	13.0	0.0	0.0	0.0	13.0
3 Vegetable and Fruits	15.5	0.0	0.0	0.0	15.6
4 Grain and Grain Products	161.1	0.8	0.6	4.4	166.9
5 Other Agricultural Products (ex. Plantation Product)	107.4	2.4	0.1	0.0	109.9
6 Foodstuff, Beverage and Animal Food	62.1	0.1	5.2	8.9	76.2
7 Petroleum, Oil and Gas	46.6	6.6	0.0	63.9	117.1
8 Coal, Ore, Stone and Sand	64.1	0.4	2.4	0.0	66.9
9 Cement, Construction Material (incl. Steel - frame)	158.2	0.4	4.0	4.2	166.7
10 Fertilizer (incl. Urea)	33.6	0.0	0.1	0.0	33.7
11 Garment, Textiles and fabric	9.8	0.0	0.0	0.0	9.8
12 Wood and Wood Products	13.9	0.4	0.1	0.0	14.4
13 Paper and Printed Matter	3.2	0.0	0.0	0.0	3.2
14 Metal and Metal Products (excl. Construction Material)	6.7	0.1	0.1	0.0	6.9
15 Industrial Material, Chemicals	21.1	0.0	0.4	0.9	22.3
16 Household articles, miscellaneous	113.0	1.5	1.5	0.8	116.8
17 Machinery and Parts, Transportation	28.1	0.0	0.1	0.1	28.3
Total	861.6	12.7	14.6	83.1	972.1
Share	89%	1%	2%	9%	100%

Source: JICA Study Team

### 8.4.3 Traffic Assignment

The following tables show the results of traffic assignment, in instances with no projects implemented and instances with all proposed projects implemented. In the case with all proposed projects, the modal share of railway will increase to 28 %.

**Table 8.22 Forecasted Modal Share (Without Case)**

	1,000 Person * km / day					
	Air	Car	Bus	Rail	IWT	Total
2015	6,469	21,628	65,278	15,879	2,737	111,992
2020	12,568	40,201	86,532	18,011	1,389	158,701
2030	57,151	112,688	244,665	33,920	3,560	451,983

	Modal Share				
	Air	Car	Bus	Rail	IWT
2015	6%	19%	58%	14%	2%
2020	8%	25%	55%	11%	1%
2030	13%	25%	54%	8%	1%

Source: JICA Study Team

**Table 8.23 Forecasted Modal Share (With Case)**

	1,000 Person * km per day					
	Air	Car	Bus	Rail	IWT	Total
Y2020	11,728	39,800	87,817	18,057	1,394	158,795
Y2030	44,957	96,736	178,314	125,684	3,139	448,830

	Modal Share (Person * km per day)				
	Air	Car	Bus	Rail	IWT
Y2020	7%	25%	55%	11%	1%
Y2030	10%	22%	40%	28%	1%

Source: JICA Study Team

## 8.5 International Air Passenger Forecast

### 8.5.1 Correlation between GDP and Air Passenger Volume in Myanmar

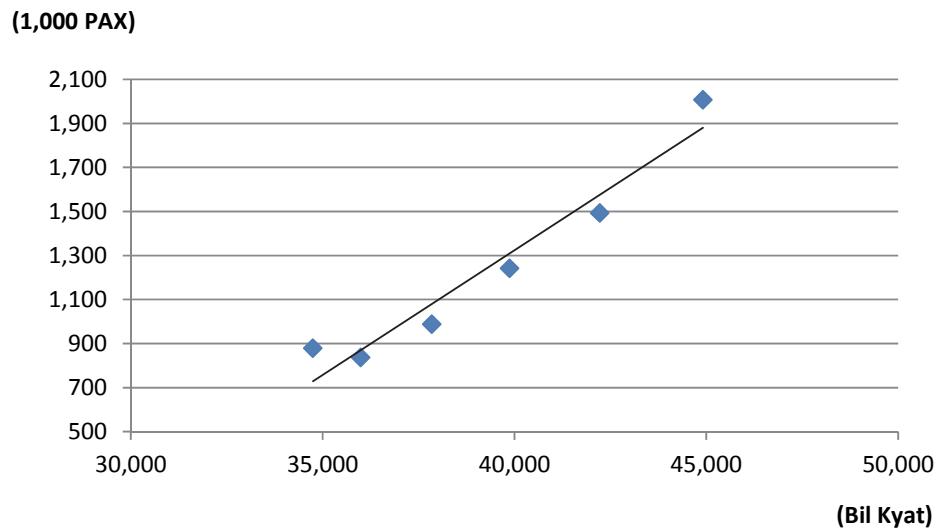
In general, the number of international passengers will increase or decrease in response to the degree of economic activity in the country. As seen in Figure 8.20, Myanmar is not an exception to this feature of economic growth. The horizontal axis (x-axis) represents Myanmar's GDP in billion Kyat (at 2005 constant prices) from 2007 to 2012, while the vertical axis (y-axis) represents the number of international air passengers in Myanmar.

The correlation coefficient between the two parameters is calculated at 0.94, which indicates a strong liner relation between the two. Accordingly, a simple liner regression model is developed as follows:

$$Y = 113.2 X - 324,909.3 \dots \dots \dots (1)$$

Where,      X: GDP in billion Kyat.

Y: International air passenger in Myanmar



Source: IMF (GDP), DCA (Passenger Volume)

**Figure 8.20 Relation between GDP and International Air Passenger in Myanmar**

### 8.5.2 International Air Passenger Forecast

By extrapolating the future GDP set by the Government of Myanmar into the formula (1) above, the number of future international air passengers in Myanmar is estimated. The existing number of international passengers was 2.0 million passengers per annum (MPA) in 2012, though this will increase to 14 MPA in 2030, according to the formula.

Assuming that Yangon International Airport's (YIA) existing share (96%) of total international passenger remains constant, the number of international passengers at YIA (or Yangon area) could be as much as 13.6 MPA, which exceeds the YIA airport terminal capacity, even after the proposed improvement (6.0MPA).

**Table 8.22 International Air Passenger Forecast in Myanmar**

(Unit: 1,000 Passengers)

	Y2012	Y2015	Y2020	Y2030
International Air Passenger	2,007	2,943	5,499	14,239
Annual Average Growth Ratio	-	14%	13%	10%

Source: JICA Study Team

**Table 8.23 Breakdown of Forecasted International Air Passenger in Myanmar**

(Unit: 1,000 Pax)

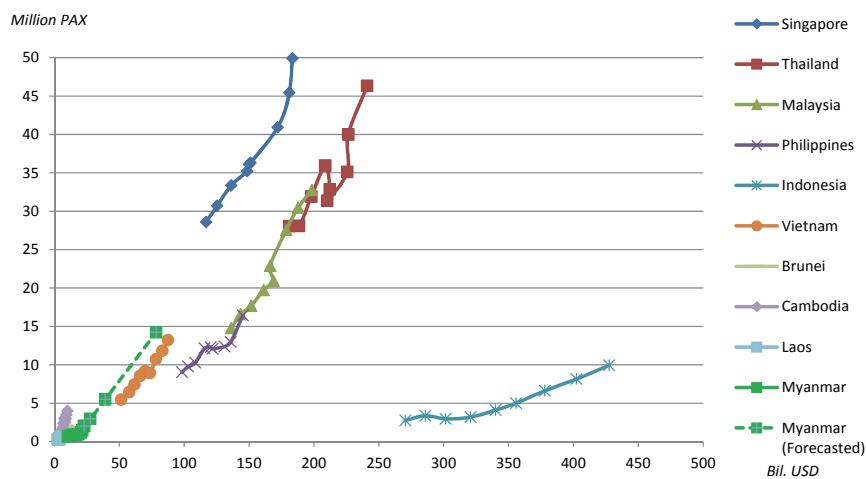
	Y2012	Y2015	Y2020	Y2030
Total International Air Passenger	2,007	2,943	5,499	14,239
Yangon Airport	1,929 (96%)	2,829	5,285	13,686
Mandalay Airport	78 (4%)	114	214	553

Source: JICA Study Team

### 8.5.3 International Air Passengers in other ASEAN Countries

Figure 8.21 shows GDP (x-axis) and international air passenger volume (y-axis) of ASEAN member countries from 2004 to 2012. The Figure shows how Singapore's share of international passengers is exceptionally high, while Indonesia's passenger numbers are lower than other countries, in terms of international air passenger ratio against the GDP.

Myanmar appears to be following the pattern of passenger numbers from Vietnam, Malaysia and Thailand, with Myanmar's estimated international air passengers in 2030 will be close to that of Vietnam and Philippines, as of 2012.



Source: JICA Study Team

**Figure 8.21 International Air Passenger Volume and GDP among ASEAN Countries**

## 8.6 International Cargo Movement

### 8.6.1 Boarder Trade between Thailand and Myanmar

Table 8.29 shows international cargo volumes as a result of cross-border trade between Thailand and Myanmar. The international cargo volume exported through the Three Pagodas Pass is significant, though the cargo imported through the Three Pagodas Pass is negligible. The primary exported commodities via the Three Pagodas Pass are “mineral fuels, oils, waxes and bituminous”. The volume of exports via other border trading points is marginal, in comparison with that of the Three Pagodas Pass.

By comparison, Mae Sot is the major importing point from Thailand and reaches more than 6 million tons per year.

**Table 8.26 Cargo Volume through Boarder Trade**

(Unit: 1,000 Ton)

Year	Import				Export			
	Mae Sot	Three Pagodas	Mae Sai	Total	Mae Sot	Three Pagodas	Mae Sai	Total
2008	379	8	145	533	98	10,751	41	10,891
2009	598	15	220	834	168	8,570	41	8,778
2010	618	47	305	969	97	8,913	72	9,083

Source: The Customs Department Thailand

**Table 8.27 Imported Cargo Volume by Commodity by Boarder Point in 2010**

(Unit: 1,000 Ton)

Mae Sot		Three Pagodas		Mae Sai	
Commodity	Volume	Commodity	Volume	Commodity	Volume
SALT, SULPHUR, EARTH & STONE, LIME & CEMENT	186	BEVERAGES, SPIRITS & VINEGAR	10	SALT, SULPHUR, EARTH & STONE, LIME & CEMENT	143
MINERAL FUELS, OILS, WAXES & BITUMINOUS SUB	90	PREPS OF VEGS, FRUITS, NUTS, ETC.	5	MINERAL FUELS, OILS, WAXES & BITUMINOUS SUB	45
IRON & STEEL	46	MINERAL FUELS, OILS, WAXES & BITUMINOUS SUB	5	BEVERAGES, SPIRITS & VINEGAR	33
BEVERAGES, SPIRITS & VINEGAR	43	ANIMAL OR VEGETABLE FATS, OILS & WAXES	4	IRON & STEEL	12
ANIMAL OR VEGETABLE FATS, OILS & WAXES	34	SALT, SULPHUR, EARTH & STONE, LIME & CEMENT	4	ARTICLES OF STONE, PLASTER, CEMENT, ASBESTOS, MICA OR SIMILAR MATERIALS	11
Others	219	Others	18	Others	60
Total	618	Total	47	Total	305

Source: The Customs Department Thailand

**Table 8.28 Exported Cargo Volume by Commodity by Boarder Point in 2010**

(Unit: 1,000 Ton)

Mae Sot		Three Pagodas		Mae Sai	
Commodity	Volume	Commodity	Volume	Commodity	Volume
WOOD & ARTICLES OF WOOD, WOOD CHARCOAL	52	MINERAL FUELS, OILS, WAXES & BITUMINOUS SUB	8,899	SALT, SULPHUR, EARTH & STONE, LIME & CEMENT	59
EDIBLE VEGETABLES	23	WOOD & ARTICLES OF WOOD, WOOD CHARCOAL	9	WOOD & ARTICLES OF WOOD, WOOD CHARCOAL	5
LIVE ANIMALS	5	VEGETABLE PLAITING MATERIALS	3	ED. FRUITS & NUTS, PEEL OF CITRUS/MELONS	3
FISH & CRUSTACEANS	4	ORES SLAG & ASH	1	EDIBLE VEGETABLES	2
FURNITURE, BEDDING, CUSHIONS, LAMPS & LIGHTING FITTINGS NESOI, ILLUMINATED SIGNS, NAMEPLATES & THE LIKE, PREFABRICATED BUILDINGS	4	LIVE ANIMALS	0	VEGETABLE PLAITING MATERIALS	1
Others	10	Others	0	Others	2
Total	97	Total	8,913	Total	72

Source: The Customs Department Thailand

### 8.6.2 International Sea Cargo Demand

A demand forecast of international sea cargo is available in “The Preparatory Survey for the Project for Expansion of Yangon Port in Thilawa Area” and “Preliminary Study on National Port Development Plan in Myanmar”.

The total cargo and container cargo throughput in 2030 is forecast to be 90 million tons and 8.1 million TEU, respectively.

**Table 8.27 Future Cargo Demand Forecast for Whole Myanmar**

(Unit: 1000 Ton)

Case	Y2011	Y2015	Y2020	Y2025	Y2030
High Case	25,696	29,607	42,999	62,221	90,000
Low Case	25,696	28,321	36,689	47,417	61,300

Source: JICA Study Team

**Table 8.28 Future Container Cargo Demand Forecast for Whole Myanmar**

(Unit: 1000 TEU)

Case	Y2010	Y2015	Y2020	Y2025	Y2030
High Case	335	892	1,986	4,014	8,100
Low Case	335	853	1,700	3,064	5,500

Source: Year 2010 – 2025: “The Preparatory Survey for the Project for Expansion of Yangon Port in Thilawa Area”, Year 2030: “Preliminary Study on National Port Development Plan in Myanmar”

### 8.6.3 Cargo Demand Forecast for Yangon Port

The existing share of cargo throughput in 2010 at Yangon Ports, including Thilawa, is 91.5 percent. Assuming this share continues in the future, the total cargo throughput at the Yangon Ports will be 57 million tons per year in 2025 (refer to Table 8.29).

Container cargo in 2025 is estimated at 41 million tons (74% of the total), which is equivalent to 3 to 4 million TEU, as shown in Table 8.28.

**Table 8.31 Future Cargo Demand Forecast for Yangon Port**

(Unit: 1,000 Ton)

Port	Category	Commodity	Y2010	Y2025
Yangon	Foreign	General Cargo	17,372	5,441
		Vehicle		396
		Grain		1,000
		Petroleum		7,285
		Container		41,063
		Total		55,185
	Coastal		1,067	2,000
Sub-Total			18,439	57,185
Others			1,718	5,036
Total			20,157	62,221

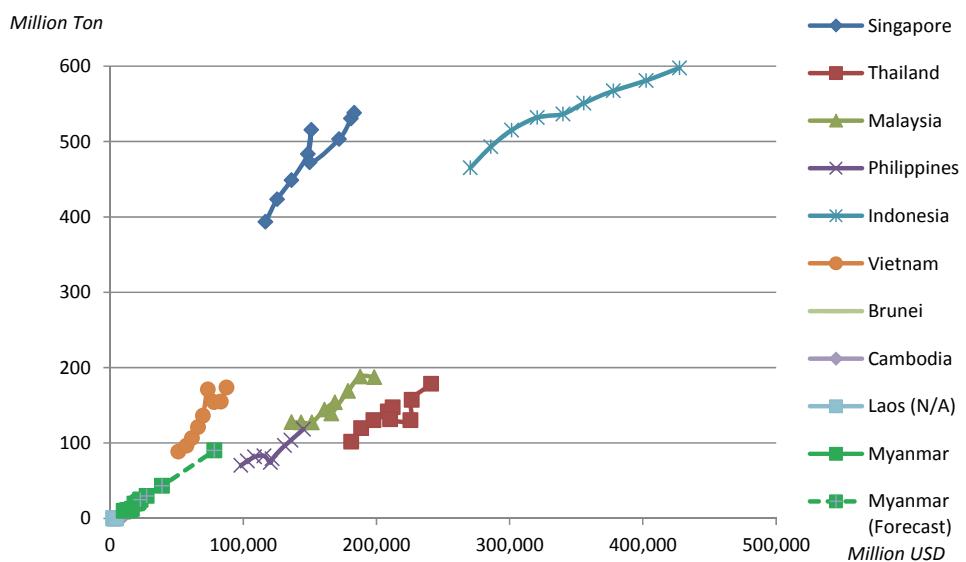
Source: The Preparatory Survey for the Project for Expansion of Yangon Port in Thilawa Area

### 8.6.4 International Sea Cargo among ASEAN Countries

Figure 8.22 illustrates the GDP (x-axis) and the international cargo throughput (y-axis) of the ASEAN member countries, from 2004 to 2011. The Figure shows how Singapore's share of international cargo throughput is exceptionally high, while Indonesia's volume data is lower than other countries, in terms of international cargo throughput ratio against the GDP.

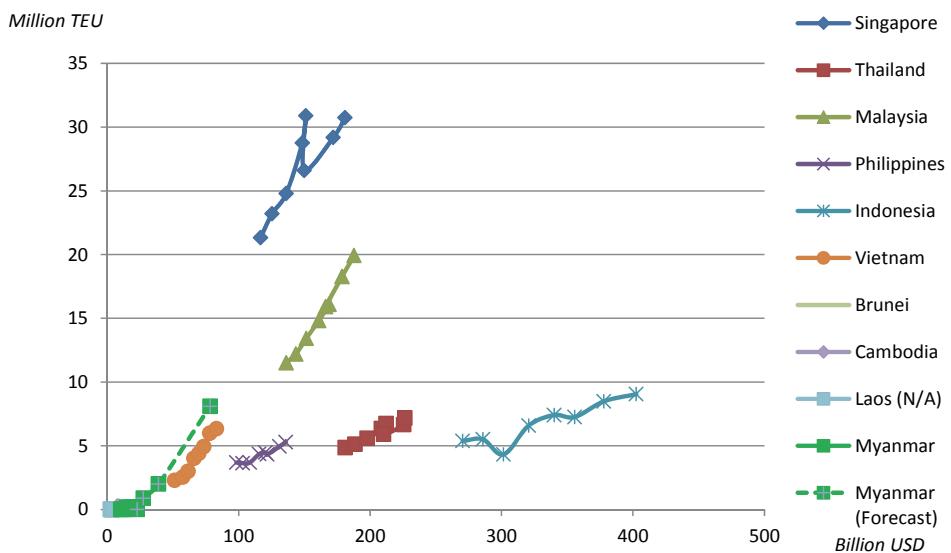
Myanmar appears to be following the pattern of international cargo throughput numbers from Vietnam and Malaysia, with Myanmar's estimated international sea cargo will be close to that of Vietnam, by 2015.

Figure 8.23 shows the comparison of container cargo volumes among ASEAN countries, from 2004 to 2012. It is forecast that the container cargo volume in Myanmar in 2030 will be close to that of Thailand, as of 2011.



Source: JICA Study Team

**Figure 8.22 Comparison between International Sea Cargo Volume and GDP**



Source: JICA Study Team

**Figure 8.23 Comparison between Container Cargo Volume and GDP**

## Chapter 9 Transport Vision, Policy, Strategy and Action

---

### **9.1 Existing Sub-sector Policy Statements**

This Chapter summarizes the important policy statements contained in government documents that are needed to formulate transport sub-sector policy in Myanmar.

During Myanmar's previous administration, the Committee for Safe and Smooth Transport Facilitation ensured policy integration and the development of related transport modes. However currently, there has been no explicit integration of transport policies and transport Ministries and departments are independently formulating sector policies and strategies.

#### **9.1.1 Overview of Existing Transport Policies**

##### **(1) MOT Policy**

Myanmar adopted a market-oriented economic development policy in 1989 to accelerate its national and regional economic growth. The Ministry of Transport (MOT), which is responsible for civil aviation and water transportation, established nine transport policy statements to support this economic development policy, as follows:

- To develop and fully utilize transport capacities to contribute towards the realization of an economically strong, modern and developed nation;
- To fulfill transport requirements, and to extend and maintain the transport infrastructure to be able to fully support increased production from other economic sectors and meet growing public and social demands;
- To ensure smooth and secure domestic and international transport systems as well as contribute towards the development of border areas and national races and the development of tourism;
- To enable all-weather river transportation through the maintenance and preservation of natural resources;
- To develop air and maritime transport infrastructures, in line with international standards for environmental protection;
- To enhance the transport sector through human resources development and upgrade expertise in management and advancing modern technology;
- To abide by international conventions, acts, laws, rules and regulations with respect to the transport sector;
- To develop domestic and international transportation and actively take a key role in the implementation of a national multi-modal transport system; and
- To plan for implementation of implement national, sub-regional and international transport networks.

### Civil Aviation Sector

In addition to the MOT policy, the Department of Civil Aviation adopted the following strategic objectives, to develop a better civil air transport environment, in line with the market-oriented economic vision:

- To ensure aviation safety and security are priorities;
- To promote infrastructure development;
- To allow the establishment of new air carriers, subject to demand and supply in the market;
- To allow the establishment of efficient air transport auxiliary services;
- To promote Public-Private Partnership (PPP) in the air transport industry;
- To develop fair competitions among air transport services;
- To encourage cooperation between air carriers;
- To enhance competitiveness of national air carriers;
- To foster air freight services;
- To support the development of tourism and trade;
- To continue pursuing gradual liberalization of air transport towards an open sky policy;
- To enhance the capacity of the aviation regulatory body;
- To create employment opportunities for nationals; and
- To develop environmentally-friendly air transport.

### **(2) MRT Policy**

The Ministry of Rail Transportation (MRT), which is responsible for railway and road transport administration, established seven transport policy statements as follows:

- To improve passenger and freight transport capability, in order to support the socio-economic development of the country in a sustainable and environmental friendly manner;
- To improve road and rail transport, including an urban transport network, so as to meet passenger and freight demand;
- To transform the state-owned road transport enterprise into a Public-Private Partnership, in a phased approach;
- To work with various stakeholders to improve traffic regulations and road safety;
- To regulate commercial licenses for passenger and freight transport services, so as to foster countrywide development;
- To enhance the capacity and ability of staff, by providing regular training for sustainable development; and
- To use all of the existing resources, including lands owned by MRT, in order to increase financial capacity of MRT.

### Rail Sector

Myanmar Railway adopted the following policy objectives to ensure safe, comfortable and punctual train operation:

- To ensure convenience for all passengers and to bring satisfaction to freighters;
- To keep the number of accidents at a minimum and to ensure total prevention of accidents;
- To have all trains running on time;
- To have all railways tracks constructed to required specifications and standards in order that they will withstand the stress and strain of constant traffic;
- To increase income and to keep expenses to a minimum;
- To promote efficiency in the management of existing staff, facilities and systems;
- To run all railways yards and workshops to full capacity;
- To keep locomotive and rolling stock break-downs to a minimum;
- To boost the design and production of machines, accessories and spare parts; and
- To never lose sight of staff privileges and welfare.

### **(3) MOC Policy for Road Sector**

The Department of Public Works adopted the following development directions, emphasizing that the extension of the road network will serve the entire country:

- Union Highway Network Master plan with 36 roads from north-south and 45 roads from east-west will cut-across 7 Regions and 7 States;
- Priorities are given to this development in each and every region, increasing contact and building relationships in these areas, and building reconciliation opportunities among national races;
- Extend and upgrade the existing roads, mostly running north to south, and construct new roads running from east to west across the Union; and
- Facilitate and promote economic activities, particularly trade and tourism, between Myanmar and other countries.

#### **9.1.2 Initial Observation of Existing Transport Policies**

As noted above, Myanmar's transport-oriented ministries and agencies have prepared specific transport policies and objectives to help support Myanmar's long-term economic development. These transport policies provide sufficient policy cover within the Ministries to extend cover beyond infrastructure development to include private sector participation, environmental considerations, issues of international cooperation and the application of standards. However, while comprehensive, there are important initiatives that these policies do not cover as well as some weak statements in terms of neighboring country modern transport policies.

- This Report's analysis finds that there has been little coordination among the transport related ministries and agencies in developing transport policies or implementing related transport projects and actions. For example, the important role of multi-modal transport, which emphasizes connectivity and seamless transport between different modes of transport, is not addressed in existing transport policies.

- The existing transport policies have not been translated into concrete strategies and actions, with priority considerations or timeframes. In addition, the proposed transport projects have not tested their feasibility, in terms of efficiency or social and economic benefits to the country.
- Monitoring, post-evaluation and feed-back mechanisms on the completed or ongoing transport projects appear to be weak, likely due to there being no organization or authority assigned to monitor these projects, in a comprehensive manner. In addition, few numerical indicators have been set to permit authorities to understand if or how projects and action milestones are achieved.
- The government has clearly identified priorities within the transport sub-sectors, although these are not identified for all modes of transport. Since the government budget for transport infrastructure development is predictably limited, addressing all priorities across all modes in the sub-sector will require a consolidated or integrated approach.

## 9.2 Transport Sector Initial Assessment by ADB

The initial assessment of Myanmar's transport sector (October 2012) was prepared by the Asian Development Bank (ADB) and provides an overview of key challenges, opportunities and priority transport needs, as of 2012. This assessment was prepared to provide background information to support ADB's interim country partnership strategy in Myanmar. This assessment is also useful for the JICA Study Team to identify key strategic and priority issues and corresponding strategies and can be made more useful to JICA by including updated 2013 information and data, obtained through consultation with specialists from the transport sector in Myanmar.

ADB's assessment conducts a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis of the transport sector in Myanmar, as shown in Table 9.1. Strengths and Weaknesses identify current conditions and issues in the sector, while Opportunities and Threats identify issues in the near future.

ADB's assessment summarizes the core issues in the Myanmar's transport sector, as follows:

- (i) *the fragmented and overlapping institutional structures for managing the sector;*
- (ii) *the lack of an overall transport sector strategy;*
- (iii) *the related lack of rigorous cost-benefit economic analysis in the decision-making process for prioritizing infrastructure investments;*
- (iv) *the need for capacity building using as a base the reasonably robust and committed institutions and officials at the subsector level;*
- (v) *the limited role of private sector; and*
- (vi) *the poor state and very low coverage of the lower level road network, resulting in local communities having inadequate access to the core road network and basic services.*

And in summary,

*"the principal sector issues are the fragmented and overlapping institutional management structure, the lack of an overall transport strategy and system for prioritizing infrastructure investment, the need for capacity building, and the serious inadequacy of the lower level road network."*

This SWOT analysis, together with the identified core issues, can help guide the development

---

of MYT-Plan policies and strategies. The MYT-Plan can capitalize on the SWOT findings by using strengths to counter the threats and capture the opportunities, while addressing or remedying weaknesses, as shown in Table 9.2.

**Table 9.1 Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis of the Myanmar Transport Sector**

	PRESENT	FUTURE	
STRENGTHS	<ul style="list-style-type: none"> <li>Sweeping political reforms are leading to resumption of multilateral and bilateral development assistance for Myanmar's transport sector;</li> <li>Transport sector is expected to be a priority area of assistance for development partners;</li> <li>Staff in the transport sector are committed and competent, and operate relatively effectively under difficult circumstances;</li> <li>Transport systems are in a poor state, providing a relatively "clean slate" for formulating a sustainable transport strategy and policies to meet future transport demand;</li> <li>National integration policy has resulted in primary road network extending to most areas of the country;</li> <li>There is little encroachment on highway rights-of-way;</li> <li>Existing rail network connects most regions of the country; and</li> <li>There is an extensive navigable river network with inland water transport services.</li> </ul>	<ul style="list-style-type: none"> <li>Political and economic environment is improving rapidly;</li> <li>Basic subsectors structure are functional;</li> <li>Staff resources of the responsible transport ministries and agencies are committed and work effectively;</li> <li>Extensive assistance is required in all areas of the transport sector; and</li> <li>Considerable scope exists for public-private-partnership initiatives.</li> </ul>	OPPORTUNITIES
WEAKNESSES	<ul style="list-style-type: none"> <li>The institutional structure is fragmented and there is a lack of clarity in defining roles and responsibilities;</li> <li>A comprehensive and integrated transport development strategy is lacking;</li> <li>State enterprises operating on a non-commercial basis dominate the transport sector;</li> <li>SOEs in civil aviation, ports, railways, and bus services are operating inefficiently;</li> <li>Many transport prices are centrally set and controlled;</li> <li>Budgetary subsidies compensate for low transport fares, distorting financial management; and</li> <li>There is a lack of familiarity with international best practices for procurement, financial management, and environmental and social safeguards.</li> </ul>	<ul style="list-style-type: none"> <li>Political reform fails to be sustained or occurs more slowly than envisaged;</li> <li>Political reform occurs too quickly, creating a vacuum in policy and regulatory control;</li> <li>Economic growth fails to materialize as quickly as expected;</li> <li>Subsector agencies are unable or unwilling to transition from subsector operators to subsector regulators and managers;</li> <li>Externally supported transport investments are uncoordinated, and</li> <li>Institutional restructuring and capacity building is not addressed.</li> </ul>	THREATS

Source: Myanmar: Transport Sector Initial Assessment (ADB, Oct 2012)

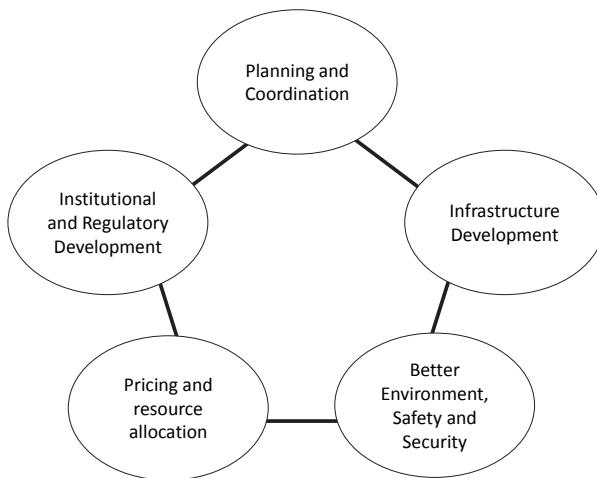
**Table 9.2 Indicative Strategies for MYT-Plan**

		<b>In Response to Threats</b>	<b>To Capture Opportunities</b>
<b>Strategy Elements</b>	<b>Capitalizing on Strengths</b>	<ul style="list-style-type: none"><li>• Assemble a council of development partners to agree on a coordinated (and targeted) approach – for example, "Transport Sector Coordination Meeting", initiated by JICA;</li><li>• Identify and support reform champions in each transport sub-sector agencies in the adoption and execution of a comprehensive transport strategy and policies; and</li><li>• Focus on upgrading road, rail and river networks, rather than expansion.</li></ul>	<ul style="list-style-type: none"><li>• Harness Official Development Assistance (ODA) in the formulation of a comprehensive transport strategy and policy, and in capacity building:MYT-Plan by JICA, YUTRA by JICA, Road Master Plan by KOICA, etc.; and</li><li>• Finetune ongoing PPP initiatives, and apply these in a calibrated manner to other sectors.</li></ul>
	<b>Remedying Weaknesses</b>	<ul style="list-style-type: none"><li>• Formulate a comprehensive and integrated transport development strategy, to serve as the rallying point and common agenda for the different agencies;</li><li>• Establish a Transport Coordinating Council, composed of the Ministers of transport and transport-related agencies;</li><li>• Privatize SOEs engagement in service provisions, starting in areas with private sector competitors; and</li><li>• Utilize PPP to rapidly infuse international best practices, and to regenerate privatized SOEs.</li></ul>	<ul style="list-style-type: none"><li>• Gradual adjustment in transport prices, to reflect factor costs and current conditions; and</li><li>• Tap ODA grants for rapid capacity-building and training of reform champions.</li></ul>

Source: JICA Study Team

### 9.3 Key areas of consideration and corresponding issues

In addition to ADB's overall assessment of the transport sector and additional review and analysis of existing conditions in key transport sectors (e.g. road and road transport, rail, air, maritime/inland waterway), this Report identifies a series of strategic or cross-sectoral issues in five key areas, as shown in Figure 9.1.



**Figure 9.1 Key Areas of Consideration**

(1) Planning and Coordination:

- Fragmented planning and poor coordination among transport infrastructure institutions, agencies and operators at national, regional and city/local levels lead to overlaps and/or shortfalls
- Integration of strategic transport and spatial development initiatives requires strengthening
- Efficient planning of transport infrastructure in rural regions is impacted by national security considerations

(2) Infrastructure Development:

- Coordination is lacking within and among the transport networks, this hinders efficient travel and modal transfer
- The lack of capacity and efficiency in most sectors is due to the low standard/quality of existing infrastructure and inadequate facilities and equipment

(3) Institutional and Regulatory:

- The roles of government and private sector in supply, management and maintenance of transport infrastructure and services needs clarifying
- Inadequate human resources and data at national, regional and city levels for transport planning and related land use development/spatial planning restricts implementation and enforcement
- Legislative and regulatory frameworks for transport infrastructure provision and operation need updating

(4) Pricing and Resource Allocation:

- Investment returns/cost recovery in the transport sector is exacerbated by a high proportion of poverty-level households, especially in rural and agricultural regions
- Impacts of transport investments on spatial development are not well understood,

including use of transport infrastructure to stimulate sustainable development.

(5) Community, Society and the Environment:

- Absence of social and environmental considerations in planning and design of transport infrastructure
- Safety standards and enforcement mechanisms, especially highway safety standards, need overhauling
- Use of inefficient transport technologies in transport sector exacerbates energy consumption
- Environmental assessment techniques, data and skills are not well developed, monitored or enforced

#### **9.4 Overall Policy Priorities**

In order to frame appropriate policies to address these strategic issues, a number of policy priorities have been developed, taking into account the Government and transport sector's Ministry and Agency programs and commitments.

Identified priorities include:

- Improve coordination among transport sector ministries and agencies;
- Improve coordination among transport sector and spatial planning and development ministries and agencies;
- Enhance mechanisms for integrated planning of transport and other sector development Programs, projects and proposals;
- Enable integration of multi-modal transport networks and services in strategic corridors;
- Ensure efficient use, upgrading and maintenance of existing transport assets before major new investments are committed;
- Enhance opportunities for private sector involvement in the provision of transport infrastructure and services;
- Provide for the equitable use of investment funds to improve transport facilities and services in rural and agricultural regions, as well as cross-border locations;
- Prioritize safety and security of transport and transport services in all states and regions;
- Emphasize the importance of environmental considerations in transport planning processes to improve potential for successful implementation;
- Adapt appropriate technologies relative to the stage of development of the country to provide future sustainable transport solutions and help reduce carbon emissions;
- Institute long term training programs in transport sector planning, management and operations to improve human resource capabilities; and
- Adopt appropriate national and international regulatory frameworks consistent with Government social and economic aspirations and human resource capabilities for their implementation and enforcement.

## **9.5 Transport Sector Vision (MYT-Plan draft)**

The Ministry of Transport (MOT) should begin to develop a set of transport policies to match the Government's Social and Economic Reform Program and its efforts to promote a market-oriented economy to accelerate national and regional economic growth.

The JICA Study Team has expanded the MOT's national transport policy to incorporate policies for the road and rail sub sectors, so it may address the full range of transportation issues and requirements in Myanmar and the wider ASEAN region. Based on this comprehensive policy framework, a Vision for the transport sector has been proposed by the JICA Study Team as follows:

*'To develop an efficient, modern, safe, and environmentally-friendly transportation system in a coordinated and sustainable manner that embraces all transport modes for the benefit of the country and people of Myanmar'.*

## **9.6 Updated Transport Policies (MYT-Plan draft)**

Myanmar's transport sector policies should incorporate the following five key elements: (1) better planning and coordination, (2) infrastructure development, (3) better environmental, safety and security considerations, (4) institutional and regulatory development, and (5) reasonable transport pricing and secure budgeting, for the benefit of the country and the people of Myanmar. The proposed (updated and expanded) list of transport policies are as follows:

(1) Better Planning and Coordination:

- To prepare and periodically update the transport statistics for better planning work;
- To establish explicit and systematic coordination mechanisms among transport-related stakeholders and further strengthen these in order to achieve higher investment efficiency;
- To inform Myanmar's citizens and international societies of future transport development plans and corresponding actions in order to encourage the private sector's investment and to attract investors more widely;
- To enable community/public participation in transport planning and project design, as well as in environmental and social impact assessments; and
- To strengthen and increase human resources in the transport planning and administration sector in order to monitor, review and update integrated transport policies, strategies, and corresponding projects and actions needed to meet changing domestic and international transport needs.

(2) Infrastructure Development:

- To maintain and improve the existing transport infrastructure, and to extend them in order to fully support increasing economic activities and meet growing public and social transport needs;
- To maximize the use of transport capabilities in the road, rail, air, maritime and inland waterway sectors to save costs in the transport infrastructure sector and achieve higher investment efficiencies;
- To strengthen connectivity along the designated development corridors and contribute to urban and regional development along the corridors.
- To ensure connectivity of higher capacity and faster speeds between major transport hubs and growth centres, providing robust transport infrastructure and reliable and cost-effective services.
- To upgrade trunk transport infrastructure and services to international standards, and conforming ASEAN transport agreements;
- To develop integrated domestic and international transportation networks in order to facilitate seamless multi-modal transport services; and
- To ensure smooth and secured rural and cross-border transport systems in order to contribute towards the development of designated border cities and rural regions.

(3) Better Environment, Safety and Security:

- To encourage the use of environmentally-friendly transport systems (e.g. less noise, less vibration, less emission gases, and fuel-efficient), especially in built-up areas, including the progressive use of modern fuel-efficient (low carbon) technologies in the transport industry;

- To improve traffic safety significantly and reduce the growing number of traffic accidents on roads as soon as possible;
- To raise awareness in the population of the need to achieve environmentally friendly and safer transport behaviors;
- To upgrade the level of safety and security in transporting fuels and other hazardous goods along designated corridors;
- To develop all-weather and natural disaster preventive land transportation by programmed upgrading and maintenance of existing railway, road, bridge and drainage structures;
- To improve the level of security in the transport sector in order to ensure cross-border trade and other economic activities with neighboring countries; and
- To monitor and enforce national standards for security, safety and integrated emergency planning for all transport modes and operations.

(4) Institutional and Regulatory Development:

- To clearly define the role of each transport related agency in terms of assets (land and infrastructure) ownership, planning, development, operation, and maintenance;
- To remove barriers and update regulations and/or customs to international standards to enhance private sector's investment in transport sector infrastructure and service;
- To plan and define the role of the private sector in investing, operating and maintaining transport infrastructure;
- To provide accountable and fair investment opportunities for domestic and international investors in the transport industry by updating necessary regulatory framework (e.g. PPP law, etc.);
- To improve efficiency of State Owned Enterprise by reforming organizational structure and with Public-Private Partnership (PPP);
- To improve the knowledge and skills of civil servants and further increase human resources in transport planning, administration and management sector to achieve higher levels of transport system development; and
- To adhere to international conventions, acts, laws, rules and regulations with respect to the transport sector.

(5) Reasonable transport pricing and secured budgeting

- To implement a "Market-oriented Mechanism" that provides transport infrastructure and services, and further enhances efficiencies in the transport business and service;
- To apply a "Beneficially Pay Principle" to the transport market and industry;
- To apply "Affordable Pricing" to improve transport accessibility for all citizens; and
- To secure the needed funds in the annual budget for transport infrastructure development.

## **9.7 MYT-Plan Cross-sector Strategic Objectives, and corresponding Strategies and Actions (Draft)**

To address the cross-sector issues, five strategic objectives and corresponding strategies and actions are proposed, as follows:

T-01 **Statistics:** Develop an initial mode of transport database, including databases for: a) road and road traffic (vehicle, passenger, and freight movement), b) rail (rail asset inventory, track condition, operation, passenger, and freight movement, etc.), c) maritime and inland water (vessel statistics, passenger and cargo movement data, maritime accidents, etc.), and d) civil aviation (air craft data, passenger and cargo movement, business performance of air lines, etc.) by the end of 2015.

**Sector Strategy T-01: To develop an initial (preliminary) database urgently and develop it step-by-step**

### Action T01

- Formulate a fully equipped special task force (unit) for data collection, data entry and analysis in each Ministry (MOT, MRT, MOC)
- Collect and update the transport infrastructure inventory, traffic data, etc., and build an initial database system and update it periodically
- Establish coordination / information exchange mechanisms (e.g. via optical cable, etc.) between the Ministries
- Use technical support from international donor agencies and other organizations, if necessary
- Publish transport statistics report regularly (e.g. monthly reports)

T-02 **Enhanced Coordination Mechanism:** Establish a high-level planning coordination mechanism by the end of 2014 to implement the Myanmar National Transport Master Plan (MYT-Plan), using 2015 as the base year.

