3.2 Present Situation of Railway Sub-sector

3.2.1 Policy and Programmes of the Railway Sub-sector

In 1997, Malawi joined the SADC. Since then, the concept of corridor development within the scope of the Regional Spatial Development Initiatives Programme (RSDIP) has been promoted vigorously with neighbouring countries in order to attract the private and public sectors for the purposes of wealth creation, poverty reduction and property expansion. The Zambia, Malawi, Mozambique-Growth Triangle (ZMM-GT) and the Nacala Development Corridor (NDC) were formulated in 2000. The Mtwara Development Corridor (MtwDC) was also formulated in 2004. The basis of the national strategy is to define how the corridors are mutually related.

The MGDS defines improvement of the transportation infrastructure as a priority sector, and the mid-term plan focuses on road improvements and water supply projects. However, it also suggests that emphasis should be placed on the railway sub-sector, which is an important central system in Malawi.

The long-term goal of the railway sub-sector is to have an efficient, affordable and effective rail network that eases the pressure on the road network and provides an alternative means of transport for both people and goods.

In the medium term, the railway sub-sector is expected to be a well-managed, viable and sustainable system that promotes accessibility as well as affordable and reliable movement of goods and people.

The development of the rail network must be linked to target areas such as ports, industrial sites and national borders. Main strategies include:

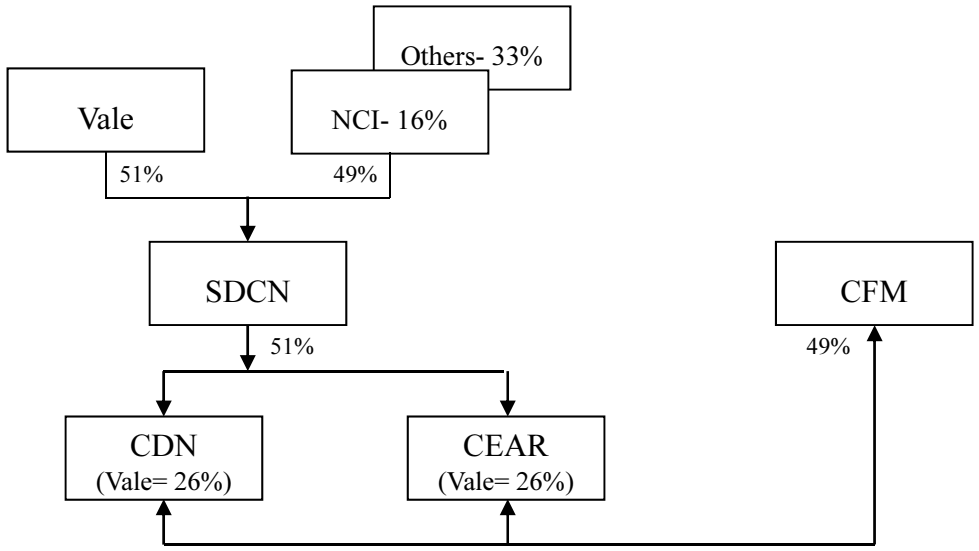
- Improving the operational efficiency and commercial viability of the existing railway infrastructure and levels of service to all users including people with disabilities at an affordable cost; and
- Promoting railway safety and environmental protection.

3.2.2 Present Status of the Railway Network in Malawi

(1) Railway Operator

CEAR currently operates 706 km of single-track line. The concession agreement allowing it to operate was signed between the GoM and CEAR on 15th November, 1999, with operation actually beginning on 1st December, 1999. The move to privatise the railway was driven by the need to improve the transport efficiency within Malawi and between Malawi and Nacala Port, to reduce the government subsidies for the railway, and to encourage private investment. Although the railway used to carry most of Malawi's international traffic, the freight transport service continues to decline and switch to road transport.

The shareholding structure of CEAR is shown in Figure 3-15.



Source: Vale

Figure 3-15 Shareholders of CEAR

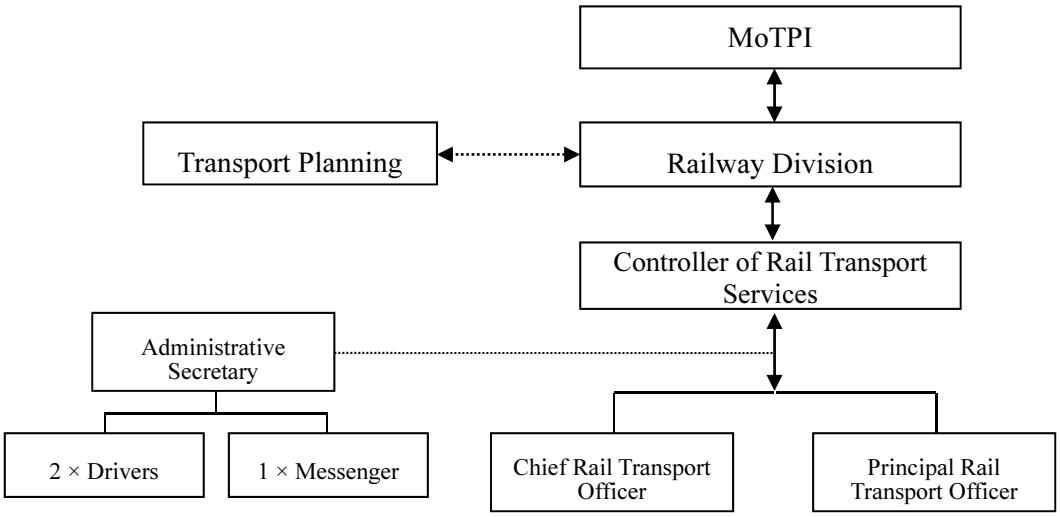
Mozambican firms have a 100% stake, of which SDCN (*Sociedade de Desenvolvimento do Corredor de Nacala*) holds 51% and CFM (*Portos e Caminhos de Ferro de Moçambique*) holds 49%. Malawi's private companies have not invested in CEAR. Brazilian company Vale (*Brazilian Companhia Vale do Rio Doce*) signed a Memorandum of Understanding (MoU) in April 2011 and a concession agreement in December 2011 with the GoM on the construction/rehabilitation and operation of a railway line from Moatize in Mozambique to *Nacala-á-Velha* Port in Mozambique, through Malawi.

(2) Railway Division in MoTPI

The Railway Division in MoTPI was established in March 2010 as an administrative department for the concession and operation of the railway. It was planned to be composed of three national professionals and four support staff, and is headed by the Controller of Rail Transport Services. The national professionals include the Controller of Rail Transport Services, Chief Rail Transport Officer, and Principal Rail Transport Officer. Although the Division started with only two professionals, the number may be increased to four in the near future to include a second full-time Principal Rail Transport Officer in the area of mechanical related inspections and regulatory enforcement. The organisational structure of the Railway Division is shown in Figure 3-16.

The purpose of the Railway Division is to ensure a safe, efficient and reliable railway transport system to assist the movement of goods, people and services. Specifically, the division has the following functions in order to achieve this purpose:

- Ensure the proper management of railway transport operation systems
- Regulate the railway transport system
- Facilitate the development of railway infrastructure



Source: Railway Division, MoTPI

Figure 3-16 Organisational Structure of Railway Division

The division has five objectives:

- To promote railway safety and environmental protection
- To ensure that the Railway Act and other legal instruments are updated periodically and strengthened
- To improve the operational efficiency and commercial viability of railway company
- To prevent adverse environmental effects of railway construction and ensure that the infrastructure is environmentally friendly
- To improve the level of service to all users including people with disabilities at an affordable cost

Consequently, the Railway Division is currently revising the concession agreement with CEAR.

(3) Railway Network

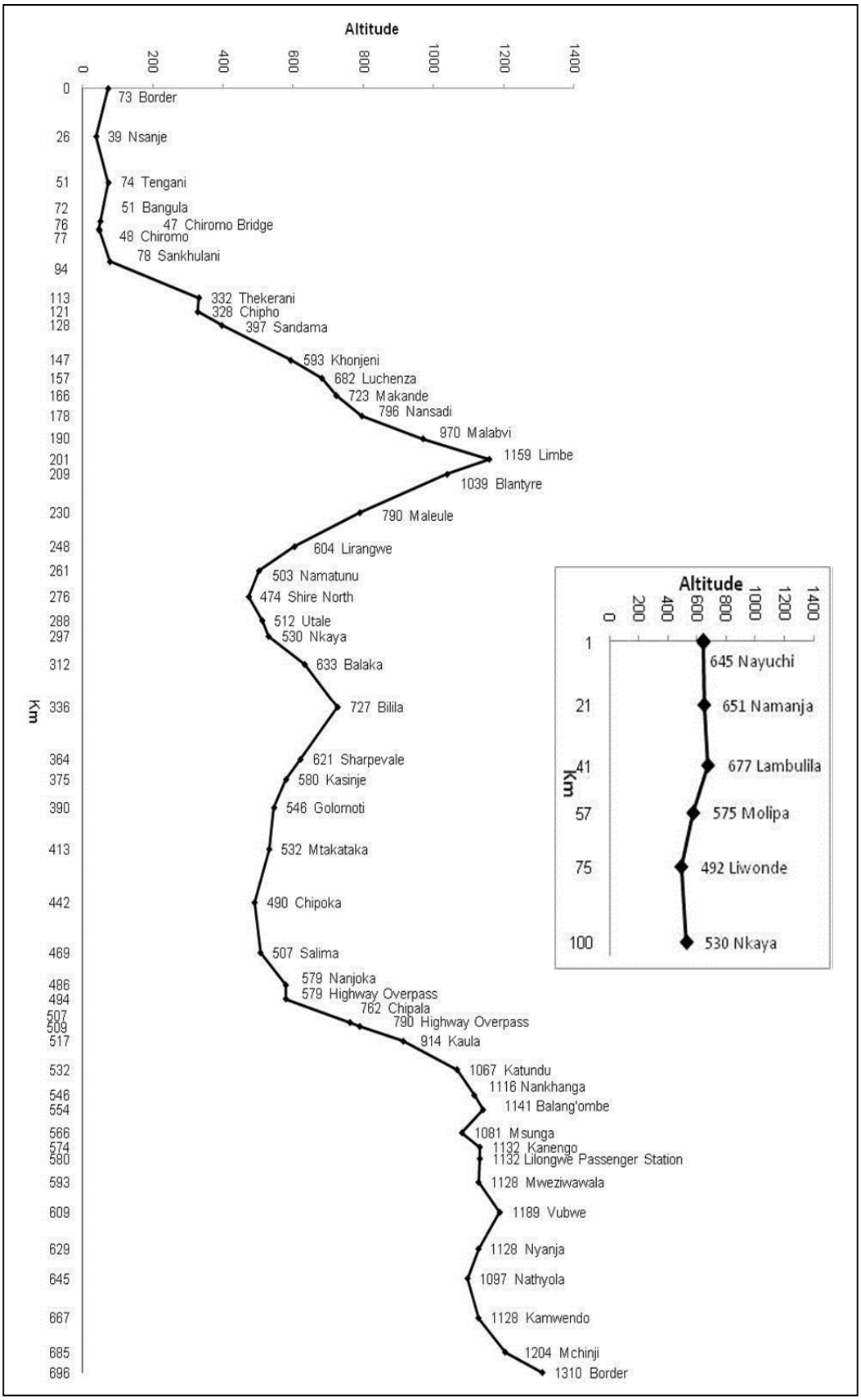
The railway network of Malawi is a non-electrified single-track line of narrow gauge (1,067 mm). The total length of lines is 797 km, 706 km of which is operational. There are two rail routes in Malawi, a 696-km long route from the Border Station at Marka (the border post with Mozambique) to Mchinji (the border post with Zambia), and a 101 km long route from Nkaya to Nayuchi (the border post with Mozambique). A route map of Malawi and neighbouring countries is shown in Figure 3-17, and a longitudinal route section of Malawi is shown in Figure 3-18.