**Sector Strategy T-02: Effective use of the National Transport Master Plan (MYT-Plan)**

The Myanmar National Transport Plan (MYT-Plan) is understood to be the only strategic plan for the development of the country's trunk (major) transport system.

### Action T02

- Formulate a planning coordination body for corridor development by inviting representatives from each Ministry and local government involved in the corridor development
- Establish coordination / information exchange mechanism between the coordination body and private investors

T-03 Participatory Planning: Establish a mechanism for people and communities to join in the planning process.

Sector Strategy T-03: Effective use of Strategic Environmental Assessment (SEA) procedure

People and communities are invited to a series of SEA meetings to express their concerns, share local knowledge, offer suggestions, etc. as a means to provide feedback into planning processes.

Action T03

- Enhance the existing EIA to cover SEA in the planning process
- Provide opportunities for the public to join the planning process through SEA

T-04 Capacity building in the public sector: Increase the number of high level experts in transport planning administration and management for better management of the transport sector.

Sector Strategy T-04-1: Establishment of Planning Unit (or department)

Establish a special unit responsible for transport planning, and strengthen staff capability with technical support from external agencies.

Action T-04-1

- Implement a fully equipped planning unit
- Develop and utilize computer models in the national transport model (strategic model)
- Invite professional technical support to improve and increase staff capacity in the field of transport modeling and planning
- Monitor the progress of the Myanmar National Transport Master Plan's (MYT-Plan) implementation
- Review and update the MYT-Plan regularly

Sector Strategy T-04-2: Technical cooperation / exchange program

Establish a bilateral technical cooperation/exchange scheme (program) with corresponding agencies in advanced countries.

Action T-04-2

- Establish an international affairs department to manage international technical cooperation projects
- Dispatch select staff to those supportive countries to study advanced technologies, techniques, etc.
- Conduct joint research and development (R&D)

T-05    Human Resources Development: Increase the number of skilled people in the transport sector.

**Sector Strategy T-05-1: Vocational Training and Professional Certification**

Increase the number of skilled workers in the transport sector to encourage efficient transport industries, increase safety, quality services and other issues of concern to the public.

**Action T-05-1**

- Identification of strategic fields that require a skilled workforce and professionals in the transport sector
- Provision of vocational training for designated sector professions
- Introduction of an ability-based grading system
- Introduction of professional certification, by type of job, in the transport industry

**Sector Strategy T-05-2: Professional Engineer**

By introducing a Professional Engineer's licensing system, the strategy will increase the number of professionals who can address public welfare and other interests. The professional status and practice of engineers is legally defined and protected by law.

**Action T-05-2**

- Designate the Ministry to be responsible for licensing Professional Engineers
- Establish Myanmar Professional Engineer (P.E. Myanmar) licensing system by 2020

T-06:    Enhanced environmental management: Increase public awareness of transport industry work to improve environmental sustainability, in the context of the transport system.

Introduce environmentally-friendly technology in the transport sector, the industry and increase public awareness of environmental issues.

**Sector Strategy T06-1: EIA Guideline**

By introducing best practices from advanced countries, introduce practical and appropriate environmental protection measures.

**Action T06-1: Develop EIA guideline in the transport sector**

- Following the EIA guideline by MOECAF, develop responsible social and environmental guidelines in the transport sector
- Consultants and contractors would be required to follow the guideline
- Develop a traffic impact assessment manual and procedures for large-scale transport projects

### Sector Strategy T06-2: Increase Public Awareness

#### Action T06-2-1: Increase public awareness

- Prepare public awareness tools (e.g. communication tools, mass media, etc.)
- Organize public awareness campaigns, seminars, etc. in public gathering places

#### Action T06-2-2: Improve awareness of transport industries

- Review and revise the existing regulation on vehicle inspection from an aspect of environmental improvement (strict regulation on emission gases)
- Regulate and limit the use of older vehicles for commercial purposes (old trucks) and public transport (old buses) and encourage replacement with new vehicles by providing preferential treatment
- Introduce preferential treatment for use of environmentally friendly vehicles (e.g. favored import tax)
- Introduce preferential treatment for environmentally friendly technology research and development

T-07	<u>Sustainable funding:</u> Secure the needed funding to meet annual budget requirements and allocate to MOT, MORT, MOC and region/state government to improve and develop infrastructure.
------	--

### Sector Strategy T-07

Secure permanent funding sources for the development of road infrastructure and service.

#### Action T-07

- Carry out a comprehensive study to identify possible sources of financing for the transport sector including the establishment of a new taxation scheme targeted to transport infrastructure development.
- Develop and enact special a purpose taxation scheme (e.g. fuel levy law, development levy law) if applicable.
- Collect fees from transport users, according to the services they use.

T-08	<u>Research and Development:</u> Develop appropriate and cost-effective infrastructure development technologies, based on environmental and local conditions.
------	---

### Strategy T-08-1: Increase technical capacity in higher education systems

#### Action T-08-1: Improve national universities

- Increase the capacity of the national universities and institutes in the transport infrastructure sector through international exchange programs, technical assistance (TA) from advanced countries, etc.
- Increase the number of university students in the transport planning and engineering sector with incentives, such as scholarships, bursaries, etc.

**Strategy T-08-2: Increase technical research and development**

**Action T-08-2: Improve the existing research and development capacity in ministries**

Increase capacity in research and development on the relevant organizations, including:

- Department of Meteorology and Hydrology (DMH), MOT
- Department of Water Resources and Improvement of River Systems (DWIR), MOT
- Myanma Shipyards (MS), MOT
- Myanma Maritime University (MMU), MOT
- Institute of Marine Technology (IMT), MOT
- Road Research Laboratory, PW/MOC
- Central Institute of Transport and Communications, MRT

## 9.8 MYT-Plan Transport Sub-sector Vision, Strategic Objectives, and corresponding Strategies and Actions

### 9.8.1 Road Transport Sector

#### Sector Vision

*"Develop all-weather and safe road transport infrastructure in order to fulfill social and economic transport needs of the nation in a coordinated manner with other modes of transport; and build robust foundation for land transport industries in terms of road infrastructure and regulatory framework; and achieve environmentally-friendly land transport system development throughout the country."*

#### Sector Issues

##### (1) Better Planning and Coordination:

- Road and bridge inventory data, traffic volume data, and other road related statistics have not been collected systematically, as such, the road and bridge asset management and road network planning is weak.
- Opportunities to improve knowledge and skill levels of MOC and MRT(RTAD) staff in the transport planning, administration and management and safety sector is limited.

##### (2) Infrastructure Development:

- Due to its geographic location, Myanmar has a number of strategic roads that form part of a broader regional transport network that must be developed, in coordination with international partners.
- Progress on improvements to the union highway network (ASEAN highways), suggested by the 2010 Brunei Action Plan, is behind schedule.
- Major projects in the transport and industrial sectors require planning coordination, as is the case with Hanthawaddy International Airport and Thilawa port and SEZ.
- There are bridges that need urgent rehabilitation or replacement. Planned new bridges should employ maintenance-free technologies to reduce the burden in the transport sector.
- The Highway truck transport services incur costs for excessive speed and accident damage, partly due to deteriorated road conditions on the union highways. Immediate maintenance or upgrading of these road segments is urgently needed.
- The existing Yangon-Mandalay Expressway is under-utilized, due to its restrictions on trucks.
- Space (right of way) for motorcyclists, cyclists and other vulnerable road users is limited and their needs should be specifically addressed.

##### (3) Better Environment, Safety and Security:

- Accident rates in Myanmar are about three times higher than those in Thailand and Vietnam. It should be noted that the expressway from Yangon to Mandalay is currently experiencing a number of accidents with fatalities.

- Although road safety measures have been implemented nationwide, total number of road accidents, injuries and death rate has been increasing.

(4) Institutional and Regulatory Development:

- Responsibilities for road development are split among several agencies, with unclear boundaries, thus exacerbating coordination and integration issues.
- The role of the private sector in developing the road infrastructure should be clearly defined.
- The existing BOT contracts require revision to meet international standards.
- Sustainable funding mechanisms in the public sector need to be developed in order to accelerate the union highway system as well as rural road development.
- Establishment of National Road Safety Council is behind schedule, accordingly, its monitoring and enforcement capability on road safety has not been fully implemented.

(5) Reasonable transport pricing and secured budgeting:

- The existing toll rates should be reviewed and adjusted to achieve maximum benefit for the public, while stimulating business development with the private sector.
- Lack of National Road Safety funding allocated for National Budget and other NGOs and INGOs and INGOs is one of the most serious obstacles to implementing road safety measures effectively and efficiently.

(6) Sector specific issues:

- Safety devices that are below standard (unsafe) are widely used in the country. Many are locally produced and sold at a low cost; the majority of the motorcyclists do not buy or use high quality helmets because of the high price for this safety equipment.
- Almost 50% of all traffic accidents are associated with motorcyclists. It is critical that the transport sector devotes serious attention to this matter.
- Level of Service (LOS) and safety of public transport systems such as buses, taxis, and urban rail should be improved urgently.
- Issues of fluctuating demand together with low freight transport tariffs must be considered in order to stimulate the transport industry.

**Sector Strategic Objectives**

In order to address the identified sector issues, seven strategic objectives are suggested as follows:

- RD-01 Update and establish safe, environmentally-friendly and modern motorways, highways and bridge designs to international standards.
- RD-02 Plan and build a hierarchical union highway and motorway network to support regional development along the designated transport corridors and major transport nodes, conforming to the ASEAN transport agreement.
- RD-03 Develop an all-weather and disaster-free trunk road network along designated transport corridors.
- RD-04 Develop cost-effective asset management measures and mechanisms.

- RD-05 Reduce the number of road accidents to the level of advanced countries as soon as possible.
- RD-06 Establish clear institutional and organizational frameworks in the road transport planning administration and management sector, establishing lines of demarcation between the central government and the region / state governments.
- RD-07 Maintain and further encourage the participation of the private sector in developing road transport infrastructure and providing transport services.
- RD-08 Improve and enhance the road and land transport industry to increase business performance.

### **Strategic objectives and corresponding strategies and actions**

RD-01: Improved Standards: Update and establish safe, environmentally-friendly and modern motorways, highways and bridge designs to international standards.

#### Sector Strategy RD-01-1: Urgent design standard updates

The existing design standards used in the road and bridge sector are reviewed by the end of year 2014, and consequently updated / improved with technical support from advanced countries.

##### Action RD-01-1

- Formulate a special task force in PW to review the existing road and bridge design standards.
- Invite specialists / senior engineers from advanced countries to support the task force.
- Update existing standards before starting a series of major works in the road and bridge sector.
- Establish a new road classification system urgently, including a new numbering system proposed by MYT-Plan, and corresponding geometric standards.
- Finalize a series of road designs, construction, and maintenance manuals.
- Establish a Road Safety Audit System (MRT).

RD-02: Road Network Development: Plan and build a hierarchical union highway and motorway network to support regional development along the designated transport corridors and major transport nodes, conforming to the ASEAN transport agreement.

#### Sector Strategy RD-02-1: Priority trunk road network development

Improve trunk road networks along the designated priority development corridors: the Central North-South Corridor (Yangon – Nay Pyi Taw – Mandalay), the East-West Corridor (Yangon – Hpa-An- Myawaddy), the Northern Corridor (Mandalay – Muse) and the Western North-South Corridor (Yangon – Pyay – Magway).

**Action RD-02-1a: Effective use of the expressway**

- Allow heavy vehicles (e.g. trucks) to use the expressway before 2018, based on the demand forecast.
- Provide more opportunities for drivers to stop and take rests to reduce accidents.
- Add more service areas along the expressway for the convenience of expressway users.

**Action RD-02-1b: Improvement of the priority union highways**

- Improve infrastructure (e.g. surface condition improvement, widening, etc.) on the union highway(s) along the priority corridors (e.g. Thaton – Eindu – Kawkareik – Myawaddy Road, etc.).
- Introduce the “Michi-no-eki” (roadside service areas) along the union highways to provide residents with business opportunities and road users (e.g. travelers) with opportunities to interact with local people and understand their products.
- Designate “heavy loaded highways” and improve these to appropriate standards, to support major freight movement that conforms to ASEAN Highway standards.

**Sector Strategy RD-02-2: Strengthen connectivity between major traffic generators**

Provide a high-speed and high-capacity road network and services to/from major dry ports, sea and river ports, and airports.

**Action RD-02-2**

- Extend the existing expressway to connect international airports to ports, and between major inland river ports (e.g. Yangon – Ywathargyi - Thilawa Port Expressway, Yangon City - Hanthawaddy Airport Expressway, etc.) (PW/MOC).
- Develop outer ring roads along designated urban growth boundaries of major growth centres, such as Yangon and Mandalay (MOC/YCDC/MCDC).
- Relocate the existing truck terminal near the Bayint Naung bridge to Ywathargyi, East Dagon township, together with relocation of MR facilities and development of a rail-based ICD (YCDC, MR/MORT).

**Sector Strategy RD-02-3**

Develop a high capacity road network and support regional development projects such as SEZs and Industrial Zones.

**Action RD-02-3**

- Support industrial development projects by providing direct and nearby access to highway on-and off ramp and expressway interchanges.

**Sector Strategy RD-02-4**

Develop cross border transport facilities and improve access to these facilities.

**Action RD-02-4**

- Improve access roads to international cross borders at Myawaddy and Three Pagodas Pass.
- Provide a single window service at international cross border points.

- Extend operational hours of cross border services.

Sector Strategy RD-02-5

Gradually upgrade the existing road infrastructure to conform to ASEAN transport agreements.

Action RD-02-5

- Complete a total of 3,000 km of ASEAN Highway Network in Myanmar (e.g. AH-1: Yangon- Mandalay- Tamu, AH-2: Mandalay-Taunggyi-Tachileik) by the year 2030.
- Install road signs and a route numbering system that are compatible with the ASEAN highway network.
- Identify freight movement patterns and volumes via ASEAN dry port network (e.g. dry ports in Yangon, Mandalay, Muse, Pyay, Monywa, Mawlamyine, Bago, and Tamu) and develop corresponding facilities.
- Develop an ICT and ITS master plan and introduce advanced technology to achieve higher efficiency in use of road infrastructure.
- Fully implement ASEAN Framework Agreements on Transport Facilitation.

Sector Strategy RD-02-6

Improve regional, state and township roads to access tourist attraction sites, such as Bagan and Taunggyi.

Action RD-02-6

- MOC and local governments to designate and improve major access roads to tourist attraction areas such as Bagan, Pyin Oo Lwin, Inle Lake, Kyaiktiyo.
- Install road signs in English and Myanmar language for visitors.
- Local governments to improve local access roads to tourist attraction areas, such as along the beach in Rakhine State.

RD-03: Safe trunk road network: Develop an all-weather and disaster-free trunk road network along designated development corridors.

Sector Strategy RD-03-1

The existing road infrastructure is not engineered to function in all weather conditions and is prone to damage from natural disasters. Economic growth in development corridors requires efficient, consistent and safe service from connected infrastructure.

Action RD-03-1

- Prepare a hazard map and identify road networks and other transport facilities that are likely to be damaged by natural disasters.
- Implement slope protection measures in landslide prone road sections.
- Implement measures to avoid flooding along the designated coarse ways.
- Carry out a series of disaster-resistant (cyclone and earthquake-resistant)

improvements of existing bridges.

- Develop an emergency transport plan, to be implemented during emergencies, such as a large-scale earthquake.

**RD-04:** Effective asset management: Develop cost-effective asset management measures and maintenance mechanism.

**Sector Strategy RD-04-1**

Properly design a maintenance mechanism for the existing road transport infrastructure and minimize the life cycle cost.

**Action RD-04-1**

- Carry out technical inspection of the existing road and bridge infrastructure and develop a database / inventory.
- Develop an asset management system, such as HDM, and a maintenance program.
- Implement preventive (proactive) measures before undertaking full-scale replacement or rehabilitation works.
- Conduct Research and Development (R&D) on cost-effective maintenance technologies.
- Provide trainings with regard to inspection, evaluation and implementation of the maintenance for transport infrastructures.
- Enforce regulations against overloading trucks.

**RD-05:** Reduction of traffic accidents: Reduce the number of road accidents to the level of advanced countries.

**Sector Strategy RD-05-1      Controlled use of the existing expressway**

In order to reduce the number of traffic accidents on the expressways, use of these roads should be controlled (limited) to permit only lower levels of road class users, until full-scale improvements can be completed.

**Action RD-05-1**

- Carry out a comprehensive road accident study on the expressway.
- Install necessary equipment to control behavior of drivers, such as speed limit notification devices.
- Provide crossing facilities for domestic animals.

**Sector Strategy RD-05-2      Upgrade the existing expressway**

Upgrade the existing expressway to international motorway standards and encourage economic activities that reduce the number of fatal accidents.

**Action RD-05-2**

- Establish a special task force team to improve safety on expressways.

- Inspect road conditions and identify critical locations/sections for improvement.
- Rehabilitate/replace expressway facilities to meet international motorway standards.

**Sector Strategy RD-05-3      Upgrade the union highway**

The union highways require urgent upgrading as industry standards are difficult to apply in some cases, due to physical constraints. However, it is suggested that the Government follow the improved design standard as much as possible.

**Action RD-05-3**

- Establish a special safety improvement task force team for union highways.
- Urgently implement safety measures (e.g. installation of guardrails, lighting, road signs, weight bridges, segregated pedestrian crossings, traffic signal installation at major intersections, etc.) at critical road sections.
- Develop highway design standards and a design manual.

**Sector Strategy RD-05-4      Safety Improvement Plan and Programs**

Develop a long-term plan for safety improvement in the road transport sector.

**Action RD-05-4**

- Develop a Road Transport Safety Improvement Master Plan.
- Develop National Road Safety Action Plan (2014 – 2020).
- Review and revise the existing laws/acts/regulations with regard to vehicle inspection/registration and introduce an advanced vehicle inspection system.
- Develop Road Safety Audit System.
- Introduce Intelligent Transport System (ITS).
- Upgrade public transport.

**Sector Strategy RD-05-5      Public awareness and capacity development**

Increase public awareness regarding road safety improvements and increase the capacity of experts/specialists in the field of road safety improvement.

**Action RD-05-5**

- Develop and disseminate road transport safety guidelines for bus and truck operators, drivers, pupil and students.
- Establish a Road Traffic Accident Research Center.
- Increase the number of road transport safety specialists.

RD-06	<b><u>Effective institutional set-up:</u></b> Establish clear institutional and organizational frameworks in the road transport planning administration and management sector, establishing lines of demarcation between the central government and the region / state governments.
-------	---

**Sector Strategy RD-06-1      Decentralization of role of Public Works**

---

PW region/state offices should be strengthened in terms of their institutional, organization and technical capacity and transformed into part of the region/state government body.

**Action RD-06-1**

- Conduct a comprehensive study on possible decentralization of road planning, administration, and management roles.
- Develop a road and road traffic database of region/state roads.
- Develop a fully computerized communication (data transfer) system between the central government (PW) and region/state PW offices.
- Increase road planning, administration and management capacity of region/state offices by providing training to central and local staff.

RD-07: <b><u>Private sector participation:</u></b> Maintain and further encourage participation of the private sector in developing and maintaining road transport infrastructure and providing transport services.
---

**Sector Strategy RD-07-1**

Promote fair and accountable business opportunities with the private sector by inviting them to partner on road infrastructure development, corresponding maintenance work and related service provision.

**Action RD-07-1: Increase business opportunities**

- Establish a special PW task force for toll road and bridge business operation.
- Review the existing procurement system and BOT contract documents, including specifications for road maintenance, and identify technical issues to be addressed.
- Update or improve the existing standard contract form for road operation and maintenance, used under the BOT scheme.
- Build a typical business model for a toll road construction project, using a PPP scheme.
- Provide business opportunities for road construction, operation, and maintenance to wider range of business entities through deregulation.

RD-08: <b><u>Stimulate growth with infrastructure:</u></b> Improve and enhance the road and land transport industry to increase business performance.
---

**Sector Strategy RD-08-1: Core road transport business improvement**

**Action RD-08-1**

- Establishment of a special business unit in MOC for public transport business development, based on YUTRA.
- Establish a JV or a similar partnership with the private sector (local and foreign) for both freight and passenger transportation at an initial stage, which can be transformed to a company (corporatization) and a Government Linked Company (GLC), with a phased approach.

**Sector Strategy RD -08-2: Non-road transport business improvement**

Encourage effective use of road transport opportunities for other types of business such as service areas and michi-no-eki and strategic use of lands owned by MOC.

**Action RD -08-2**

- Establish a special business unit in MOC for studying and implementing a series of non-road transport businesses, using road transport facilities and other MOC assets.
- MOC to run the real estate business jointly with private sector.
- Road Transport (MRT) work on the non-road transport business development jointly.

## 9.8.2 Railway Sector

### Sector Vision

*"Develop safe rail network and services along the designated major economic development corridors in order to fulfill social and economic transport needs of the nation in a coordinated manner with other modes of transport to achieve higher inter-modality; contribute to the environmental improvement through introduction of low carbon technologies, and build preferred business environment through provision of safe, punctual, comfort and high capacity rail transport services with affordable yet reasonable prices."*

### Sector issues

#### (1) Better Planning and Coordination:

- The inventory data, passenger analysis and freight handling volume data for railways and bridges are not well prepared and are not digitized. As a result, asset management, service development and business planning capacity is weak.
- The human resources available for planning and business promotion sectors is very limited.
- The Government requires planning coordination with major projects in other transport and industrial sectors, such as Highway truck terminals in Yangon and Mandalay, Hanthawaddy International Airport and Thilawa port and SEZ and dry ports.

#### (2) Infrastructure Development:

- The railway is a valuable national asset that should be preserved and used to its maximum utility. Large investments, however, will be necessary to revitalize the system and make it competitive in the transport market.
- MR focused on line extensions in the past, even to areas with low traffic demand and areas ill-suited for railways as a principle mode of transport.
- There are several strategic railway lines that reach cities near international border areas, such as Myitkyina, Lashio, Kalay in the north, and Thanbyuzayat and Dawei in the south. Development of international inter-modal facilities in these areas must be considered in coordination with international partners.
- At the 13th Special Working Group Meeting on Singapore-Kunming Rail Link held in Myanmar in October 2011, both countries agreed to postpone off the construction of Namtok (Thailand) - Three Pagoda Pass (Border) - Thanbyuzayat (Myanmar) missing link. (MRT)
- The throughput of container and general cargo at the ports in the Yangon area have been increasing sharply, while the transport capacity of MR is limited.
- In Myanmar, Dawei Deep Seaport and the Special Economic Zone Project have been being implemented. A rail link from Dawei (Myanmar) to Kanchanaburi (Thailand) is scheduled for future construction, during the project's third phase. This would be a new spur line of the Singapore-Kunming Rail Link-SKRL.

- Progress of the cross-border railway network development (e.g. Thanbyuzayat – Three Pagoda Pass, 111 km by 2020 as part of Trans Asian Railway Line) is likely to be behind the schedule. Similarly, the rail network extension from the Three Pagodas Pass to Bangkok may not happen in a short-term.
- The quality of railway transport services is low because of deteriorated tracks, aging coaches and wagons as well as poor maintenance.
- There are many old rail bridges that need urgent rehabilitation or replacement to mitigate against large-scale accidents.
- The majority of existing rolling stocks is very old (over 30-years old), which is one of the obstacles for MR to improve train operation efficiency.
- The existing main railroads of Yangon-Mandalay, Yangon-Pyay, Yangon-Mawlamyine are not utilized effectively.
- MR plays a vital role in inter-city passenger and freight transport services. The service level of Yangon Circular Rail Line needs to be improved in order to accommodate the increasing travel demand in Yangon.
- The quality of railway transport services, in terms of speed and accident control, is low mainly because of deteriorated track conditions and aged and poorly maintained passenger coaches and freight wagons.
- In addition to the inter-city passenger and freight transport services, MR plays a vital role in Yangon as an urban rail passenger transport service provider. The service level of Yangon Circular Rail Line must be improved to accommodate the increasing travel demand in Yangon.
- Other important actions that MR should undertake include:
  - Upgrading of the Yangon Station Yard facilities and modernization of signaling system.
  - Establishing a modernized track maintenance system.
  - Upgrading the Insein Diesel Locomotive Workshop.
  - Moving RBE workshop to Ywarthargyi.
  - Constructing a new track maintenance workshop in Ywarthargyi.
  - Rehabilitating rail lines, including:
    - Bago – Mawlamyine rail line (Progress to 100 km/h running speed)
    - Yangon – Pyay – Bagan rail line
    - Bagan – Mandalay rail line
    - Ywahtaung – Khin U rail line (Progress to 100 km/h running speed)

(3) Better Environment, Safety and Security:

- Even though accidents are seldom serious (mainly because of low running speeds), actual accident rates in the rail sector are very high, as compared with Thailand and Vietnam, mainly because of poor track conditions and (mostly) primitive signaling system.
- Improvements are needed in terms of track rehabilitation and modernization of signaling systems, automatic level crossing, train control systems, and protection systems.

(4) Institutional and Regulatory Development:

- Myanmar Railways (MR) has the sole responsibility for rail infrastructure development
-

and rail-related transport service production. Accordingly, there is no competition within the rail sector, though MR has been faced with tough competition with other modes of transport such as highway buses, inland water transport and highway trucks.

(5) Reasonable transport pricing and secured budgeting

- The business performance of MR has been very poor and MR's profit and loss statement has been negative since 2006, mainly due to increased fuel costs and other factors such as operation of non-profitable railways. Accordingly, about 20 % of MR's expenditure are typically subsidized by the central government. A critical due-diligence survey is needed before making additional investment in the rail sector.
- MR has been faced with poor business performance problems, that is, negative profit and loss statement recent years.

(6) Sector Specific Issues

- Unprofitable rail line have been subsidized by the Government.

**Sector Strategic Policies and Objectives**

In order to address the identified sector issues, seven strategic objectives are suggested as follows:

RWY-01 Develop effective asset management measures and mechanisms to fully utilize the existing assets.

RWY-02 Rehabilitate the existing rail infrastructure and associated systems along the designated development corridors and to/from major transport nodes to a higher standard.

RWY-03 Develop all-weather and disaster-free trunk rail network and services along the designated development corridors.

RWY-04 Reduce the number of rail accidents to the level of advanced countries, as soon as possible.

RWY-05 Introduce environmentally-friendly technology in the rail infrastructure and rail transport industry.

RWY-06 Increase participation of the private sector in developing rail and rail-related infrastructure and businesses such as ICD development and operation and rail-based freight forwarding business.

RWY-07 Improve MR's business performance, focusing on market-driven freight transport services.

RWY-08 Be prepared for early introduction of High Speed Railway (HSR) Passenger Service.

RWY-09 Encourage and promote business and industrial activities along rail corridors, that can yield stable demand of both passenger and freight.

RWY-10 Reduce operational and management costs by streamlining the institutions, the number of staffs, etc.

### **Strategic objectives and corresponding strategies and actions**

**RWY-01 Asset Management System:** Develop effective asset management measures and mechanisms to fully utilize the existing assets.

#### Sector Strategy RWY-01-1

Establish a sustainable maintenance mechanism for the rail infrastructure and minimize life cycle costs.

##### Action RWY-01-1

- Carry out technical inspections of the existing rail infrastructure and develop a database/inventory of these by the end of 2015.
- Develop an asset management system and a maintenance program in 2015/2016.
- Implement preventive and proactive measures before doing full-scale replacement or rehabilitation works by 2016.
- Conduct Research and Development (R&D) on cost-effective maintenance technologies in 2015/2016, followed by establishment of a rail research centre.
- Provide training in inspection, evaluation and rail infrastructure maintenance in 2014.

**RWY-02: Cost-effective Rail Network Development:** Rehabilitate the existing rail infrastructure and associated systems along the designated development corridors and to/from major transport nodes to a higher standard.

#### Sector Strategy RWY-02-1: Priority Rail Corridor Development

Improve railway networks along the priority development corridors: the Central North-South Corridor, the East-West Corridor, the Northern Corridor and the Western North-South Corridor, Cross-border lines of Tamu – Kalay, Lashio – Muse, Dawei–Kanchanaburi.

##### Action RWY-02-1

- Improve railway infrastructure and enhance railway transport services along the priority corridors (e.g. Yangon – Mandalay Section, Yangon - Hanthawaddy / Bago Section, Bago-Mawlamyine Section, Yangon-Pyay Section).
- Develop logistics centres at major railway stations (e.g. Yangon and Mandalay ICD/Dry Ports) in conjunction with the Thilawa port development.

#### Sector Strategy RWY-02-2: Strategic extension and new rail line construction

Provide high-speed and high-capacity railway network and service, connecting major ports and airports.

##### Action RWY-02-2

- Rehabilitate the existing rail line in the Yangon port area to accommodate increasing container volumes in 2015/2016.
- Increase the capacity of the Thilawa rail line to the Thilawa port and SEZ in

accordance with the increasing demand of international container cargo.

- Develop dry ports/ICDs in Yangon (Ywa Thar Gyi) and Mandalay (Myinge) area in conjunction with Thilawa port and SEZs development along the corridor.
- Construct an extension from Thanbyuzayat to Three Pagoda Pass where the State Railway of Thailand (SRT) confirms the connection and through-operation with Myanmar.
- Develop an airport rail access to the newly developed Hanthawaddy International Airport, as part of the future high speed rail (HSR: Yangon – NPT - Mandalay).
- Construct new rail infrastructure (LRT, MRT, subway) at Yangon Circular Line and Mandalay Circular Line and an LRT line, linking Mandalay to Mandalay International Airport.
- Rail network long-term plans include;
  - 1) Construct high speed train for the Ywa Thar Gyi-Nay Pyi Taw-Mandalay section
  - 2) Construct new double line for Yangon- Ywa Thar Gyi
  - 3) Set maximum speed of 100 km/h for Mawlamyine-Dawei section
  - 4) Set maximum speed of 100 km/h for Kalay-Tamu section
  - 5) Set maximum speed of 100 km/h for Pathein-Pakokku section
  - 6) Set maximum speed of 100 km/h for Okposu-Bago section
  - 7) Construct new circular line in Mandalay
  - 8) Construct subway systems in Yangon City
  - 9) Construct LRT system for Mandalay – Kyaukse
  - 10) Upgrade the Thazi-Shwenyaung section
  - 11) Construct double line for Yangon-Mogyobyt
  - 12) Extend rail network of the Yangon and Mandalay Circular Rail Line

**RWY-03: Safe rail transport service provision:** Develop all-weather and disaster-free trunk rail network and services along the designated development corridors.

**Sector Strategy RWY-03-1**

Develop disaster-resistant rail infrastructure along the designated development corridors.

**Action RWY-03-1**

- Prepare a hazard map and designate rail sections and other transport facilities in 2014/2015 that are likely to be damaged by natural disaster.
- Implement slope protection measures in landslide prone railway sections by 2014.
- Implement measures such as truck level elevations to avoid flooding along the designated flooding sections in 2014/2015.
- Carry out a series of disaster-resistant (cyclone and earthquake-resistant) improvements (or replacement) of the existing bridges in 2014/2015.
- Develop an emergency transport plan, to be implemented during emergencies, such as a large-scale earthquake.

**RWY-04 Safety First:** Reduce the number of rail accidents down to the level of advanced countries, as soon as possible.

Sector Strategy RWY-04-1 Urgent rehabilitation

Carry out urgent rehabilitation of the critical railway sections in a practical manner. While it is understood there are cases in which design standards may be difficult to apply, due to physical constraints until full-scale improvements are complete, the Report recommends to follow design standards and develop improvement manuals, as much as possible.

Action RWY-04-1

- Establish a special task force team to examine safety improvements of the existing rail systems, mainly focusing on the rail and track condition and signals and communication in 2014/2015.
- Inspect the existing rail and track conditions and identify critical locations and sections during /2015/2016.
- Rehabilitate or replace existing rail and tracks to meet the MR standard during /2015/2016.
- Replacement of rolling stock, rehabilitation of the existing rolling stock and identification of the critical problems

Sector Strategy RWY-04-2 Safety Improvement Plan and Programs

Develop a long-term safety improvement plan, as a part of the MR modernization plan.

Action RWY-04-2

- Review, revise or develop laws/acts/regulations/manuals with regard to train operation, civil works, vehicle inspection and maintenance, etc. to improve safety.
- Develop a Rail Transport Safety Improvement Master Plan.
- Invite technical assistance to update skills and knowledge in the field of safety improvement.

**RWY-05: Enhanced environmental consideration:** Introduce environmentally-friendly technology in the rail infrastructure and rail transport industry.

Sector Strategy RWY-05-1: Low Carbon Tackle with global warming issues

By introducing best practices from advanced countries, introduce practical and applicable low carbon technologies in the rail sector.

Action RWY-05-1: Introduction of advanced low-carbon technologies

- Develop a plan for introduction of low-carbon technologies in the rail sector with technical support from external advisors in 2014/2015.
- Import environmentally-friendly and energy-saving locomotives, DEMU and other low-carbon technologies.
- Introduce renewable energy, where applicable (e.g. lighting at stations).

- Introduce electrification of the rail system or a hybrid system at circular line and other trunk lines by 2035.

**RWY-06:** Private sector participation: Encourage participation of the private sector in developing rail and rail-related infrastructure and business such as ICD facilities development and its operation and rail-based freight forwarding business.

Sector Strategy RWY-06-1

Encourage fair and accountable business opportunities with the private sector by inviting them into rail and non-rail business opportunities.

Action RWY-06-1: Increase business opportunities for private sector

- Establish a special task force in MR for PPP application and MR-private company joint operation in the rail sector in 2014.
- Review existing laws and acts that regulate MR's business activities with the private sector, and identify technical issues to be addressed in 2014/2015.
- Build a typical business model for a PPP project (e.g. Yangon station building and surrounding area development, ICD facilities building and operation project under PPP scheme).

**RWY-07:** Industry efficiency: Improve MR's business performance, focusing on market-driven freight transport services.

Sector Strategy RWY-07-1: Core rail business improvement

Action RWY-07-1

- Establish a special business unit for rail passenger and freight business improvement in 2014/2015.
- Develop a short- and mid-term business plan with technical support from external advisors, during 2014/2015.
- Develop a container train operation, based on the business plan.
- Conduct an urgent study on rail services and operations in the Ywar Thar Gyi area.

Sector Strategy RWY-07-2: Non-rail business improvement

Encourage effective use of MR/MRT assets and the strategic use of lands in prime locations.

Action RWY-07-2

- Establish a special business unit for carrying out a series of non-rail business, using MR/MRT assets like land and station buildings.
- Plan urban re-generation projects at or near major rail stations such as Yangon, Insein, Kyee Myint Daing, New Ma Hlwa Gone and Mandalay stations.
- MR/MRT to run the real estate business jointly with private sector.

**RWY-08** Sector readiness: Be prepared for early introduction of High Speed Railway (HSR) Passenger Service

Sector Strategy RWY-08-1: Early Introduction of High Speed Railway (HSR) Service

Action RWY-08-1

- Establish a special project unit for HSR development.
- Study the development of HSR between the Yangon downtown and the Hanthawady airport, with possible extension to Nay Pyi Taw and Mandalay.

**RWY-09** Stimulate economic growth: Encourage and promote business and industrial activities along rail corridors, that can yield stable demand of both passenger and freight.

Sector Strategy RWY 09 – 1: Business Environment Improvement

Action RWY 09 – 1

- Upgrade the stations and goods-sheds, which are located at the major city and main transportation nodes.
- Try to connect other modes of transport with business opportunities.
- Promote non-rail business development along the rail corridor such as shopping malls, recreation centers, hotels and restaurants with consideration to environmental issues.
- Improve transport capability and service provision to improve customer satisfaction.
- Introduce Public Private Partnerships in MR and joint operations with private companies, in the rail passenger and freight sector.
- Construct logistics hubs, logistics centers and dry ports near railway areas and try to enhance multi-modal transport capability.

**RWY-10** Reduce operational and management costs by streamlining the institutions, the number of staffs, etc.

Sector Strategy RWY – 10 – 1: Reorganization

Action RWY – 10 – 1

- Modernize or reorganize the existing institute of Myanma Railways.
- Carry out rail operations streamlining, while maintaining skilled and experienced labor, staffs and supervisors.
- Modify the State-owned enterprise to a semi-public organization (Public Private Partnership sector) and reduce unnecessary costs.

### 9.8.3 Waterway Transport Sector

#### Sector Vision

*“Develop world-class international gateway port(s) as one of the hub seaports in Asia and all-weather and 24-hours inland waterway transport services along the designated development corridors in order to fulfill social and economic transport needs of the nation in a coordinated manner with other modes of transport to enable higher inter-modality; and build preferred business environment in the country through provision of safe, punctual, and high-capacity water transport services with competitive prices.”*

#### Sector issues

##### Maritime Transport and Ports

###### (1) Better Planning and Coordination:

- The maritime sector is expected to play a vital role in increasing the variety of industries in the country, with an emphasis on high-level inter-modality and accessibility at major ports.
- It is necessary to develop a port improvement master plan for each of the existing major ports to modernize port management and increase inter-modality.
- The sub-sector vision can be achieved with the development of new deep-sea ports at strategic locations, one of which should be close to the national development axis (the North-South Corridor).

###### (2) Infrastructure Development:

- The existing Yangon Ports (not including the Thilawa port) currently handle nearly 90% of international cargo and the dominance of the Yangon Ports (including Thilawa in future), as the country's gateway port will likely remain in the future.
- It is projected that a total of international cargo throughput in Myanmar will be approximately 62 million tons by 2025, including containers and bulk cargo.
- Total container throughput in Myanmar will be close to 4 million TEU in 2025 (nearly 8 times the existing throughput).
- Existing ports in Myanmar, including the Yangon Port, are located on rivers and are constrained by shallow draft, high siltation, and variability in water depths. It is critical to have precise bathymetry data of the concerned areas as soon as possible for safe navigation, and to develop an electronic navigational chart (ENC) to an international standard.
- In addition, it is important to improve the navigation channel along the Yangon River and the Yangon port area by deepening and widening the existing channel and installing preventive measures for sedimentation in order to accommodate larger vessels.
- Should the Yangon ports continue to dominate and if handling volumes increase, these ports will become a bottleneck for the country's industrial activities and may worsen traffic congestion in the city of Yangon. As such, port development in Thilawa should be accelerated.

- Cargo handling efficiency requires immediate improvement, in order to reduce cargo dwelling time.
- Current private sector development in Thilawa needs additional analysis, in terms of its location and connectivity with the newly developed SEZ in its hinterland.

(3) Better Environment, Safety and Security:

- Limited pilotage system and congested traffic in the Yangon Port area are resulting in a reduction of safety.
- With regard to port facilities, including private sector's facilities, a set of technical standard should be introduced to increase safety levels.

(4) Institutional and Regulatory Development:

- Efficiency improvements are needed for existing port management (reduction of paper works), including vessel entry procedure, cargo handling, accounting settlement between vessel owners, port master, port facility owners, cargo handling service providers, and custom clearance procedures. In addition, Electric Data Interchange (EDI) in port operation should be introduced.
- This Report recommends introducing bounded transportation from sea transport to inland water transport and land transport by developing inland / river ICDs at strategic locations to accommodate increasing container cargo transport demand and to enable faster intermodal transport.

(5) Reasonable transport pricing and secured budgeting

- The existing cargo handling tariff is relatively high in comparison with those of other major ports. A competitive and reasonable tariff structure should be established.

**Inland Water Transport and River Ports**

(1) Better Planning and Coordination:

- Statistics in the inland water transport sector are not well developed. Information from the private vessel owners or forwarders is limited or difficult to obtain, leading to difficulty in planning and marketing.
- Inter-modal facilities between water and land transport have not been well developed.
- There is no bounded transfer service between the inland water transport and the sea transport.

(2) Infrastructure Development:

- The unique characteristics of inland water transport (e.g. slow speed, cost differences between upstream and downstream movements, low carbon footprints per ton-km, pre-determined location, etc.) limit its competitiveness to specific market niches. In short, it is less flexible than road transport and is presently not an appropriate mode for all seasons. It is necessary to overcome such limitations technically, while fully taking advantage of its unique characteristics of low carbon footprints and competitiveness in specific market.
- The four major rivers are the natural assets of the country that should be conserved and maintained by the government for navigation and other purposes. However, the large differences in water levels between dry and wet seasons pose unique challenges. There

are many bottlenecks and dangerous sections for navigation, which is made worse by the limited navigation aid facilities. Hence, it is recommended to carry out a comprehensive study on these navigation channels.

- Hydrographic data about rivers is inadequate and oftentimes outdated. As such, there is no sound basis for issuance of navigation charts, restrictions, determination of maintenance and repair works, or formulation of future plans. Hence it is highly important that a comprehensive study be carried out on the navigation channels of these.
- The navigation channel along the Ayeyawaddy River is one of the major transport routes of the country (the Western North – South development corridor). Hence, it will be important to increase safety and transport capacity by improving the navigation channel, enabling 24-hour navigation and introducing new vessels.
- The navigation channel along the Chindwin River, as a spur line from the Ayeyawaddy River, plays a vital role to support socio-economic activities in Sagaing Region, and which is connected to India through Kalewa. The provision of water transport services along the Chindwin River may not be financially viable because of limited demand, but it is very important to provide such services, to maintain basic services for residents along the river.
- Aging and deteriorating vessels are a primary obstacle to achieving safe and fast water transport services.

(3) Better Environment, Safety and Security:

- Insufficient navigation aids and outdated navigation chart lead to deterioration of safety and service level (speed).

(4) Institutional and Regulatory Development:

- Role of Inland Water Transport (IWT) in the transport market needs to be revisited urgently, that is, as one of the semi-public organizations, IWT is expected to play a vital role in increasing welfare of the nation and developing the water transport industries. IWT needs to change its role of service provider to a supporting organization of the water transport industries.

(5) Reasonable transport pricing and secured budgeting

- Government-set tariffs are said to be excessively low and act as a disincentive to improve water transport business or for new investments in vessels, the majority of these are very old.

**Sector Strategic Objectives**

In order to address the identified sector issues, this Report recommends seven strategic objectives, as follows:

**Maritime Transport**

- WT-01 Enhance port capacity of Yangon port (including Thilawa area) to meet sharply increasing cargo demands and to reduce dwelling time of cargoes and ships in the port.
- WT-02 Develop a deep seaport that can accommodate mother vessels in trunk routes to support the further increasing import and export of goods, at reasonable cost to users in the Central North-South Development Corridor.
-

WT-03 Formulate a port master plan for each sea port and their hinterlands.

WT-04 Invest in effective and efficient port management.

### **Inland Water Transport**

WT-05 Establish key sections of the inland waterways as navigable throughout the year.

WT-06 Provide effective inland water transport network.

WT-07 Redefine the role of IWT and develop a corresponding business plan.

WT-08 Encourage the replacement of old vessels with safer and new environmentally-friendly vessels.

### **Strategic objectives and corresponding strategies and actions**

WT-01: Urgent Port Capacity Improvement for Yangon port: Enhance port capacity of Yangon port (including Thilawa area) to meet sharply increasing cargo demands and to reduce dwelling time of cargoes and ships in the port.

#### Sector Strategy WT-01-1: Urgent Navigational Capacity and Safety Improvement in Yangon port

##### Action WT-01-1

- Carry out a comprehensive bathymetry survey of the Yangon port area, and develop an electronic navigational chart (ENC) in line with international standards.
- Examine and implement effective measures to ease the constraints in inner-bar and outer-bar and to accommodate larger vessels, such as widening and/or deepening of the channel, civil structure to prevent the channel from sedimentation, effective maintenance dredging system.
- Examine and implement effective measures to secure safety navigation in the port, such as a navigational aid system, pilotage system including pilot fixed station and pilot boats.

#### Sector Strategy WT-01-2: Effective and Efficient Terminal Improvement in Yangon port

##### Action WT-01-2

- Improve capacity of the existing Yangon ports and cargo handling efficiency, considering development needs for waterfront area from urban side as well as constraints in urban traffic.
- Improve inter-modality with truck, inland water and railway operators with the development of warehouses and ICDs, and enable bounded transportation to/from the port.
- Develop and/or redevelop cargo-wise designated terminals such as oil, steel products, construction materials, in coordination with its hinterland (SEZ) development.

- Planning should emphasize improvements in inter-modality with MR and container truck operators, to secure the space for MR and container trucks.

#### Sector Strategy WT-01-3: Accelerated Development of Yangon Port in Thilawa Area

##### Action WT-01-3

- Develop multipurpose terminals, including container handling and cargo-wise specialized terminals such as oil, steel products, construction materials in a harmonized manner and in good coordination and linkages with hinterland (SEZ) development.
- Improve inter-modality between truck, inland water and railway operators, together with the development of warehouses and ICDs, and enable bounded transportation to/from the port.

WT-02	<u>New port infrastructure:</u> Develop a deep seaport that can accommodate mother vessels in trunk routes to support the further increasing import and export of goods, at reasonable cost to users in the Central North-South Development Corridor.
-------	---

#### Sector Strategy WT-02-1

By 2030, construct and begin operation of at least one deep seaport in the country, which can form part of the network of major ocean liners in order to make Myanmar one of the key players in the international supply-chain systems.

##### Actions WT-02-1

- Develop a maritime sector master plan that includes long-term strategies and corresponding action programs for port development, including deep seaports, by the end of 2015.
- Carry out a preliminary feasibility study to select a deep seaport area by the end of 2016, followed by a feasibility study in the selected location in 2017-2019. It is recommended that such a deep-sea port be positioned close to the national development axis, namely the Central North-South Development Corridor.

WT-03	<u>Port planning and development:</u> Formulate a port master plan for each sea port and their hinterlands.
-------	---

#### Sector Strategy WT-03-1: Port Development / Improvement Master Plans

Following the maritime sector master plan, a master development plan for each port should be developed. Basic directions of each port development are as follows:

Yangon Ports: As the most important international gateway port with the wide hinterland of Greater Yangon, Ayeyarwaddy Delta and Central North-South Development Corridor, the Yangon port capacity should be further improved through the channel and navigational improvement, and terminal development with appropriate role demarcation between Yangon area and Thilawa area.

Dawei Port:	This is one of the ideal locations for a deep-sea port development, especially as an industrial port in the Southern region of the country, with hinterland that includes Thailand and having a great potential as an international hub port connecting the Asian countries and the market in the western region including Europe, India and the Middle East.
Kyaukpyu Port:	The gas and oil pipeline is already developed from this port to Yunnan Province, China. The economic corridor starting from Kyaukpyu, passing through Mandalay to Yunnan is one of the major economic corridors of the country. This port and its hinterland can be developed further as a gateway port to Yunnan Province and an industrial activity center in Rakhine State, with SEZ development.
Sittwe Port:	The hinterland of this port includes the northeastern part of India including Assam State as well as Chin State and the northern part of Rakhine State. This port can be both a regional hub port for these states and development of this port will increase opportunity for Assam to trade through this port.
Pathein Port:	This is a regional hub in the Delta Area where inter-modal function should be further strengthened. Since the water depth in the Delta Area is shallow, it is difficult to develop this port as an international gateway, but it should be developed as the regional hub of the Delta Area.
Mawlamyine Port:	The existing port cannot be developed as an international gateway port, due to its physical constraints. However, its hinterland has great potential for further development as one of the transport nodes of the East-West Corridor and as an important regional hub for Mon and Kayin State.
Myeik Port:	As the port located at the south-end of the country, this port is expected to play a vital role as the regional hub of Tanintharyi region.

Actions WT-03-2

- Complete all of the port improvements and development master plans for the above major ports by the end of year 2017.
- Carry out feasibility studies on proposed components of each master plan during 2017-2019, followed by their implementation.

WT-04    Strengthen administration: Invest in effective and efficient port management.

Sector Strategy WT-04-1: Port management and information system to reduce dwelling time of cargoes and ships in the port.

Action WT-04-1

- Simplify port-related procedures, in accordance with the FAL convention.
- Introduce port management and information systems, including Port EDI system (named Port-MIS in Myanmar), which is an initial EDI to be introduced in

2014/2015, in coordination with the customs system (MACCS).

**Sector Strategy WT-04-2: Appropriate Port Tariff**

**Action WT-04-2**

- Examine current tariffs, taking into account competitiveness with other ports in neighboring countries.
- Set the competitive and reasonable tariff for port users.

**Sector Strategy WT-04-3: Unified Technical Standard and Regulation for Port Structures**

**Action WT-04-3**

- Set a Unified technical standard and regulation for port structure to secure the safety of port facilities

WT-05	<u>Expand navigation options:</u> Establish key sections of the inland waterways as navigable throughout the year.
-------	--

**Sector Strategy WT-05-1: Navigation Improvement**

Improve inland waterway networks along the priority development corridors, namely the Northern Corridor, the Western North-South Corridor / the Main River Corridor and the Delta Area Network.

**Actions WT-05-01**

- Carry out a comprehensive study on the navigation channels of the Ayeyarwaddy River and the Chindwin River, including river chart development with basic data such as water depth, water level and current velocity.
- Increase navigation capacity along the priority water transport corridors, including Yangon – Mandalay, Mandalay – Kalewa (- Homalin –Khamti), and Mandalay – Bhamo.
- Secure safe navigation by installing advanced navigation aid equipment, including facilities for night navigation.

WT-06	<u>Modernize infrastructure:</u> Provide effective inland water transport network.
-------	--

**Sector Strategy WT-06-1: Improvement and Modernization of River Ports**

Improve and modernize major river ports along the Ayeyarwaddy River and the Chindwin River in order to achieve improved efficiency and cargo handling speed.

**Actions WT-06-01**

- Modernization of major river ports along the priority corridors (such as ports in Mandalay Bhamo, Kalewa, Monywa, Magway, Pyay and Yangon) will include a series of feasibility studies in 2014; Mandalay port has completed a feasibility study in 2014.

- Step-wise modernization of cargo handling equipment at major river ports should include transition time for port works to be accustomed to mechanized cargo handling from manual handling.
- Improve connectivity with other modes such as international shipping, truck and railway operators together with proper handling and storage facilities like warehouses in order to facilitate multi-modal transport.

Sector Strategy WT-06-2: Improvement of Inland Water Transport Service

Actions WT-06-02

- Maintain national minimum service in remote area with appropriate subsidy schemes.
- Note that international maritime transport has less-barriers, as compared to inland water transport. Supporting international transport will enable bounded transportation to/from sea ports and effective berth operation in the ports.

WT-07	<u>Self-sustaining IWT</u> : Redefine the role of IWT and develop a corresponding business plan.
-------	--

Sector Strategy WT-07-1: Proactive change towards self-supportive IWT

Improve and change the nature of the organization from a government supported entity to a self-supportive organization.

Actions WT-07-01

- Examine carefully route-wise profitability.
- Develop a new business plan for IWT, in which the basic direction of IWT function will be focused into ship management in order to collaborate with the private sector.
- Replace IWT aged vessels and build new vessels with new technology (such as shallow draft vessel, environmentally-friendly vessel, etc.) jointly with private sector.
- Support replacement of aged vessels owned by the private sector by providing preferential treatment and/or advanced financial scheme such as “joint ship building”.
- Privatize IWT’s cargo transport services jointly with private sector.
- Ensure that IWT continues to provide passenger and cargo transport services in remote areas, where transport services are difficult to install and on routes that have no private sector provider.

WT-08	<u>Upgrade equipment</u> : Encourage the replacement of old vessels with safer and new environmentally- friendly vessels.
-------	---

**Sector Strategy WT-08-1: Encourage replacement of old and low capacity vessels**

Vessel owners should be encouraged to replace their old and less economical vessels with new vessels, through preferential treatment schemes by the Government.

**Actions WT-08-1**

- Carry out a study on ages and condition of vessels owned by IWT and the private sector.
- IWT to build new vessels, and provide in the market with reasonable prices for the private sector.
- Increase capacity of existing shipyards and modernize associated facilities in order to provide better quality services.
- Examine effective measures (financial support, etc.) to encourage the private vessel owners to replace aged vessels with new vessels (leasing, joint ship building, etc.).

**Sector Strategy WT-08-2: Development of vessel safety regulations/standards**

**Actions WT-08-2**

- Develop vessel safety regulations/standards urgently.
- Deploy Technical Assistance (TA) for the planned vessel safety regulations/standards improvement.
- Develop enforcement mechanisms and effective vessel inspection systems.

**Sector Strategy WT-08-3: Introduction of advanced low-carbon technologies**

By introducing best practices from advanced countries, introduce practical and appropriate advanced low-carbon technologies in the water transport sector.

**Action WT-08-3**

- Develop a plan for the introduction of low-carbon technologies in the water transport sector.
- Import environmentally-friendly and energy-saving vessels and other low-carbon technologies, in the initial stage.
- Introduce early renewable energy where applicable (e.g. at ports, navigation system, etc.).

#### 9.8.4 Civil Aviation Sector

##### Sector Vision

*"Develop and strengthen the safe, secured, efficient, sustainable and environmentally friendly aviation industry in order to make Myanmar one of the major aviation hubs in Asia."*

##### Sector issues

###### (1) Better Planning and Coordination:

- Underutilization of Mandalay International Airport (a design capacity of 3.0 MPPA) and Nay Pyi Taw International Airport (a design capacity of 5.0 MPPA) means that forecasted demand for these airports is far below the design capacity – 1.9 MPPA for MIA in 2020 and 0.2 MMPPA for NIA in 2020).
- There are possible risks of overinvestment and roles of demarcation between Yangon International Airport (6.0 MPPA in 2015) and Hanthawaddy International Airport (12.0 MPPA in 2017) are unclear. This leads to the ICAO demand forecast of 7.0 MPPA in total in 2018, which is far below the aggregated design capacity of the two airports (18.0 MPPA).
- Poor land transport accessibility to the Hanthawaddy International Airport results in there being no fast or reliable land transport access to reach the HIA as of today.

###### (2) Infrastructure Development:

- There is limited passenger capacity of the Yangon International Airport and DCA evaluates its capacity at most at 6.0 MPPA. Increased passenger demand can be accommodated by extending operation hours, shortening the aircraft turnaround time, and use of flight schedule, slot and spot.
- There are 69 airports in Myanmar, most of which are non-compliant with ICAO standards and requirements; 28 airports have unpaved runways.

###### (3) Better Environment, Safety and Security:

- There is a risk of having a multi-airport system in the Yangon / Bago region. Because this is a small area, complicated operations and corresponding control would be required, and could lead to double investment for airlines and other airport related business entities.
- Improvements to the sector will require updating of air navigation services with neighboring countries. This is necessary to implement Performance Based Navigation (PBN) which must be compliant with ICAO acceptable specifications, and accordingly to modernize Communications, Navigation, Surveillance (CNS) and Air Traffic Management (ATM).

###### (4) Institutional and Regulatory Development:

- The government has taken initial steps to commercialize aerodromes, privatize Myanma Airways, and restructure its aviation institutions in accordance with global best practices.
- The DCA is unlike other aviation institutions in other developing countries because it is still heavily centralized and combines regulatory and operational functions with built-in conflict of interests.

(5) Reasonable transport pricing and secured budgeting

- The use of PPP schemes is encouraged in developing airport related infrastructure.
- Joint operation with international airlines from other countries is expected.

**Sector Strategic Objectives**

In order to address the identified sector issues, five strategic objectives are suggested, as follows:

- CA-01: Strengthen regulatory functions of the Department of Civil Aviation, so as to monitor and regulate the increasingly influential roles and activities of other organizations.
- CA-02: Develop a safe and efficient airport system for the Yangon metropolitan area as the country's international prime gateway city to cope with increasing international and domestic air transport demand.
- CA-03: Develop a nationwide airport system in order to cope with increasing air traffic demand and contribute to balanced national socio-economic development.
- CA-04: Modernize Air Navigation Services in line with the ICAO GANP so as to provide seamless services and support safe and efficient air transport.
- CA-05: Allocate service provision functions currently under the Department of Civil Aviation to appropriate entities in order to improve effectiveness and efficiency of the service production and provision.

**Strategic objectives and corresponding strategies and actions**

- |   |
|---|
| CA-01: <u>Responsible industry oversight</u> : Strengthen regulatory functions of the Department of Civil Aviation, so as to monitor and regulate the increasingly influential roles and activities of other organizations. |
|---|

Sector Strategy CA-01-1: Scrutinize results of ICAO Universal Safety Oversight Audit Program and identify the areas where strengthening is required.

Action CA-01-1

- Scrutinize the results of the ICAO Universal Safety Oversight Audit Program and identify areas that require improvement in 2014/2015.

Sector Strategy CA-01-2: Assessment on forthcoming changes in roles and activities of DCA and other organizations

Action CA-01-2

- Evaluate forthcoming changes in roles and activities of the DCA and other organizations, and identify the areas that require improvement to cope with such changes by the end of 2015.
- The assessment should include effects of allotting service provision function of DCA to several entities and creation of new SPCs for YIA, HIA and Mandalay International Airport.

Sector Strategy CA-01-3: Amend rules and regulations of licensing, audit, etc. for regulating civil aviation activities as necessary.

Action CA-01-3

- Amend rules and regulations of licensing, audit, etc. for regulating civil aviation activities in 2016/2017.
- In order to do this, DCA should establish an implementing mechanism in DCA, in line with the proposed amendment of rules and regulations.

CA-02: Plan for future growth: Develop a safe and efficient airport system for the Yangon metropolitan area as the country's international prime gateway city to cope with increasing international and domestic air transport demand.

Sector Strategy CA-02-1: Continue ongoing process of the projects for Yangon International Airport (YIA) and Hanthawaddy International Airport (HIA) with utmost care, and make adjustments as and when necessary.

Action CA-02-1

- Continue the ongoing selection process of the concessionaires who will implement the 30-year BOT projects for YIA and HIA with the utmost care so as to coordinate the 2 separate projects to achieve a single goal, i.e. to develop an efficient airport system for Yangon metropolitan area.

Sector Strategy CA-02-2: Coordinate with concerned organizations for provision of reasonable access to HIA at appropriate timing.

As HIA is located about 80km northeast of downtown Yangon, high-speed access will be required for successful utilization of HIA.

Action CA-02-2

- Coordinate with concerned organizations, such as Ministry of Construction, Ministry of Rail Transportation and Yangon City Development Committee in 2014/2015.

Sector Strategy CA-02-3: Establish effective means to encourage airlines to utilize both YIA and HIA.

In order to make these 2 projects viable, air services should be provided at both YIA and HIA, in equal share. However, it is natural that air operators will prefer to stay in YIA, because YIA is much closer to the demand center.

Action CA-02-3

- Establish effective means to encourage airlines to utilize both YIA and HIA, (e.g. exemption of Air Navigation Facility Charge for landing aircraft at HIA, application of preferential cooperate tax, etc.) in 2015/2016

Sector Strategy CA-02-4: Establish rules and regulations for monitor and control of various charges at the airports to avoid the abuse of monopoly positions.

There will be competition between YIA and HIA to attract air operators and air passengers.

Action CA-02-4

- Establish rules and regulations to monitor and control various charges at the airports to avoid the abuse of monopoly positions by the concessionaires in 2014/2015.

Sector Strategy CA-02-5: Monitor and check the performances of the Special Purpose Companies for YIA and HIA if they comply with the contracts.

Action CA-02-5

- Monitor and check the performances of the SPCs (Special Purpose Companies) formed by the successful tenderers for YIA and HIA, if they comply with the contracts throughout the 30-year BOT period (2014~).

Sector Strategy CA-02-6: Control and regulate operations of YIA and HIA to protect the interest of the travelling public.

Action CA-02-6

- Control and regulate operations of YIA and HIA in terms of safety and security of air transport and commercial aspects (based on rules and regulations established by Action 1-4) to protect the interest of the travelling public throughout the 30-year BOT period (2014~).

**CA-03:** Planning at a national level: Develop a nationwide airport system in order to cope with increasing air traffic demand and contribute to balanced national socio-economic development.

Sector Strategy CA-03-1: Identify strategic airports for international air services to promote regional socio-economic developments.

Four (4) international airports, including Hanthawaddy, may not be enough to support globalized socio-economic activities in Myanmar. For example, Thailand has 7 international airports, and Vietnam has 9 international airports.

Action CA-03-1

- Identify some airports from the existing domestic facilities that have the potential to be internationalized, most probably start with regional international charter operations, from a strategic viewpoint of formulating air transport network (such as Heho and Nyaung U, alternatively Pakokku) in 2014/2015.
- Prepare a master development plan and conduct a feasibility study for each of the strategic airports for international services. Technical cooperation from a donor country/agency will probably be necessary in 2015/2016.
- MOT to develop the strategic airports according to the master plans.

Sector Strategy CA-03-2: Prepare a nationwide airport development master plan.

Action CA-03-2

- Prepare a nationwide airport development master plan for systematic and balanced development of the domestic airports. It must include a study on the necessity of some airports that have no traffic in the last few years (2014/2015).
- Produce a development plan for each individual airport, based on the priorities set in the nationwide airport development master plan (2015~).
- MOT to develop each airport according to its development plans.

Sector Strategy CA-03-3: Financial arrangement for development of the strategic airports for international services and priority domestic airports.

Development of a strategic airport for international services would cost several hundred million US dollars each, and DCA, in close coordination with the Ministry of Transport and other concerned ministries, should make advance financial arrangements for development of these strategic airports.

Action CA-03-3

- A soft loan, such as from Japan (0.01% interest rate, 40-year repayment period including 10-year grace period) can reduce the overall cost, including payment of interest.
  - \* It must be noted that even if the development were done with a BOT scheme, the overall cost would ultimately be borne by air passengers.

Sector Strategy CA-03-4: Monitor traffic growth and review airport development plans periodically.

Action CA-03-4

- Monitor traffic growth and review airport development plans, based on the actual trend of air transport periodically, e.g. at 5-year intervals.

CA-04: Update industry services: Modernize Air Navigation Services in line with the ICAO GANP so as to provide seamless services and support safe and efficient air transport.

Sector Strategy CA-04-1: Develop a master plan for modernization of Air Navigation Services.

Action CA-04-1

- Develop a master plan for the modernization of Air Navigation Services, including air traffic forecasts for airports and air routes, roadmaps for implementation of Performance Based Navigation (PBN), air route plans, roadmaps for modernization of Air Traffic Management / Communications, Navigation and Surveillance (CNS) / Aeronautical Information Management, and phased implementation plans (2014/2015).
- Invite Technical Assistance on CNS/ATM improvement from international aid agencies (from the middle of 2014).

Sector Strategy CA-04-2: Establish rules and regulations for provision of the modern Air Navigation Services and aircraft operations under these services.

There is need to establish rules, regulations and procedures for the provision of modern Air Navigation Services and aircraft operations under these services.

Action CA-04-2

- Review the existing rules, regulations and procedures and make necessary updates in 2014.

Sector Strategy A-04-3: Improve CNS/ATM systems and provide modern Air Navigation Services based on the Master Plan

Action CA-04-3

- Improve CNS/ATM systems according to the master plan for modernization of Air Navigation Services.
- Implement PBN, and followed by a PBN Roadmap.
- Provide modern Air Navigation Services and maintain the modernized CNS/ATM equipment properly by 2015/2016.

Sector Strategy CA-04-4: Enhance capability of DCA officers for transition to the modern Air Navigation Services.

Action CA-04-4

- In order to provide modern Air Navigation services with modern CNS/ATM equipment, the capability of DCA staff, such as air traffic controllers, engineers and other technical staff who operate and maintain CNS/ATM equipment, should be enhanced through training. DCA should require instructors to carry out trainings at early stages of development.

CA-05: Strategic partnerships with the private sector: Allocate service provision functions currently under the Department of Civil Aviation to appropriate entities in order to improve effectiveness and efficiency of the service production and provision.

Sector Strategy CA-05-1: Conduct a comprehensive study, and produce plans for separation of service provision functions.

There are several ways to allocate service provision functions. For example, by creating (a) a single entity (civil aviation authority) for both airport and air navigation services, (b) separate entities for airport and air navigation services, or (c) further separation of entities for the major airports. In addition, there is a choice of the type of entity, including a budgetary unit of the Government, a 100% state-owned enterprise, a partially privatized corporation or a fully privatized corporation.

Action CA-05-1

- Conduct a comprehensive study to identify the best ways to separate service functions and produce detailed plans for separation in 2014/2015.

Sector Strategy CA-05-2: Amend laws/constitutions related to DCA and create new laws/constitutions related to establishment of service providers as necessary.

Action CA-05-2

- Initiate amendment of laws/constitutions related to DCA and create new laws/constitutions required for establishing the service providers.
- Implement actual separation of service provision functions by 2015/2016.

## Chapter 10 Corridor-Based Transport Infrastructure Development

---

### 10.1 Introduction

This Chapter describes an approach to develop Myanmar's corridor-based transport infrastructure and in doing so, it identifies priority corridors and necessary transport infrastructure and services, along designated corridors.

In order to identify priority corridors, the Study Team conducted numerical analysis for each transport corridor, based on the MYT-Plan's Socio-Economic Framework and passenger and freight demand forecasts. In addition, the characteristics and transport needs of each corridor are discussed in this Chapter, based on the National Spatial Development Framework. The corresponding transport infrastructure and services are also considered. Finally, a set component projects for each of the 10 priority corridors is proposed for further consideration by Joint Coordination Committee (JCC) members, using analysis from the budgetary framework and traffic demand forecast.

### 10.2 Background

#### Why is a corridor development approach important for Myanmar?

In Myanmar, multiple governmental agencies are responsible for developing and maintaining transport infrastructure and for providing transport services, including MOT, MRT, MOC, the Ministry of Border Affairs. Each of these Ministries establishes transport committees, such as the National Transport Coordination Committee under MOT, and the National Transport Facilitation Committee under MRT.

To date, there has been no comprehensive or definitive national level transport policy or strategy that can guide the country's transport sector and govern future development directions or corresponding investments. While each of the transport ministries is responsible for a long list of infrastructure projects as part of a long-term development plan, these projects are rarely tested analytically for potential benefits or how they address sector priorities. Corridor prioritization is a key issue that should be addressed in the transport sector, because the Government's ability to fund deep investment in transport infrastructure is severely hampered by a limited budget and competing priorities.

As a result, the Study Team recommends corridor-based transport infrastructure, to acknowledge the fiscal challenges while advancing infrastructure development as much as possible.

To support this finding, the ADB (2010)<sup>1</sup> proposed that the corridor development, once completed, would:

- (i) provide a spatial focus to transport improvement, connecting growth centers and catalyzing the development of surrounding locations;

---

<sup>1</sup> Strategy and Action Plan for the Greater Mekong Sub-region North – South Corridor (ADB, 2010)

- (ii) open up many opportunities for various types of investment;
- (iii) promote synergy and enhance the impact on regional economy
- (iv) provide a mechanism for prioritizing and coordinating investments; and
- (v) generate tangible demonstration effects.

ADB suggested these advantages for the Greater Mekong sub-region, though it can also be applied to Myanmar. The Study Team concluded, therefore that a corridor based infrastructure development approach was most appropriate for Myanmar; this was presented at the 5th Joint Coordination Committee (JCC) Meeting, held on 25th November 2013; JCC voted in favor of this approach.

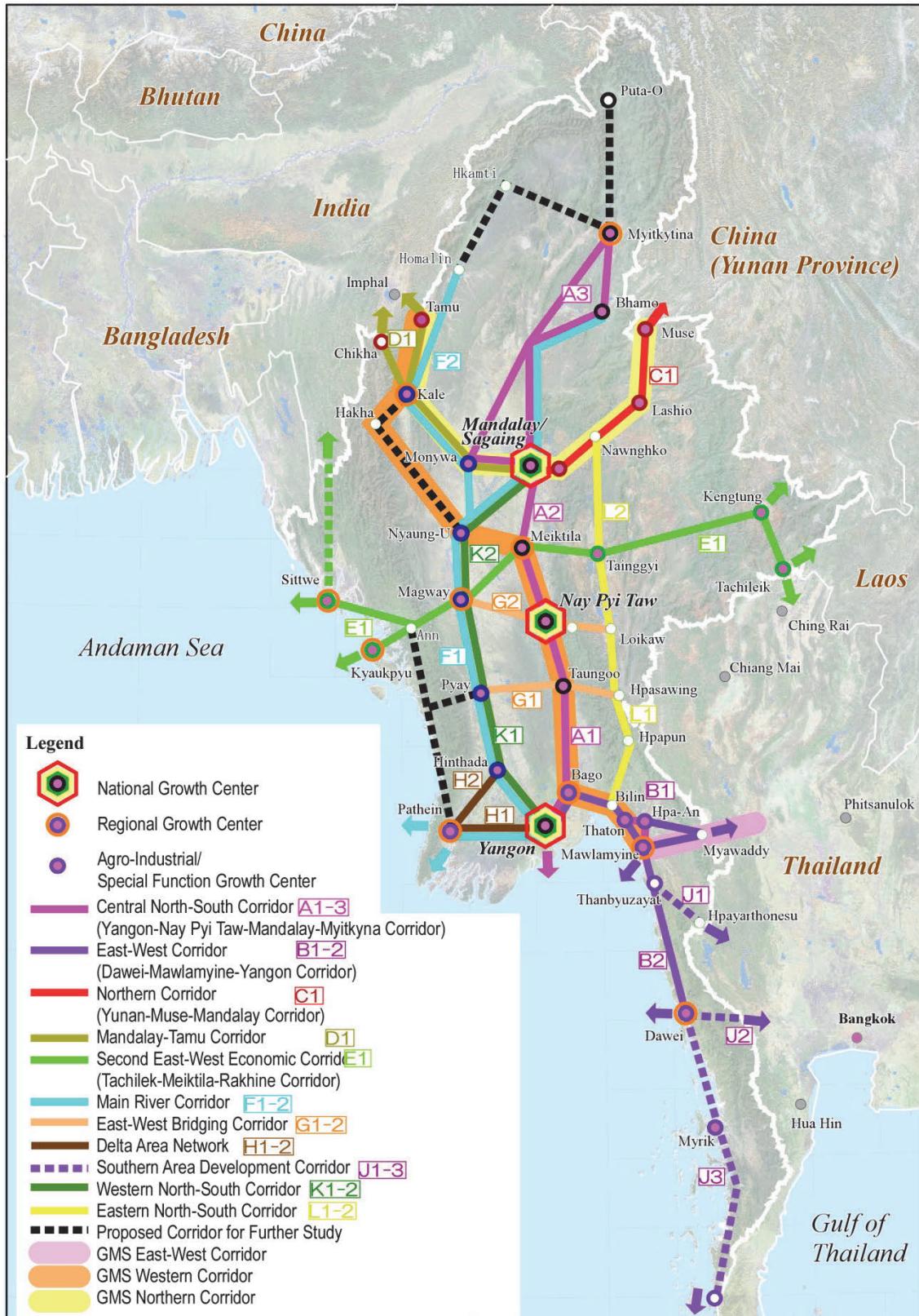
### **10.3 Development Corridors in Myanmar**

Chapter 4 of this final report proposes a National Spatial Development Framework, based on international, national, regional and city development policies and related transport networks and facilities. In this analysis, core development centers are grouped into a three level hierarchy: national, regional, agro-industrial/special function.

At the first hierarchy level, there are three national growth centers: Yangon, Mandalay and Nay Pyi Taw, where major concentrations of people, commerce, industry, and government activities exist. These national growth centers also perform the role of tourism hubs. At the second level, seven regional growth centers were identified, including: Myitkyina, Sittwe, Kyaukpyu, Pathein, Bago (Hanthawaddy), Mawlamyine, and Dawei. In these centers, clusters of commerce and industry are common and state/regional-level government administration, education and health and other social services are also provided. At the third level, major concentrations of agro-industry and commerce exist and are often related to the agricultural economic-base, border towns and other special function settlements.

The Study Team identified 10 development corridors that connect strategic activity hubs (corridor F and K may be combined into one). Selection was based on whether corridors embodied important city and economic activities, such as industrial zones, agro-industrial centers, strategic transport networks, international and national networks and major nodes for all transport modes. These development corridors include:

- A. Central North-South Corridor
- B. East - West Corridor
- C. Northern Corridor
- D. Mandalay - Tamu Corridor
- E. Second East - West Corridor
- F. Main River Corridor (part of the Western North-South Corridor)
- G. East - West Bridging Corridor
- H. Delta Area Network
- J. Southern Area Development Corridor
- K. Western North-South Corridor
- L. Eastern North - South Corridor



Source: JICA Study Team

**Figure 10.1 National Spatial Development Framework and Development Corridors**

## **10.4 Planning Method Statement**

### **10.4.1 The Planning Principle**

The planning principle used to formulate the corridor-based transport infrastructure development plan, its evaluation and the prioritization of the development corridors, includes the following three prerequisites: 1) effective investment, 2) accountability, and 3) coordination among relevant agencies.

#### Effective Investment

As discussed in Chapter 2 of this final report, the Government of Myanmar is expected to invest fixed capital of 48 trillion Kyat (at year 2013 constant prices) in the transport sector between 2014 and 2030 to achieve the desired economic growth target of 7.2 % per annum. However, the Government should plan that a substantial proportion of this investment will come from international donors and the private sector, because the Government has limited budget capacity. If financed, the corridor development plan will act as a guide for investors to understand how funds are spent, to what extent the project will generate benefits, and which are the priority corridors.

#### Accountability

Investment in the development of transport corridors may contribute to positive economic impacts, such as reducing travel time and associated costs. The scale of these impacts may vary, depending on where investments are made. The corridor development plan should be prepared taking into account the scale and probability of impacts from transport projects. A corridor development plan designed with impact in mind will need to use computerized transport models and the database developed in the Study. Also, multi-criteria analysis, which normally is used to select the priority projects, should be applied to the corridor development plan, to ensure accountability in the planning process and achievement of the corridor development plan objectives.

#### Coordination Among Corresponding Agencies

All stakeholders should be informed and preferably involved in the planning process for the corridor-based transport infrastructure development plan. Contributions from these stakeholders in meetings is needed and is most profitable if each JCC member, representing his or her ministry, is fully informed of corridor issues and participates in the joint planning process. As such, a series of meetings and discussions were organized for the Study, and included the Joint Coordination Committee (JCC) for MYT-Plan, related agencies and the SEA. Each member was assigned a series of tasks, including preparing a long-list of projects with corresponding descriptions, a mapping of the projects, evaluation criteria (multi-criteria analysis), and confirmation of the priority projects.

### **10.4.2 Multi-Criteria Analysis**

As noted, the corridor-based transport infrastructure plan should be developed with the full and accountable participation of all key stakeholders. A multi-criteria analysis method is widely used to support decision-making processes in these meetings and as a tool to ensure the accountability in the planning process. For the MYT-Plan, a simple multi-criteria analysis method was established to determine priority corridors and set corresponding projects. The evaluation criteria include:

- (i) Connectivity between the growth centers;
- (ii) Contribution to the national and local economy;
- (iii) Investment impacts; and
- (iv) Investment efficiency.

## **10.5 Corridor analysis**

By combining the Main River Corridor (F) and the Western North – South Corridor (K) into one corridor, named K: Western North – South Corridor, the 10 development corridors include the following:

- A. Central North-South Corridor
- B. East - West Corridor
- C. Northern Corridor
- D. Mandalay - Tamu Corridor
- E. Second East - West Corridor
- G. East - West Bridging Corridor
- H. Delta Area Network
- J. Southern Area Development Corridor
- K. Western North-South Corridor (including Corridor F)
- L. Eastern North - South Corridor

### **10.5.1 Population and economic activities**

Corridor development impacts, in terms of the number of beneficiaries (represented by population) and concentration level of economic activities (represented by GDP) are important to include in this Study. Table 10.1 presents the 2012 population and the GRDP of the sphere of influence, for each corridor.

In 2012, Myanmar's population was 61 million and the country had a GDP of 47 trillion Kyat. Among the 10 development corridors, larger populations and associated economic activity can be seen along A: Central North-South Corridor (41% of total population and 50% of GRDP), followed by K: Western North-South Corridor (33% of total population and 42% of GRDP), B: East – West Corridor (28% of total population and 35% of GRDP), and H: Delta Area Network (21% of total population and 27% of GRDP).

**Table 10.1 2012 Population and GRDP by Development Corridor**

Development Corridor	Section	Code	2012 Population (,000)	% of National Population	2012 GRDP (Kyat billion)	% of National GDP
A. Central North-South Corridor	Yangon-Nay Pyi Taw	A1	11,714	41%	13,170	50%
	Nay Pyi Taw-Mandalay	A2	6,323		4,457	
	Mandalay - Myitkyna	A3	7,035		5,648	
B. East - West Corridor	Yangon - Hpa-An - Myawaddy	B1	14,052	28%	14,543	35%
	Mawlamyine - Dawei	B2	2,753		2,039	
C. Northern Corridor	Mandalay - Muse	C1	6,042	10%	4,503	10%
D. Mandalay - Tamu Corridor	Mandalay - Tamu	D1	8,722	14%	6,992	15%
E. Second East - West Corridor	Tachilek - Meiktila - Kyaukpyu	E1	10,636	17%	6,938	15%
G. East - West Bridging Corridor	Hpasawing - Pyay	G1	2,664	12%	1,727	11%
	Loikaw - Magway	G2	4,767		3,214	
H. Delta Area Network	Yangon - Pathein	H1	8,992	21%	10,076	27%
	Pathein - Hinthada	H2	3,766		2,651	
J. Southern Area Development Corridor	Thanbyuzayat - Hparyathonesu	J1	2,537	8%	1,482	8%
	Dawai - Thai Border	J2	811		781	
	Dawei - Kawthaung	J3	1,756		1,679	
K. Western North-South Corridor	Yangon - Pyay - Magway	K1	12,810	33%	14,388	42%
	Magway - Mandalay	K2	7,096		5,468	
L. Eastern North - South Corridor	Bilin - Loikaw	L1	3,896	12%	2,550	9%
	Loikaw - Nawngko	L2	3,247		1,900	

Source: JICA Study Team

### 10.5.2 Freight Transport Demand

Freight transport demands are an important indicator of corridor functionality and form a basis to understand project impacts. Investments made in building capacity and increasing infrastructure quality will generally lead to improvements in the freight transport industry. In addition, improvements in specific modes of transport can change the transport market along corridors, resulting in modal shift.

Table 10.2 shows 2013 freight demand (in million tonnage-kilometers) for each development corridor. Among the development corridors, A: Central North-South Corridor is shown to be the main freight transport corridor in Myanmar, because between Yangon and Mandalay, authorities measure 41 million ton-km of freight traffic per day; this accounts for 48% of all freight movement generated in Myanmar. In addition to this corridor, part of B: East-West Corridor (Yangon – Hpa – An- Myawaddy), C: Northern Corridor (Mandalay – Muse), part of K: Western North – South Corridor (Yangon – Pyay – Magway) are major freight transport corridors in the country.

**Table 10.2 2013 Freight Demand and Modal Share by Development Corridor**

Development Corridor	Section	Code	2013 Freight demand (million ton-km)	% of traffic demand along corridor	Modal Share (ton-km) in 2013		
					Road	Rail	River
A. Central North-South Corridor	Yangon-Nay Pyi Taw	A1	23.3	27%	93%	7%	0%
	Nay Pyi Taw- Mandalay	A2	15.4	18%	92%	8%	0%
	Mandalay - Myitkyna	A3	2.6	3%	67%	13%	20%
B. East - West Corridor	Yangon - Hpa-An - Myawaddy	B1	10.0	12%	95%	5%	0%
	Mawlamyine - Dawei	B2	0.4	0%	92%	8%	0%
C. Northern Corridor	Mandalay - Muse	C1	11.1	13%	98%	2%	0%
D. Mandalay - Tamu Corridor	Mandalay - Tamu	D1	1.4	2%	75%	7%	18%
E. Second East - West Corridor	Tachilek - Meiktila - Kyaukpyu	E1	2.4	3%	97%	3%	0%
G. East - West Bridging Corridor	Hpasawing - Pyay	G1	0.1	0%	100%	0%	0%
	Loikaw - Magway	G2	1.0	1%	100%	0%	0%
H. Delta Area Network	Yangon - Pathein	H1	1.4	2%	52%	0%	48%
	Pathein - Hinthada	H2	0.2	0%	97%	3%	0%
J. Southern Area Development Corridor	Thanbyuzayat - Hparyarhonesu	J1	0.0	0%	-	-	-
	Dawai - Thai Border	J2	0.0	0%	100%	0%	0%
	Dawei - Kawthaung	J3	0.1	0%	100%	0%	0%
K. Western North-South Corridor	Yangon - Pyay - Magway	K1	8.8	10%	61%	6%	33%
	Magway - Mandalay	K2	2.1	2%	12%	8%	80%
L. Eastern North - South Corridor	Bilin - Loikaw	L1	0.2	0%	100%	0%	0%
	Loikaw - Nawngko	L2	0.1	0%	97%	3%	0%

Source: JICA Study Team

### 10.5.3 Passenger Transport Demand

The corridor-based transport infrastructure development also contributes to the improvement of passenger transport by reducing travel time and costs. It also provides opportunities for diversified transport businesses/services along the corridor and improved passenger comfort and safety. In order to gauge the likely impacts on passengers from the proposed corridor improvements, existing passenger demand for each development corridor was estimated, based on the transport model developed for MYT-Plan.