(4) Train Operation

Since the concession was signed in December 1999, CEAR currently operates freight and passenger trains. The freight trains are composed of 30 cars. The usual train formation of a passenger train is six cars for a coach, two cars for a covered wagon and one car for a brake van.

Source: CEAR

Figure 3-17 Railway Route Map of Malawi



Source: Study Team

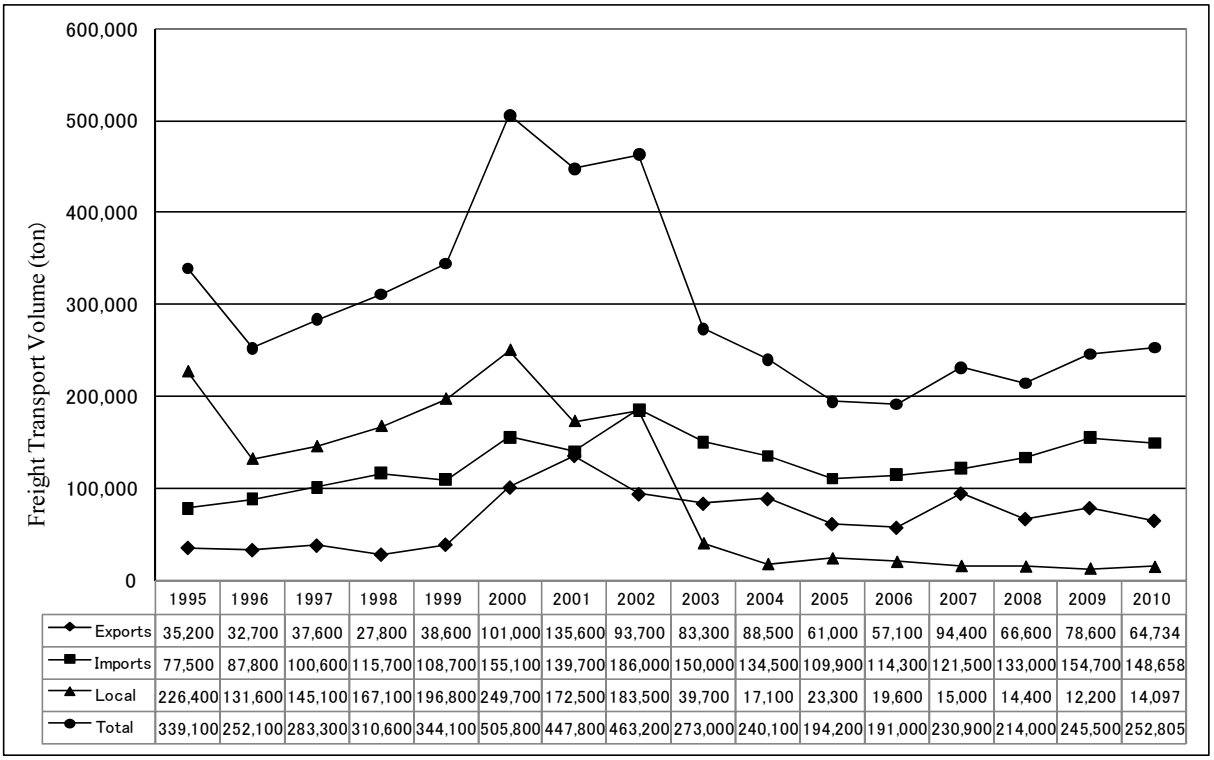
Figure 3-18 Longitudinal Section of Railway in Malawi

Due to insufficient rolling stock, the freight trains operate depending on transportation demand. These trains run from Blantyre to Nayuchi and from Lilongwe to Nayuchi on the Malawi side. *Corredor de Desenvolvimento do Norte* (CDN) operates from Nayuchi to Nacala Port on the Mozambique side. The train operators and locomotives change over at Nayuchi Station, thus solving problems such as the regulation of train operation and language and also ensuring interoperability of CEAR and CDN.

a) Freight Transport

After reaching a peak of 510,000 tonnes in 2000, the freight transport volume has gradually decreased, falling to 250,000 tonnes by 2010. Freight volumes remain at around 100,000 tonnes for exports and over 100,000 tonnes for imports. In contrast, the rail share decreased from 26% in 2000 to 11% in 2006 due to the growth of truck transportation, as shown in Figure 3-19 and Table 3-19. On the other hand, the volume of domestic freight transportation dropped dramatically and decreased to 14,000 tonnes in 2010. This resulted in a shift from rail to road due to poor transportation services such as the lack of operating locomotives.

The transit of international freight takes an average of 3 days, whereas the handling of freight takes 24 hours, so most of the time is taken up in transit. On the other hand, the custom clearance time at Nayuchi is officially given as one hour, which would satisfy forwarders, but it currently takes one or two days due to lack of locomotives. If the handling of freight can be rationalised by containerization, it will also be more attractive for forwarders.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Exports	35,200	32,700	37,600	27,800	38,600	101,000	135,600	93,700	83,300	88,500	61,000	57,100	94,400	66,600	78,600	64,734
Imports	77,500	87,800	100,600	115,700	108,700	155,100	139,700	186,000	150,000	134,500	109,900	114,300	121,500	133,000	154,700	148,658
Local	226,400	131,600	145,100	167,100	196,800	249,700	172,500	183,500	39,700	17,100	23,300	19,600	15,000	14,400	12,200	14,097
Total	339,100	252,100	283,300	310,600	344,100	505,800	447,800	463,200	273,000	240,100	194,200	191,000	230,900	214,000	245,500	252,805

Note: *The number of passengers in 2010 is estimated from actual data until October 2010.
Source: CEAR

Figure 3-19 Freight Transport

Table 3-20 Market Share of Rail in Total Export and Import

(Unit: 1000 tonnes)

Item		2000	2001	2002	2003	2004	2005	2006
All Transport Modes	Export	389	430	378	505	460	500	417
	Import	578	652	1,778	1,070	1,212	1,141	1,119
	Total	967	1,082	2,156	1,575	1,672	1,641	1,536
Rail	Export	101	136	94	83	89	61	57
	Import	155	140	186	150	135	110	114
	Total	256	276	280	233	224	171	171
Market Share of Rail		26%	26%	13%	15%	13%	10%	11%

Source: Malawi Compact Programme Development 2011-2016, Millennium Challenge Account

Domestic freight is carried between Blantyre and Kanengo (Lilongwe), and the transit time is an average of 2 days. Compared with truck transportation, with a transit time of 12 hours at an average speed of 25 km/h, it is clear that train freight between Blantyre and Kanengo (Lilongwe) is at a disadvantage in terms of transit time.

The import freight tariff is about 1.6 times higher than the export tariff. In concession agreements, it was agreed to divide the ticket tariff between Malawi and Mozambique calculated by using the transportation distance. However, the tariff income depends on the departure and arrival points (see Table 3-21).

Table 3-21 Tariffs of International Freight

International Freight	Blantyre – Nacala (US$)		Kanengo (Lilongwe) – Nacala (US$)	
	Export	Import	Export	Import
20 ft loaded container up to 12.5 tonnes	593.10	947.57	796.43	1301.13
20 ft loaded container over 12.5 tonnes	651.41	1066.88	874.46	1446.23
Break bulk (per tonne)	31.00	60.74	39.33	78.25

Source: CEAR

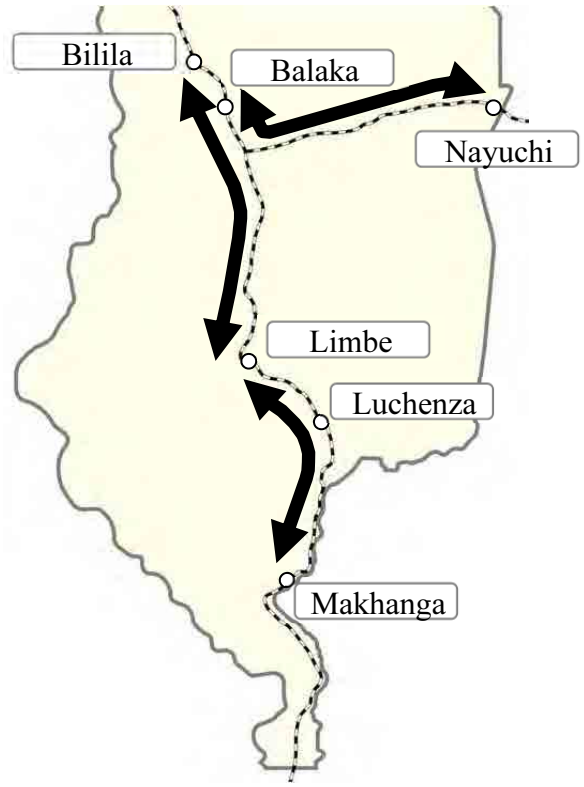
b) Passenger Transport

Passenger transport is operated under a consignment contract between MoTPI and CEAR. The passenger train runs only once a week between Limbe and Makhanga, Limbe and Bilila, Balaka and Nayuchi, as shown in Figure 3-20.

These sections are in remote regions with no road traffic or where the roads are in poor condition. In addition, the passenger train is operated only as a domestic service.

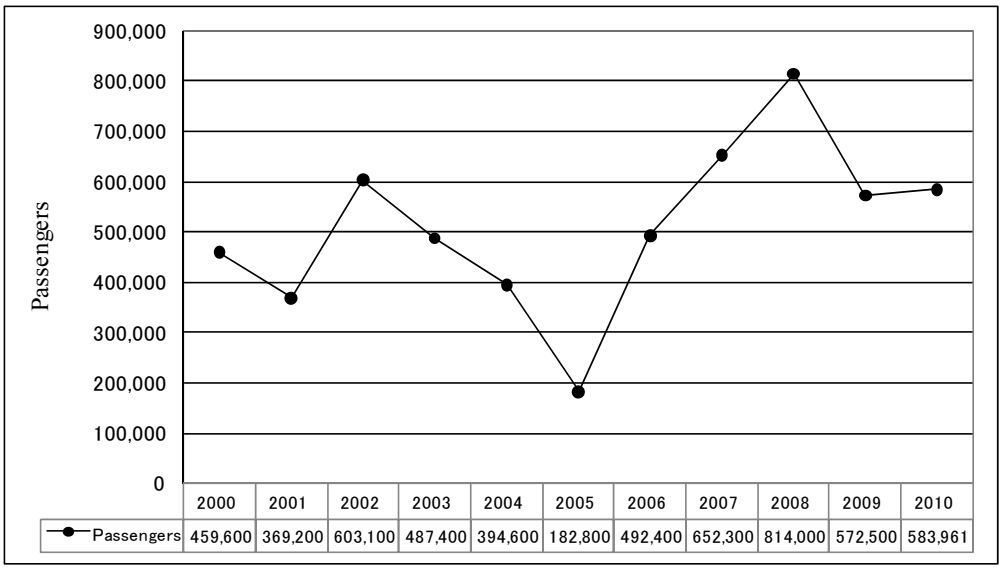
The average number of passengers in the last 10 years is about 500,000 per year. The drop in passengers from 2003 to 2005 was likely caused by the cancellation of train operations after the Rivirivi Bridge near Balaka was washed away (see Figure 3-21).

Passenger tariffs are based on a zone tariff system of MWK50 per zone (about 15 km), up to a maximum of MWK400.



Source: Study Team

Figure 3-20 Route Map of Passenger Train Operation



Note: *The number of passengers in 2010 is estimated from actual data until October 2010.
Source: CEAR

Figure 3-21 Passenger Transport

(5) Revenue and Expenditure

The revenue statements of CEAR are shown in Table 3-22. In principle, CEAR has no budget and is driven by the revenue projected based on offers from clients. Usually, the marketing department solicits traffic offers from customers and uses these offers to draw up a budget. All

departments contribute to the budget-making process by drawing up their own department budgets, which are then consolidated into one. The direct expenses section as well as the indirect expenses section of the budget are determined based on the projected revenue; this means that all costs are budgeted to be lower than the revenue to enable the firm to make a profit.

The total profit after overheads, however, has been in the red since the concession agreement was signed. The losses are mainly caused by payroll costs, and have been compensated by CDN which has the same capital structure.

Table 3-22 Revenue Statement

(Unit: MWK1000)

Description	2006	2007	2008	2009	2010
REVENUE					
Freight revenue	306,947	370,154	405,367	468,155	502,480
Passenger revenue	36,239	43,051	53,739	38,128	36,899
Passenger subsidy	62,570	63,029	63,241	63,584	67,831
Sundry Traffic	1,385	670	87	6,431	4,725
Total Sales Revenue	**407,141**	**476,904**	**522,435**	**576,297**	**611,935**
Cost of Sales	-180,377	-285,937	-281,995	-277,054	-245,867
Gross Profit	**226,764**	**190,967**	**240,440**	**299,243**	**366,068**
Other operating revenue	22,707	79,474	126,060	31,802	28,384
Interest Income	9,312	1,390	594	357	222
Other income	78,939	-13,787	-38,024	-164,471	-21,689
Total Profit Before Overheads	**337,722**	**258,043**	**329,070**	**166,931**	**372,984**
OVERHEADS					
Pension and death contributions	-16,241	-16,180	-23,113	-18,602	-14,938
Directors fees and expenses	-7,733	-8,044	-8,249	-7,754	0
Auditors' remuneration – current year	-2,224	-1,798	-2,164	-2,176	-3,758
Depreciation	-24,910	-25,879	-50,987	-54,673	-56,983
Fuel expenses	-15,352	-15,778	-21,804	-15,946	-9,507
Lubricants	-775	-653	-817	-918	-395
Spares & maintenance – Locomotive	-32,347	-18,708	-8,062	-10,160	-3,507
Spares & maintenance – Other	-77,288	-26,944	-46,733	-32,743	-35,734
Rail Track & Bridge Maintenance	-37,447	-15,680	-13,115	-24,729	-9,861
Payroll costs	-113,942	-146,303	-239,308	-247,056	-267,396
Travel costs	-12,735	-17,383	-50,902	-52,641	-37,620
Utilities	-28,955	-28,240	-29,128	-26,299	-32,660
Outside services	-3,238	0	0	0	-250
Other operating costs	-174,818	-131,765	-20,369	-88,537	-97,101
Legal fees	-12	-1,639	-2,534	-8,541	-4,039
Staff Expenses	0	0	-29,382	-20,380	-30,598
Concession fee	-69,109	-70,040	-70,272	-70,648	-75,367
Loss before interest and taxation	**-279,403**	**-266,990**	**-287,868**	**-514,870**	**-306,730**
Net financing expenses	-91,376	-103,969	-34,059	-24,627	-34,820
Profit (Loss) before taxation	**-370779**	**-370,959**	**-321,927**	**-539,497**	**-341,551**
Income tax expense	-200	0	0	0	0
Profit (Loss) After taxation	**-370,979**	**-370,959**	**-321,927**	**-539,497**	**-341,551**
Other Comprehinsive Income	0	0	0	0	0
NET CONTRIBUTION	**-370,979**	**-370,959**	**-321,927**	**-539,497**	**-341,551**

Source: CEAR

(6) Current Situation of Railway Facilities

a) Rolling Stock

CEAR owns ten mainline diesel locomotives with average availability of 60%, as shown in Table 3-23. They have 400 vacuum brake wagons of various categories comprising open, high sided, covered or box wagons, tank cars and container flats.

Table 3-23 Types of Locomotive

Operator	Type	Model	Builder	Available	Requiring Rehab.	Total
CEAR	Mainline	MLW ALCO 251	Canadian built	5	5	10
	Shunting	EMD 1345 HP	ex-Taiwan built	2	2	4
		Cummins	Belgium built	2	2	4
CDN	Mainline	n.a.	Indian built	n/a	n/a	4
		GE	U.S.A. built	n/a	n/a	2
		GE	hired from Sheltam	n/a	n/a	2
	Shunting	various types		n/a	n/a	4

Source: CEAR

b) Maintenance and Inspection Works

Maintenance and inspection of the rolling stock are conducted at the Limbe workshop based on a 4-year cycle for major overhaul, and normal preventative work. Lack of spare parts is a major problem for maintenance work at present.

c) Maintenance of Tracks

CEAR currently has eight gangs each with a Permanent Way Inspector, two key men, ten length men, a trolley driver and a trolley man. Each gang roughly maintains 100 km of track by using a motor trolley and the maintenance is labour intensive, using lightweight equipment such as tamping sets, rail drilling machines, rail cutting machines, and rail grinding sets. Although there is a maintenance schedule as shown in Table 3-24, the work has not been conducted according to this schedule in practice.

d) Signalling and Telecommunication

A Combo Box GPS-based system is currently used for the entire network with a base station in Limbe in the Control Office and user equipment installed in all locomotives. The base station and users are connected through GSM and in places where there is no satellite coverage.

e) Track

Rail tracks in Malawi consist of 30 kg/m rail on steel sleepers or 40 kg/m rail on prestressed concrete (PC) sleepers. The ballast for 30 kg/m rail sections is mostly earth and the ballast for 40 kg/m rail sections is stone.

Rail fasteners are pandrol or screw type. Pandrol fasteners are frequently vandalised or stolen in Malawi, therefore the screw type is preferred. Anti-vandal Pandrol clips could be used to avoid steal of these fasteners.

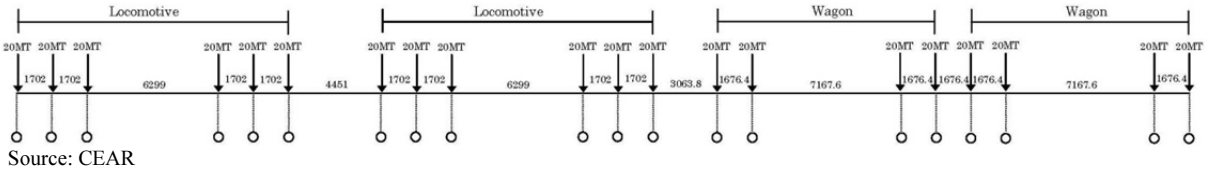
Table 3-24 Annual Maintenance Schedule

	ITEM OF WORK	QUOTA PER ANNUM	RAINS AND HOT SEASON				COOL AND DRY SEASON					HOT SEASON		RAINS
			JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	Through Packing	As Reqd.												
2	Lubricating Fishplates And Fishbolts	Whole Length												
3	Clearing And Cutting Drains Inc. Culverts	All												
4	Screening Ballast, Formation And Cess Work	Five Kms Minimum												
5	Slacks And Grass Cutting	As Reqd.												
6	Points, Crossings And Miscellaneous Work	As Reqd.												

Source: CEAR

f) Design Standards

Two design axle loads of 15 tonnes/axle and 18 tonnes/axle are currently applied. It is intended to upgrade this to 20 tonnes/axle. The CEAR train load on design structures is shown in Figure 3-22. In addition to CEAR loading, British Standards are also used.



Source: CEAR

Figure 3-22 Train Design Load

g) New Line Construction Plan

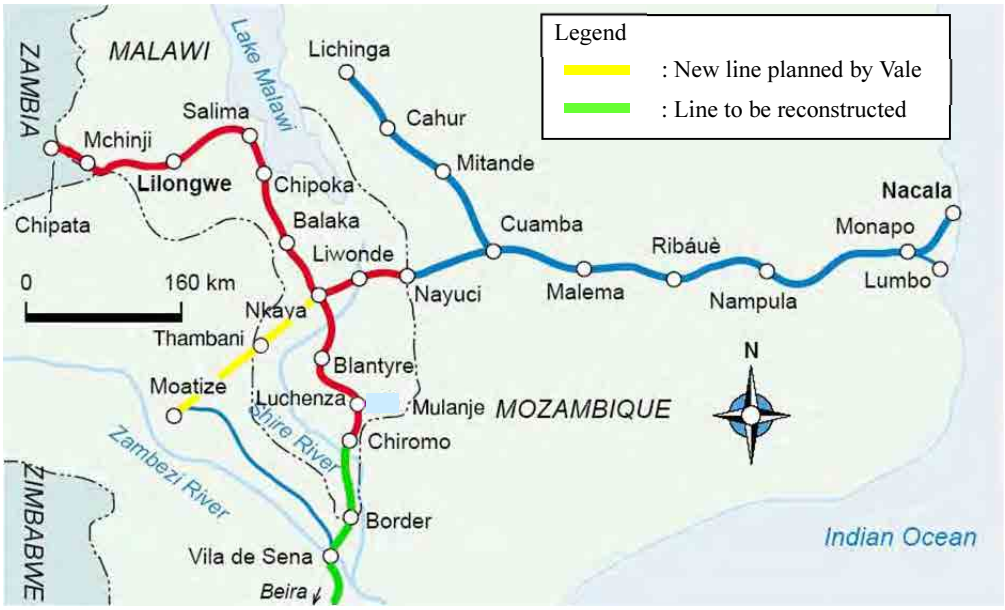
The extension line between Mchinji and Chipata in Zambia with a length of 24 km was opened in April 2010, however regular train services have not started. This line is intended to export 1.45 million tonnes of copper ore from the Copper Belt in Zambia to Nacala Port and import general cargo from Nacala Port and to transport clinker from Lusaka to Blantyre in combination with road transport.