Table 10.3 shows passenger demand (in person-kilometers) by development corridor in 2013. Development corridor A: Central North-South Corridor, should be designated as the main passenger transport corridor in Myanmar, particularly between Yangon and Mandalay, which carry 44 million passenger-kilometers per day and accounts for 55% of all passenger demands (in terms of passenger-kilometers) generated in Myanmar. In addition to this corridor, B: East-West Corridor (Yangon ~ Hpa-An ~ Myawaddy) is another major passenger transport corridor.

**Table 10.3 2013 Passenger Demand and Modal Share by Development Corridor**

Development Corridor	Section	Code	2013 Traffic demand (million person-km)	% of traffic demand along corridor	Modal Share				
					Air	Car	IWT	Rail	Bus
A. Central North-South Corridor	Yangon-Nay Pyi Taw	A1	21.6	30%	1%	13%	0%	6%	80%
	Nay Pyi Taw- Mandalay	A2	14.4	20%	0%	15%	0%	14%	70%
	Mandalay - Myitkyna	A3	6.8	5%	8%	10%	10%	60%	13%
B. East - West Corridor	Yangon - Hpa-An - Myawaddy	B1	7.8	12%	0%	23%	0%	14%	64%
	Mawlamyine - Dawei	B2	0.5	1%	0%	22%	0%	10%	68%
C. Northern Corridor	Mandalay - Muse	C1	4.0	5%	0%	41%	0%	21%	38%
D. Mandalay - Tamu Corridor	Mandalay - Tamu	D1	1.9	4%	2%	22%	0%	11%	65%
E. Second East - West Corridor	Tachilek - Meiktila - Kyaukpyu	E1	4.1	6%	5%	26%	0%	10%	58%
G. East - West Bridging Corridor	Hpasawing - Pyay	G1	0.0	0%	0%	0%	0%	0%	100%
	Loikaw - Magway	G2	2.1	0%	17%	0%	0%	46%	37%
H. Delta Area Network	Yangon - Pathein	H1	3.9	5%	1%	24%	14%	0%	61%
	Pathein - Hinthada	H2	0.6	1%	0%	24%	0%	17%	59%
J. Southern Area Development Corridor	Thanbyuzayat - Hpayarthonesu	J1	0.0	0%	0%	100%	0%	0%	0%
	Dawai - Thai Border	J2	0.0	0%	0%	46%	0%	0%	54%
	Dawei - Kawthaung	J3	0.9	1%	87%	9%	0%	0%	4%
K. Western North-South Corridor	Yangon - Pyay - Magway	K1	6.2	5%	0%	22%	0%	23%	55%
	Magway - Mandalay	K2	1.8	2%	1%	9%	0%	45%	45%
L. Eastern North - South Corridor	Bilin - Loikaw	L1	0.0	0%	0%	0%	0%	0%	100%
	Loikaw - Nawngko	L2	0.2	0%	0%	17%	0%	79%	4%

Source: JICA Study Team

#### 10.5.4 Capacity versus Demand

The importance and urgency of corridor development can be assessed by comparing the traffic volume (demand) with capacity (supply), or the so-called volume capacity ratio (V/C ratio). Where the corridor V/C ratio is close to or exceeds 1.0, transport capacity for this corridor should be increased, or demand should be limited so as to not excessively exceed capacity.

Future traffic demand for both passenger and freight traffic is projected, using a conventional four-step transport demand forecast model, as explained in Chapter 8. The future corridor-based traffic demand volume is estimated by aggregating the projected traffic volumes of transport links forming the corridor.

Road-based traffic capacity for passenger traffic is set to 40 % of the existing road design capacity (of typical cross section of the road to form the corridor), while the remaining 60% is allocated to freight, as a freight carrying capacity of the road segment.

Table 10.4 presents the volume capacity ratio for each corridor by comparing the year 2030 passenger and freight demand (volume) and existing road-based capacity (capacity) for the year 2013. These V/C ratios indicate how urgent improvement is required for capacity expansion. The corridors that require urgent capacity expansion include A: Central North-South Corridor

(Yangon – Nay Pyi Taw – Mandalay), B: East-West Corridor (Yangon – Hpa An – Myawaddy), K: Western North-South Corridor (Yangon – Pyay – Magway) for both passenger and freight, C: Northern Corridor (Mandalay – Muse) for freight traffic and H: Delta Area Network (Yangon – Pathein) for passenger traffic.

**Table 10.4 Volume Capacity Ratio by Development Corridor**

Development Corridor	Section	Code	Freight Volume Capacity Ratio	Passenger Volume Capacity Ratio
A. Central North-South Corridor	Yangon-Nay Pyi Taw	A1	1.09	1.30
	Nay Pyi Taw- Mandalay	A2	1.09	1.49
	Mandalay - Myitkyna	A3	0.42	0.81
B. East - West Corridor	Yangon - Hpa-An - Myawaddy	B1	1.81	1.98
	Mawlamyine - Dawei	B2	0.16	0.09
C. Northern Corridor	Mandalay - Muse	C1	2.14	0.87
D. Mandalay - Tamu Corridor	Mandalay - Tamu	D1	0.19	0.48
E. Second East - West Corridor	Tachilek - Meiktila - Kyaukpyu	E1	0.18	0.32
G. East - West Bridging Corridor	Hpasawing - Pyay	G1	0.03	0.01
	Loikaw - Magway	G2	0.12	0.51
H. Delta Area Network	Yangon - Pathein	H1	0.67	1.45
	Pathein - Hinthada	H2	0.08	0.31
J. Southern Area Development Corridor	Thanbyuzayat - Hpayarthonnesu	J1	0.00	0.00
	Dawai - Thai Border	J2	0.00	0.00
	Dawei - Kawthaung	J3	0.01	0.09
K. Western North-South Corridor	Yangon - Pyay - Magway	K1	1.67	1.05
	Magway - Mandalay	K2	0.94	0.60
L. Eastern North - South Corridor	Bilin - Loikaw	L1	0.03	0.01
	Loikaw - Nawngko	L2	0.02	0.02

Source: JICA Study Team

### 10.5.5 Selection of priority corridors

The multi-criteria analysis uses the best (and most current) numerical data available; this is adapted to assess the need and urgency of improvements for each development corridor. Ultimately, the analysis presents corridors of highest priority, in terms of investment needs.

The evaluation indicators of the multi-criteria analysis applied in the assessment include “connectivity” between growth centers (a corridor having connection with a larger growth center is given a high score), “contribution” to regional economy (a corridor having a larger existing and/or future GRDP generated in the sphere of influence along the corridor is given a high score), “traffic demand” (a corridor of higher traffic demand is given a high score) and “investment efficiency” (a corridor showing a higher volume capacity ratio is given a high score).

Each evaluation indicator ranges from 1 (low priority) to 5 (high priority) and a consolidated evaluation is made by averaging the score of each evaluation indicator.

Table 10.5 presents assessment results for each corridor and indicates development corridors of first priority, including:

- A: Central North-South Corridor (Yangon – Nay Pyi Taw – Mandalay)
- B: East-West Corridor (Yangon – Hpa An- Myawaddy)
- C: Northern Corridor (Mandalay – Muse)
- K: Western North-South Corridor (Yangon – Pyay – Magway)
- H: Delta Area Network

The average score for these first priority corridors exceeds 3.5.

**Table 10.5 Multi-criteria Analysis and Indicated Priority Development Corridors**

Development Corridor	Section	Code	Growth Center	Contribution (Economy)	Investment Impact (Traffic)	Investment Efficiency	Average Score
A. Central North-South Corridor	Yangon-Nay Pyi Taw	A1	5	5	5	5	5.0
	Nay Pyi Taw- Mandalay	A2	5	3	5	5	4.5
	Mandalay – Myitkyna	A3	4	4	2	2	3.0
B. East - West Corridor	Yangon - Hpa-An - Myawaddy	B1	4	5	4	3	4.0
	Mawlamyine – Dawei	B2	3	1	1	1	1.5
C. Northern Corridor	Mandalay – Muse	C1	4	3	3	4	3.5
D. Mandalay - Tamu Corridor	Mandalay – Tamu	D1	4	4	2	1	2.8
E. Second East - West Corridor	Tachilek - Meiktila – Kyaukpyu	E1	3	4	2	1	2.5
G. East - West Bridging Corridor	Hpasawing – Pyay	G1	3	1	1	1	1.5
	Loikaw – Magway	G2	3	2	1	1	1.8
H. Delta Area Network	Yangon – Pathein	H1	4	4	3	4	3.5
	Pathein – Hinthada	H2	3	1	1	1	1.5
J. Southern Area Development Corridor	Thanbyuzayat – Hparyarhonesu	J1	3	1	1	1	1.5
	Dawai - Thai Border	J2	3	1	1	1	1.5
	Dawei – Kawthaung	J3	3	1	1	1	1.5
K. Western North-South Corridor	Yangon - Pyay – Magway	K1	4	5	3	4	4.0
	Magway – Mandalay	K2	4	4	2	3	3.3
L. Eastern North - South Corridor	Bilin – Loikaw	L1	3	1	1	1	1.5
	Loikaw – Nawngkho	L2	3	1	1	1	1.5

 First priority corridor  
 Second priority corridor

Source: JICA Study Team

## 10.6 Corridor-Based Transport Infrastructure Development Policy

### 10.6.1 Generic Policy in the Provision of Transport Services

Table 10.6 presents the characteristics of each identified corridor, in terms of demographic condition, dominant industrial activities, scale of socio-economic activities, and physical conditions (distance between neighboring centers, geographic conditions, etc.). These characteristics inform the generic requirements for transport services.

**Table 10.6 Transport Demand and Needs of Development Corridors and Desired Mode of Transport Provided along Development Corridors**

Development Corridor	Between National Growth Centers	Between National and Regional Growth Centers	Between Regional Growth Centers
Distance	300-600 km	100-400km	100-200km
Population of center city	1 - 8 million	200,000-500,000	100,000-300,000
Transport Demand and Characteristics	Over 100 mil pax-km per day Over 100 mil ton-km per day <ul style="list-style-type: none"> <li>• Frequent business trip</li> <li>• Frequent and large freight transport demand</li> <li>• International freight movement (container)</li> <li>• Visitors from overseas</li> <li>• Exceed the existing traffic capacity along the corridor shortly</li> </ul>	17 mil pax-km per day 20 mil ton-km per day <ul style="list-style-type: none"> <li>• Frequent business trip (HQs and branch, etc.)</li> <li>• Freight distribution to/from national centers (Dry port / ICD – and centers)</li> <li>• Special purpose trip such as tourism (ex. Mandalay – Bagan)</li> </ul>	3 mil pax-km per day 6 mil ton-km per day <ul style="list-style-type: none"> <li>• Occasional business trip between neighboring regional centers</li> <li>• Passenger and commodity movement within a limited sphere of influence.</li> </ul>
Transport Needs	<ul style="list-style-type: none"> <li>• High speed (P)</li> <li>• High capacity (F/P)</li> <li>• High frequency (F/P)</li> <li>• Redundancy (F/P)</li> <li>• Dedicated network/service (F)</li> <li>• Regular and punctual operation (F/P)</li> <li>• Multimode (F/P)</li> </ul>	<ul style="list-style-type: none"> <li>• Regular speed (P)</li> <li>• Medium capacity (F/P)</li> <li>• Regular frequency (F/P)</li> <li>• Multimode (F/P)</li> <li>• Regional terminal facility (F/P)</li> </ul>	<ul style="list-style-type: none"> <li>• Regular speed (P)</li> <li>• On-demand operation (F)</li> <li>• Vehicular traffic dominant (F/P)</li> </ul>
Preferred transport services (Passenger)			
Expressway	A	B	B/C
Union Highway	B	A	A
High Speed Rail	A	C	D
Improved Railway	B	B/C	B/C
Inland Waterway	D	B/C	B/C
Air	A	B/C	D
Preferred transport services (Freight)			
Expressway	A	B	B/C
Union Highway	A	A	A
High Speed Rail	D	D	D
Improved Railway	A	B/C	B/C
Inland Waterway	A	B/C	B/C
Air	C	C	D

Note 1: A: Most appropriate, B: Appropriate, C: Slightly appropriate, D: Not appropriate

Note 2: P: for passenger movement, F: for freight movement

Source: JICA Study Team

By the year 2030, the development corridors that connect the National Growth Centers (i.e. Yangon, Nay Pyi Taw and Mandalay) will exhibit a high degree of traffic demand, exceeding 100 million passenger-kilometer per day and 100 million ton-kilometer of daily freight. Typical transport needs observed along this corridor are:

- Frequent business trips: A considerable number of business trips are observed between Yangon, Nay Pyi Taw, and Mandalay for business meetings and conferences. These travelers require fast, efficient and frequent transport services at a reasonable fare ) and they are willing to pay more for services of a higher level.
- Frequent and large freight transport demand: There is a high volume of freight movement including logs, construction materials, manufactured goods, food stuffs, and fuel mainly from/through Yangon and the Yangon Ports to Nay Pyi Taw, Mandalay and vice versa. It is a common requirement to provide reliable transport services (e.g. safety and regular operation) between shippers and consignees, yet the exact transport needs and means for freight transport do vary and are determined by commodity type and cargo volume.
- International freight movement: A considerable volume of international cargo, such as manufactured goods and petroleum, will be transported to/from Yangon/Thilawa Ports along the corridor towns. Transport infrastructure meeting international standards are required to carry international freight traffic as needed (e.g. reefer container/warehouse, container handling equipment, trailers, single-window border procedure).
- Visitors from overseas: Yangon/Nay Pyi Taw/Mandalay act as the gateways through which overseas business/commercial and tourism visitors travel; these travelers prefer fast and punctual transport services.
- Exceeding the existing traffic capacity: As the National Growth Centers' populations grow and economic activity results in traffic capacity exceeding limits along the corridor, the volume of passenger and freight traffic increases by over 10% per annum. Transport capacity should be expanded, maximizing the existing transport capacity and installing additional transport network surge capacity.

Along the corridors connecting the National Growth Centers, expressways, high-speed rail (HSR), and the air are suitable to carry passenger traffic. Freight transportation can take advantage of expressways, union highways (national highways), improved railways, and inland waterways in Myanmar.

Along the development corridors between the National and the Regional Growth Centers, the demand varies between corridors, and reaches at about 17 million passenger-kilometers per day and 20 million ton-kilometer per day by 2030, on average. Their travel distances are limited to a few hundreds kilometers and typical transport characteristics observed along these corridors include:

- Frequent business trips: A large number of trips observed between National and Regional Centers for business purposes. These travelers favor efficient, regular and frequent transport services by road and railway, due to limited travel distances.
- Freight distribution to/from national centers: Multi-modal transport and trans-shipment facilities between different transport modes. Also, terminal facilities for consolidated cargos.
- Special purpose trip such as tourism: Efficient, regular and reliable (safe) transport services.

- Along development corridors between National and Regional Growth Centers: Road and railway are desired modes of transport and suitable to carry passenger traffic; road and railway are also suitable for freight traffic, considering the transport demands and needs identified along the corridor.

### 10.6.2 Basic policy in infrastructure provision

The required generic features of transport facilities (by type of corridor) are summarized in Table 10.7.

**Table 10.7 Transport Demand and Needs of Development Corridors and Desired Mode of Transport Provided along Development Corridors**

Development Corridor	Between National Growth Centers	Between National and Regional Growth Centers	Between Regional Growth Centers
Proposed Infrastructure/Service			
Expressway and Highway, and related facilities	<ul style="list-style-type: none"> <li>• Expressway (4-8 lane, full-access controlled, toll)</li> <li>• National Highway (4 - 6 lane), heavy loaded road standard</li> <li>• Bypass passing major cities</li> <li>• Faster access to international nodes (ports and int'l airport)</li> <li>• Logistics hub (dry port, ICD)</li> <li>• Passenger terminal (mixed use building)</li> <li>• Road monitoring and management system (ITS, etc)</li> <li>• Road safety / emergency facilities</li> <li>• Roadside station (Michi no Eki)</li> </ul>	<ul style="list-style-type: none"> <li>• Expressway (spur line, toll)</li> <li>• National Highway (4 – 6 lane), heavy loaded road standard</li> <li>• Freight terminal (rail and truck ICD)</li> <li>• Regional Roads (2 - 4 lane)</li> <li>• Passenger terminal (bus)</li> <li>• Cross boarder facilities (one-stop service)</li> <li>• Roadside station (Michi no Eki)</li> </ul>	<ul style="list-style-type: none"> <li>• National Highway (2 - 4 lane)</li> <li>• Regional Roads (2 - 4 lane)</li> <li>• Missing link improvement</li> <li>• Passenger terminal (bus)</li> <li>• Roadside station (limited)</li> </ul>
HSR and Rail	<ul style="list-style-type: none"> <li>• High-speed Passenger Rail (HSR)</li> <li>• Airport Rail Access</li> <li>• Improved (faster) passenger rail</li> <li>• Container Wagon (40ft high cube)</li> <li>• Fuel Wagon</li> <li>• Dry port / ICD and equipment</li> <li>• International railway (SKRL Line)</li> <li>• Modernized train operation and control system</li> <li>• Multi-purpose station</li> </ul>	<ul style="list-style-type: none"> <li>• Rail access to major nodes (city/port/airport/SEZ)</li> <li>• Dry port</li> <li>• Multi-purpose station</li> </ul>	<ul style="list-style-type: none"> <li>• NA</li> </ul>
Maritime / Inland water Coastal	<ul style="list-style-type: none"> <li>• Deep seaport and associated facilities</li> <li>• Navigation channel improvement and maintenance</li> <li>• River container / freight terminal</li> <li>• River passenger terminal</li> <li>• Navigation aid, security and safe improvement</li> <li>• Ship building</li> </ul>	<ul style="list-style-type: none"> <li>• Major ports improvement / modernization</li> <li>• River passenger terminal improvement</li> <li>• Navigation aid, security and safe improvement</li> <li>• Ship building</li> </ul>	<ul style="list-style-type: none"> <li>• NA</li> </ul>
Air	<ul style="list-style-type: none"> <li>• New International airport</li> <li>• Improvement of the existing international airports</li> <li>• Logistics/passenger terminal improvement and development</li> <li>• Upgrade of airport terminal security</li> <li>• New air traffic control systems</li> <li>• Upgrade of air navigation systems</li> <li>• Introduction of Instrument Flight Rules (IFR)</li> <li>• Meet Open Sky Policy (P)</li> </ul>	<ul style="list-style-type: none"> <li>• Upgrade selected local airports to international airports</li> <li>• Other local airport improvements/ expansion</li> <li>• Upgrade of airport terminal security</li> <li>• New air traffic control systems</li> <li>• Upgrade of air navigation systems</li> <li>• Introduction of Instrument Flight Rules (IFR)</li> </ul>	<ul style="list-style-type: none"> <li>• NA</li> </ul>

Source: JICA Study Team

## **10.7 Proposed project component**

### **10.7.1 Proposed project component along the priority development corridors**

Section 10.6 identified the priority corridors, applying multi-criteria analysis as an evaluation method and socio-economic data and traffic demand to develop evaluation indicators. The priority development corridors include:

- A: Central North-South Corridor (Yangon – Nay Pyi Taw – Mandalay)
- B: East-West Corridor (Yangon – Hpa An- Myawaddy)
- C: Northern Corridor (Mandalay – Muse)
- K: Western North-South Corridor (Yangon – Pyay – Magway)
- H: Delta Area Network

The following discussion summarizes the project components for each priority corridor, highlighting the socio-economic conditions of the corridor, the existing and future transport demands and services and the list of priority projects for the corridor.

#### **A. Central North-South Corridor**

##### **Socio-Economic Conditions of the Corridor**

Most economic activities occur in highly populated cities and are located along the Central North-South Corridor. The city of Yangon, formerly the nation's capital, has a population of approximately 7.2 million people (2012). Other major cities along the corridor include Bago (population 2.1 million), Nay Pyi Taw (1.2 million) and Mandalay (1.5 million). The Central North-South Corridor accommodates 41% of the nation's population and generated 50% of the GDP in 2012, and this corridor ranks in the top 10 of development corridors, by population and GDP.

The production activities along the development corridor, mainly from the Industrial Zones in Yangon and Mandalay, produce Myanmar's majority of industrial products. According to the 2013 traffic demand forecast, detailed in the Study, Yangon produces 28% of Myanmar's manufactured goods and 28% of its foodstuffs, whereas Mandalay produces 27% of the manufactured goods and 20% of the foodstuffs. The Special Economic Zone project in Thilawa (Yangon) is in development and there are 21 Industrial Zone projects are under discussion or under development in Yangon. These two cities will remain major freight production nodes for the next decades.

##### **Transport Demand and Service**

All modes of transport along the Central North-South Corridor can carry passenger and freight traffic, including roads, expressways between Yangon and Mandalay, railway, inland water transport, and air transport. In 2013, the corridor was used for 43 million passenger-kilometers of passenger traffic and 41 million ton-kilometers of freight traffic. These figures account for 48% of all freight traffic and 55% of all passengers transported for all corridors. While all modes are used along the corridor, the road carries the majority of passenger and freight traffic. The modal distribution for freight is: road (91%), rail (8%), and water (1%), and the passenger distribution is: bus (66%), car (13%), rail (17%), air (2%) and water transport (2%). Linking all national growth centers along the corridor, this combined development contributes to rapid increases in both freight (maximum of 11% p.a. from 2013 to 2030) and passenger (11% p.a. during the same period) traffic demands. By 2030, the future traffic demand reaches nearly 100

million passenger-kilometer and 100 million ton-kilometer per day.

#### Proposed Major Project Component

Considering the corridor developments needs and demand data, and the proposed infrastructure and services for the transport corridor between National Growth Centers, the following development strategy is proposed for the Central North-South Corridor development.

- Provide high-speed, high capacity, safe and reliable transport network and services as the primary corridor element
- Enable multi-modal transport
- Make efficient use of existing transport facilities
- Segregate inter- and intra-city traffic

Table 10.8 and 10.9 and Figure 10.2 to Figure 10.5 summarize a range of priority transport projects along the Central North-South Corridor that will achieve the above corridor development strategies. These projects were developed using project assessments in ongoing transport studies.

**Table 10.8 Selected Major Priority Actions/Projects along Central North-South Corridor**

	Road	Rail	Inland Water
Selected Priority Actions / Projects			
Infrastructure	<ul style="list-style-type: none"> <li>• Upgrading Expressway, NH-1 and NH-2</li> <li>• Bypass (Circular Ring Road) at Yangon and Mandalay.</li> <li>• Extension of Expressway to Yangon, Thilawa Port and Hanthawaddy Airport</li> <li>• Heavy loaded roads/bridges</li> <li>• Relocation (close to Rail ICD) /upgrading truck terminal in Yangon</li> </ul>	<ul style="list-style-type: none"> <li>• Rehabilitation and Modernization of the existing railway, including procurement of DEMU</li> <li>• New workshop in Ywa Thar Gyi area</li> <li>• Extension to Thilawa Port</li> <li>• Extension to Hanthawaddy Airport (spur line)</li> <li>• Dry port at Mandalay (Myintnge) and Yangon (Ywa Thar Gyi)</li> <li>• Airport Rail Access (HSR)</li> </ul>	<ul style="list-style-type: none"> <li>• Mandalay Port development</li> <li>• Yangon Port capacity improvement</li> <li>• River navigation channel improvement (Yangon River)</li> <li>• Replacement of old ships and barges</li> <li>• Navigation aid system in the Yangon Port area</li> </ul>
Service	<ul style="list-style-type: none"> <li>• Open Expressway to trucks</li> <li>• Roadside station (Michi no eki)</li> </ul>	<ul style="list-style-type: none"> <li>• MR Freight business improvement</li> </ul>	<ul style="list-style-type: none"> <li>• Navigation aid in the Yangon Port area</li> <li>• Introduction of EDI (Port-MIS)</li> </ul>
		Maritime	Air
Selected Priority Actions / Projects			
Infrastructure	<ul style="list-style-type: none"> <li>• Capacity expansion of the existing ports in Yangon</li> <li>• Thilawa Port Development</li> <li>• Offshore Deep seaport at the Yangon River mouth</li> </ul>	<ul style="list-style-type: none"> <li>• Yangon Int'l Airport improvement</li> <li>• Hanthawaddy International Airport</li> <li>• Mandalay Int'l Airport improvement</li> </ul>	
Service	<ul style="list-style-type: none"> <li>• Introduction of EDI (Port-MIS)</li> </ul>	<ul style="list-style-type: none"> <li>• Airline development to/from Nay Pyi Taw</li> <li>• A series of navigation modernization such as IFR</li> </ul>	

Note: DEMU: diesel electric multiple unit, PTB: passenger terminal building, IFR: instrument flight rules

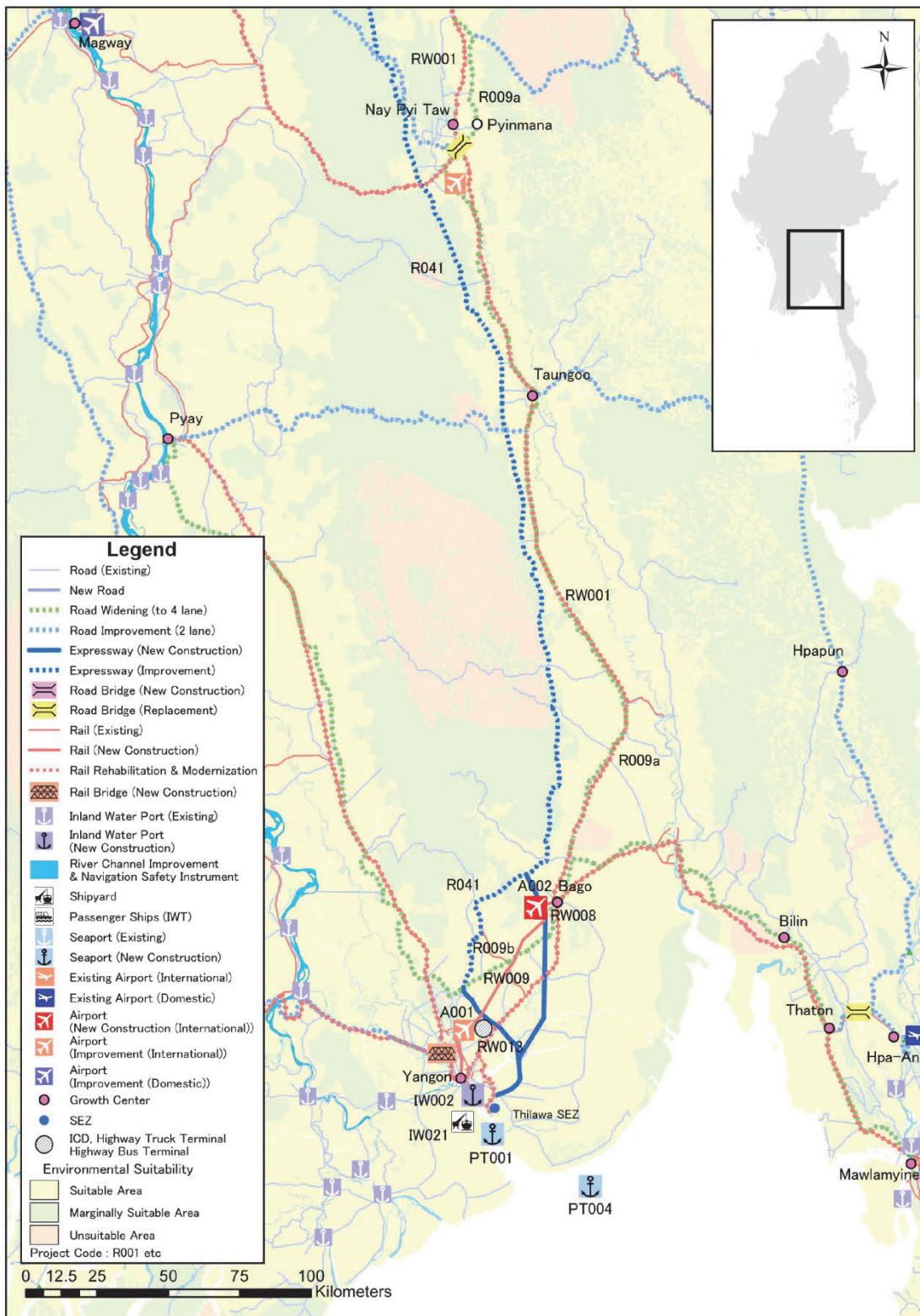
Source: JICA Study Team

**Table 10.9 List of Priority Infrastructure Projects along the Central North-South Corridor**

Corridor	Sector	Project ID	Project	Total Project Cost (Bil. MMK)
A1,B1,H1,K1	Aviation	A001	Yangon International Airport	195.0
A1,B1	Aviation	A002	Hanthawaddy International Airport	1,403.0
A2,A3,C1,D1,K2	Aviation	A003	Mandalay International Airport	21.0
A3	Aviation	A008	Myitkyina Airport (major domestic)	24.0
A3	Aviation	A018	Bhamo Airport	9.0
A1, A2	Railway	RW001	Yangon - Mandalay	1,755.0
A3	Railway	RW002	Myohaung-Myitkyina	912.0
A1	Railway	RW008	Bago-Hanthawaddy	29.0
A1	Railway	RW009	Yangon - Hanthawaddy	2,000.0
A1	Railway	RW013	Yangon MR ICD, Workshop, etc.	40.0
A3	Railway	RW014	Mandalay MR ICD, truck terminal, etc.	10.0
A3	Road	R007	Shwebo – Myitkyina Road	462.0
A1, A2	Road	R009a	Bago – Mandalay Road	880.0
A1, A2	Road	R009b	Yangon (from toll gate) - Bago Road	84.0
A3	Road	R013	Mandalay – Thabeikkyin – Tagaung – Bhamo Road	274.0
A2	Road	R027	2 bridges on Yangon-Mandalay Road	10.0
A1	Road	R041	Yangon - Mandalay Expressway	676.0
A1	Road	R042	Yangon City - Thilawa Port Expressway	243.0
A1	Road	R043	Yangon City - Hanthawaddy - Existing Expressway	388.0
A2,A3	Road	R044	Mandalay Circular Expressway	340.0
A1,B1,H1,K1	Sea Port	PT001	Yangon Port in Thilawa (Phase 1)	223.0
A1,B1,H1,K1	Sea Port	PT001a	Yangon Port in Thilawa (Phase 2)	554.0
A1,B1,H1,K1	Sea Port	PT001b	Yangon Port in Thilawa (Phase 3)	194.0
A1,B1,H1,K1	Sea Port	PT002	Yangon Port Capacity and Connectivity Improvement	205.0
A1,B1,H1,K1	Sea Port	PT003	Yangon Port in Thilawa (Post Thilawa)	485.0
A1,B1,H1,K1	Sea Port	PT004	Offshore Yangon River (Deep Seaport)	2,427.0
				13,843

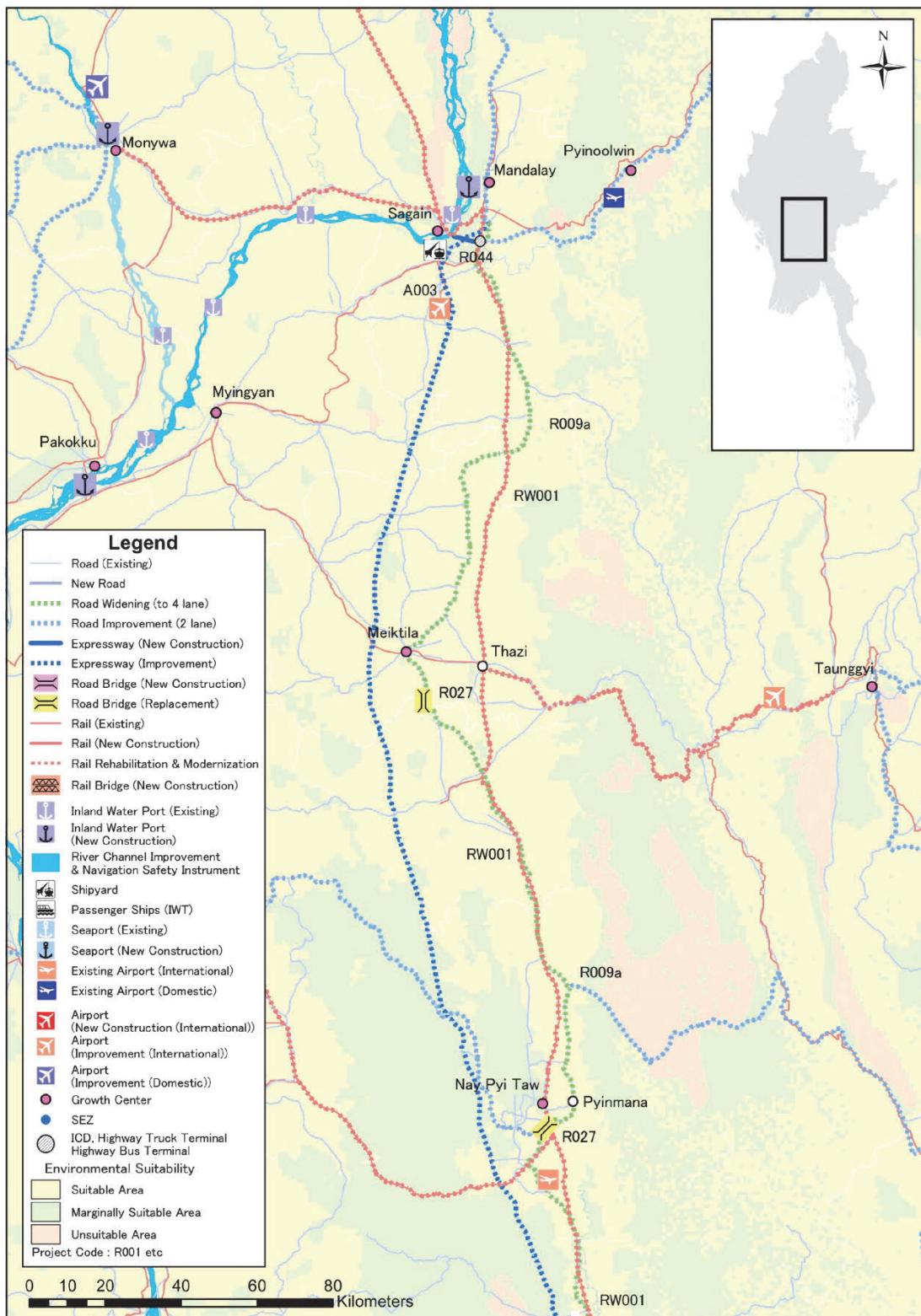
Source: JICA Study Team

Note: Details of the project information are available in the technical notes.



Source: JICA Study Team

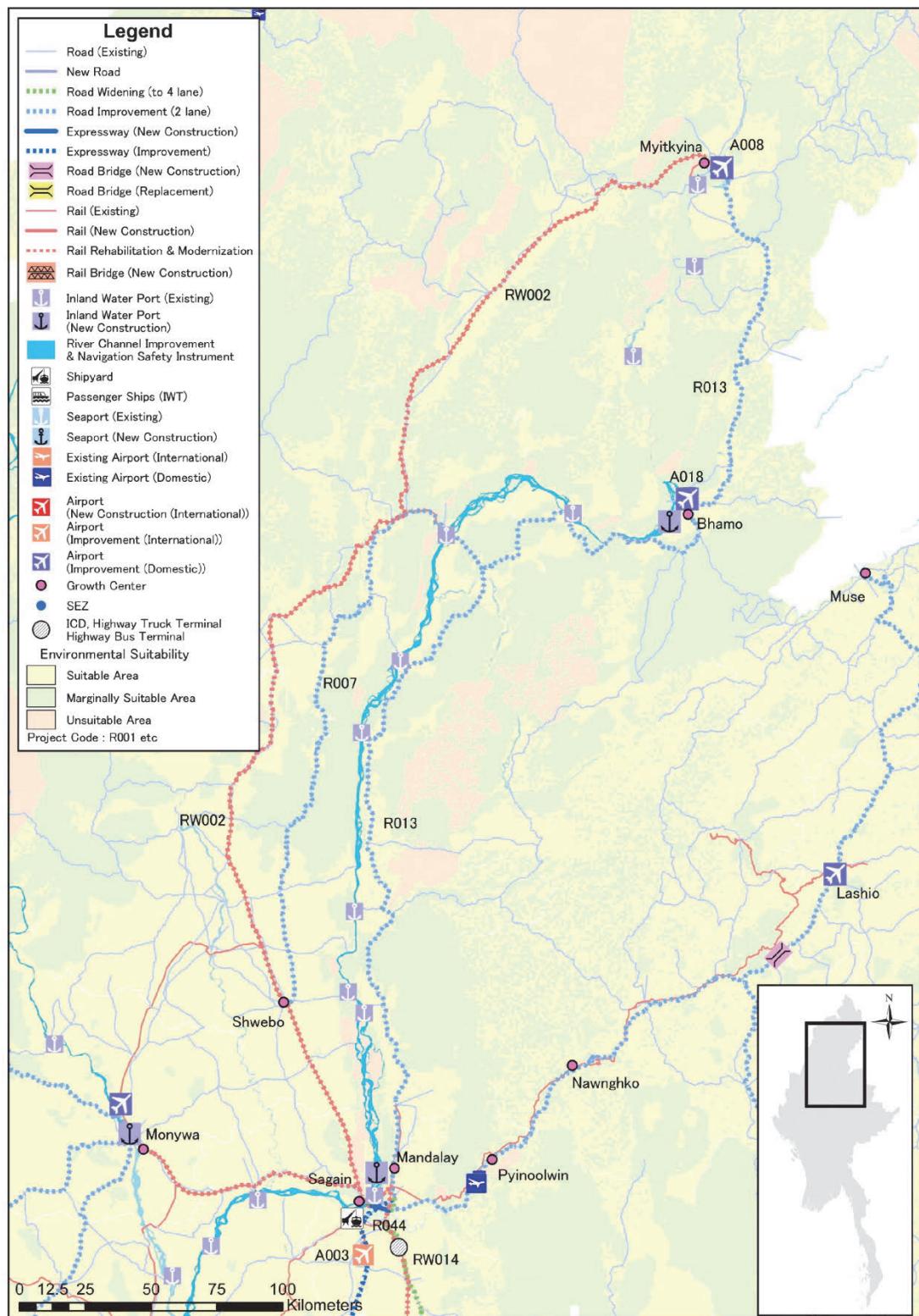
**Figure 10.2 Corridor-based Transport Infrastructure Development Plan  
– A. Central North-South Corridor (1/4)**



Source: JICA Study Team

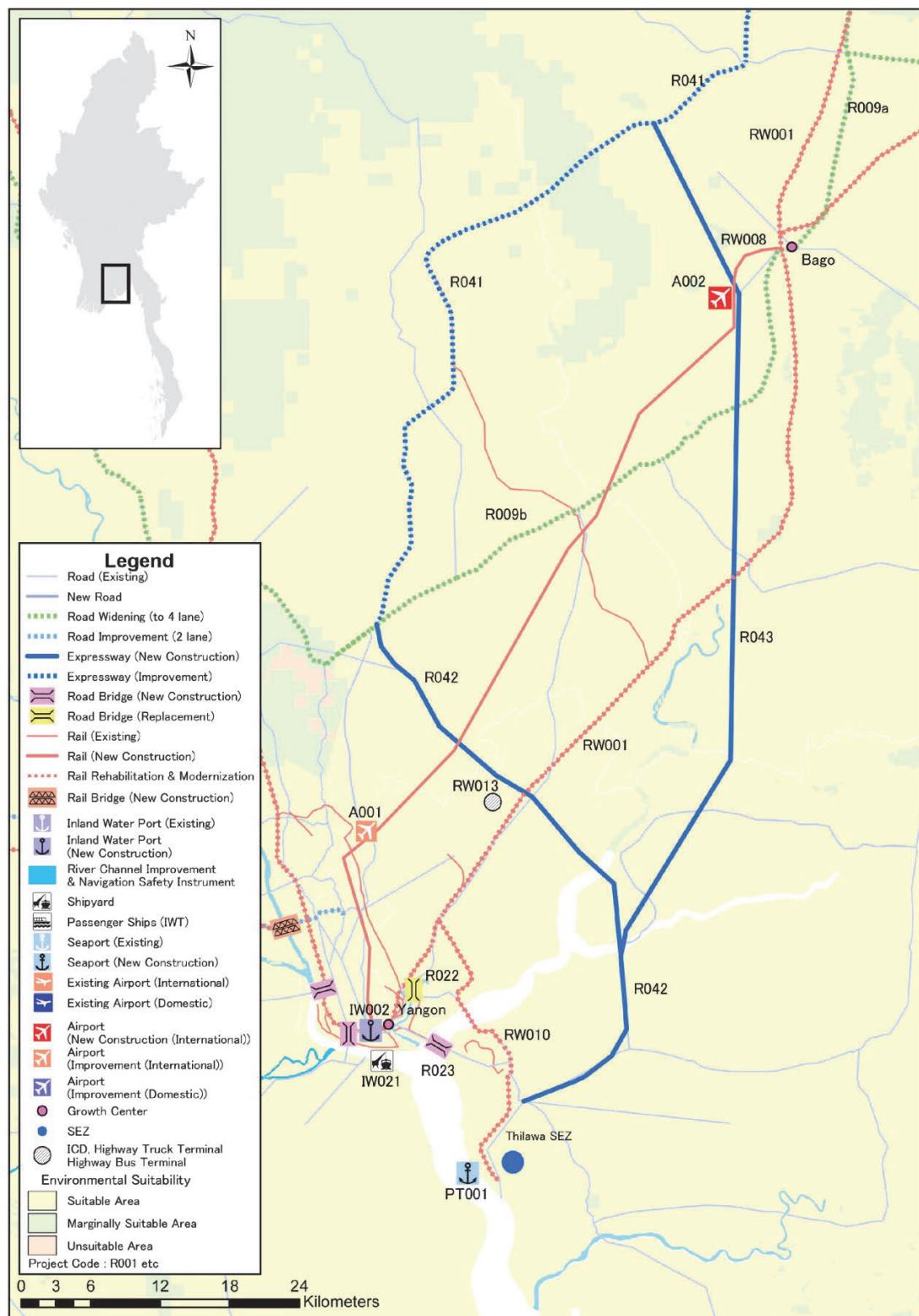
**Figure 10.3 Corridor-based Transport Infrastructure Development Plan**  
**- A. Central North-South Corridor (2/4)**

---



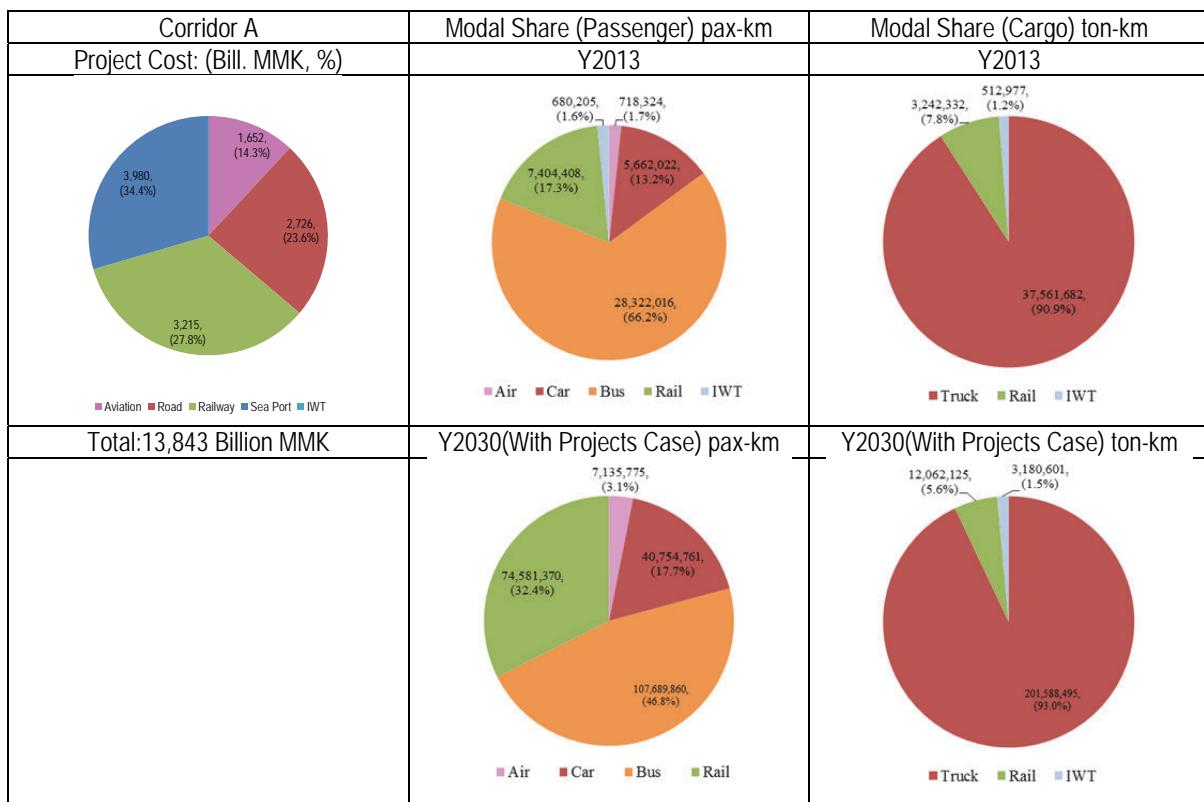
Source: JICA Study Team

**Figure 10.4 Corridor-based Transport Infrastructure Development Plan – A. Central North-South Corridor (3/4)**



Source: JICA Study Team

## **Figure 10.5 Corridor-based Transport Infrastructure Development Plan – A. Central North-South Corridor (4/4)**

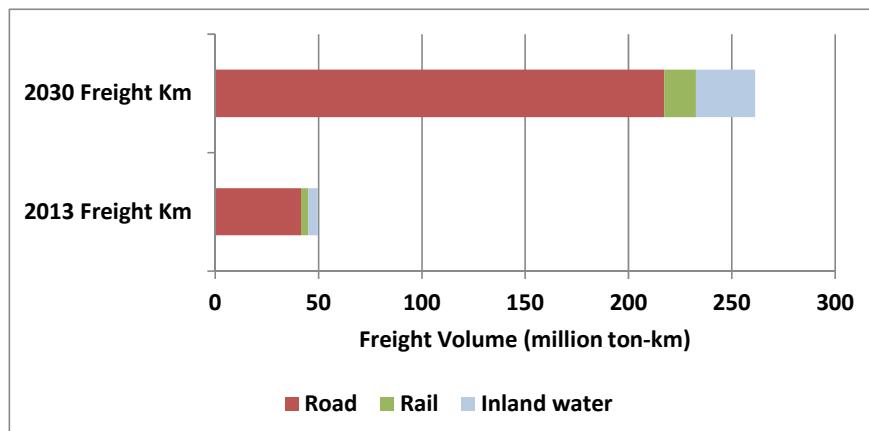


Source: JICA Study Team

**Figure 10.6 Proposed Project Cost and Modal Share – A. Central North-South Corridor**

#### Box: Corridor Analysis on Central North-South Corridor: Yangon – Mandalay

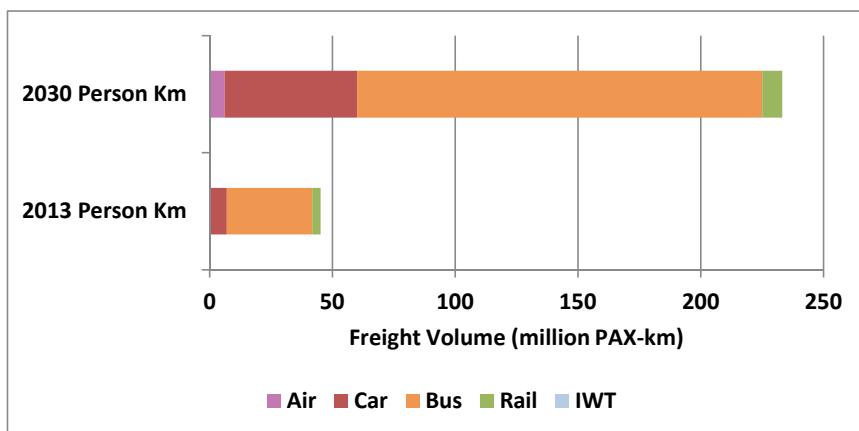
In 2013, the Central North-South Corridor between Yangon and Mandalay experiences 50 million ton-kilometers of daily freight traffic by: road (84% of freight traffic along the corridor), rail (7%) and inland water (9%). The freight traffic along the corridor is projected to increase by 10% p.a. until 2030.



Source: JICA Study Team

### Figure 10.7 2013 and 2030 Freight Demand by Transport Mode between Yangon and Mandalay

Along the same corridor between Yangon and Mandalay, a total of 45 million passenger-kilometers of daily passenger trips travel by: bus (77% of passenger traffic along the corridor), car (15%), and rail (7%). Travel demand along the corridor is projected to increase by 10% per annum (p.a.) until 2030. The number of air and car passengers will increase significantly by 23% p.a. and 12% p.a., respectively.



Source: JICA Study Team

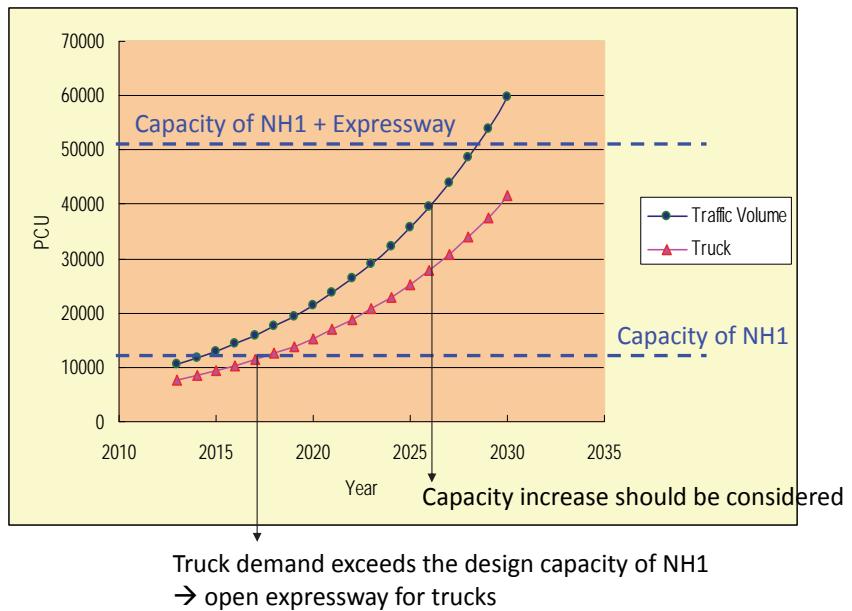
### Figure 10.8 2013 and 2030 Passenger Demand by Transport Mode between Yangon and Mandalay

Along the same corridor between Yangon and Mandalay, the vehicular traffic volume on Expressway and National Highway No. 1 is estimated at 5,100 vehicles (10,500 PCUs) in 2013 and 31,000 vehicles (59,600 PCUs) in 2030. The road capacity (design capacity) of the Expressway (4 lane, double carriageway) is estimated at 28,800-43,200 PCUs/day and National Highway No. 1 (2 lane, single carriageway) at 9,600-12,000 PCUs/day. The following table and figure report vehicular traffic volume and volume capacity ratios between Yangon and Mandalay and indicate that the National Highway No. 1 will be oversaturated in a few years unless the Expressway is open to heavy vehicles. The table and figure also indicate that vehicular traffic demand along the same corridor will exceed the currently available road capacity (of both Expressway and National Highway No. 1) and the road improvement project(s) is unavoidable to increase road capacity by 2030.

**Table 10.10 Vehicular Traffic Volume and Volume Capacity Ratio between Yangon and Mandalay**

Year	Car	Bus	Truck	Total	Design Capacity (PCUs)	Volume / Capacity Ratio
2013 (Vehicle)	1,366	743	3,041	5,150	38,400	-
2013 (PCU)	1,366	1,486	7,603	10,455		0.19 - 0.27
2030 (Vehicle)	10,901	3,574	16,628	31,103	55,200	-
2030 (PCU)	10,901	7,148	41,571	59,619		1.08 - 1.55

Source: JICA Study Team



Source: JICA Study Team

**Figure 10.9 Vehicular Traffic Demand Forecast along the Yangon and Mandalay Corridor**

## **B. East - West Corridor**

### Socio-Economic Conditions of the Corridor

Like the Central North-South Corridor, intense economic activities and highly populated cities are situated along the East-West Corridor. The city of Yangon is home to 7.2 million residents in 2012. Other major cities along the corridor include Bago (population 2.1 million), Hpa-an (0.9 million), and Mawlamyine (1.9 million). The East-West Corridor accommodates 28 % of the national population and generated 35% of the nation's GDP in 2012.

The production activities along the development corridor, mainly from Yangon and Kayin, produce a considerable quantity of industrial products. According to the traffic demand forecast, described in the Study, for 2013, Yangon produced 28% of Myanmar's manufactured goods and 28% of food stuffs. Kayin State produced 12% of Myanmar's construction materials. Along the corridor, these two cities will remain as major freight production nodes for the next decades.

### Transport Demand and Service

A key feature of the East-West Corridor is that it includes a portion of the GMS East-West Corridor, which contributes to generating the cross border trade between Myanmar and Thailand. Along the East-West Corridor, highway, railway and air transport are available to carry passenger and freight traffic. In 2013, the corridor, mainly the section between Yangon and Myawaddy, transported 10 million passenger-kilometers of daily passenger traffic and 10 million ton-kilometers of daily freight traffic. These figures account for 10% of all freight traffic and 13% of all passengers transported along all corridors. The road carries a majority of the traffic along the corridor, and in terms of freight traffic, the modal share between Yangon and Myawaddy is road (95%) and rail (5%). For passenger traffic, the modal share is bus (64%), car (22%), rail (14%). Linking national and regional growth centers along the corridor, the corridor development will contribute to a rapid increase in both freight (maximum of 10% p.a. from 2013 to 2030) and passenger (10% p.a. during the same period) traffic demand and the future traffic demand reaches nearly 36 million passenger-kilometers and 53 million ton-kilometers per day by 2030. A potential risk along the corridor is the limited road capacity between Hpa-An and Myawaddy. Part of road section between Hpa-An and Myawaddy in mountainous area allows one-way traffic only, Hpa-an to Myawaddy direction on the odd days and Myawaddy to Hpa-an direction on the even days.

### Proposed Major Project Component

Considering the corridor developments needs and demand data, and the proposed infrastructure and services for the transport corridor between National and Regional Growth Centers, the following development strategy is proposed for the East-West Corridor development.

- Improve connectivity (land transport, freight movement) between Myanmar and Thailand
- Contribute to the coastal development between Yangon and Mawlamyine
- Integrate the corridor with the new transport hub (Hanthawady International Airport)
- Use the existing transport facilities efficiently
- Provide safe/reliable transport network/service, particularly for freight transport

Figures 10.11 and 10.12 and Figures 10.10, 10.11 and 10.12 summarize a range of priority transport projects along the East-West Corridor that will achieve the above corridor development strategies. These projects were developed using project assessments in ongoing transport studies.

---

**Table 10.11 Selected Major Priority Actions/Projects along East-West Corridor**

	Road	Rail
Selected Priority Actions		
Infrastructure	<ul style="list-style-type: none"> <li>Upgrading and widening of roads along the EW Corridor</li> <li>Bypass at major cities along the EW corridor</li> <li>Heavy loaded roads/ bridges</li> <li>Dry port at Myawaddy</li> </ul>	<ul style="list-style-type: none"> <li>Rehabilitation between Bago and Mawlamyine</li> </ul>
Service	<ul style="list-style-type: none"> <li>Trade facilitation between Thailand and Myanmar (One-stop cross border facility and service, transit terminal)</li> <li>Roadside station (Michi no eki)</li> </ul>	
		<b>Inland water / maritime</b>
		<b>Air</b>
Selected Priority Actions		
Infrastructure	<ul style="list-style-type: none"> <li>Yangon Port in Thilawa Area Development</li> <li>Off-shore deep seaport at the Yangon River mouth</li> <li>Mawlamyine port improvement</li> <li>Kalegauk port development</li> <li>Dawei port development</li> </ul>	<ul style="list-style-type: none"> <li>Yangon Int'l Airport improvement</li> <li></li> <li>Dawei Airport improvement (major domestic airport)</li> <li>Mawlamyine Airport improvement (domestic airport, PTB, TRW, TWY)</li> </ul>
Service	<ul style="list-style-type: none"> <li>Introduction of EDI (Port-MIS)</li> </ul>	<ul style="list-style-type: none"> <li>A series of navigation modernization such as IFR</li> </ul>

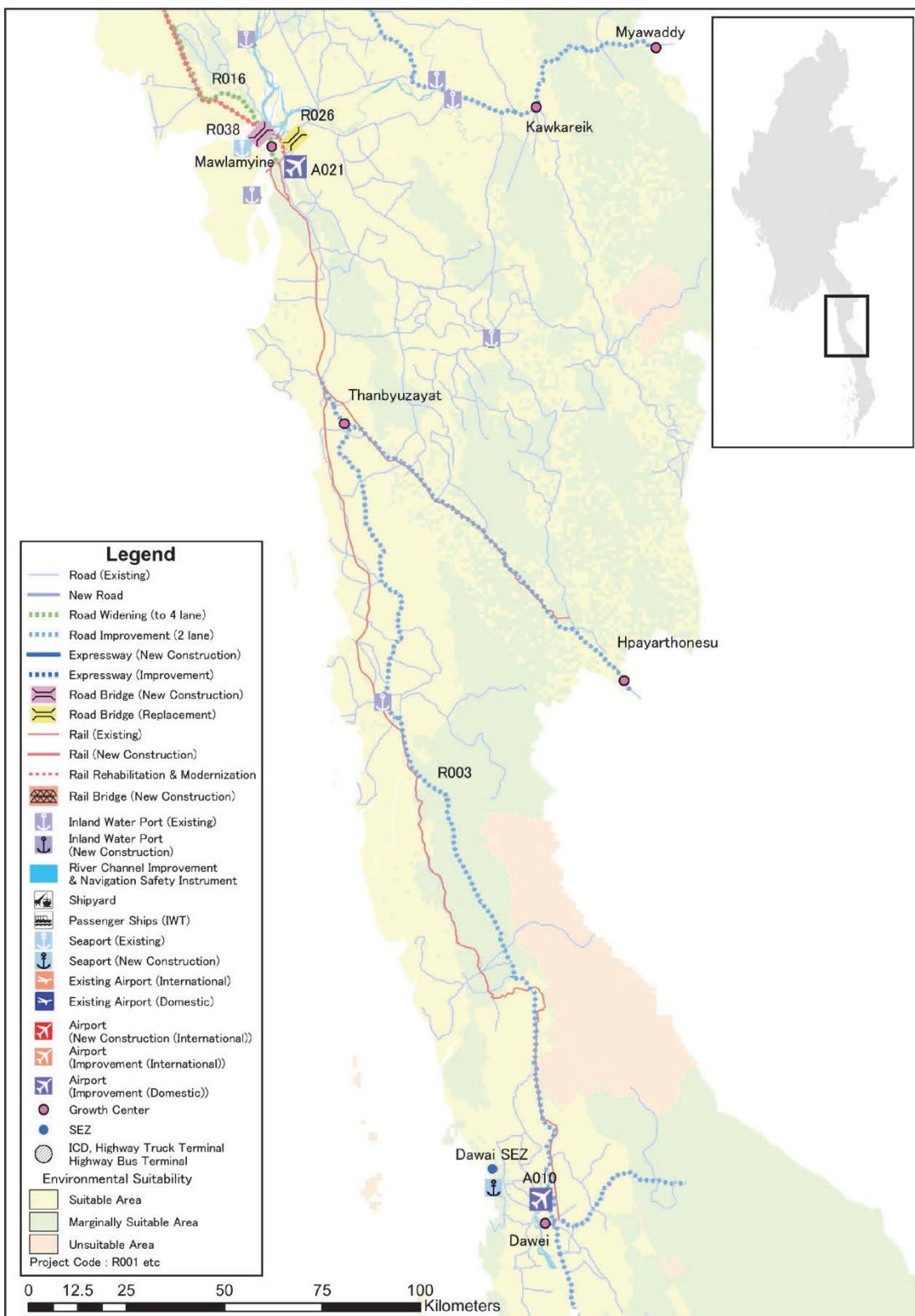
Note: PTB: passenger terminal building, IFR: instrument flight rules, TWY: taxiway, TWR: Aerodrome Control Tower or Aerodrome Control

Source: JICA Study Team

**Table 10.12 List of Major Priority Projects along East-West Corridor**

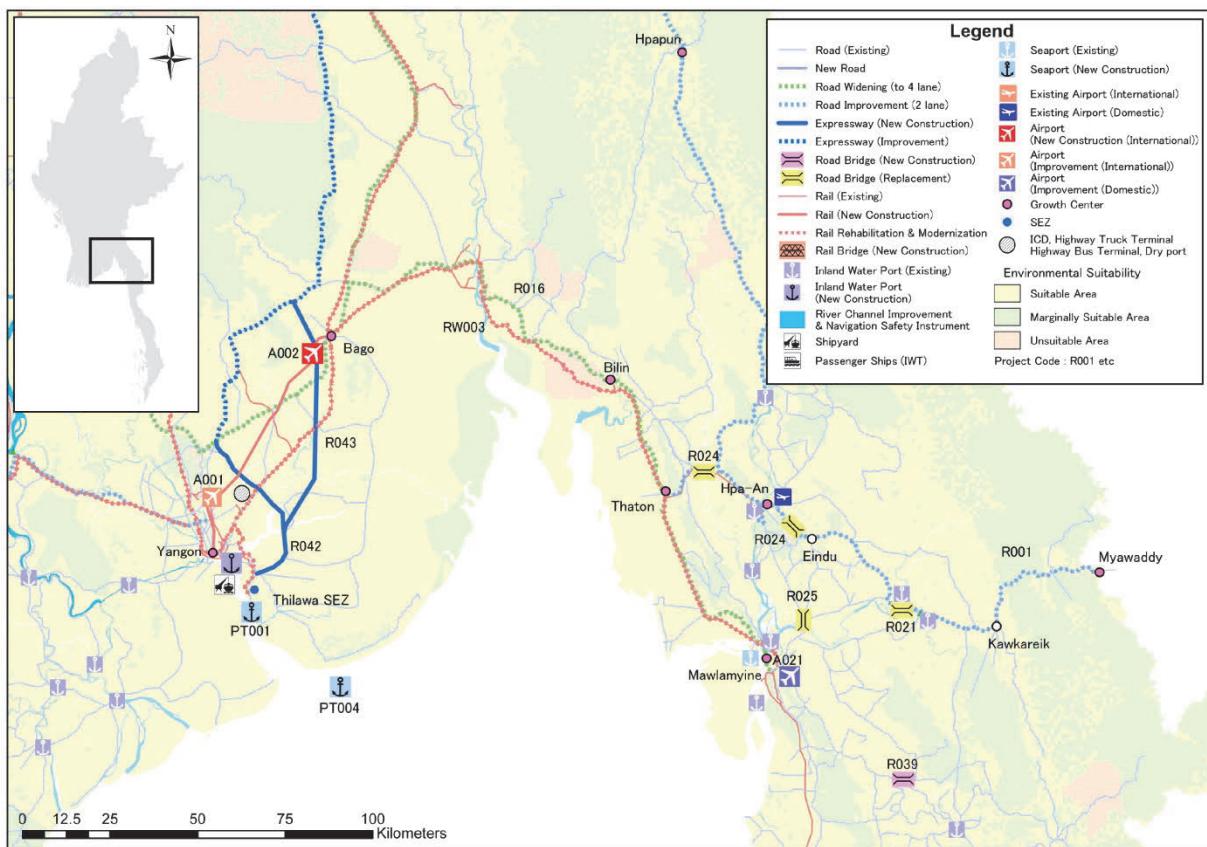
Corridor	Sector	Project ID	Project	Total Project Cost (Bil. MMK)
A1,B1,H1,K1	Aviation	A001	Yangon International Airport	195.0
A1,B1	Aviation	A002	Hanthawaddy International Airport	1,403.0
B2,J2,J3	Aviation	A010	Dawei Airport (major domestic)	37.0
B1,B2,J1	Aviation	A021	Mawlamyine Airport	2.0
B1	Railway	RW003	Bago-Mawlamyine	366.0
B1	Road	R001	Thaton – Eindu – Kawkareik – Myawaddy Road	192.0
B2,J3	Road	R003	Thanbyuzayat – Dawei – Myeik – Kawthonng Road	907.0
B1,B2	Road	R016	Payagyi – Mawlamyine - Thanbuzayat Road	393.0
B1	Road	R021	Gyaing (Kawkareik) Bridge	21.0
B1	Road	R024	Don Tha Mi and Naung Lon Bridge	16.0
B1	Road	R025	Gyaing (Zarthapyin) Bridge	34.0
B2	Road	R026	Atran Bridge	17.0
B2	Road	R038	Thanlwin (Chaungsone) Bridge	23.0
B1	Road	R039	Chaungnitwa Bridge	14.0
B1	Road	R042	Yangon City - Thilawa Port Expressway	243.0
B1	Road	R043	Yangon City - Hanthawaddy - Existing Expressway	388.0
A1,B1,H1,K1	Sea Port	PT001	Yangon Port in Thilawa (Phase 1)	223.0
A1,B1,H1,K1	Sea Port	PT001a	Yangon Port in Thilawa (Phase 2)	554.0
A1,B1,H1,K1	Sea Port	PT001b	Yangon Port in Thilawa (Phase 3)	194.0
A1,B1,H1,K1	Sea Port	PT002	Yangon Port Capacity and Connectivity Improvement	205.0
A1,B1,H1,K1	Sea Port	PT003	Yangon Port in Thilawa (Post Thilawa)	485.0
A1,B1,H1,K1	Sea Port	PT004	Offshore Yangon River (Deep Seaport)	2,427.0
B2, J2, J3	Sea Port	PT006	Dawai Port	2,000.0
B1,B2, J1	Sea Port	PT008	Mawlamyaing Port	49.0
				10,388

Source: JICA Study Team



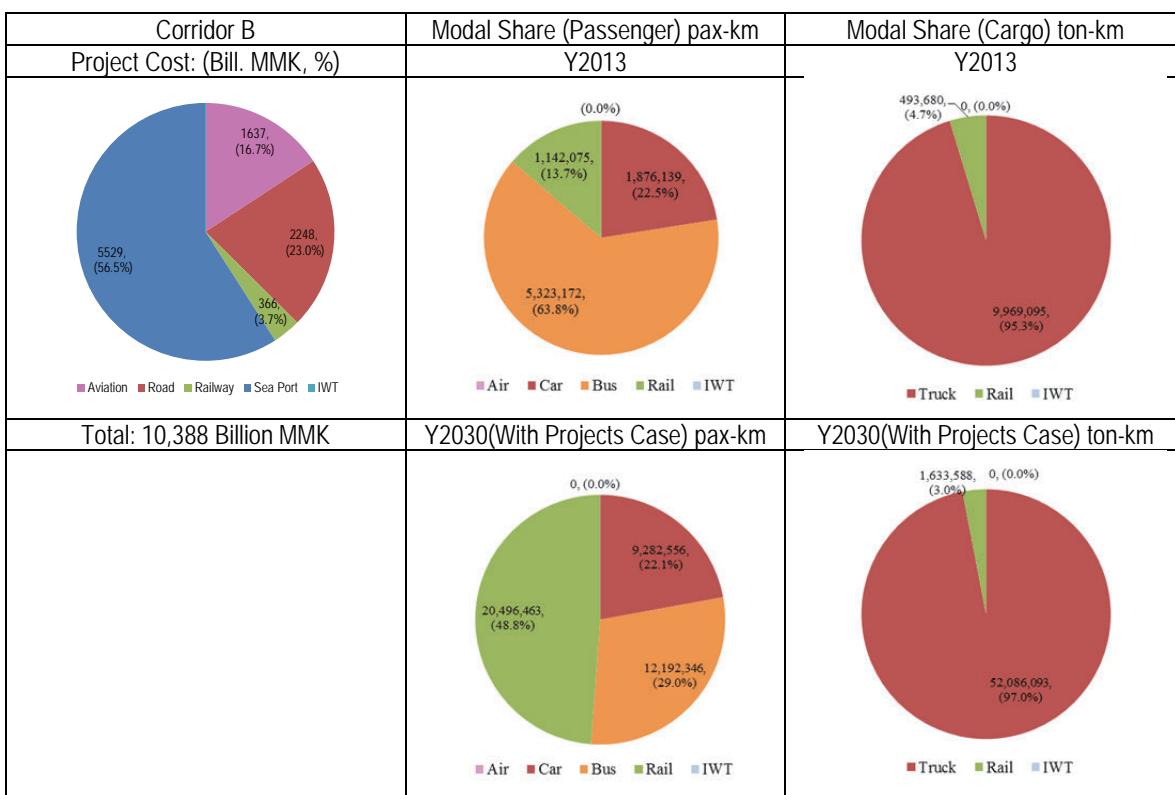
Source: JICA Study Team

**Figure 10.10 Corridor-based Transport Infrastructure Development Plan – B. East-West Corridor (1/2)**



Source: JICA Study Team

**Figure 10.11 Corridor-based Transport Infrastructure Development Plan – B. East-West Corridor (2/2)**



**Figure 10.12 Proposed Project Cost and Modal Share – B. East-West Corridor**

### C. Northern Corridor

#### Socio-Economic Conditions of the Corridor

Along the Northern Corridor, most economic activities and populations are situated in Mandalay. The city of Mandalay is home to 1.4 million residents in 2012 and no other major cities are present along the corridor. Other major cities located near the corridor include Sagaing (0.8 million) and Monywa (1.8 million), which also enjoy benefits of development of the Northern Corridor. The Northern Corridor accommodates 10 % of the national population and 10 % of the nation's GDP in 2012.

The production activities along the development corridor, mainly from Mandalay, produce a considerable quantity of industrial products. According to the traffic demand forecast, described in the Study, for 2013, Mandalay produces 20% of Myanmar's food stuffs, 26% of construction materials and 27% of manufactured goods. Also, Shan produces 11% of the nation's food stuffs, 14% of construction materials and 26% of manufactured goods, which are sourced mainly from China.

#### Transport Demand and Service

The Northern Corridor functions as the major trade corridor between Myanmar and China. It also includes a portion of the GMS Northern Corridor. Along the Northern Corridor, highway, railway and air transport are available to carry passenger and freight traffic. In 2013, the corridor transported 4 million passenger-kilometers of daily passenger traffic and 11 million ton-kilometers of daily freight traffic. These figures account for 13% of all freight traffic and 5% of all passengers transported along the corridors. The road carries a majority of traffic along

the corridor, and in terms of freight traffic, the modal share is road (98%) and rail (2%). For passenger traffic, the modal share is bus (38%), car (41%) and rail (21%). Linking national and agro-industrial growth centers along the corridor, the corridor development will contribute to a rapid increase in both freight (maximum of 9% p.a. from 2013 to 2030) and passenger (8% p.a. during the same period) traffic demand and the future traffic demand reaches nearly 17 million passenger-kilometer and 44 million ton-kilometer per day by 2030.

#### Proposed Infrastructure Project Component

Considering the corridor developments needs and demand data, and the proposed infrastructure and services, the following development strategy is proposed for the Northern Corridor.

- Improve connectivity (land transport, freight movement) between Myanmar and Yunnan Province
- Contribute to the industrial development in Muse, Lashio, Mandalay / Sagain area
- Integrate the corridor with the new transport hub (Mandalay and Muse Dry port)
- Use the existing transport facilities efficiently
- Provide safe/reliable transport network/service, particularly for freight transport.

Tables 10.13 and 10.14 and Figures 10.13 and 10.14 summarize selected road and railway sectors that will achieve the above corridor development strategies. These projects were developed using project assessments in ongoing transport studies.

**Table 10.13 Selected Major Priority Actions/Projects along East-West Corridor**

		Road	Rail
Selected Priority Actions			
Infrastructure	<ul style="list-style-type: none"><li>• Improvement of Mandalay – Lashio – Muse Road</li><li>• Dry port at Muse</li><li>• A series of bridge improvement</li></ul>	<ul style="list-style-type: none"><li>• Mandalay Dry Port / ICD</li></ul>	
Service	<ul style="list-style-type: none"><li>• Trade facilitation between China/Myanmar and associated infra/service development (One-stop cross border facility and service, transit terminal)</li></ul>		
		Inland water / maritime	Air
Selected Priority Actions			
Infrastructure	<ul style="list-style-type: none"><li>• NA</li></ul>	<ul style="list-style-type: none"><li>• Lashio Airport Improvement (domestic: PAPI, PTB, TWR, TWY)</li><li>• Mandalay Airport Improvement (international)</li></ul>	
Service		<ul style="list-style-type: none"><li>• A series of navigation modernization such as IFR</li></ul>	

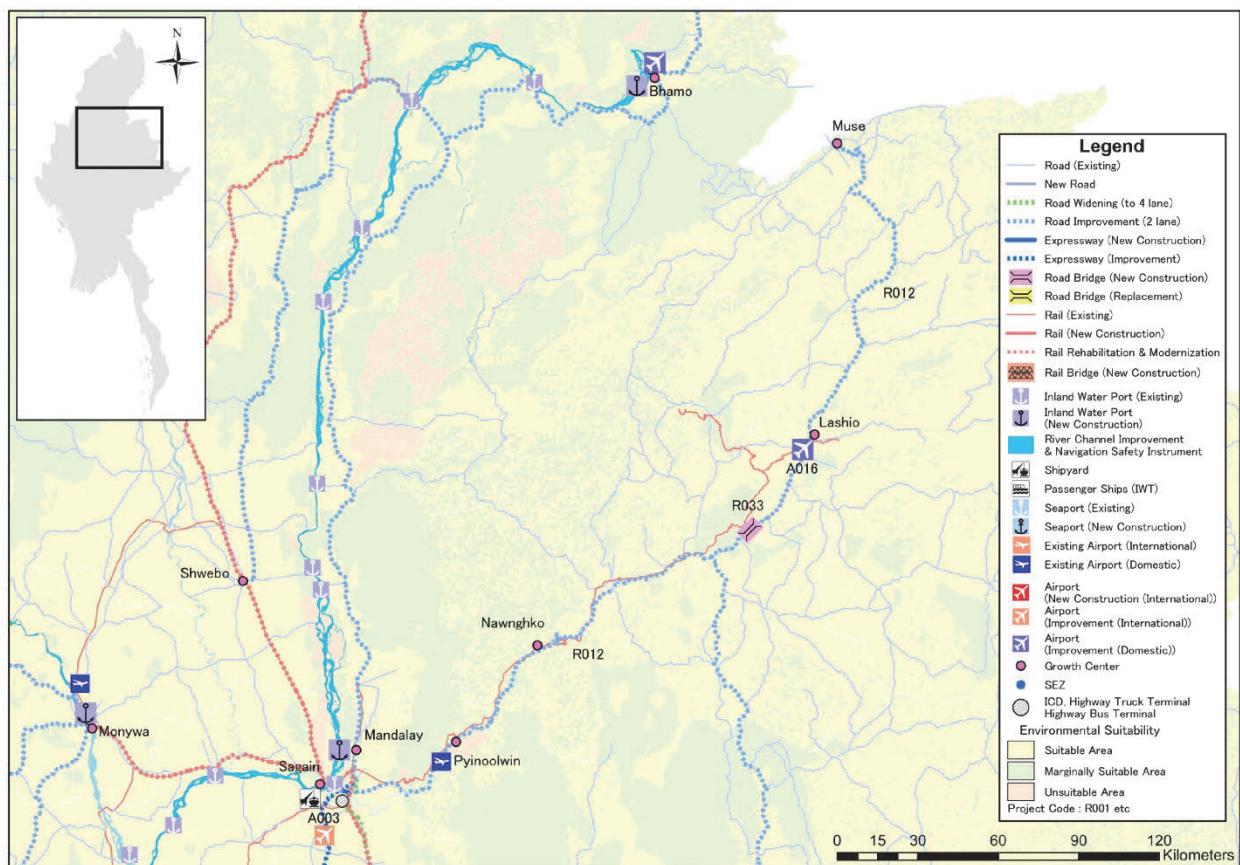
Note: PTB: passenger terminal building, IFR: instrument flight rules, TWY: taxiway, TWR: Aerodrome Control Tower or Aerodrome Control

Source: JICA Study Team

**Table 10.14 List of Priority Projects along Northern Corridor**

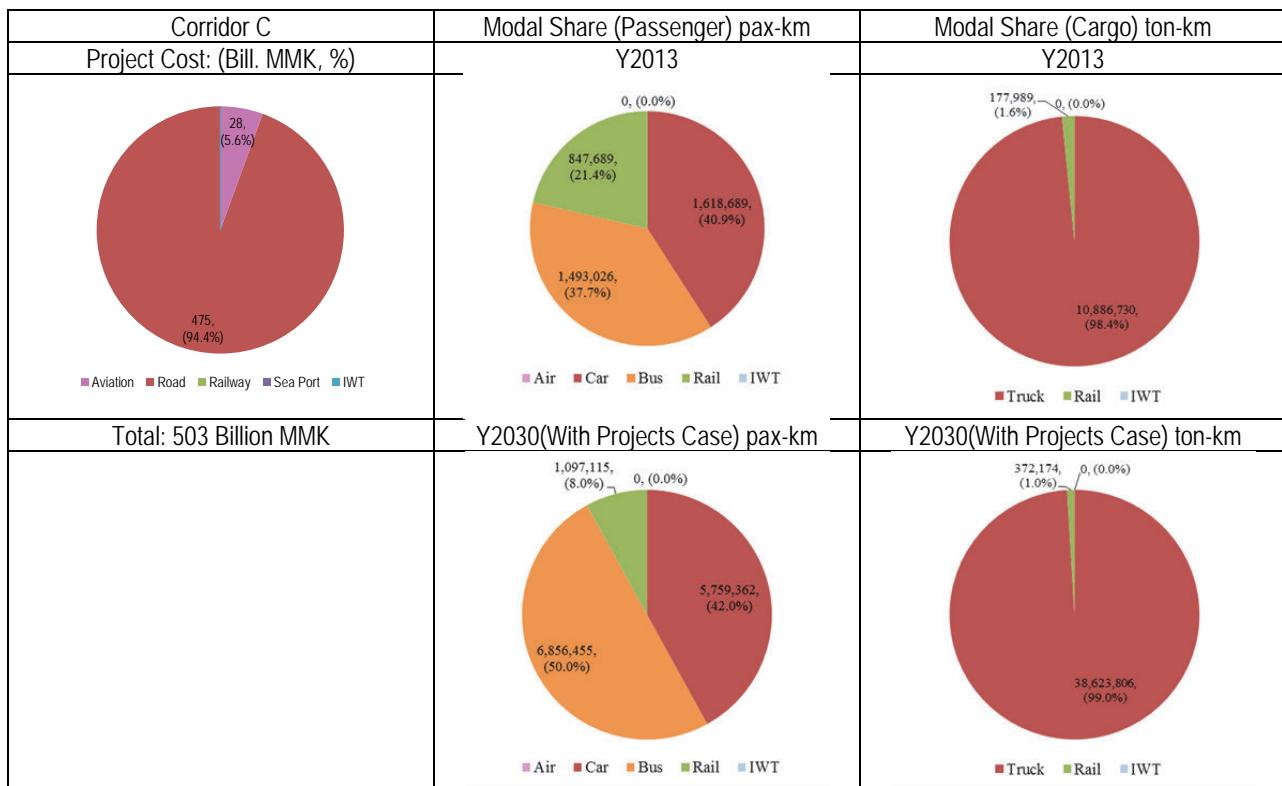
Corridor	Sector	Project ID	Project	Total Project Cost (Bil. MMK)
A2,A3,C1,D1,K2	Aviation	A003	Mandalay International Airport	21.0
C1	Aviation	A016	Lashio Airport	7.0
C1	Road	R012	Mandalay – Lashio – Muse Road	440.0
C1	Road	R033	New Goat twin Viaduct	35.0
				503

Source: JICA Study Team



Source: JICA Study Team

**Figure 10.13 Corridor-based Transport Infrastructure Development Plan – C. Northern Corridor**



**Figure 10.14 Proposed Project Cost and Modal Share – C. Northern Corridor**

## **F. Main River Corridor**

The socio-economic conditions and traffic features along the Main River Corridor are described as part of K: Western North-South Corridor, the following section. The section includes priority actions and projects for the selected transport sub-sector, through the assessment of the planned transport projects and proposed projects by ongoing transport studies.