On the other hand, Vale plans to construct a new line connecting the Moatize coal mine with Nacala-a-Velha Port via Thambani in Chikwawa District and Nkaya in Balaka District to transport their coal. The route distance is 906 km. The design load criterion being considered is 26 tonnes/axle compared with CEAR's construction standard of 20 tonnes/axles, but this design has not been finalised. Construction work will commence within 2012 and completion is planned for 2014. They also plan to construct a new locomotive workshop at Liwonde where a

small workshop is operated now, to maintain the locomotives.

The coal train will be composed of four locomotives and 120 hopper wagons (car length: 13 m, loading capacity: 60 tonnes, gross weight: 85 tonnes). The total traction capacity will be 10,200 tonnes. Twelve round trains per day will be operated on the line to transport 12 to 18 million tonnes of coking coal and fuel coal annually. Other than these trains, extra transport capacity of one to three million tonnes per year will be secured to transport sugar and copper ore for both Malawi and Zambia. As to passenger and domestic freight trains, a dedicated time schedule for their operation will be drawn up.

These trains will be operated by CEAR within Malawi and by CDN between Nayuchi and Nacala Port.



Source: Study Team

Figure 3-23 Future Extension Plan

3.2.3 Railway Operation in the Study Area

The railway network in the Study Area consists of the 120 km operational section between Limbe and Makhanga and the 81 km non-operational section between Makhanga and Marka. As described in previous sections, there are various problems related to transportation in Malawi as well as in the Study Area. The identified problems are as follows.

(1) Present Condition of Facilities

Trains operate between Limbe and Makhanga, however, this section has not been maintained. In embankment sections which account for 30% of the whole line, the shoulders have collapsed in most places. There are a few cutting slope sections and the collapsed earth has been washed away. There are 105 bridges with a total length of 1,047 m and almost all of them have deteriorated and need to be replaced. In particular, almost all wooden sleepers on the bridges are rotten and have lost their original capacity to support the weight of trains.

An outline of the facilities is given in Table 3-25.

Table 3-25 Outline of Facilities

Item		No.	Length (km)	Good (%)	Fair (%)	Poor (%)	Remarks
Rail		-	120.6	0	100	0	Type 30 kg/m
Embankment		-	36.2*	0*	70*	30*	Assumptions based on the site survey
Cutting slope		-	12.1*	0*	90*	10*	Assumptions based on the site survey
Bridge	Girder (Span ≥5 m)	40	0.972	0*	0*	100*	Replacement is needed
	Girder (Span <5 m)	65	0.075	0*	100*	0*	Repair is needed
Culvert		282	-	50*	0*	50*	50% of culverts will be replaced

Station	Location (km)	No. of Sidings	Length of Siding (m)					Storage Tracks (m)	
			1	2	3	4	5	1	2
Makhanga	80.4	1	505	-	-	-	-	-	-
Sankhulani	93.9	4	478	478	383	383	-	-	-
Thekerani	113.4	1	314	-	-	-	-	70	-
Chipho	121.1	1	487	-	-	-	-	-	-
Sandama	128.5	1	338	-	-	-	-	97	-
Khonjeni	147.1	1	353	-	-	-	-	-	-
Luchenza	157.0	2	343	275	-	-	-	71	-
Makande	166.5	1	382	-	-	-	-	-	-
Nansadi	177.6	1	313	-	-	-	-	77	-
Malabvi	189.8	1	303	-	-	-	-	-	-
Limbe	201.0	6	n/a	n/a	n/a	n/a	n/a	-	-

Source: CEAR, *Study Team

(2) Situation of Train Operation

The railway operations in the Study Area comprise three unscheduled freight trains which run weekly between Limbe and Luchenza to transport sugar containers. Previously, tea was also transported by rail. Near Luchenza Station, there are warehouses owned by SDV Company for storage and shipping of Illovo sugar. Approximately 2,000 tonnes are shipped per year by 20 ft. container.

Regarding passenger transport, passenger trains are shuttled between Limbe and Makhanga weekly. The congestion ratio of the train is over 150%, which means a crush load. However, this service is often suspended because the availability of locomotives has deteriorated to 60% and there were only five available mainline locomotives in June 2011.

As a public service obligation (PSO), this passenger train service is important to transport cash crops produced along the line where the road network including access roads are very poor.

According to the statistics of tickets sales shown in Tables 3-26 and 3-27, most passengers' destinations are in the area between Luchenza and Thekerani.

Table 3-28 shows passenger demand on three passenger train operation routes in 2010. More than half (55%) of the passengers have travelled on the south-bound route, i.e. the route in the Study Area.

Table 3-26 Number of Tickets Sold at Limbe Station

Station	Fare (MWK)	No. of Tickets Sold
Malabvi	50	12
Nansadi	100	23
Luchenza, Khonjeni	150	89
Makapwa	200	33
Sandama, Chipho	250	56
Thekerani	300	67
Thukuta, Sankhulani	350	29
Osiyana, Makhanga	400	30
Total	-	339

Source: CEAR

Table 3-27 Number of Tickets Sold at Makhanga Station

Station	Fare (MWK)	No. of Tickets Sold
Thukuta, Sankhulani	50	90
Thekerani	100	70
Sandama, Chipho	150	50
Makapwa	200	40
Luchenza, Khonjeni	250	71
Nansadi	300	30
Malabvi	350	10
Limbe	400	46
Total	-	407

Source: CEAR

Table 3-28 Passenger Demand per Month in 2010

(Unit: No. of Passenger)

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Aug.	Sep.	Oct.	Total
All routes	49,612	38,504	45,962	53,598	46,609	41,197	64,445	53,619	44,992	486,634
South-bound route	27,446	21,300	25,426	29,650	25,784	22,790	35,651	29,662	24,890	269,206
North-bound route	14,779	11,470	13,692	15,967	13,884	12,273	19,198	15,973	13,403	144,968
East-bound route	73,87	5,734	6,844	7,980	6,941	6,134	9,596	7,984	6,699	72,460

Source: CEAR

One problem in train operation that requires urgent intervention is with inadequate telecommunications system. There is no telecommunications means, including mobile phone, between Makhanga and Luchenza, so the train operator at CEAR headquarters cannot acquire necessary data on the situation of train operations within this dead communication corridor, and if there is any trouble with a locomotive, they cannot arrange an alternative locomotive. Furthermore, the Combo Box Global Positioning System (GPS) train control system which is installed at the train operation division of CEAR headquarters has never been used.

(3) Economic Losses caused by Disconnection of Railway Line

The economic losses due to the disconnection of the railway line are estimated to be as follows:

- The major industry in the Southern Region is agriculture. As it is difficult to transport fertiliser and agricultural products by rail, users are forced to use other means of transport which may not be as efficient as rail due to the distances covered.

- This has resulted in the loss of transport means for local residents who previously depended on railway transportation along the Ruo River on the border between Malawi and Mozambique. Combination trains were operated every day before 1997, but it has become a weekly service after the disconnection. This has severely reduced the opportunities for local residents to sell agricultural products at the markets in Limbe and Blantyre, etc. and caused their income to decline, hindering efforts to reduce poverty.
- There has been a dramatic impact on transporting Illovo Sugar Ltd.'s products, which is the biggest sugar growing and processing company in Malawi. Before 1997, the company used to transport products from Bangula to Nacala Port directly, but now they have to transport products to Blantyre and Limbe by truck via the M1 road which is inefficient due to steep hills. From there, sugar is transferred to trains for transport to Nacala Port. Therefore, Illovo Sugar is adversely affected by the inefficient transport system.

3.2.4 Results of Railway Inventory Survey

The study team conducted a railway inventory survey to assess the present condition of the 80.4-km non-operational section between Makhanga and Border (Marka). An outline of the survey is as follows, while details of the railway inventory survey results are given in Appendix-4.

The collected inventory data shows that the railway line was in reasonably good shape at the time when the washaway caused the section from Bangula to Border (Marka) to be closed. This is evident by the condition of the railway track itself which is still in fair condition as per observations recorded in the database.

The main problem is the sleepers, most of which have been stolen. Wooden sleepers, which were predominantly installed at structures, have either rotted or been vandalised, while the metal ones have either decayed, disappeared, or been damaged by thieves.

The embankment is generally in fair condition in most places except where it has been flooded and washed away. However, the ballast has been fouled in most places and needs to be replaced along almost the whole length of the track. Structures are varied: some are still in good condition but others require rehabilitation.

a) Track Condition (see Photos 3-11)

The track condition was surveyed throughout the 80.4 km, taking note of the condition of the rail and ballast, and the type and condition of sleepers and fasteners.

The survey found that the rail itself was in fair condition. However, the ballast needs to be replaced along almost the whole length of the railway. It may be possible to salvage some of the ballast from the track. Regarding the sleepers, most of them are made of steel and wood at structure locations, but most of the wooden ones had been stolen while the steel ones had deteriorated and most of them are rusty. Since the environment of Malawi has deteriorated, it may not make sense to replace the steel and wooden sleepers with wooden ones as there is no

longer an ample supply of wood in Malawi. To upgrade the railway line, concrete sleepers would be the logical choice as an alternative to the existing steel sleepers. Hence, it is necessary to replace all the sleepers in the area of interest from Makhanga to Border (Marka). Fasteners were generally in fair condition where they existed, but had suffered steal in most locations.

	
Track in Good Condition	**Track in Bad Condition**

Photos by Study Team, November 2010

Photos 3-11 Track Conditions

b) Bridges and Culverts (see Photos 3-12)

Most of the bridge and culvert structures were in fair condition except at locations where they had collapsed due to the length of time taken without maintenance. In some locations, due to the changing environment, an existing structure itself is in good condition but is no longer effective due to siltation. Hence, protective and other remedies are required to make these structures as efficient as they used to be prior to the washaway.

	
Typical Bridge	**Typical Culvert**

Photos by Study Team, November 2010

Photos 3-12 Track Conditions

c) Embankment and Cutting Slopes (see Photos 3-13)

Most of the track between Makhanga and Border (Marka) is laid on either an embankment or flat area. There are very few cutting slopes and they are low in height. In addition to the areas of embankment failure or collapse identified in previous surveys, new places were found with

further deterioration of the railway embankment. The main types of collapse are surface failure and washaway.