## **K. Western North-South Corridor**

### Socio-Economic Condition of the Corridor

Like the Central North-South Corridor, economic activities and populations of the Western North-South Corridor are situated in Yangon and Mandalay. Other major cities located along the corridor include Pyay (1.2 million) and Magway (1.9 million). The Western North-South Corridor is home to 33 % of Myanmar's population and 42 % of GDP in 2012. The production activities along the development corridor, mainly from Yangon and Mandalay, produce a high quantity of industrial products, as described earlier.

### Transport Demand and Service

In terms of transport infrastructure and service, a key feature of the Western North-South Corridor is the river transport by the Ayeyarwaddy River. In 2013, the corridor transported 6 million passenger-kilometers of daily passenger traffic and 11 million ton-kilometers of daily freight traffic. These figures account for 12% of all freight traffic and 10% of all passengers transported along the corridors. Unlike other corridors, the inland water transport carries the majority of traffic along the corridor, and in terms of freight traffic, the modal share is road (52%), rail (6%) and inland water transport (42%), and for passenger traffic, the share is bus (53%), car (19%) and rail (28%). Linking national and regional growth centers along the corridor, the corridor development will contribute to a rapid increase in both freight (maximum of 11% p.a. from 2013 to 2030) and passenger (9% p.a. during the same period) traffic demand; future traffic demand reaches nearly 32 million passenger-kilometers and 52 million ton-kilometers per day by 2030.

### Proposed Infrastructure Project Component

The following development strategy is proposed for the development of the Western North-South Corridor.

- Provide high-speed, high capacity, safe and reliable transport network and services as the primary corridor element
- Alternative routes for the central north-south corridor (to form two primary elements in the North-South network)
- Enable multi-modal transport
- Make efficient use of the existing transport facilities
- Segregate inter- and intra-city traffic

Tables 10.15 and 10.16 and Figures 10.15 ~ 10.20 summarize selected projects that will achieve the above corridor development strategies along the Western Northern Corridor. These projects were developed using project assessments in ongoing transport studies.

**Table 10.15 Selected Priority Actions/Projects along Western North-South Corridor**

		Road	Rail
<b>Selected Priority Actions</b>			
Infrastructure	<ul style="list-style-type: none"> <li>• Yangon – Pyay road improvement</li> <li>• Pyay – Magway road improvement</li> <li>• Magway – Mandalay road improvement</li> <li>• Monywa – Pathein road</li> </ul>	<ul style="list-style-type: none"> <li>• Yangon – Pyay railway improvement</li> <li>• Yangon – Hlawga urban rail improvement</li> <li>• Procurement of DEMU</li> </ul>	
Service	<ul style="list-style-type: none"> <li>• Roadside station (Michi no eki)</li> </ul>		
<b>Inland water / maritime</b>		<b>Air</b>	
<b>Selected Priority Actions</b>			
Infrastructure	<ul style="list-style-type: none"> <li>• Mandalay Port</li> <li>• Yangon Port</li> <li>• Pakkoku Port</li> <li>• Magway Port</li> <li>• Monyuwa Port</li> </ul>	<ul style="list-style-type: none"> <li>• Yangon International Airport</li> <li>• Mandalay International Airport</li> <li>• Nyaung U Airport (regional international airport) (Alternative as a regional international airport : Pakokku airport)</li> </ul>	
Service	<ul style="list-style-type: none"> <li>• A series of vessel procurement</li> </ul>	<ul style="list-style-type: none"> <li>• A series of navigation modernization such as IFR</li> </ul>	

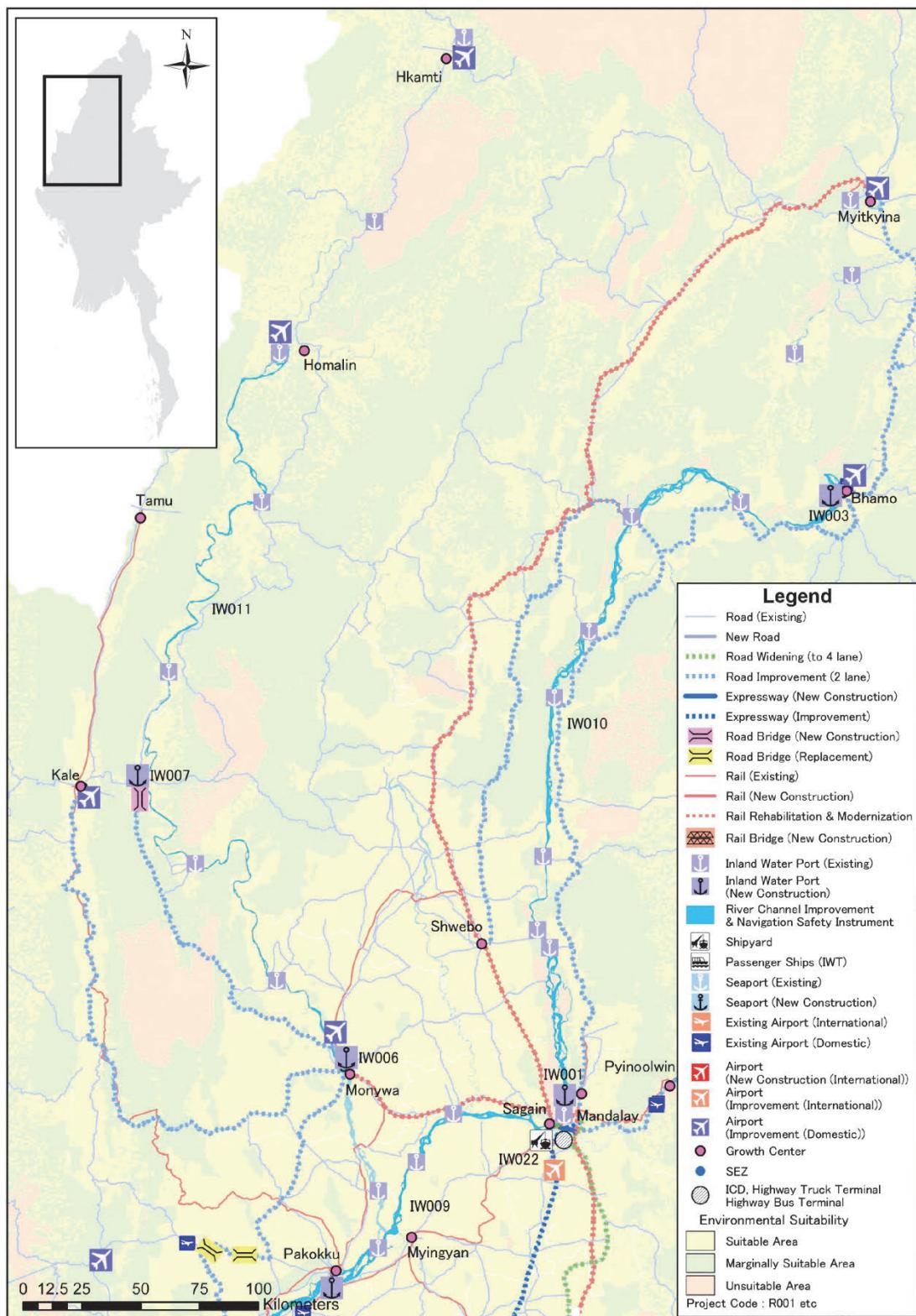
Note: PTB: passenger terminal building, IFR: instrument flight rules, TWY: taxiway, TWR: Aerodrome Control Tower or Aerodrome Control

Source: JICA Study Team

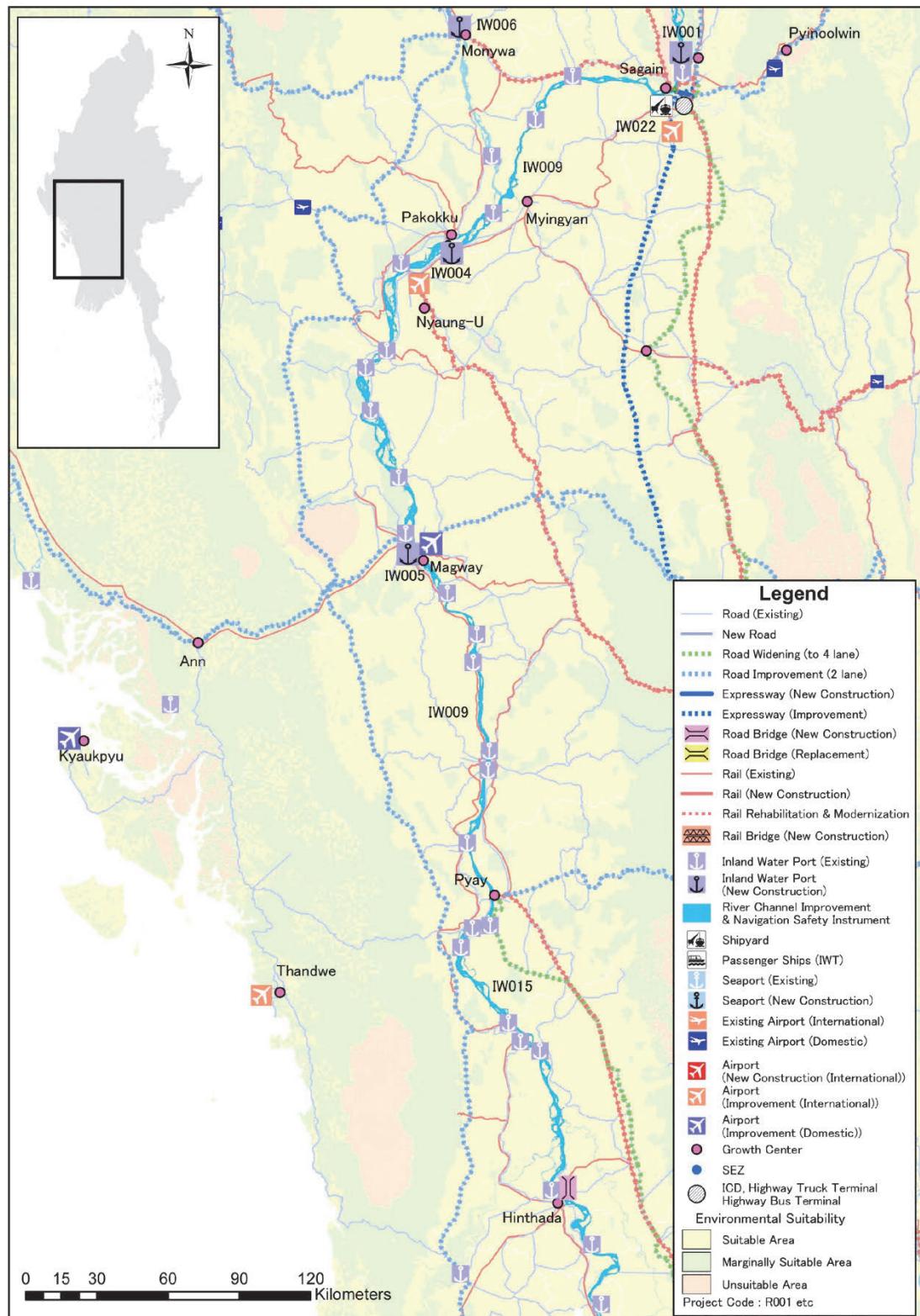
**Table 10.16 List of Priority Projects along Main River Corridor and Western North-South Corridor**

Corridor	Sector	Project ID	Project	Total Project Cost (Bil. MMK)
A1,B1,H1,K1	Aviation	A001	Yangon International Airport	195.0
A2,A3,C1,D1,K2	Aviation	A003	Mandalay International Airport	21.0
K2,D1	Aviation	A005	Nyaung U International Airport (Alt. Pakokku)	107.0
E1,G2,K1,K2	Aviation	A028	Magway Airport	2.0
K1,K2,D1	Aviation	A029	Kyauktu Airport	2.0
F1,F2	IWT	IW001	Mandalay Port	123.0
F1, H1	IWT	IW002	Yangon Port (Including Connectivity)	303.0
F1	IWT	IW003	Bhamo Port	93.0
F1,F2	IWT	IW004	Pakkoku Port	22.0
F1	IWT	IW005	Magway Port	22.0
F2	IWT	IW006	Monywa Port	21.0
F2	IWT	IW007	Kalewa Port	21.0
F1,H1	IWT	IW009	Yangon - Mandalay channel improvement	187.0
F1	IWT	IW010	Mandalay - Bhamo channel improvement	130.0
F2	IWT	IW011	Monywa - Upstream channel improvement	36.0
F1,H1	IWT	IW012	Ayeyarwady Delta channel improvement	54.0
F1,H1	IWT	IW015	Yangon - Mandalay Navigation safety improvement	20.0
F1	IWT	IW016	Mandalay - Bhamo Navigation safety improvement	20.0
F2	IWT	IW017	Monywa - Upstream Navigation safety improvement	20.0
F1,H1	IWT	IW018	Ayeyarwady Delta Navigation safety improvement	20.0
F1,F2	IWT	IW022	Mandalay Shipyard modernization	30.0
F1,H1	IWT	IW025	Ayeyarwady Delta IWT vessels	20.0
K1	Railway	RW004	Yangon-Pyay	432.0
K1	Road	R010	Yangon – Pyay - Mandalay Road	1,139.0
D1,K1,H1	Road	R011	Monywa – Pathein Road	700.0
A1,B1,H1,K1	Sea Port	PT001	Yangon Port in Thilawa (Phase 1)	223.0
A1,B1,H1,K1	Sea Port	PT001a	Yangon Port in Thilawa (Phase 2)	554.0
A1,B1,H1,K1	Sea Port	PT001b	Yangon Port in Thilawa (Phase 3)	194.0
A1,B1,H1,K1	Sea Port	PT002	Yangon Port Capacity and Connectivity Improvement	205.0
A1,B1,H1,K1	Sea Port	PT003	Yangon Port in Thilawa (Post Thilawa)	485.0
A1,B1,H1,K1	Sea Port	PT004	Offshore Yangon River (Deep Seaport)	2,427.0
H1,H2,F1	Sea Port	PT009	Pathein Port	49.0
				7,877

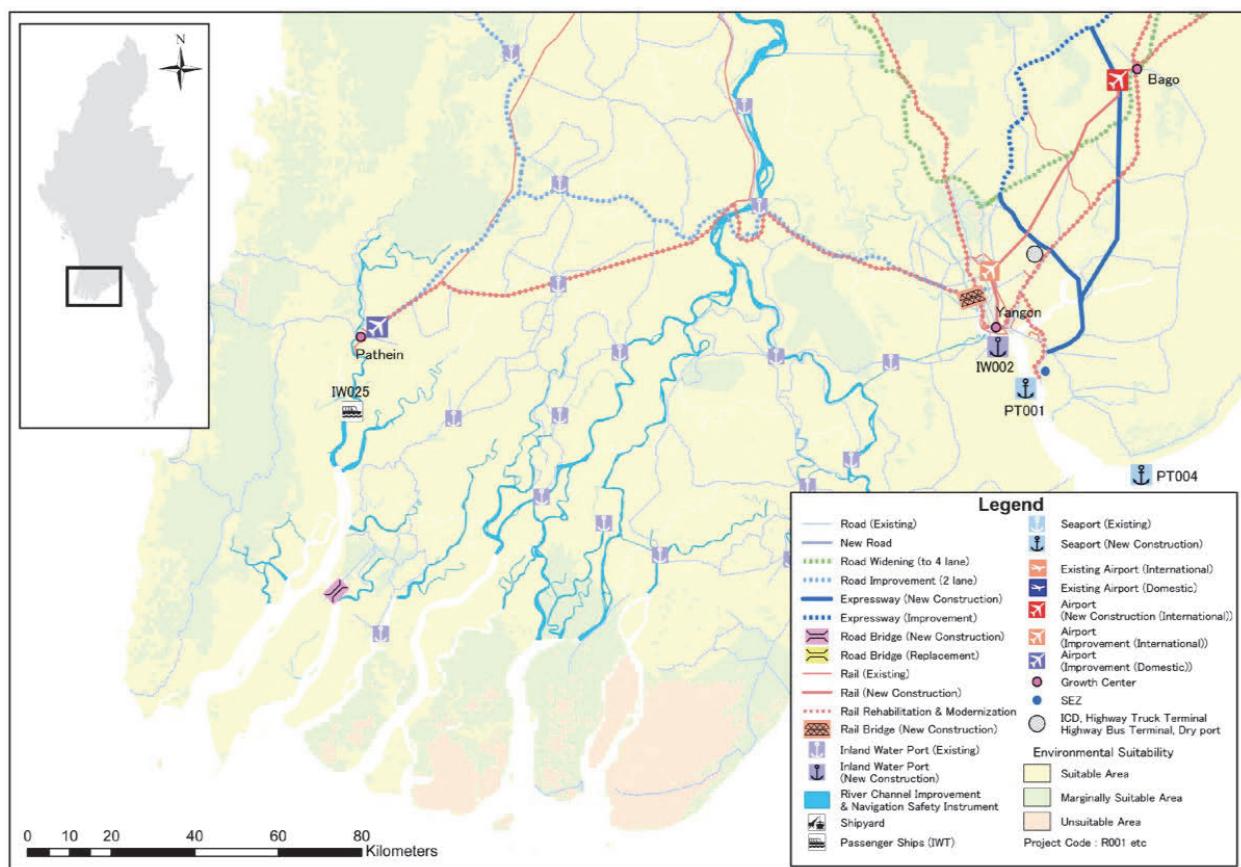
Source: JICA Study Team



**Figure 10.15 Corridor-based Transport Infrastructure Development Plan  
– F. Main River Corridor (1/3)**

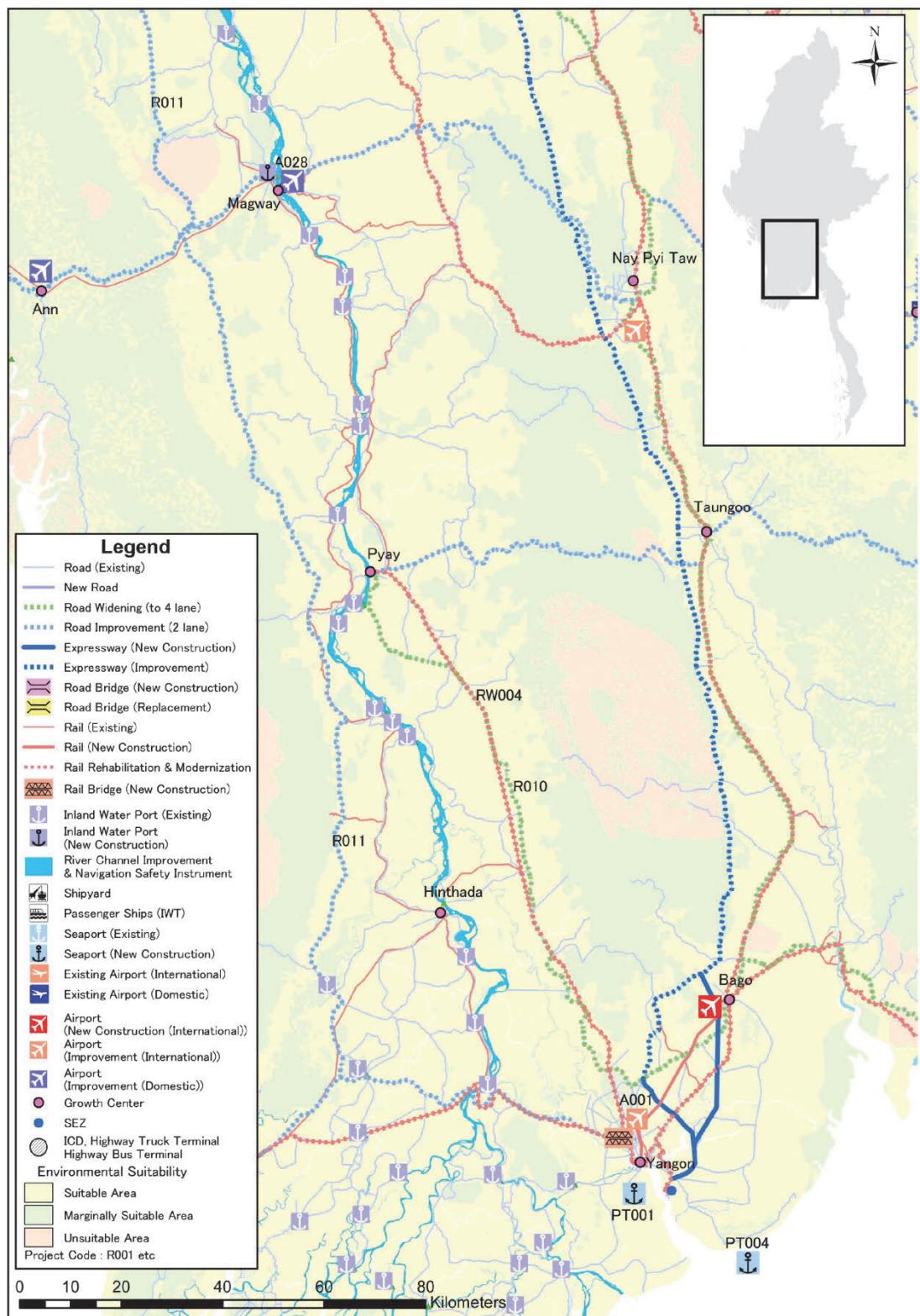


**Figure 10.16 Corridor-based Transport Infrastructure Development Plan  
– F. Main River Corridor (2/3)**



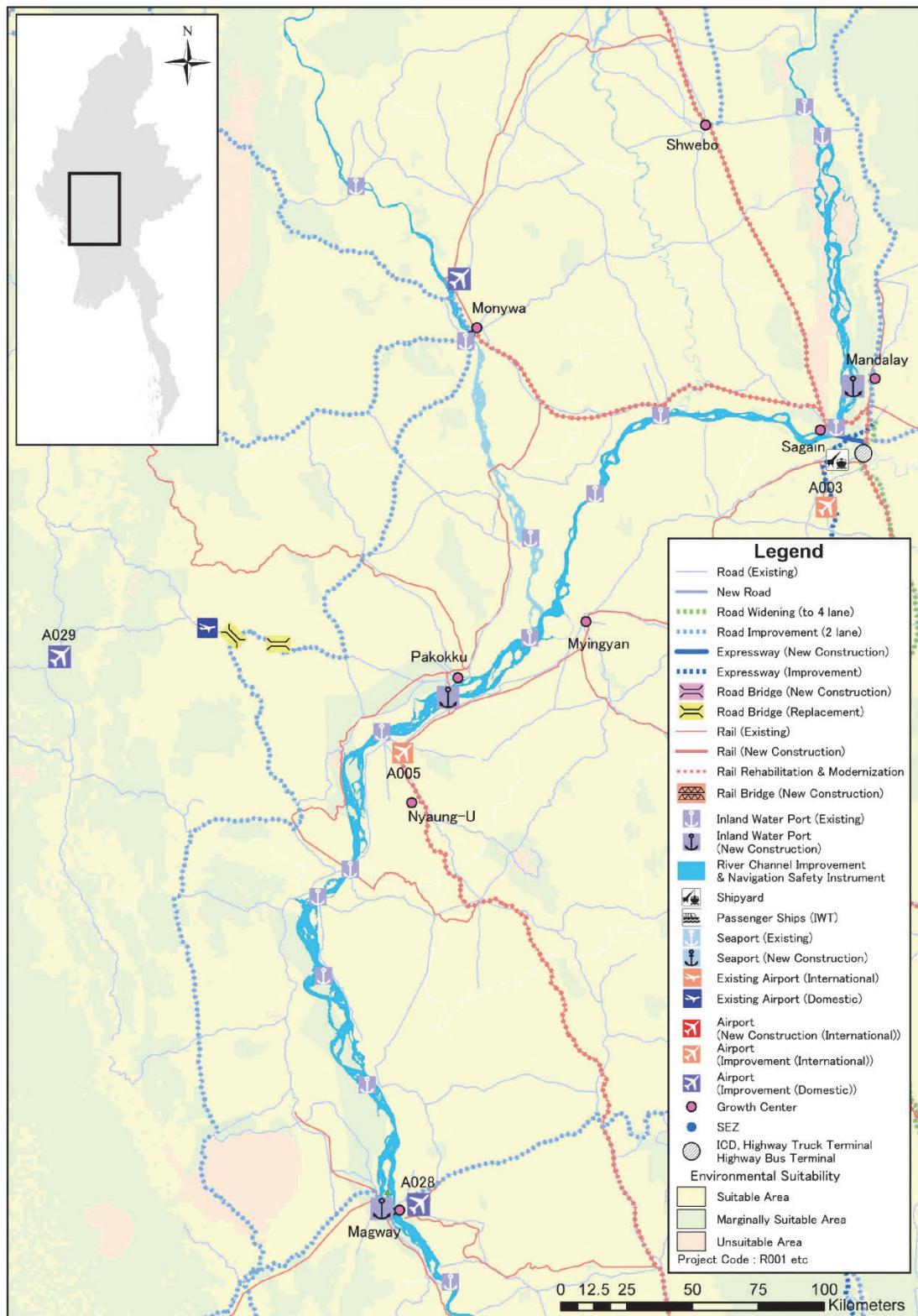
Source: JICA Study Team

**Figure 10.17 Corridor-based Transport Infrastructure Development Plan  
– F. Main River Corridor (3/3)**



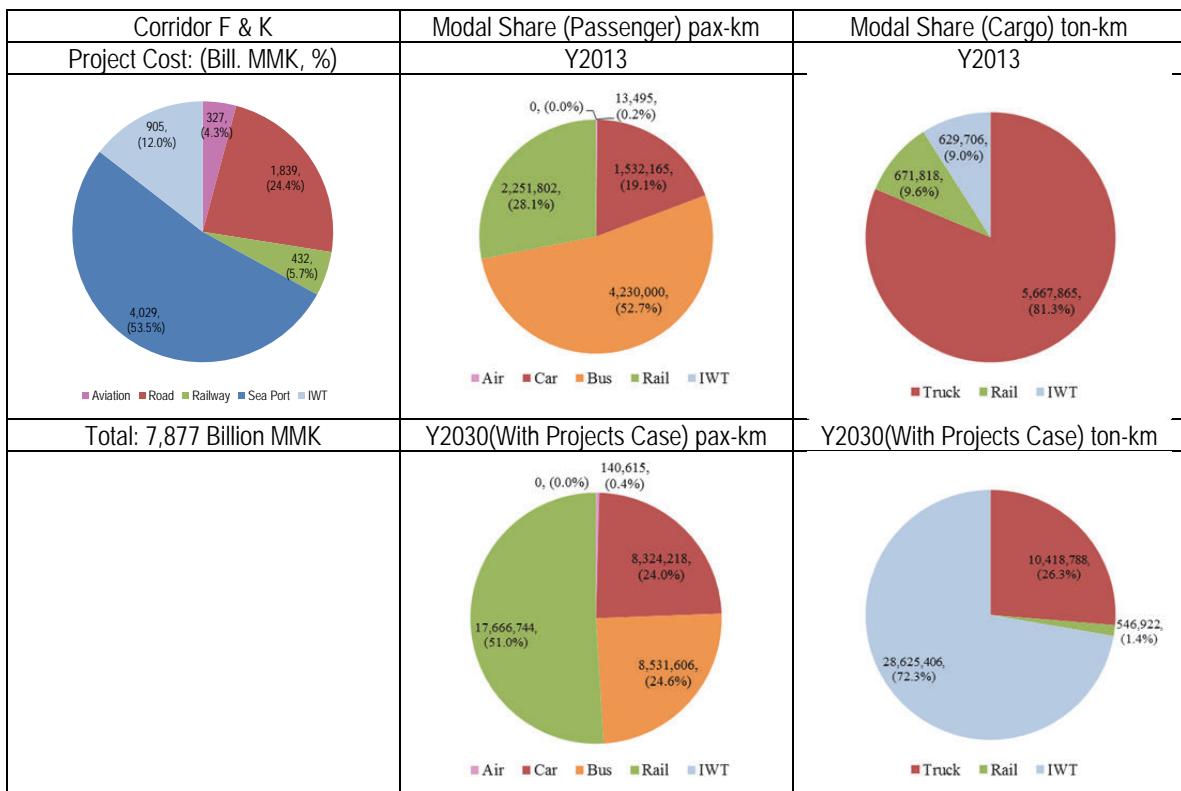
Source: JICA Study Team

**Figure 10.18 Corridor-based Transport Infrastructure Development Plan – K. Western North-South Corridor (1/2)**



Source: JICA Study Team

**Figure 10.19 Corridor-based Transport Infrastructure Development Plan – K. Western North-South Corridor (2/2)**



**Figure 10.20 Proposed Project Cost and Modal Share – K. Western North-South Corridor**

## H. Delta Area Network

### Socio-Economic Conditions, Transport Demands and Services of the Corridor

In 2012, the Delta Area Network's population represented 21% of the national total and economic activities account for 27% of the nation's GDP. In 2013, the corridor saw 4.6 million passenger-kilometers of daily passenger traffic and 1.6 million ton-kilometers of daily freight traffic. These figures account for 2% of all freight traffic and 6% of all passengers transported for all corridors. The Delta Area's modal distribution for freight traffic is road (56%), rail (1%) and water transport (43%). The passenger distribution is bus (61%), car (24%) and rail (2%), and water transport (12%). In the future, corridor development will contribute to an increase in both freight (maximum of 8.9% p.a. from 2013 to 2030) and passenger (6.3% p.a. during the same period) traffic demand as future traffic demand reaches 12.7 million passenger-kilometers and 6.7 million ton-kilometers per day by 2030.

### Proposed Infrastructure Project Component

Given current corridor developments needs and demand data, and the proposed infrastructure and services for the transport corridor between the Yangon metropolitan area and the Delta area, the following development strategy is recommended for the Delta Area development.

- Provide a safe and reliable transport network and related services, as the primary corridor element
- Enable intermodal-modal transport between water and land transport

- Make efficient use of existing water transport routes
- IWT to play a vital role in providing the water transport services

Tables 10.17 and 10.18 and Figures 10.21 and 10.22 summarize selected projects that will achieve the above corridor development strategies along the Western Northern Corridor. These projects were developed using project assessments in ongoing transport studies.

**Table 10.17 Selected Priority Actions/Projects in the Delta Area**

	Road	Rail
Selected Priority Actions		
Infrastructure	<ul style="list-style-type: none"><li>• Hinthada Bridge construction</li><li>• Hlaing Bridge construction</li><li>• Yangon – Pathein Road</li><li>• etc.</li></ul>	<ul style="list-style-type: none"><li>• Yangon – Pathein railway improvement</li></ul>
Service	<ul style="list-style-type: none"><li>• Improve highway truck services</li></ul>	<ul style="list-style-type: none"><li>• Intermodal transfer between rail and inland water transport</li></ul>
Inland water / maritime		Air
Selected Priority Actions		
Infrastructure	<ul style="list-style-type: none"><li>• Procurement of new vessels</li><li>• Connectivity improvement</li><li>• River channel improvement</li><li>• A series of river port improvements</li><li>• Navigation safety improvement</li></ul>	<ul style="list-style-type: none"><li>• Pathein airport minor improvement</li></ul>
Service	<ul style="list-style-type: none"><li>• Improve passenger and freight transport service by new vessels (IWT)</li></ul>	<ul style="list-style-type: none"><li>• A series of navigation modernization such as IFR</li></ul>

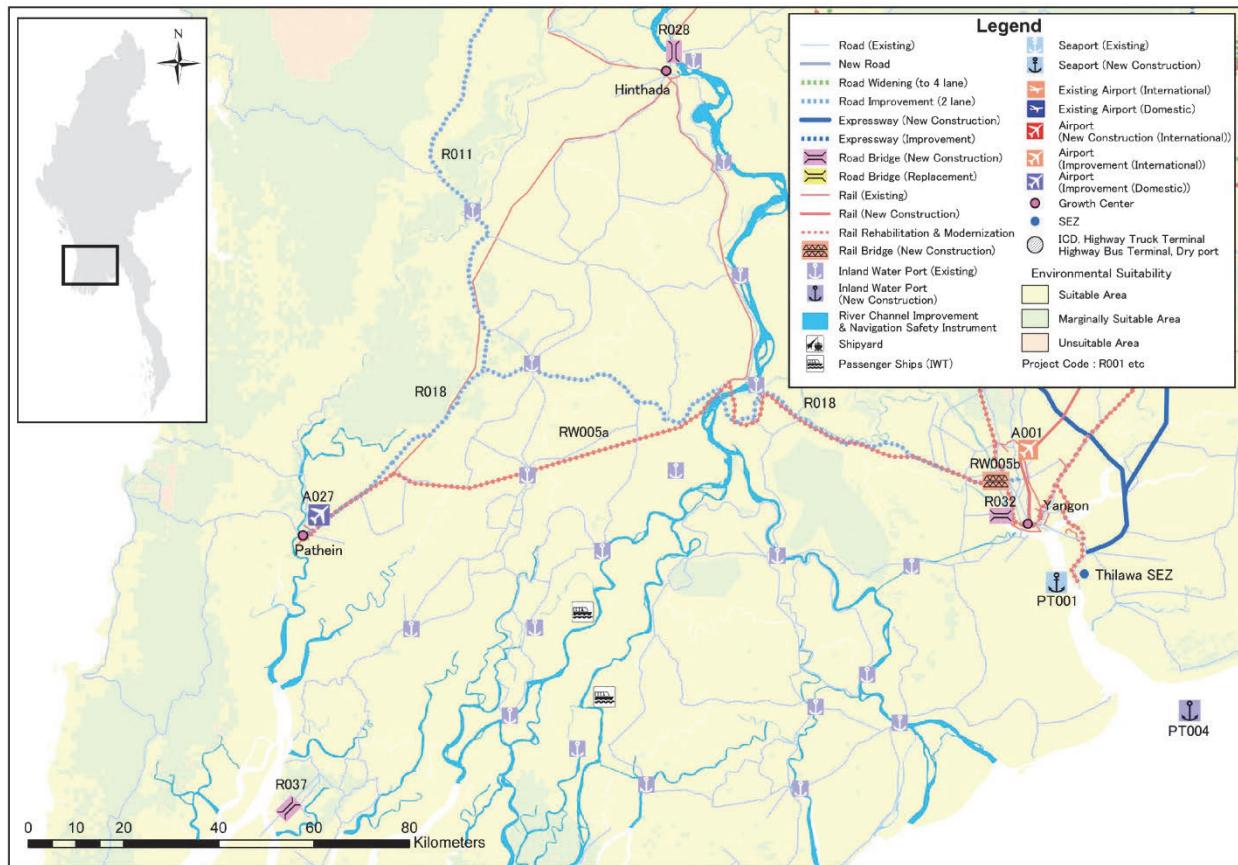
Note: IFR: instrument flight rules

Source: JICA Study Team

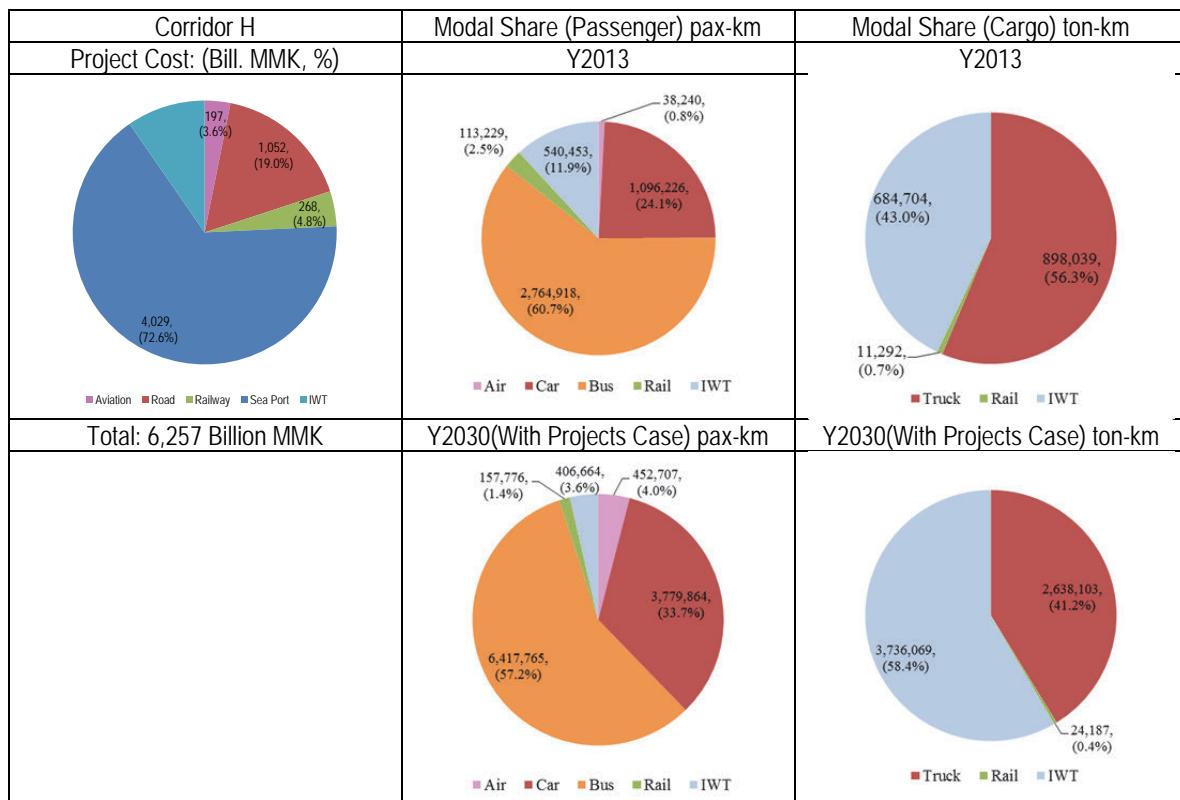
**Table 10.18 List of Priority Projects along Delta Area Network**

Corridor	Sector	Project ID	Project	Total Project Cost (Bil. MMK)
A1,B1,H1,K1	Aviation	A001	Yangon International Airport	195.0
H1	Aviation	A027	Pathein Airport	2.0
F1, H1	IWT	IW002	Yangon Port (Including Connectivity)	303.0
F1,H1	IWT	IW009	Yangon - Mandalay channel improvement	187.0
F1,H1	IWT	IW012	Ayeyarwady Delta channel improvement	54.0
F1,H1	IWT	IW015	Yangon - Mandalay Navigation safety improvement	20.0
F1,H1	IWT	IW018	Ayeyarwady Delta Navigation safety improvement	20.0
F1,H1	IWT	IW025	Ayeyarwady Delta IWT vessels	20.0
H1	Railway	RW005a	Yangon-Pathein	239.0
H1	Railway	RW005b	Bridge	29.0
D1,K1,H1	Road	R011	Monywa – Pathein Road	700.0
H1	Road	R018	Yangon – Pathein Road	124.0
H2	Road	R028	Hinthata Bridge	141.0
H1	Road	R032	Hlaing River Bridge	58.0
H1	Road	R037	Thetkal Thoung Bridge	29.0
A1,B1,H1,K1	Sea Port	PT001	Yangon Port in Thilawa (Phase 1)	223.0
A1,B1,H1,K1	Sea Port	PT001a	Yangon Port in Thilawa (Phase 2)	554.0
A1,B1,H1,K1	Sea Port	PT001b	Yangon Port in Thilawa (Phase 3)	194.0
A1,B1,H1,K1	Sea Port	PT002	Yangon Port Capacity and Connectivity Improvement	205.0
A1,B1,H1,K1	Sea Port	PT003	Yangon Port in Thilawa (Post Thilawa)	485.0
A1,B1,H1,K1	Sea Port	PT004	Offshore Yangon River (Deep Seaport)	2,427.0
H1,H2,F1	Sea Port	PT009	Pathein Port	49.0
				6,258

Source: JICA Study Team



**Figure 10.21 Corridor-based Transport Infrastructure Development Plan – H. Delta Area Network**



**Figure 10.22 Proposed Project Cost and Modal Share – H. Delta Area Network**

### **10.7.2 Proposed project component along other development corridors**

The following discussion summarizes the project components of other development corridors, listing the priority projects of the corridor.

#### **D. Mandalay - Tamu Corridor**

##### **Socio-Economic Condition, Transport Demand and Service of the Corridor**

In 2012, Mandalay-Tamu Corridor's population represented 14% of national total and economic activities accounted for 15% of national GDP; these figures are from Mandalay alone. In 2013, the corridor saw 3.0 million passenger-kilometers of daily passenger traffic and 1.4 million ton-kilometers of daily freight traffic. These figures account for 2% of all freight traffic and 2% of all passengers transported along the corridors. The modal share for the freight traffic is road (75%), rail (7%) and inland water transport (18%). The modal share for passenger traffic is bus (65%), car (22%) and rail (11%). The corridor development will contribute to an increase in both freight (6.7% p.a. from 2013 to 2030) and passenger (6.4% p.a. during the same period) traffic demand and the future traffic demand will reach 8.5 million passenger-kilometers and 5.4 million ton-kilometers per day by 2030.

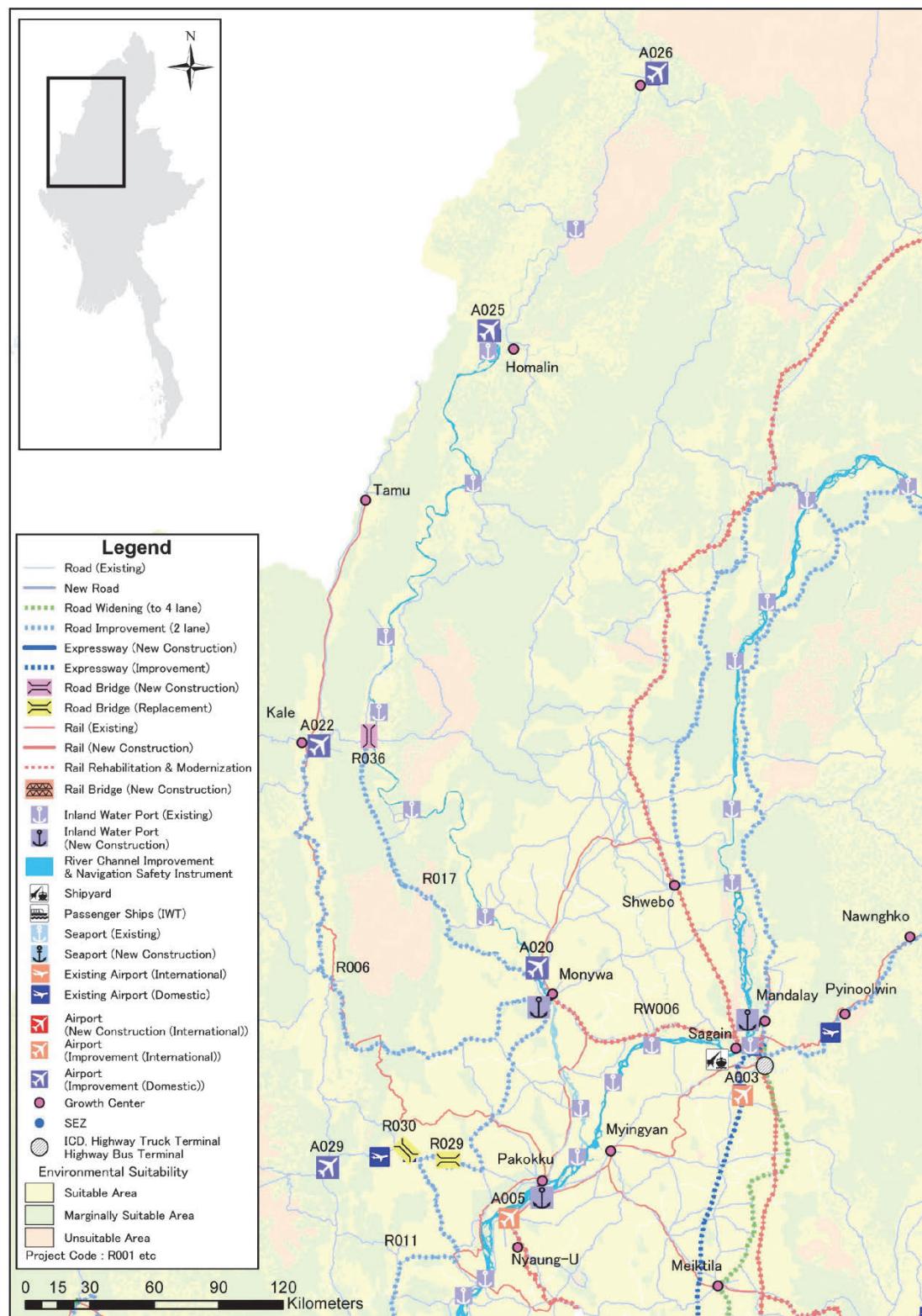
##### **Proposed Major Project Component**

Tables 10.19 and Figures 10.23 and 10.24 summarize a range of priority transport projects along the Mandalay - Tamu Corridor that will achieve the above corridor development strategies. These projects were developed using project assessments in ongoing transport studies.

**Table 10.19 List of Priority Projects along Mandalay – Tamu Corridor**

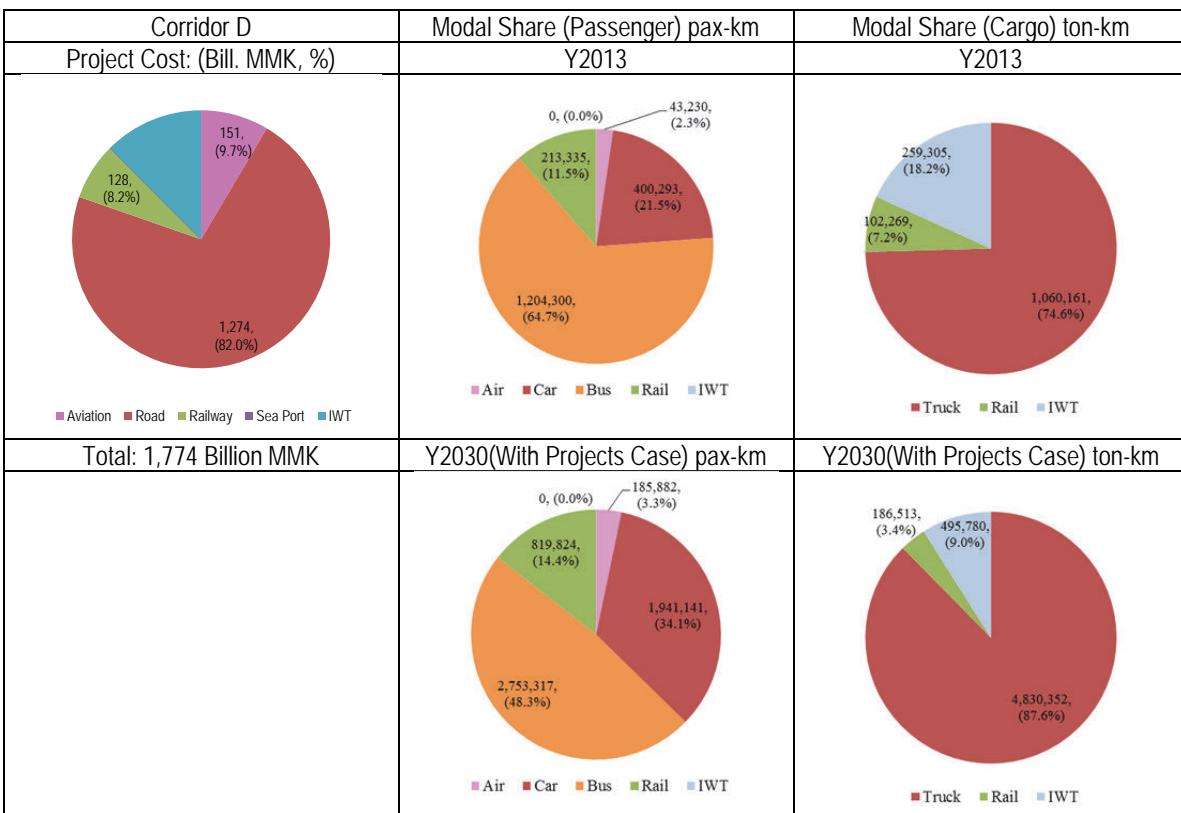
Corridor	Sector	Project ID	Project	Total Project Cost (Bil. MMK)
A2,A3,C1,D1,K2	Aviation	A003	Mandalay International Airport	21.0
K2,D1	Aviation	A005	Nyaung U International Airport (Alt. Pakokku)	107.0
D1	Aviation	A020	Monywar Airport	7.0
D1	Aviation	A022	Kalay Airport	4.0
D1	Aviation	A025	Hommalin Airport	5.0
D1	Aviation	A026	Kanti Airport	5.0
K1,K2,D1	Aviation	A029	Kyauktu Airport	2.0
F1,F2	IWT	IW001	Mandalay Port	123.0
F2	IWT	IW006	Monywa Port	21.0
F2	IWT	IW007	Kalewa Port	21.0
F2	IWT	IW011	Monywa - Upstream channel improvement	36.0
F2	IWT	IW017	Monywa - Upstream Navigation safety improvement	20.0
D1	Railway	RW006	Myohaung-Monywa	128.0
D1	Road	R006	Monywa - Pale - Gangaw – Kalaymyo Road	302.0
D1,K1,H1	Road	R011	Monywa – Pathein Road	700.0
D1	Road	R017	Monywa – Yargyi – Kalewa Road	181.0
D1	Road	R029	Yaw Chaung (Yepyar) Bridge	39.0
D1	Road	R030	Yaw Chaung (Ohn Taw) Bridge	29.0
D1	Road	R036	Chindwin (Kalaywa) Bridge	23.0
				1,774

Source: JICA Study Team



Source: JICA Study Team

**Figure 10.23 Corridor-based Transport Infrastructure Development Plan  
– D. Mandalay-Tamu Corridor**



**Figure 10.24 Proposed Project Cost and Modal Share – D. Mandalay-Tamu Corridor**

### **E. Second East - West Corridor**

#### **Socio-Economic Conditions, Transport Demand and Services of the Corridor**

In 2012, the Second East - West Corridor population represented 17% of the national total and economic activities accounted for 15% of the nation's GDP. In 2013, the corridor saw 4.1 million passenger-kilometers of daily passenger traffic and 2.4 million ton-kilometers of daily freight traffic. These figures account for 3% of all freight traffic and 6% of all passenger transported for all corridors. The modal distribution for freight is: road (97%) and rail (3%), and the passenger distribution is: bus (58%), car (26%), rail (10%) and air (5%). The corridor development will contribute to an increase in both freight (6.8% p.a. from 2013 to 2030) and passenger (7.2% p.a. during the same period) traffic demand and the future traffic demand will reach 13 million passenger-kilometers and 9.9 million ton-kilometers per day by 2030.

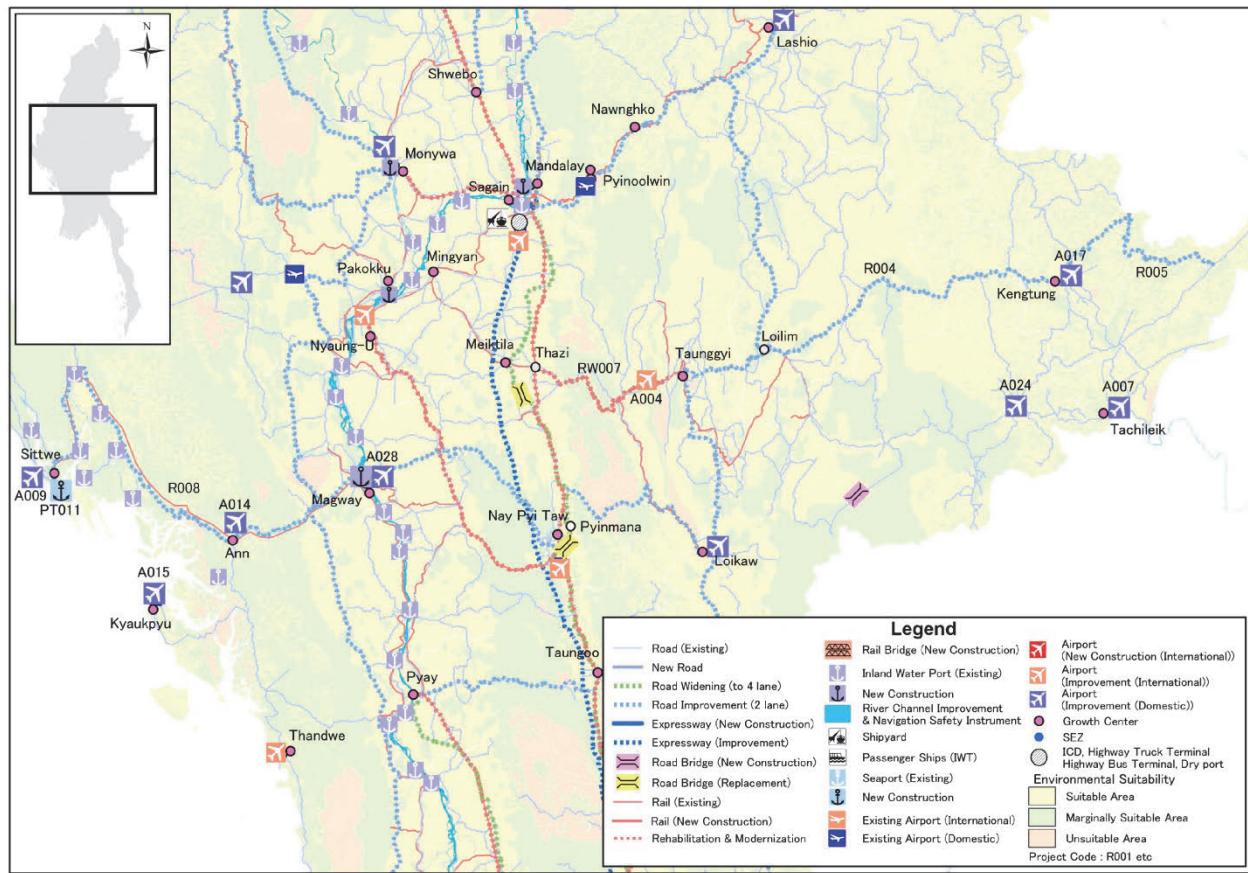
#### **Proposed Major Project Component**

Table 10.20 and Figure 10.25 and 10.26 summarize a range of priority transport projects along the Second East - West Corridor.

**Table 10.20 List of Priority Projects along Second East - West Corridor**

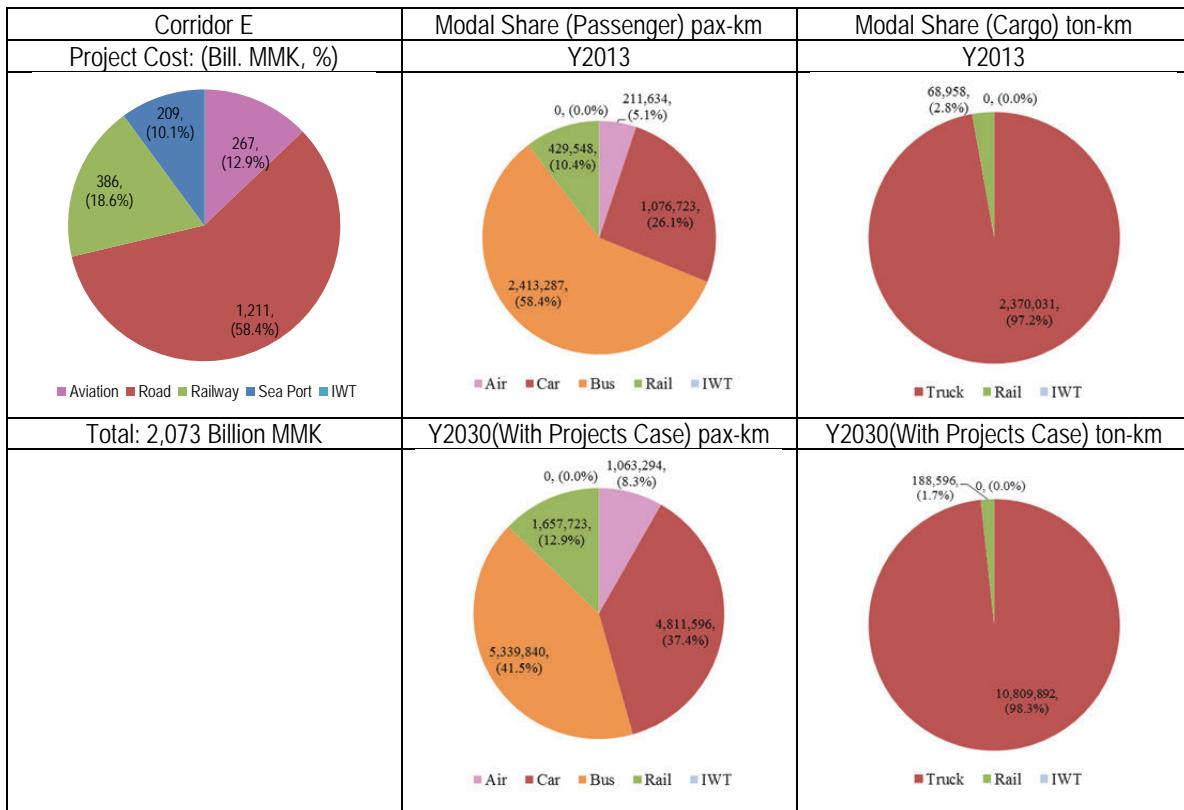
Corridor	Sector	Project ID	Project	Total Project Cost (Bil. MMK)
E1,L2	Aviation	A004	Heho International Airport	146.0
E1	Aviation	A007	Tachileik Airport (major domestic)	76.0
E1	Aviation	A009	Sittwe Airport (major domestic)	21.0
E1	Aviation	A014	Ann Airport	7.0
E1	Aviation	A015	Kyaukphyu Airport	8.0
E1	Aviation	A017	Kengtung Airport	5.0
E1	Aviation	A024	Mong-Hsat Airport	2.0
E1,G2,K1,K2	Aviation	A028	Magway Airport	2.0
E1	Railway	RW007	Pyawbwe-Shwenyayng	386.0
E1	Road	R004	Taunggyi – Loillim – Kyaington Road	658.0
E1	Road	R005	Kyaington – Mongla Road	90.0
E1	Road	R008	Minbu – Ann – Kyauktaw – Sittwe Road	463.0
E1	Sea Port	PT011	Sittwe Port	209.0
				2,073

Source: JICA Study Team



Source: JICA Study Team

**Figure 10.25 Corridor-based Transport Infrastructure Development Plan – E. Second East-West Corridor**



**Figure 10.26 Proposed Project Cost and Modal Share – E. Second East-West Corridor**

## **G. East - West Bridging Corridor**

### Socio-Economic Conditions, Transport Demands and Services of the Corridor

In 2012, the East-West Bridging Corridor's population represented 12% of the national total and economic activities accounted for 11% of the nation's GDP. In 2013, the corridor saw 2.1 million passenger-kilometers of daily passenger traffic and 1.1 million ton-kilometers of daily freight traffic. These figures account for 1% of all freight traffic and 3% of all passengers transported for all corridors. The corridor's freight traffic relies on roads for 100% of its freight transport, and the modal distribution for passenger traffic is bus (38%), car (17%) and rail (45%). The corridor development will contribute to an increase in both freight (maximum of 6.9% p.a. from 2013 to 2030) and passenger (7.8% p.a. during the same period) traffic demand and the future traffic demand will reach 7.5 million passenger-kilometers and 3.1 million ton-kilometers per day by 2030.

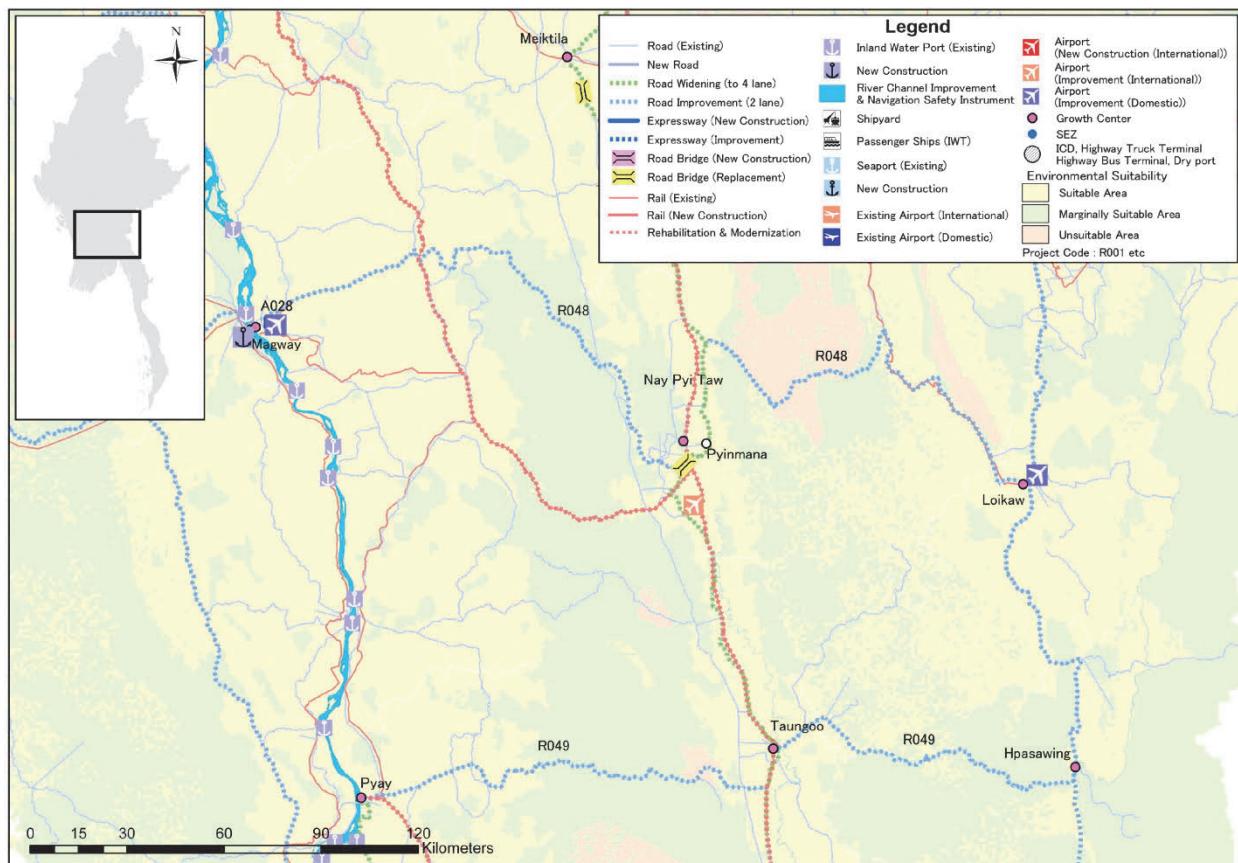
### Proposed Project Component

Table 10.21 and Figure 10.27 and 10.28 summarize a range of priority transport projects along the East - West Bridging Corridor.

**Table 10.21 List of Priority Projects along East - West Bridging Corridor**

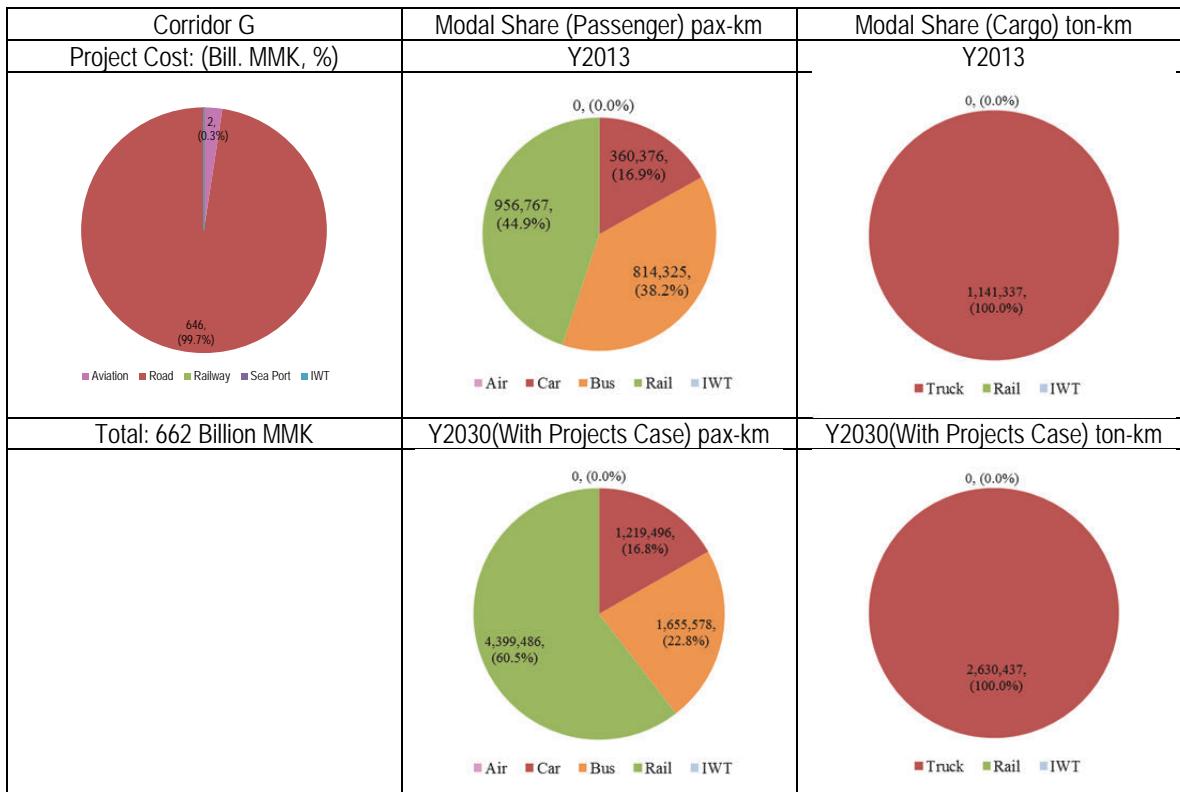
Corridor	Sector	Project ID	Project	Total Project Cost (Bil. MMK)
E1,G2,L1,L2	Aviation	A019	Loikaw Airport	7.0
E1,G2,K1,K2	Aviation	A028	Magway Airport	2.0
G2	Road	R048	Loikaw - Magway Road	363.0
G1	Road	R049	Hpasawing - Pyay Road	283.0
				655

Source: JICA Study Team



Source: JICA Study Team

**Figure 10.27 Corridor-based Transport Infrastructure Development Plan – G. East-West Bridging Corridor**



**Figure 10.28 Proposed Project Cost and Modal Share – G. East-West Bridging Corridor**

### **J. Southern Area Development Corridor**

#### **Socio-Economic Conditions, Transport Demands and Services of the Corridor**

In 2012, the Southern Area Development Corridor's population accounted for 8% of the national total and economic activities represented 8% of the nation's GDP. In 2013, the corridor saw 0.9 million passenger-kilometers of daily passenger traffic and 0.1 million ton-kilometers of daily freight traffic. These figures account for less than 1% of all freight traffic and 1% of all passengers transported for all corridors. The corridor's freight traffic relies on roads for 100% of its freight transport. The corridor development will contribute to an increase in both freight (maximum of 10.0% p.a. from 2013 to 2030) and passenger (5.3% p.a. during the same period) traffic demand and the future traffic demand will reach 2.2 million passenger-kilometers and 0.4 million ton-kilometers per day by 2030.

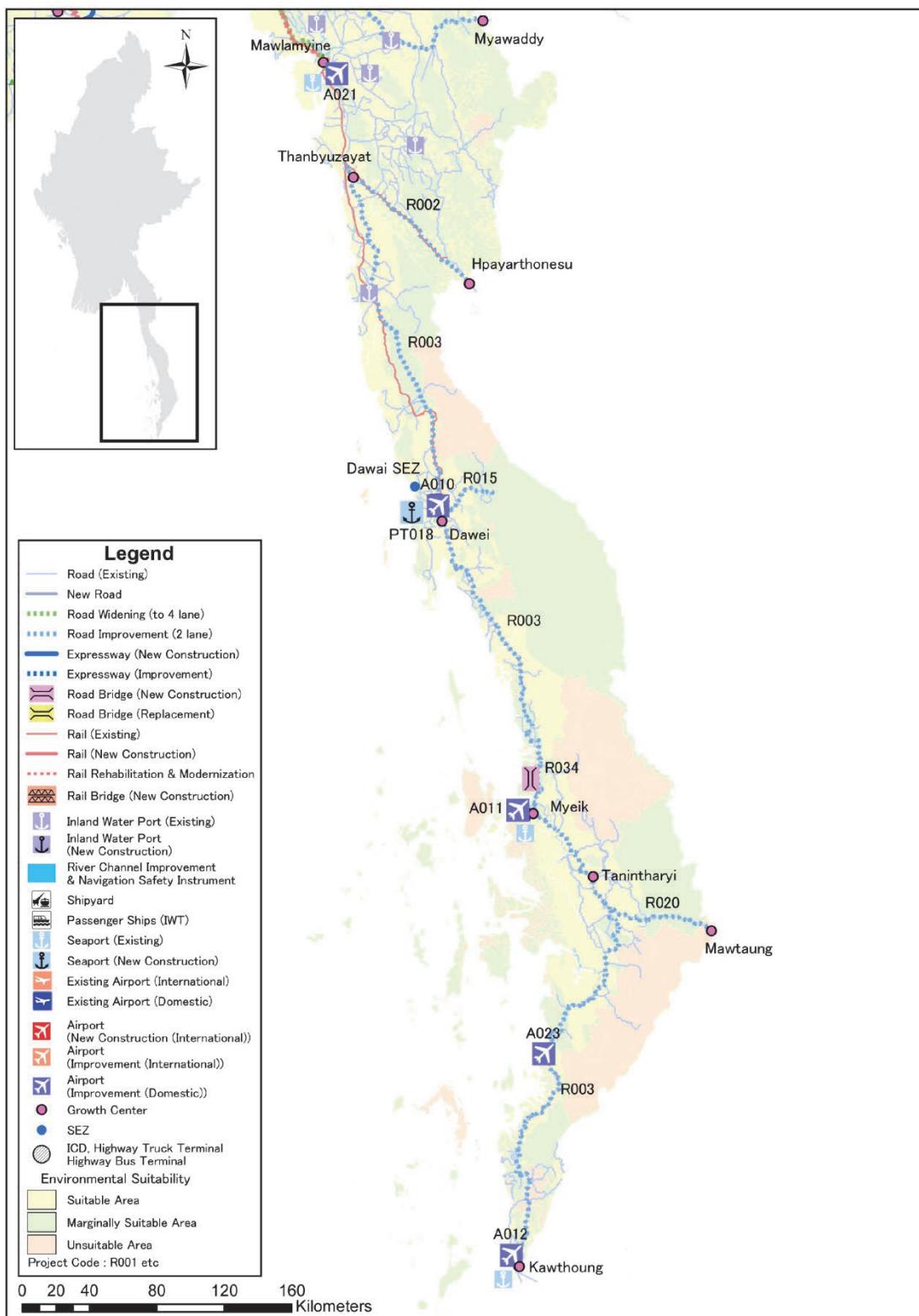
#### **Proposed Major Project Component**

Table 10.22 and Figures 10.29 and 10.30 summarize a range of priority transport projects along the Southern Area Development Corridor.

**Table 10.22 List of Priority Projects along Southern Area Development Corridor**

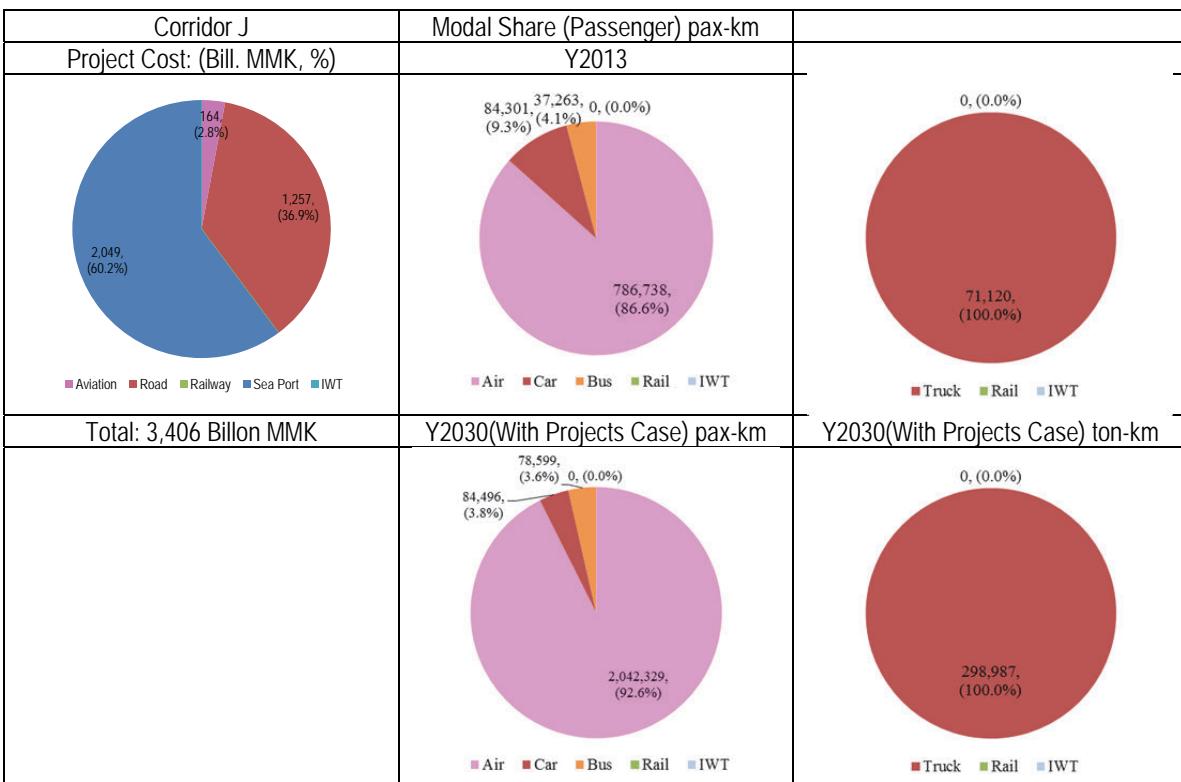
Corridor	Sector	Project ID	Project	Total Project Cost (Bil. MMK)
B2,J2,J3	Aviation	A010	Dawei Airport (major domestic)	37.0
J2,J3	Aviation	A011	Myeik Airport (major domestic)	45.0
J3	Aviation	A012	Kawthoung Airport	9.0
B1,B2,J1	Aviation	A021	Mawlamyine Airport	2.0
J3	Aviation	A023	Bokpyinn Airport	7.0
J1	Road	R002	Three Pagoda Pass	101.0
B2,J3	Road	R003	Thanbyuzayat – Dawei – Myeik – Kawthonng Road	907.0
J2	Road	R015	Dawei – Phunamron Road	128.0
J3	Road	R020	Tanintharyi – Mawtaung Road	107.0
J3	Road	R034	Tha Mouk Bridge	14.0
B1,B2, J1	Sea Port	PT008	Mawlamyaing Port	49.0
B2, J2, J3	Sea Port	PT006	Dawai Port	2,000.0
				3,406

Source: JICA Study Team



Source: JICA Study Team

**Figure 10.29 Corridor-based Transport Infrastructure Development Plan – J. Southern Area Development Corridor**



**Figure 10.30 Proposed Project Cost and Modal Share  
– J. Southern Area Development Corridor**

### **L. Eastern North - South Corridor**

#### Socio- economic Condition, Transport Demand and Service of the Corridor

In 2012, the Eastern North - South Corridor's population accounted for 12% of the national total and economic activities represented 9% of the nation's GDP. In 2013, the corridor saw 0.2 million passenger-kilometers of daily passenger traffic and 0.3 million ton-kilometers of daily freight traffic. These figures account for less than 1% of all freight traffic and 1% of all passengers transported for all corridors. The modal distribution of freight traffic is road (99%) and rail (1%). The corridor development will contribute to an increase in both freight (maximum of 7.2% p.a. from 2013 to 2030) and passenger (4.6% p.a. during the same period) traffic demand and the future traffic demand will reach 0.5 million passenger-kilometers and 0.3 million ton-kilometers per day by 2030.

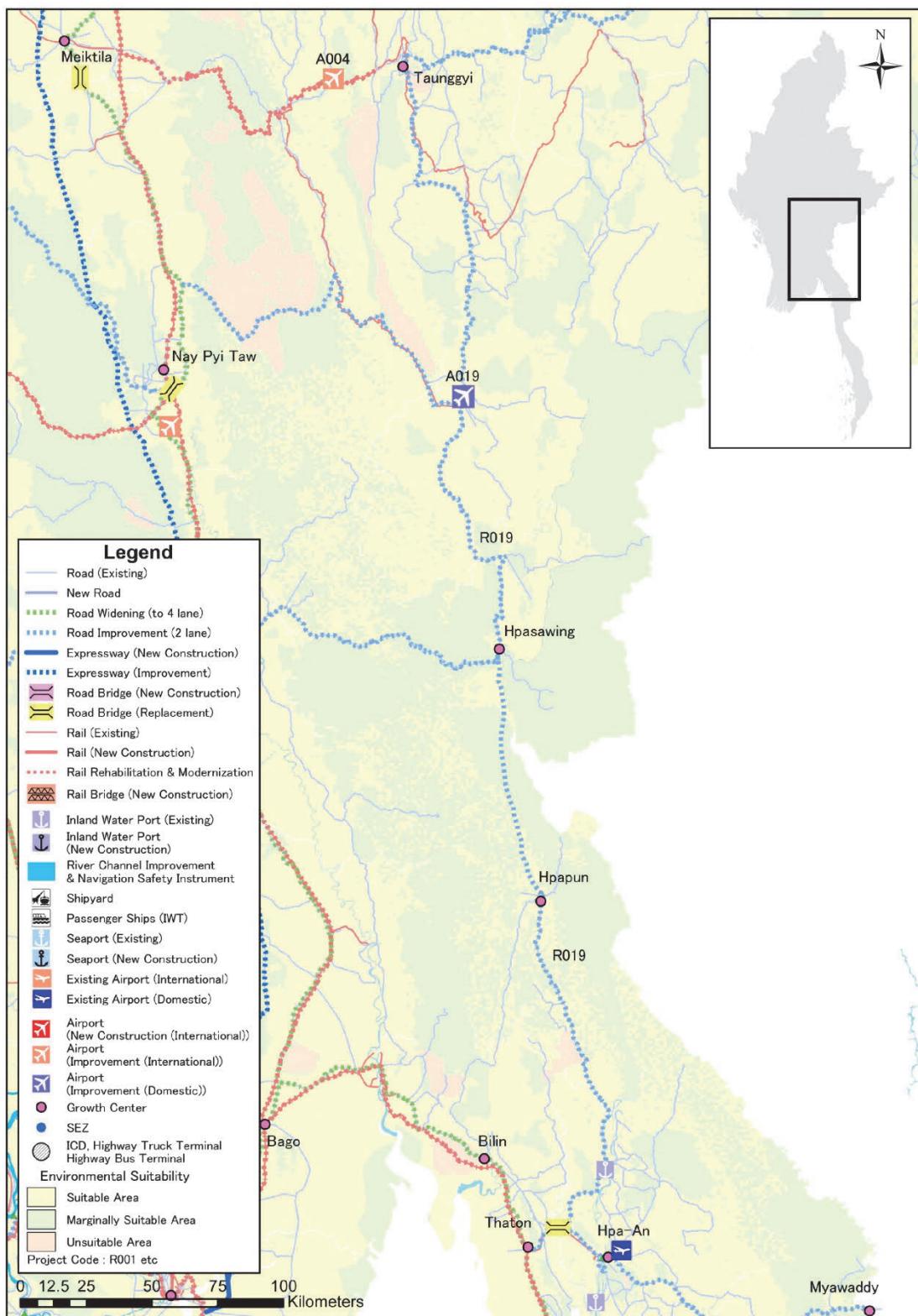
#### Proposed Project Component

Table 10.23 and Figures 10.31 to 10.33 summarize a range of priority transport projects along the Eastern North - South Corridor.