	
Embankment Section	**Cutting Slope Section**

Photos by Study Team, November 2010

Photos 3-13 Embankment and Cutting Slope

d) Stations (see Photos 3-14)

All the stations between Makhanga and Border (Marka), including the location, number of loops, loop line length and spur lines, were investigated.

Some station layouts as at the time of the survey were different from those noted in previous surveys. At Tengani Station, there is a spur that was previously not recorded. At Nsanje, some of the rail infrastructure in loops has been removed to make way for the new port. At Chiromo, illegal occupants have built houses over the track. At all other stations, buildings such as the station buildings, offices, other buildings, etc. are illegally occupied as well. Most of the buildings have been damaged by floods at Chiromo.

	
Border Station (Marka)	**Bangula Station**

Photos by Study Team, November 2010

Photos 3-14 Stations

e) Level Crossings (see Photos 3-15)

All the level crossings, including the width, date when installed if known, and name of the

principal user of the level crossing, were investigated. A total of 38 unprotected level crossings were found.

	
Level Crossing 1	**Level Crossing 2**

Photos by Study Team, November 2010

Photos 3-15 Level Crossings

f) Washaway Sections (see Photos 3-16)

All the washaway sections were investigated. The railway does not operate between Makhanga Station and Border Station (Marka) predominantly due to washaway. There are four major washaway sections in the target area. The main washaway occurred at the Shire River between Chiromo and Bangula measuring around 400 m wide and at the location about 8 km away from Border Station (Marka) station. In addition, there is a slightly smaller one between Chiromo Station and Makhanga Station. Over the years, due to the discontinued use and lack of maintenance, other minor washaway areas have also developed. The total length of all washaway sections is about 1.4 km.

	
Washaway at 8.5 km	**Washaway at 73.5 km**

Photos by Study Team, November 2010

Photos 3-16 Washaway Sections

g) Illegal Occupation (see Photos 3-17)

Wherever squatters have occupied the right-of-way, the study team noted the location,

condition, and extent of the illegal occupation.

A total of six areas on the target route are illegally occupied, and are being used for markets, maize fields and toilets by neighbouring residents. It is easy to remove illegal occupiers and objects because no permanent constructions have been built. However, a humane way to handle this situation is required.

Illegal Occupation 1

Illegal Occupation 2

Photos by Study Team, November 2010

Photos 3-17 Illegal Occupation

Table 3-29 Summary of Railway Inventory Survey Results

Item		No.	Length (km)	Good (%)	Fair (%)	Poor (%)	Remarks
Embankment		-	62.5	0	92	8	
Bridge	Steel Truss	1	0.18	0	100	0	One is Shire Bridge (fair condition)
	Concrete	3	0.07	0	0	100	New constructions are required
	Girder (Span ≥ 5 m)	46	0.80	58	29	13	
	Girder (Span <5 m)	55	0.18	39	50	11	
Culvert		39	-	49	41	10	

Station	Location (km)	No. of Sidings	Length of Siding (m)					Storage Tracks (m)	
			1	2	3	4	5	1	2
Border (Marka)	0.8	3	540	480	445	-	-	61	-
Nsanje	26.4	2	489	212	-	-	-	-	-
Nyamula	38.5	1	550	-	-	-	-	-	-
Tengani	50.9	1	510	-	-	-	-	95	-
Bangula	71.7	3	525	480	343	-	-	520	-
Chiromo	77.1	1	329	-	-	-	-	-	-
Makhanga	80.4	1	505	-	-	-	-	-	-

Source: Study Team

3.2.5 Major Findings and Problems of the Railway Sub-sector

Major findings and problems of the railway sub-sector are described below. Major problems are summarised in Table 3-30. The location of these problems are shown in Figure 3-24.

(1) Rehabilitation of Limbe–Luchenza Section

The major problem in this section is the dilapidated bridges. The vertical alignment is

steepest along the whole line. All steel bridges and tracks should be replaced. Provisional roads for the rehabilitation works could be built.

1. Route Length	:	44.0 km
2. Number of Bridges (Span ≥ 5m)	:	16
3. Embankment Condition	:	No major embankment
4. Track Condition	:	Bad; must be replaced
5. Rehabilitation Method	:	Preparing parallel provisional roads
6. Major findings of the survey	:	- Wooden sleepers on the bridges are badly rotten and must be replaced urgently. - One bridge has been repaired with trough girders; however, the piers do not seem to have enough bearing capacity.

(2) Rehabilitation of Luchenza–Makhanga Section

The major problem in this section is the dilapidated bridges. The vertical alignment is relatively steep, but the section between Makhanga and Sankhulani is flat. Half of the steel bridges and tracks should be replaced. Provisional roads for the rehabilitation works cannot be built.

1. Route Length	:	76.6 km
2. Number of Bridges (Span ≥ 5m)	:	24
3. Embankment Condition	:	The embankment has collapsed in parts.
4. Track Condition	:	Fair to bad
5. Rehabilitation Method	:	One-way construction method without provisional road
6. Major findings of the survey	:	- Wooden sleepers on the bridges are badly rotten and must be replaced urgently. - Some sections without drainage have flooded. - The area between Sankhulani and Osiyani stations is often flooded. The length of the flooding area is 2.3 km from Km 86.7 to Km 89.0. This section must be improved by constructing embankments or elevated structures. - There are many bushes, which must be cut down properly.

(3) Reconstruction of Makhanga–Bangula Section

The major problem in this section is the disconnection by the washaway in 1997. There have been some minor collapses on the 3 m high embankment. The alignment near Chiromo is very close to the New Shire River. When the new Chiromo Bridge is constructed, it should be located further from the river.

1. Route Length	:	8.7 km
2. Number of Bridges (Span ≥ 5m)	:	3
3. Embankment Condition	:	Minor landslides
4. Track Condition	:	Bad; must be replaced
5. Rehabilitation Method	:	Preparing parallel provisional roads

6. Major findings of the survey	:	- The length of the major washaway section is 380 m. It is not recommended to construct a railway bridge on the existing alignment. - The toes of the embankments are encroached upon by the river at many sections. - There are seven pipe culverts with insufficient cross-sectional area to handle inundation.

(4) Reconstruction of Bangula–Nsanje Section

There are no major dilapidated structures. The vertical alignment is almost flat. Drainage is insufficient. The embankment shoulder has collapsed in parts.

1. Route Length	:	45.4 km
2. Number of Bridges (Span ≥ 5m)	:	30
3. Embankment Condition	:	The shoulder has collapsed in parts, but the height is only about 2 m.
4. Track Condition	:	Fair
5. Rehabilitation Method	:	Preparing parallel construction roads on the adjacent cultivated land
6. Major findings of the survey	:	- Although there is no washaway part in this section, there are minor collapses of embankments at 19 locations. - As almost all sections are installed parallel to M1, the reconstruction work would be easy.

(5) Reconstruction of Nsanje–Border (Marka) Section

The major problem in this section is 60 m wide wadi at 4 km from the border. The vertical alignment is almost flat. The track is thickly covered with trees. The embankment shoulder has collapsed in parts. There are many trough girder bridges.

1. Route Length	:	25.6 km
2. Number of Bridges (Span ≥ 5m)	:	19
3. Embankment Condition	:	The shoulder has collapsed in parts, but the height is only about 2 m.
4. Track Condition	:	Fair to bad
5. Rehabilitation Method	:	Preparing parallel construction roads
6. Major findings of the survey	:	- Eight washaway sections were found, the longest of which is 260 m at Km 8.5. It must be reconstructed by reinforced concrete (RC) bridges or plate girders, and others by embankments and culverts.

(6) Reconstruction of *Villa Nova de Frontela-Dona Ana* Section

The vertical alignment is almost flat. Some sections of track need rehabilitation due to deformation of the rails, etc. However, a detailed survey has not been conducted by the Study Team for this section, and so the rehabilitation cost will depend on whether bridges are reconstructed and other conditions.

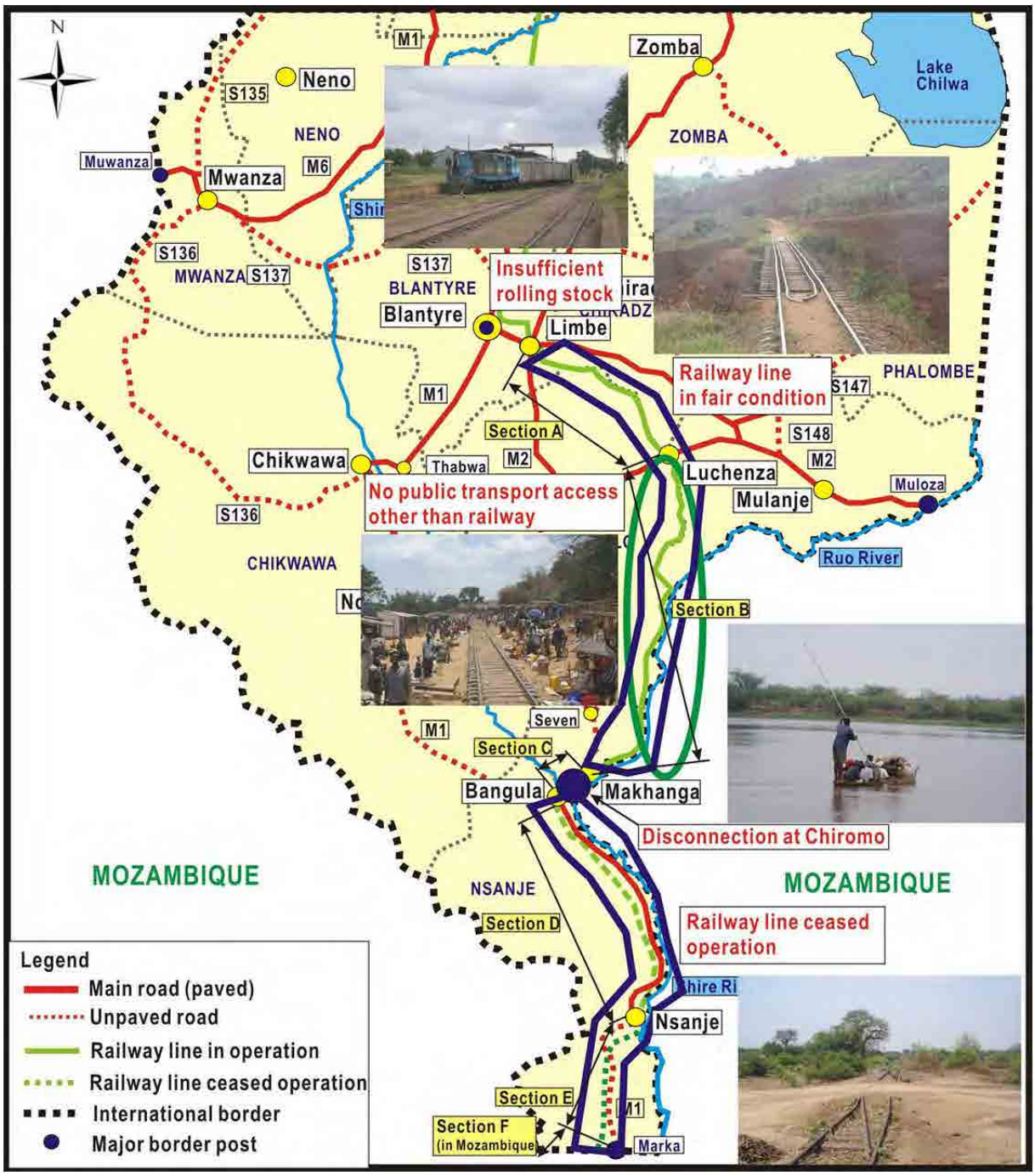
1. Route Length	:	44 km
2. Number of Bridges (Span ≥ 5m)	:	N/A
3. Embankment Condition	:	There are not many embankment sections with minor collapse
4. Track Condition	:	Fair to bad
5. Rehabilitation Method	:	Preparing parallel provisional roads

Table 3-30 Major Problems of the Railway Sub-sector

Major Problems	Section-related					
	A	B	C	D	E	F
Passenger trains run only once a week.	X	X				
There are no freight trains services since the washaway.			X	X	X	X
There is no proper maintenance due to lack of financial resources.	X	X	X	X	X	X
30kg/m rails on aged steel sleepers and insufficient ballast	X	X	X	X	X	X
A GPS-based communication system is not used.	X	X				
Operation of freight trains is unreliable due to insufficient rolling stock.	X	X				
Transport capacity is insufficient due to lack of diesel locomotives.	X	X				
CEAR is not properly supervised by MoTPI.	X	X	X	X	X	
There is no OJT for CEAR personnel.	X	X	X	X	X	
Wooden sleepers on the bridges are badly rotten	X	X	X	X	X	X
➢ Some sections without drainage have been flooded. ➢ The area between Sankhulani and Osiyani stations is often flooded. ➢ There are many bushes, which must be cut down properly.		X				
➢ The length of the major washaway section is 380 m. ➢ The toes of the embankments are encroached upon by the river ➢ There are seven pipe culverts with insufficient cross-sectional area			X			
Although there is no washaway part in this section, there are minor collapses of embankments at 19 locations.				X		
Eight washaway sections were found, among them the section with a 60 m wide wadi should be reconstructed with bridges.					X	

NOTE: A: Limbe–Luchenza, B: Luchenza–Makhanga, C: Makhanga–Bangula, D: Bangula–Nsanje, E: Nsanje–Border (Marka), F: *Villa Nova de Frontela–Dona Ana*

Source: Study Team



Source: Study Team

Figure 3-24 Location of Major Problems of Railway Sub-sector

3.3 Present Situation of the Inland Waterway Transport Sub-sector

Even though the inland waterway transport sub-sector plays a limited role compared with the road and railway sub-sectors at present, it is expected to play an increasingly role on Lake Malawi and after the completion of Nsanje International Port as a part of the Sena Corridor defined in the Study.

3.3.1 Regulatory Body of the Inland Waterway Transport Sub-sector

The Marine Department under MoTPI is responsible for all matters relating to the inland waterway transport sub-sector. The mandate of the Marine Department is prescribed in the Inland Waters Shipping Act (1995), which provides a legal framework for the inland waterway transport sub-sector. The responsibilities of the Marine Department are as follows:

- Registration, issuance of licences and securing the seaworthiness of all commercial vessels
- Supervision of management of all ports and harbours
- Supervision of the manning requirement of all vessels

3.3.2 Inland Waterway Transport on Lake Malawi

(1) Ports on Lake Malawi

The major ports on Lake Malawi are: Chipoka Port, Nkhata-Bay Port, Chilumba Port and Monkey-Bay Port. Since Lake Malawi is an international lake also forming borders with Mozambique and Tanzania, all these ports are used to handle domestic and international passengers and cargoes. Table 3-31 summarises the major port facilities of Chipoka, Nkhata-Bay and Chilumba Ports.

Table 3-31 Major Port Facilities of the Ports on Lake Malawi

Port	Facility	Dimensions/Area	Condition
Chipoka Port	Concrete block quay	150 m × 40 m	Good condition
	Steel sheet jetty	50 m × 50 m	Not in use, acts as a breakwater
	Port administration/customs office	65 m²	Good condition
	Goods shed	820 m²	Good condition
	Passenger waiting hall	260 m²	Good condition
Nkhata-Bay Port	Unifloat jetty with Bailey bridge	n.a.	Moderate condition
	Port administration/customs office	40 m²	Good condition
	General cargo shed	385 m²	Good condition
	General cargo shed	275 m²	Good condition
	Passenger waiting shed	80 m²	Good condition
Chilumba Port	Concrete block quay	100 m × 25 m	Good condition
	Fixed concrete quay	70 m × 15 m	Good condition
	Port administration/customs offices	108 m²	Good condition
	Cargo shed	875 m²	Good condition
	Passenger waiting building	195 m²	Good condition

Source: Final Report, EU Multimodal Transport Study, November 2010

(2) Lake Traffic

Table 3-32 shows the lake traffic volume between 2003 and 2009. Both cargo and passenger traffic have been increasing, particularly since 2006. The main commodities transported are sugar and fish for export, and fertilizer and drinks for import.

Table 3-32 Lake Traffic Volume

Year	Cargo Volume (tonne)	No. of Passengers
2003	6,690	66,902
2004	4,179	66,008
2005	14,380	62,037
2006	17,885	58,656
2007	21,214	68,309
2008	22,496	72,095
2009	23,140	71,545

Source: Final Report, EU Multimodal Transport Study, November 2010

3.3.3 Nsanje International Port

The first phase of the Nsanje port development programme was completed in October 2010. The port facility of Nsanje International Port is a quay 200 m long, and can handle three barges (each 64 m long) with capacity for handling 48 20-ft containers. The second phase of the programme consists of constructing a storage area (9,000 m^2) to store 230 containers.

3.3.4 Shire–Zambezi Waterways Development Project

At present, the SADC Secretariat is preparing to select a consultant to carry out the feasibility study of the Shire–Zambezi Waterways Development Project, which will be financed by AfDB. The results of this feasibility study will form the basic policy of the GoM and the GoMZ for developing the Shire–Zambezi Waterway Corridor and international cooperation for its operation.

The overall objective of the project is to contribute to the provision of an efficient transport system, with affordable costs and reliable modes for the countries sharing the Zambezi River Basin, namely Malawi, Mozambique and Zambia by opening up the Shire and Zambezi Rivers for navigation to the Indian Ocean.

Source: Study Team

Figure 3-25 Location of the Shire-Zambezi Inland Waterway

According to the Draft Terms of Reference of the feasibility study, the study consists of the following major work items:

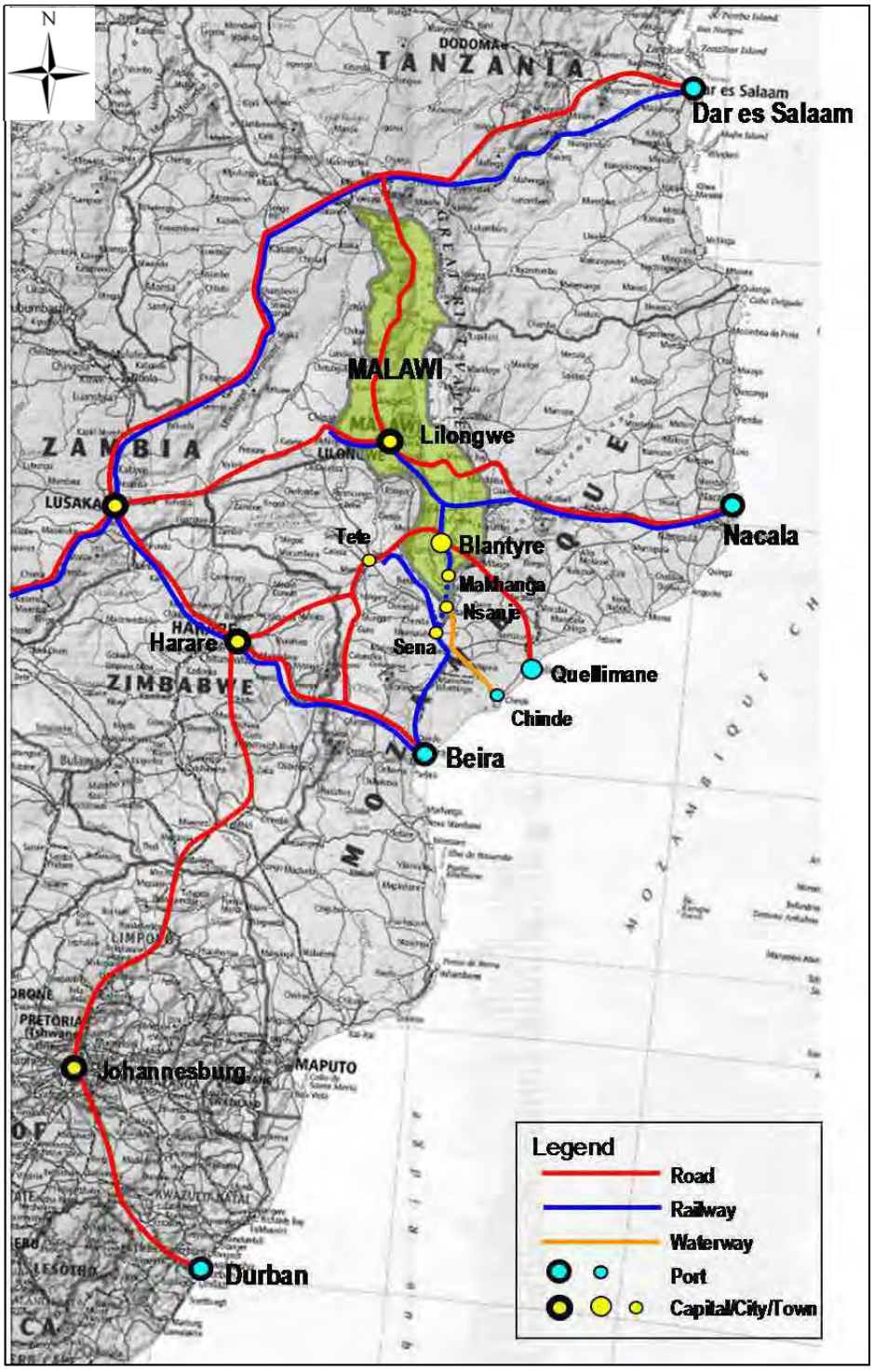
- Navigability and technical investigations
- Transport economics and market analyses
- Social and environmental impact assessment
- Investment financing and legal aspects

This feasibility study is expected to be completed within 18 months after commencement.