**Table 10.23 List of Priority Projects along the Eastern North - South Corridor**

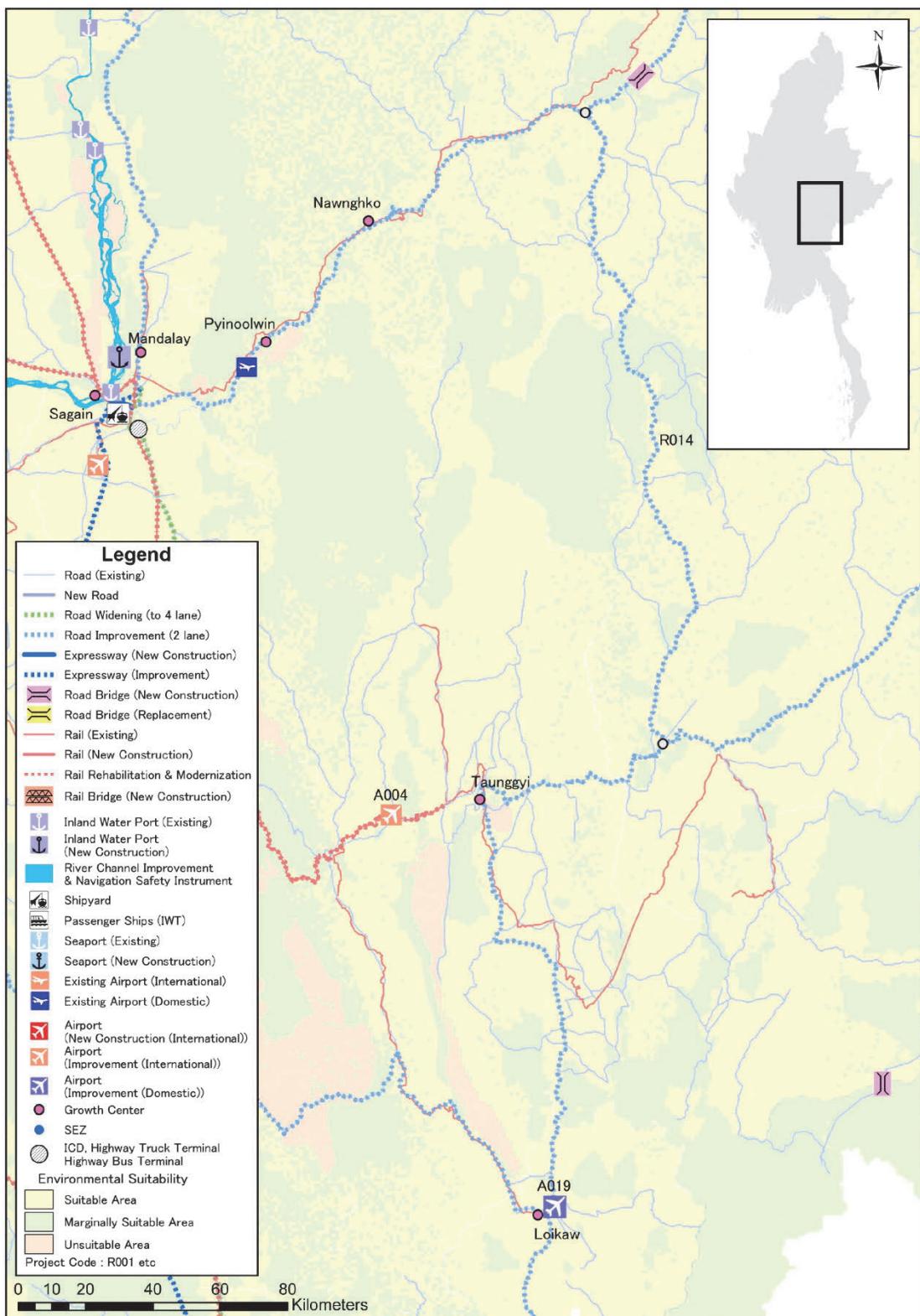
Corridor	Sector	Project ID	Project	Total Project Cost (Bil. MMK)
E1,L2	Aviation	A004	Heho International Airport	146.0
E1,G2,L1,L2	Aviation	A019	Loikaw Airport	7.0
L2	Road	R014	Thibaw – Loilem Road	232.0
L1	Road	R019	Taunggyi – Loikaw – Hpapun – Pha an Road	660.0
				1,045

Source: JICA Study Team



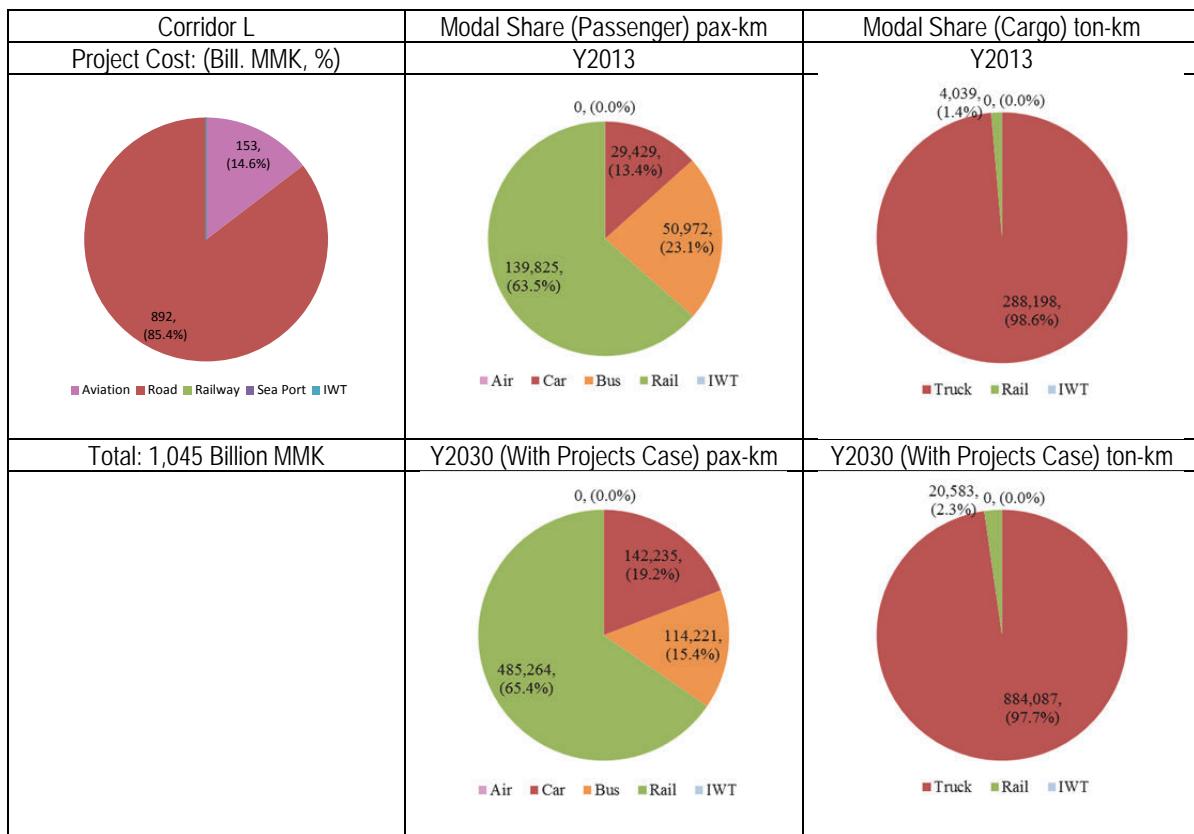
Source: JICA Study Team

**Figure 10.31 Corridor-based Transport Infrastructure Development Plan  
– L. Eastern North - South Corridor (1/2)**



Source: JICA Study Team

**Figure 10.32 Corridor-based Transport Infrastructure Development Plan  
– L. Eastern North - South Corridor (2/2)**



**Figure 10.33 Proposed Project Cost and Modal Share – L. Eastern North - South Corridor**

---

## Chapter 11 Implementation Plan

### **11.1 Introduction**

This Chapter summarizes priority investments in the transport sector over the next fifteen years (until 2030) and includes recommended actions to implement the MYT-Plan.

While many of these investments may be implemented within the next five years, several are high priority actions that, if not acted upon very soon, would mean that Myanmar will miss opportunities to stimulate domestic growth, either by not taking advantage of favorable trade agreements with neighboring countries or by failing to catalyze domestic growth opportunities.

As well, these initiatives must be supported by capable and well-resourced government stakeholders, at the national level and state/region levels. Ministries and Departments will require improved capacity to plan and implement coordinated activities. A framework for this type of support is described in this Chapter, both to implement the short-term investments as well as to launch studies for longer-term capacity activities.

### **11.2 Implementation Plan**

As discussed in Chapter 10, corridor-based transport projects are based on analysis that includes three frameworks, namely: financial, environmental and special.

Implementation of these projects will require two programs: a six year nationally-focused plan (2014/2015 to 2020) and a ten-year balanced national and urban/rural plan (2021 to 2030). Due to the intensity of the projects, especially during the six-year program, a number of related investments and “soft components” should be made, including:

- Prioritize strategic infrastructure development and asset maintenance and management
- Identify key capacity building requirements in the public sector, at the national and state/regional levels
- Calculate detailed capital costs for all elements of programs, including air, road, rail, seaport and inland water; see Table 11.1 for a preliminary cost breakdown summary
- Identify needed policy changes to improve sector regulation and technical guidelines
- Identify strategies to encourage new partnerships and investment with aid agencies, the private sector and regional bodies like the Association of Southeast Asian Nations (ASEAN)
- Identify important industry investments that will help sustain the improved transport sector
- Develop a communications plan to describe a business case for sector development and outreach/promotional materials to present the value of these projects and spin off benefits to investors. This must confirm the financial feasibility of projects and

prioritize them, according to their economic, social and environmental outcomes

- Identify needed environmental assessment analysis for each initiative within the programs

### **11.3 Overall Capital Investment**

The MYT-Plan analysis concludes that 48 trillion Kyat of Gross Fixed Capital Formation (GFCF) will be required to fund the needed transport sector investments, through to 2030, as described in Chapter 2 of this Report. This investment is allocated to two programs: 1) a five-year program (2014 – 2020) that will see 87% of the program funding for national-level transport systems; and 2) a ten-year program (2020 – 2030) that includes an investment allocation (pattern) that is “well-balanced” between national systems and urban/rural systems.

The five-year program (2014 – 2020) will cost 11.678 trillion Kyat and the program focus is on national systems, hence 10.144 trillion Kyat (87%) is designated to national level trunk and related infrastructure while 1.53 trillion Kyat (13%) is slated for urban/rural transport systems. The ten-year plan (2020 – 2030) will cost 36.390 trillion Kyat and will invest 16.544 trillion Kyat (45%) in trunk transport systems to encourage economic activities in other industrial and 19.85 trillion Kyat (55%) to increase quality of life of the nations through investment to the urban and rural transport systems. Table 11.1 illustrates the investment in national level transport systems against transport sector capital formation.

**Table 11.1 Gross Fixed Capital Formation in the Transport Sector and the Investment to the National Level Transport Systems**

Unit: Billion Kyat at 2013 constant prices			
	<b>2014-2020</b>	<b>2020-2030</b>	<b>2014-2030</b>
Investment in the national level transport systems	10,144	16,544	26,688
	87%	45%	56%
Transport Sector Capital Formation	11,678	36,390	48,068

Source: JICA Study Team

Tables 11.1 through 11.3 and Figure 11.1 identify projects by transportation sector within the two program timeframes. While some infrastructure projects will be implemented within five years, most of the projects will be completed between 2020 and 2030.

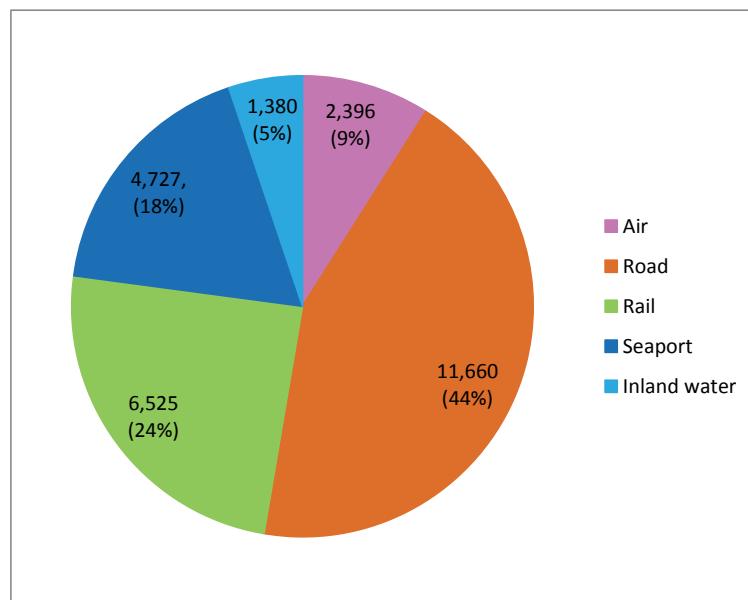
**Table 11.2 Summary of the Proposed Investment by Sectors**

Unit: Billion Kyat at 2013 constant prices

Sector	Investment				2014 - 2030 (Bil. MMK)	2014 - 2030 + over 2030 (Bil. MMK)
	- Y2015	Y2016 - Y2020	Y2021 - Y2030	Over Y2030		
Air	319	1,155	922	0	2,396	2,396
Road	588	2,788	8,285	2	11,660	11,662
Rail	327	1,994	4,204	413	6,525	6,938
Seaport	501	1,872	2,354	1,796	4,727	6,523
Inland water	39	562	779	372	1,380	1,752
Total	1,774	8,371	16,544	2,582	26,688	29,271

**Table 11.3 Summary of the Proposed Investment by Sectors (% of Total Project Cost)**

Sector	Investment				2014 - 2030 (Bil. MMK)	2014 - 2030 + over 2030 (Bil. MMK)
	- Y2015	Y2016 - Y2020	Y2021 - Y2030	Over Y2030		
Air	18%	14%	6%	0%	9%	8%
Road	33%	33%	50%	0%	44%	40%
Rail	18%	24%	25%	16%	24%	24%
Seaport	28%	22%	14%	70%	18%	22%
Inland water	2%	7%	5%	14%	5%	6%
Total	100%	100%	100%	100%	100%	100%



Source: JICA Study Team

**Figure 11.1 Investment by transport sub-sector  
between 2013 and 2030 (billion MMK at 2013 constant process)**

**Table 11.4 Investment Program (Air Sector)**

Sector	Corridor	Project ID	Project	Implementation Schedule																				Budget					Total Project Cost (Bil. MMK)	Contents					
				2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	- Y2015	Y2016 - Y2020	Y2021 - Y2030	Over Y2030
Aviation	A1,B1,H1,K1	A001	Yangon International Airport																											49.0	146.0	0.0	0.0	195.0	Improvement by PPP concessionaire On-going
	A1,B1	A002	Hanthawaddy International Airport																											263.0	439.0	701.0	0.0	1,403.0	Construction by PPP concessionaire
	A2,A3,C1,D1,K2	A003	Mandalay International Airport																											0.0	21.0	0.0	0.0	21.0	Improvement by PPP concessionaire
	E1,L2	A004	Heho International Airport																											0.0	119.0	27.0	0.0	146.0	Runway pavement, TWY, PTB, Apron, Control Tower, Administration building, AGL, Rescue and Fire-fighting, Utilities
	K2,D1	A005	Nyaung U International Airport (Alt. Pakokku)																											0.0	88.0	19.0	0.0	107.0	Runway pavement, TWY, PTB, Apron, Control Tower, Administration building, AGL, Rescue and Fire-fighting, Utilities
	Other	A006	Thandwe International Airport																										0.0	46.0	11.0	0.0	57.0	Runway pavement, TWY, PTB, Apron, Control Tower, Administration building, AGL, Rescue and Fire-fighting, Utilities	
	E1	A007	Tachileik Airport (major domestic)																										0.0	54.0	22.0	0.0	76.0	Runway, PTB, Apron, TWY, RWY Renewal of PAPI, SALS	
	A3	A008	Myilkyna Airport (major domestic)																										0.0	17.0	7.0	0.0	24.0	Installation of PAPI, SALS Expansion of PTB, Renewal of RWY, TWY, Apron Lights	
	E1	A009	Sittwe Airport (major domestic)																										0.0	15.0	6.0	0.0	21.0	Extension of runway and apron, fire-fighting, renewal of SALS/PAPI/TWY/Apron lights	
	B2,J2,J3	A010	Dawei Airport (major domestic)																										0.0	26.0	11.0	0.0	37.0	Relocation of apron, TWY, fire-fighting engine, expansion of apron, renewal of RWY lights	
	J2,J3	A011	Myeik Airport (major domestic)																										0.0	32.0	13.0	0.0	45.0	Expansion of Apron and PTB Renewal of PAPI, RWY, TWY, Apron Lights	
	J3	A012	Kawthoung Airport																										0.0	6.0	3.0	0.0	9.0	PTB, Apron, Taxiway	
	Other	A013	Putao Airport																										0.0	5.0	2.0	0.0	7.0	PTB, Apron, Taxiway	
	E1	A014	Ann Airport																										0.0	5.0	2.0	0.0	7.0	PTB, Apron, Taxiway PAPI, SALS	
	E1	A015	Kyaukphyu Airport																										0.0	6.0	2.0	0.0	8.0	PTB, Apron, Taxiway PAPI, RTIL, SALS	
	C1	A016	Lashio Airport																										0.0	5.0	2.0	0.0	7.0	PTB, Apron, Taxiway PAPI, SALS	
	E1	A017	Kengtung Airport																										0.0	4.0	1.0	0.0	5.0	PTB, Apron, Taxiway	
	A3	A018	Bhamo Airport																										0.0	6.0	3.0	0.0	9.0	PTB, Apron, Taxiway	
	E1,G2,L1,L2	A019	Loikaw Airport																										0.0	5.0	2.0	0.0	7.0	PTB, Apron, Taxiway PAPI, RTIL, SALS	
	D1	A020	Monywar Airport																										0.0	5.0	2.0	0.0	7.0	PTB, Apron, Taxiway PAPI, RTIL, SALS	
	B1,B2,J1	A021	Mawlamyine Airport																										0.0	1.0	1.0	0.0	2.0	Minor improvement	
	D1	A022	Kalay Airport																										0.0	3.0	1.0	0.0	4.0	PTB, Apron, Taxiway SALS	
	J3	A023	Bokpyinn Airport																										0.0	5.0	2.0	0.0	7.0	PTB, Apron, Taxiway PAPI, RTIL, SALS	
	E1	A024	Mong-Hsat Airport																										0.0	1.0	1.0	0.0	2.0	PTB, Apron, Taxiway PAPI, RTIL, SALS	
	D1	A025	Hommalin Airport																										0.0	4.0	1.0	0.0	5.0	PAPI, RTIL, SALS	
	D1	A026	Kanti Airport																										0.0	4.0	1.0	0.0	5.0	PTB, Apron, Taxiway PAPI, RTIL, SALS	
	H1	A027	Pathein Airport																										0.0	1.0	1.0	0.0	2.0	Minor improvement	
	E1,G2,K1,K2	A028	Magway Airport																										0.0	1.0	1.0	0.0	2.0	Minor improvement	
	K1,K2,D1	A029	Kyauktu Airport																										0.0	1.0	1.0	0.0	2.0	PAPI, RTIL, SALS	
	Other	A030	Coco Island Airport																										0.0	1.0	1.0	0.0	2.0	PAPI, RTIL, SALS	
	Common	A031	Soft Component																										5.0	80.0	75.0	0.0	160.0	A series of projects for improvement of CNS/ATM systems (refer to the technical note on the aviation sector)	
	Common	A032	Soft Component																										2.0	3.0	0.0	0.0	5.0	A series of TA and other actions for DCA reorganization (refer to the technical note on the aviation sector)	

**Table 11.5 Investment Program (Road Sector)**

Sector	Corridor	Project ID	Project	Implementation Schedule																				Budget				Total Project Cost (Bil. MMK)	Contents						
				2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	- Y2015	Y2016	Y2021	Over Y2030
Road	B1	R001	Thalon – Eindu – Kawkareik – Myawaddy Road																											0.0	192.0	0.0	0.0	192.0	L: 198km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)
	J1	R002	Three Pagoda Pass																											0.0	101.0	0.0	0.0	101.0	L: 104km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)
	B2,J3	R003	Thanbyuzayat – Dawei – Myeik – Kawthonng Road																										0.0	907.0	0.0	0.0	907.0	L: 934km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)	
	E1	R004	Taunggyi – Loilim – Kyaington Road																										110.0	548.0	0.0	0.0	658.0	L: 677km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)	
	E1	R005	Kyaington – Mongla Road																									0.0	90.0	0.0	0.0	90.0	L: 93km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)		
	D1	R006	Monywa - Pale - Gangaw – Kalaymyo Road																									0.0	0.0	302.0	0.0	302.0	L: 311km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)		
	A3	R007	Shwebo – Myitkyina Road																								0.0	0.0	462.0	0.0	462.0	L: 476km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)			
	E1	R008	Minbu – Ann – Kyauktaw – Sittwe Road																								0.0	0.0	463.0	0.0	463.0	L: 477km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)			
	A1, A2	R009a	Bago – Mandalay Road																								0.0	0.0	880.0	0.0	880.0	L: 604km, 4-lane single carriageway Improvement (roughness, pavement, scholder, etc.)			
	A1, A2	R009b	Yangon (from toll gate) - Bago Road																							0.0	0.0	84.0	0.0	84.0	L: 50 km, 4-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	K1	R010	Yangon – Pyay - Mandalay Road																							0.0	0.0	1,139.0	0.0	1,139.0	L: 782km, 4-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	D1,K1,H1	R011	Monywa – Pathein Road																							0.0	0.0	700.0	0.0	700.0	L: 721km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	C1	R012	Mandalay – Lashio – Muse Road																							0.0	0.0	440.0	0.0	440.0	L: 459km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	A3	R013	Mandalay – Thabeikkyin – Tagaung – Bhamo Road																							0.0	0.0	274.0	0.0	274.0	L: 282km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	L2	R014	Thibaw – Loilem Road																							0.0	0.0	232.0	0.0	232.0	L: 239km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	J2	R015	Dawei – Phunamron Road																							0.0	0.0	128.0	0.0	128.0	L: 132km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	B1,B2	R016	Payagyi – Mawlamyaine – Thanbuzayat Road																							0.0	0.0	393.0	0.0	393.0	L: 270km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	D1	R017	Monywa – Yargyi – Kalewa Road																							0.0	0.0	181.0	0.0	181.0	L: 186km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	H1	R018	Yangon – Pathein Road																							0.0	0.0	124.0	0.0	124.0	L: 128km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	L1	R019	Taunggyi – Loikaw – Hpapun – Pha an Road																							0.0	0.0	660.0	0.0	660.0	L: 680km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	J3	R020	Tanintharyi – Mawtaung Road																							0.0	0.0	107.0	0.0	107.0	L: 110km, 2-lane single carriageway Improvement (roughness, pavement, scholder, etc.)				
	B1	R021	Gyaing (Kawkareik) Bridge																							0.0	21.0	0.0	0.0	21.0	Replacement L: 450m				
	Urban	R022	New Thaketa Bridge																							0.0	15.0	0.0	0.0	15.0	Replacement L: 190m				
	Urban	R023	Bago Bridge																							24.0	121.0	0.0	0.0	145.0	Replacement L: 3000m				
	B1	R024	Don Tha Mi and Naung Lon Bridge																							0.0	16.0	0.0	0.0	16.0	Replacement L: 200+120m				
	B1	R025	Gyaing (Zarthapyin) Bridge																							0.0	34.0	0.0	0.0	34.0	Replacement L: 870m				
	B2	R026	Atran Bridge																							0.0	17.0	0.0	0.0	17.0	Replacement L: 433m				
	A2	R027	2 bridges on Yangon-Mandalay Road																							0.0	10.0	0.0	0.0	10.0	Replacement L: 100+100m				
	H1, H2	R028	Hinthata Bridge																							0.0	141.0	0.0	0.0	141.0	Replacement L: 3620m				
	D1	R029	Yaw Chaung (Yepyar) Bridge																							0.0	0.0	39.0	0.0	39.0	Replacement L: 1000m				
	D1	R030	Yaw Chaung (Ohn Taw) Bridge																							0.0	0.0	29.0	0.0	29.0	Replacement L: 760m				
	Urban	R031	Dala Bridge																							0.0	121.0	0.0	0.0	121.0	New bridge L: 1210				
	H1	R032	Hlaing River Bridge																							0.0	0.0	58.0	0.0	58.0	New bridge L: 1200m				
	C1	R033	New Goat twin Viaduct																							0.0	0.0	35.0	0.0	35.0	New bridge L: 910m				
	J3	R034	Tha Mouk Bridge																							0.0	0.0	14.0	0.0	14.0	New bridge L: 350m				
	Urban	R035	Wataya Bridge																							0.0	0.0	30.0	0.0	30.0	New bridge L: 500m				

Projects in the first priority corridor

Projects outside the priority corridor, but of higher priority (projects in the regional centers, etc.)

#### Projects in the first priority corridor

Projects outside the priority corridor, but of higher priority (projects in the regional centers, etc.)

## Projects outside the priority corridor, b)

**Table 11.5 Investment Program (Road Sector)(Cont.)**

Sector	Corridor	Project ID	Project	Implementation Schedule												(Cont.) Budget				Total Project Cost (Bil. MMK)	Contents														
				2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	- Y2015	Y2016 - Y2020	Y2021 - Y2030	Over Y2030
Road	D1	R036	Chindwin (Kalaywa) Bridge																											0.0	0.0	23.0	0.0	23.0	New bridge L: 600m
	H1	R037	Thetkal Thoung Bridge																											0.0	0.0	29.0	0.0	29.0	New bridge L: 760m
	B2	R038	Thanlwin (Chaungsone) Bridge																											0.0	0.0	23.0	0.0	23.0	New bridge L: 600m
	B1	R039	Chaungnitkwa Bridge																											0.0	0.0	14.0	0.0	14.0	New bridge L: 360m
	Urban	R040	Thanlwin (Tarsolpha) Bridge																										0.0	0.0	12.0	0.0	12.0	New bridge L: 305m	
	A1	R041	Yangon - Mandalay Expressway																										193.0	483.0	0.0	0.0	676.0	Improvement (surface, alignment, safety facilities, lighting, etc.) L: 50km	
	B1	R042	Yangon City - Thilawa Port Expressway																										0.0	243.0	0.0	0.0	243.0	New expressway L: 50km	
	B1	R043	Yangon City - Hanthawaddy - Existing Expressway																										0.0	0.0	388.0	0.0	388.0	New expressway L: 80km	
	A2,A3	R044	Mandalay Circular Expressway																										0.0	0.0	340.0	0.0	340.0	New expressway L: 70km	
	Other	R045	Road Asset Management Improvement																										1.0	5.0	10.0	1.0	17.0	Database development, survey, training	
	Other	R046	Road Sector Administration Improvement																										0.5	2.5	5.0	0.5	8.5	Technical assistance (TA) and training, procurement of PC etc.	
	G2	R048	Loikaw - Magway Road																										0.0	0.0	363.0	0.0	363.0	L: 380km, 2-lane single carriageway Improvement (roughness, pavement, shoulder, etc.)	
	G1	R049	Hapasaung - Pyay Road																										0.0	0.0	283.0	0.0	283.0	L: 300km, 2-lane single carriageway Improvement (roughness, pavement, shoulder, etc.)	

Projects in the first priority corridor

Projects outside the priority corridor, but of higher priority (projects in the regional centers, etc.)

Projects in the second priority corridor

**Table 11.6 Investment Program (Rail Sector)**

Sector	Corridor	Project ID	Project	Implementation Schedule																				Budget				Total Project Cost (Bil. MMK)	Contents						
				2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	- Y2015	Y2016 - Y2020	Y2021 - Y2030	Over Y2030
Railway	A1, A2	RW001	Yangon - Mandalay																											219.0	1,097.0	439.0	0.0	1,755.0	Railway improvement and modernization (rail track, signal and communication, level crossing, trains, etc.)
	A3	RW002	Myohaung-Myitkyina																											91.0	456.0	365.0	0.0	912.0	Railway improvement and modernization (rail track, signal and communication, level crossing, trains, etc.)
	B1	RW003	Bago-Mawlamyine																											0.0	183.0	183.0	0.0	366.0	Railway improvement and modernization (rail track, signal and communication, level crossing, trains, etc.)
	K1	RW004	Yangon-Pyay																											0.0	162.0	270.0	0.0	432.0	Railway improvement and modernization (rail track, signal and communication, level crossing, trains, etc.)
	H1	RW005a	Yangon-Pathein																											0.0	30.0	209.0	0.0	239.0	Railway improvement and modernization (rail track, signal and communication, level crossing, trains, etc.)
	H1	RW005b	Bridge																											0.0	4.0	25.0	0.0	29.0	New rail bridge crossing the Hlaing River.
	D1	RW006	Myohaung-Monywa																											0.0	0.0	37.0	91.0	128.0	Railway improvement and modernization (rail track, signal and communication, level crossing, trains, etc.)
	E1	RW007	Pyawbwe-Shwenyaung																											0.0	0.0	64.0	322.0	386.0	Railway improvement and modernization (rail track, signal and communication, level crossing, trains, etc.)
	A1	RW008	Bago-Hanthawaddy																											12.0	17.0	0.0	0.0	29.0	Spur line from Bago to Hanthawaddy International Airport (single track)
	A1	RW009	Yangon - Hanthawaddy																											0.0	0.0	2,000.0	0.0	2,000.0	New Airport Rail Access Project
	Other	RW010	Togyaung-Thilawa																											0.0	0.0	56.0	0.0	56.0	Railway improvement and modernization (rail track, signal and communication, level crossing, trains, etc.)
	Other	RW011	Naypyitaw - Bagan																											0.0	0.0	556.0	0.0	556.0	Railway improvement and modernization (rail track, signal and communication, level crossing, trains, etc.)
	A1	RW013	Yangon MR ICD, Workshop, etc.																											3.0	37.0	0.0	0.0	40.0	DEMU, Locomotive workshop in Ywatharygyi area, New Inland Container Depot (ICD), YCDC truck terminal, etc.
	A2, A3	RW014	Mandalay MR ICD, truck terminal, etc.																											2.0	8.0	0.0	0.0	10.0	New Inland Container Depot (ICD), truck terminal, etc.
Total																											327	1,994	4,204	413	6,938				

### Projects in the first priority corridor

Projects outside the priority corridor, but of higher priority (projects in the regional centers, etc.)

#### Projects in the second priority corridor

**Table 11.7 Investment Program (Maritime Sector)**

Sector	Corridor	Project ID	Project	Implementation Schedule																	Budget				Total Project Cost (Bil. MMK)	Contents									
				2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	- Y2015	Y2016 - Y2020	Y2021 - Y2030	Over Y2030
Sea Port	A1,B1,H1,K1	PT001	Yangon Port in Thilawa (Phase 1)																											223.0	0.0	0.0	0.0	223.0	New port construction in Thilawa area.
	A1,B1,H1,K1	PT001a	Yangon Port in Thilawa (Phase 2)																											10.0	500.0	44.0	0.0	554.0	New port construction in Thilawa area.
	A1,B1,H1,K1	PT001b	Yangon Port in Thilawa (Phase 3)																										0.0	0.0	194.0	0.0	194.0	New port construction in Thilawa area.	
	A1,B1,H1,K1	PT002	Yangon Port Capacity and Connectivity Improvement																										5.0	200.0	0.0	0.0	205.0	Capacity expansion of the existing Yangon port including and connectivity improvement between inland water transport and sea transport.	
	A1,B1,H1,K1	PT003	Yangon Port in Thilawa (Post Thilawa)																										0.0	0.0	388.0	97.0	485.0	New port construction in Thilawa area (south of the Thilawa SEZ).	
	A1,B1,H1,K1	PT004	Offshore Yangon River (Deep Seaport)																										0.0	0.0	728.1	1,698.9	2,427.0	New deep seaport construction at the river mouth of the Yangon River.	
	B2, J2, J3	PT006	Dawei Port																										0.0	1,000.0	1,000.0	0.0	2,000.0	New deep sea port construction in Dawei.	
	B1,B2, J1	PT007	Kalegauk Port																										10.0	39.0	0.0	0.0	49.0	New seaport construction in Kalegauk.	
	B1,B2, J1	PT008	Mawlamyaing Port																										10.0	39.0	0.0	0.0	49.0	Improvement of the existing port in Mawlamyaing.	
	H1,H2,F1	PT009	Pathein Port																										10.0	39.0	0.0	0.0	49.0	Improvement of the existing port in Pathein.	
	E1	PT011	Sittwe Port																										209.0	0.0	0.0	0.0	209.0	Port and facility improvement of the Sittwe port.	
	Common	PT013	Yangon Port Channel Navigation																										5.0	20.0	0.0	0.0	25.0	Navigation safety facilities installment.	
	Common	PT015	Law & Regulation update and TA																										2.0	10.0	0.0	0.0	12.0	Review and update the existing laws and regulations and TA	
	Common	PT016	Statistics development and TA																										2.0	10.0	0.0	0.0	12.0	Statistics development, procurement of equipment and TA	
	Common	PT017	EDI : Yangon Port & Other ports																										15.0	15.0	0.0	0.0	30.0	EDI (Port-MIS) installation, including river ports	
Total																										501	1,872	2,354	1,796	6,523					

#### Projects in the first priority corridor

Projects outside the priority corridor, but of higher priority (projects in the regional centers, etc.)

### Projects outside the priority corridor, but Projects in the second priority corridor

**Table 11.8 Investment Program (Inland Water Transport Sector)**

Sector	Corridor	Project ID	Project	Implementation Schedule												Budget				Total Project Cost (Bil. MMK)	Contents														
				2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	- Y2015	Y2016 - Y2020	Y2021 - Y2030	Over Y2030
IWT	F1,F2	IW001	Mandalay Port																											2.0	39.0	43.0	39.0	123.0	New river port construction in Mandalay.
	F1,H1	IW002	Yangon Port (Including Connectivity)																											2.0	99.0	103.0	99.0	303.0	Port expansion for river transport including backyard facilities
	F1	IW003	Bhamo Port																										0.0	41.0	26.0	26.0	93.0	New port construction in Bhamo.	
	F1,F2	IW004	Pakkoku Port																										0.0	12.0	10.0	0.0	22.0	New port construction in Pakkoku.	
	F1	IW005	Magway Port																										0.0	12.0	10.0	0.0	22.0	New port construction in Magway.	
	F2	IW006	Monywa Port																										0.0	0.0	21.0	0.0	21.0	New port construction in Monywa.	
	F2	IW007	Kalewa Port																										0.0	0.0	21.0	0.0	21.0	New port construction in Kalewa.	
	Other	IW008	Other 10 Ports construction																										0.0	0.0	87.0	58.0	145.0	New port construction in other 10 locations.	
	F1,H1	IW009	Yangon - Mandalay channel improvement																										4.0	61.0	61.0	61.0	187.0	Comprehensive navigation channel improvement for future container transport.	
	F1	IW010	Mandalay - Bhamo channel improvement																										0.0	0.0	65.0	65.0	130.0	Navigation channel improvement for all seasons.	
	F2	IW011	Monywa - Upstream channel improvement																										0.0	0.0	22.0	14.0	36.0	Navigation channel improvement for all seasons.	
	F1,H1	IW012	Ayeyarwady Delta channel improvement																										2.0	32.0	10.0	10.0	54.0	Navigation channel improvement for all seasons.	
	Other	IW013	Rakhaing River channel improvement																										0.0	13.0	41.0	0.0	54.0	Navigation channel improvement for all seasons.	
	Other	IW014	Thanlwin River channel improvement																										0.0	13.0	41.0	0.0	54.0	Navigation channel improvement for all seasons.	
	F1	IW015	Yangon - Mandalay Navigation safety improvement																										0.0	10.0	10.0	0.0	20.0	Navigation channel improvement for all seasons.	
	F1	IW016	Mandalay - Bhamo Navigation safety improvement																										0.0	8.0	12.0	0.0	20.0	Navigation channel improvement for all seasons.	
	F2	IW017	Monywa - Upstream Navigation safety improvement																										0.0	4.0	16.0	0.0	20.0	Navigation channel improvement for all seasons.	
	F1,H1	IW018	Ayeyarwady Delta Navigation safety improvement																										0.0	8.0	12.0	0.0	20.0	Installment of navigation safety systems	
	Other	IW019	Rakhaing River Navigation safety improvement																										0.0	0.0	20.0	0.0	20.0	Installment of navigation safety systems	
	Other	IW020	Thanlwin River Navigation safety improvement																										0.0	0.0	20.0	0.0	20.0	Installment of navigation safety systems	
	F1,H1	IW021	Dalla Shipyard modernization																										24.0	24.0	0.0	0.0	48.0	Capacity development of the existing Dalla Shipyard and modernization	
	F1,F2	IW022	Mandalay Shipyard modernization																										0.0	18.0	12.0	0.0	30.0	Capacity development of the existing Mandalay Shipyard and modernization	
	F1,H1	IW025	Ayeyarwady Delta IWT vessels																										0.0	20.0	0.0	0.0	20.0	Procurement of IWT vessels	
	F1	IW026	Mandalay - Upstream IWT vessels																										0.0	12.0	0.0	0.0	12.0	Procurement of IWT vessels	
	F2	IW027	Chindwin River IWT vessels																										0.0	3.0	2.0	0.0	5.0	Procurement of IWT vessels	
	Other	IW028	Rakhaing River IWT vessels																										0.0	3.0	2.0	0.0	5.0	Procurement of IWT vessels	
	Other	IW029	Thanlwin River IWT vessels																										0.0	3.0	2.0	0.0	5.0	Procurement of IWT vessels	
	Other	IW030	IWT barge and tugs																										0.0	100.0	100.0	0.0	200.0	Procurement of IWT barge and tugs.	
	Common	IW031	Vessel safety improvement and TA																										0.0	10.0	0.0	0.0	10.0	Vessel safety related systems installment and TA.	
	Common	IW032	Navigation safety improvement and TA																										3.0	7.0	0.0	0.0	10.0	Navigation safety systems installment and TA.	
	Common	IW033	Statistics Development																										1.0	4.0	0.0	0.0	5.0	River transport statistics development and TA.	
	Common	IW034	Port operation and management improvement and TA																										1.0	4.0	0.0	0.0	5.0	River port operation and management improvement and TA.	
	Common	IW035	Container transport system install and TA																										0.0	2.0	10.0	0.0	12.0	Systems for river container transport and TA.	
Total																										39	562	779	372	1752					

#### Projects in the first priority corridor

Projects outside the priority corridor, but of higher priority (projects in the regional centers, etc.)

### Projects in the second priority corridor