3.4 Transport Corridor Development in Neighbouring Countries

3.4.1 Present Status of Beira, Durban, Nacala and Other Corridors

The existing transport corridor networks connecting with Malawi are shown in Figure 3-26. The Beira and Nacala Corridors are the main access to ports from the Study Area.

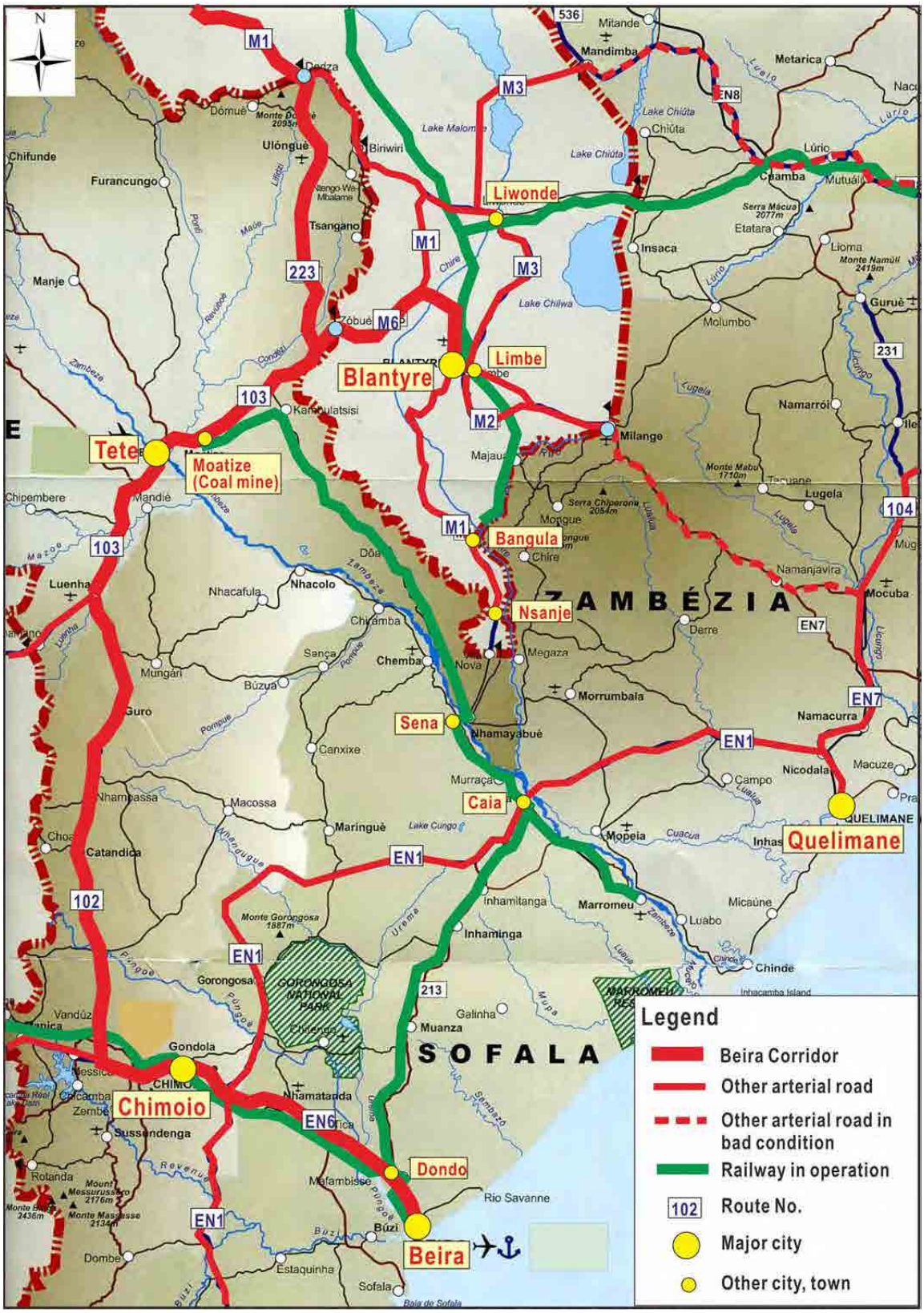


Source: Study Team

Figure 3-26 Transport Corridor Networks

(1) Beira Corridor

Figure 3-27 shows location of the Beira Corridor.



Source: Study Team

Figure 3-27 Location of Beira Corridor

a) Port

Beira Port is the hub of the Beira Corridor, which was constructed by the Portuguese in 1890. Before the economic crises, Zimbabwe was the main customer of Beira Port. However, after the economic crises in Zimbabwe, cargoes related to Zimbabwe were drastically decreased and Malawi has become the main customer. Because of the limited draft of the main approach channel, size of vessels call Beira Port were limited and only feeder services mainly transhipped at Durban Port were used by June 2011. Table 3-33 shows the cargo throughput at Beira Port. In 2009, shares of general cargoes handled at Beira Port were 31% in Malawi and 19% in Zimbabwe, while Zimbabwe still keep the highest share for imported liquid cargo (fuel) as there is an oil pipeline system connecting Beira Port and Zimbabwe. Major commodities related to Malawi handled at Beira Port are fertilizer, wheat, pulses and fuel for import.

Table 3-33 Cargo Throughput at Beira Port

(Unit: 1000 metric tonnes)

Item	2001	2002	2003	2004	2005	2006	2007	2008	2009
Grand Total	2,448	2,794	2,359	2,310	2,471	2,817	3,959	4,750	3,030
1. General Cargo	1,225	1,698	1,543	1,367	1,536	1,848	2,982	3,743	2,080
1) Transit	853	1,175	1,069	863	1,058	1,124	862	1,099	1,170
a) Malawi	92	401	245	333	456	427	347	613	637
- Export	44	107	118	179	162	113	193	132	192
- Import	48	294	127	154	294	314	153	481	445
b) Zimbabwe	746	767	796	503	526	562	463	295	397
c) Other countries	14	8	27	31	76	135	57	192	207
2) Mozambique	293	450	428	450	451	702	841	891	889
3) Coastal shipping	79	74	47	55	26	22	66	40	18
2. Liquid Cargo (Fuel)	1,205	1,080	772	899	883	915	940	955	901
1) Transit	834	887	530	663	684	713	759	757	716
a) Malawi	12	52	229	369	234	196	250	179	228
b) Zimbabwe	821	835	301	294	449	517	536	578	489
2) Mozambique	371	192	242	235	199	202	181	198	185
3. Other Liquid Cargo	18	16	44	44	52	54	37	52	50

Source: CFM-Centro

Table 3-34 shows containers handled at Beira Port. As at other major ports in the region, the container handling volume at this port has increased rapidly in recent years. The total of 92,236 Twenty-foot Equivalent Unit (TEU) handled in 2009 is 3.1 times that handled in 2001. Containers related Malawi are 25,950 TEU in 2009 (12,644 TEU for export and 13,306 TEU for import) and their share is about 41% of total containers handled at Beira Port. This means that Beira Port is one of the most important gateways of Malawi for both export and import.

In July 2011, CFM completed dredging of the main approach channel of Beira Port to secure a draft of 13m to 14m. After completion of the dredging work, some shipping companies (Maersk of Denmark, Pacific International Line (PIL) of Singapore, CMA/CGN of France and Evergreen of Taiwan) have already started to call at the port with main liners (vessel size of 2,000 to 3,000 TEUs) connecting directly to Europe, the Middle East and Asia.

Table 3-34 Containers Handled at Beira Port

(Unit: TEU)

Item	2001	2002	2003	2004	2005	2006	2007	2008	2009
Grand Total	15,204	15,299	24,929	27,607	29,450	35,397	44,935	57,933	62,789
1. International	13,509	13,933	22,214	22,542	28,053	33,338	39,970	54,793	61,582
1) Transit	1,822	1,486	5,370	6,903	7,017	6,262	6,624	10,612	11,089
a) Malawi	4,020	6,259	11,727	14,101	21,313	15,076	22,201	25,463	25,950
- Export	2,000	3,250	6,113	7,705	12,161	7,992	14,511	10,345	12,644
- Import	2,020	3,009	5,614	6,396	9,152	7,084	7,690	15,118	13,306
b) Zimbabwe	12,581	9,192	8,806	10,593	7,720	6,587	6,980	5,651	8,960
- Export	10,816	7,746	5,388	6,784	4,241	4,316	4,130	2,526	3,618
- Import	1,765	1,446	3,418	3,809	3,479	2,271	2,850	3,125	5,342
c) Other countries	24	6	709	1,317	2,837	3,470	3,675	7,281	5,626
d) Empty container	33	34	1,243	1,777	701	521	99	206	121
2) Mozambique	11,687	12,447	16,844	15,639	21,036	27,076	33,346	44,181	50,493
a) Export	1,526	1,739	2,699	2,240	4,112	7,835	8,274	10,723	11,888
b) Import	4,461	6,731	8,029	8,206	9,199	9,038	15,563	17,446	17,019
c) Empty container	5,700	3,977	6,116	5,193	7,725	10,203	9,509	16,012	21,586
2. National	1,695	1,366	2,715	5,065	1,397	2,059	4,965	3,140	1,207

Source: CFM-Centro

Several other shipping companies, including Mediterranean Shipping Company (MSC), are considering operating a main liner service to Beira Port. In addition, Vale started to ship coal from the Moatize coal mine to the Middle East and Asian countries in September 2011. According to *Cornelder de Mozambique*, the port operator of Beira Port, cargo handling volume has increased dramatically by almost 40% after the completion of dredging works and upgrading of some port facilities.

b) Roads

The Beira Corridor is used for road transport along the Beira–Mutare–Harare–Chirundu–Lusaka Route, which overlaps with the Harare–Chirundu–Lusaka section of the North–South Corridor, and the Beira–Tete–Blantyre Route, the so-called Tete Route, and the Beira–Nhamilabue–Nsanje–Blantyre Route, the so-called Sena Route, as the shortest route to the sea for inland countries including Malawi, Zambia, and Zimbabwe. For these inland countries which rely on foreign trade, it is important to secure alternative corridors.

- Harare Route: Beira–Mutare–Harare–Chirundu–Lusaka
- Tete Route: Beira–Tete–Blantyre
- Sena Route: Beira–Nhamilabue–Nsanje–Blantyre

The Beira road corridor is a network of two main roads leaving Beira north-west towards Harare, with a crossroad next to the Zimbabwe border running to Tete, and from there a branch to Malawi's border. A branch road follows the Malawi border on the Mozambican side, west of Blantyre. Most of the road traffic to or from Malawi uses these branches.

c) Railways

Companhia Dos Caminhos De Ferro Da Beira (CCFB) was established with a 25-years concessionaire contract. The cost of rehabilitating the Machipanda and the Sena Lines is

US$230 million, financed by the International Development Association (IDA) of WB and the European Investment Bank (EIB). The Beira Railway system comprises two railway lines:

- Machipanda Line (Beira Railway): 317 km linking Beira Port to the railway network in Zimbabwe (along the Beira Corridor).
- Sena Line: 600 km linking Beira Port to the Moatize coal mines via Inhamitanga, Caija and Vila de Sena.

The Sena Line separates from the Machipanda Line at Dondo (a station about 28 km from Beira) and goes northward, crossing the Zambezi River between *Vila de Sena* and *Dona Ana* (298 km from Dondo). The line again diverges at Dona Ana, from where a 254 km line runs on the north bank of the Zambezi River to Moatize and a 44-km branch line extends northward to *Vila Nova de Frontela* near the Malawi border.

However, the GoMZ was not satisfied with the management of CCFB and the results of rehabilitation works, and has already decided to terminate the concession contract with CCFB. After the termination, CFM Centro will take over the management and operation of the Beira Railway system. However, even after the completion of rehabilitation of the Sena Line, its transport capacity will be limited to 6 million tonnes per year (5 million tonnes for Vale's coal transportation and 1 million tonnes for other coal companies and general cargoes), mainly due to the limited axle load of trains and insufficient facilities (such as loops and stations). Vale started to transport coal from the Moatize coal mine to Beira Port in August 2011 using their own locomotives and wagons, while another coal mining company, Riversdale, has already brought their own locomotives to the Beira Station yard. Hence, CFM plans to upgrade the Sena Line with 12 to 18 million tonnes of transport capacity and is going to carry out the F/S soon.

d) Issues and Bottlenecks

1) Port

The biggest problem of Beira Port, which was the limited draft of the approach channel, has already been solved by the completion of dredging works in July 2011. CFM has already started continuous maintenance dredging works of the approach channel. Moreover, some projects for expanding and upgrading the port facility in line with future demand, such as the construction of a new coal terminal and expansion of the container terminal, are ongoing. The layout map of the expansion plan for Beira Port is shown in Figure 3-28.

One of the issues in Beira Port after the completion of improvement works is congestion in the port area and traffic congestion around the port. Many activities, such as sacking bulk cargoes and placing/displacing cargoes to/from containers, are carried out on the quay side or in nearby warehouses, while trailers carrying cargoes are concentrated on one approach road to the port. This problem may cause a bottleneck for port operations as cargo handling at Beira Port rapidly increases.

Source: CFM-Central

Figure 3-28 Layout of Beira Port Expansion Plan

2) Roads

The Tete Bridge, which crosses the Zambezi River, on the road corridor had been under reconstruction for years, resulting in huge congestion. The reconstruction works of the bridge was completed and it was reopened to traffic without restrictions in early February 2011.

3) Railways

The Sena Railway required extensive rehabilitation, and although the estimated economic benefits are substantial, the relatively slow growth of traffic did not make the line commercially viable without a high share of public-sector financial support. This issue will be dealt with by several ongoing development plans for large-scale coal mining at Moatize; it is now necessary to consider an alternative route for transporting coal, because of the limited transportation capacity of the railway track even after the rehabilitation.

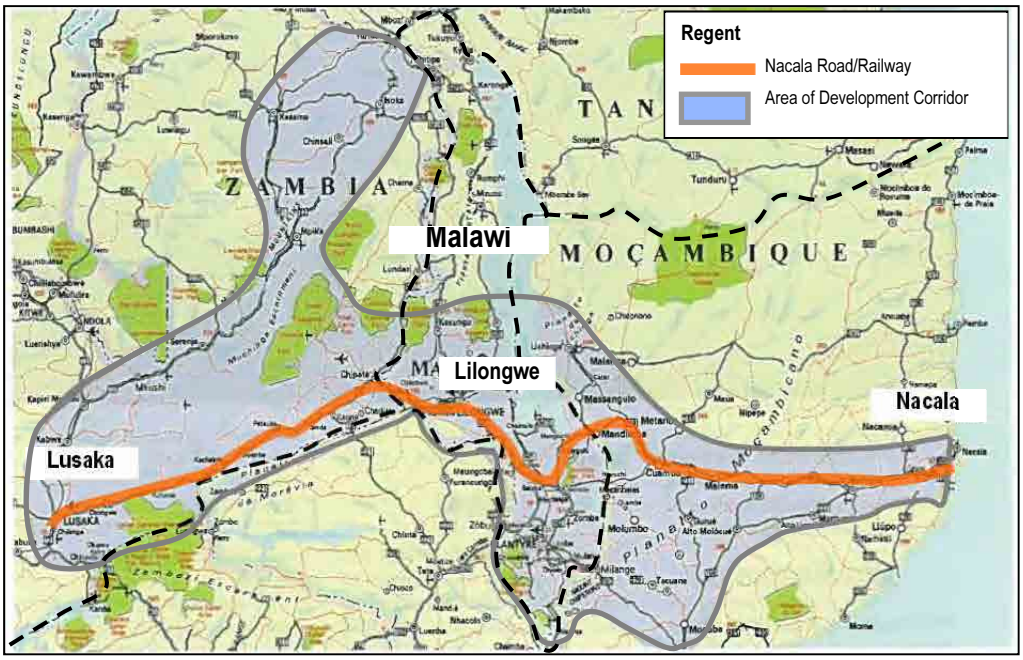
According to CFM-Central, regarding the tariff required by CCFB, an agreement between CCFB and Vale on coal transportation from the Moatize coal mine to the port has not been reached yet. On the other hand, Vale has procured two diesel locomotives and 16 wagons and keeps them at its workshop in Beira.

(2) Nacala Corridor

The railway corridor extends from Nacala Port on the Indian Ocean, through Entre-Lagos to the Malawi border at Nayuchi, and includes the region along the railway line from Cuamba to Lichinga. The Nacala Corridor Agreement was signed in September 2000 by the Presidents of Malawi and Mozambique, transforming the transportation corridor into a broad-based economic development area. Zambia subsequently joined the Agreement.

According to the Spatial Development Initiative (SDI), the study area of the Nacala

Development Corridor is as shown in Figure 3-29.



Source: SDI

Figure 3-29 Area of the Nacala Development Corridor

a) Port

Nacala Port is a natural deep sea port with potential to operate efficiently. The port has undergone several improvements in terms of institutional set-up, acquisition of equipment, and general improvement of port infrastructure. However, the port still has operational inefficiencies compared to other regional ports such as Dar es Salaam, Beira, Durban, and Mombasa. These include inadequate handling equipment, inadequate storage space and managerial problems causing a ship turnaround time of two or three days despite the relatively small container exchange. Containers handled at Nacala Port in 2009 were 52,620 TEU in total (see Table 3-35).

Table 3-35 Cargoes/Containers Handled at Nacala Port

Item	2004	2005	2006	2007	2008	2009
Total Cargo volume (1000 tonnes)	907	875	950	1,100	1,046	1,270
1) Domestic	95	73	79	75	59	44
2) International - Mozambique	628	616	741	784	700	878
3) International - Transit	175	185	108	218	253	303
4) International - Transhipment	9	2	23	23	35	45
Containers (TEU)	30,225	31,118	33,128	44,687	49,770	52,620
1) Domestic	5,625	4,955	5,344	4,793	3,787	4,356
2) International - Mozambique	18,869	21,691	22,879	31,515	36,896	38,262
3) International - Transit	5,153	4,158	3,909	6,043	6,208	6,178
4) International - Transhipment	578	314	996	2,336	2,879	3,824

Source: Preparatory Survey on Nacala Port Development Project, JICA

b) Roads

Road is an alternative transport mode to the railway between Malawi and Nacala. The road

condition from Mandimba/Chiponde to Nampula ranges from very poor in many places to good. The distance from Blantyre to Nacala by road is 849 km.

- The Nacala Road Corridor: Nacala–Nampula–Cuamba–Mandimba/Chiponde–Mangochi–Liwonde–Dedza–Lilongwe–Mchinji/Chipata–Luangwa–Lusaka

c) Railways

The Nacala Railway Corridor is currently Malawi's only railway route to a port for overseas markets. It has two border crossings, one at Nayuchi in Malawi and the other at Entre-Lagos in Mozambique.

d) Issues and Bottlenecks

1) Port

Shipping lines are discouraged by the unacceptably slow handling times, often as slow as 4–6 containers an hour. Difficulty in locating containers in the yard and insufficient coordination with the railway are some of the major problems experienced. All these factors cause a ship turnaround time of two or three days despite the relatively small container exchange.

The general cargo area has old cranes 7–9 metres in depth. The main problems are the relatively long time taken to load and offload cargoes and slowness in clearing cargo from the port due to inadequate handling equipment.

2) Roads

Due to the poor condition from Malawi to Nampula, the road corridor has an alternative route. This route is only lightly used at present with trucks typically crossing the Malawi–Mozambique border near Mulanje, although the trip is longer than the Mandimba–Nampula route.

3) Railways

The railway line links eastern Zambia, central and southern Malawi, and northern Mozambique to Nacala Port over a distance of about 750 km. The railway suffers from flooding, resulting in frequent problems with washaway of bridges and managerial problems due to lack of budget and personnel capacity which makes its traffic unreliable.

The railway infrastructure is in good condition with the exception of 77 km between Cuamba and the border with Malawi. Trains slow to 15–20 km/h to successfully traverse this section of the line. In addition, companies operate the Nacala Railway, CEAR in Malawi and CDN in Mozambique, face shortages of locomotives and wagons.

(3) Durban Corridor

a) Port

Durban is the hub of the North-South Corridor (including Durban and Tete Corridors), serving as a gateway to international trade not only to/from RSA, but also to/from Botswana, Zimbabwe, Zambia, and Malawi.

Durban Port has the largest share of containerized cargo in Africa, handling about 65% of all containers passing through ports in RSA. Almost all major shipping lines including Maersk,

MSC, OOCL, COSCO, EMC, PIL, NYK, Mitsui OSK, and K Line, make calls at this port, many of which use transhipment via feeder services from the Port of Cape Town.

The volume of container cargo handled at Durban Port, which reached 2.64 million TEU in 2008, has been increasing rapidly as have throughputs at other major ports in Africa, following containerization and economic growth in the region (see Table 3-36). With the recent rapid increase in cargo handling volume, the port has become heavily congested; leading to delays in container handling operations.

Table 3-36 Containers Handled at Durban Port (in 2008)

(Unit: TEU)

Landed	**Full**	**Empty**	**Total Landed**
Deep sea	839,755	140,686	980,441
Coastwise	5,998	6,443	12,441
Transhipped	223,533	70,135	293,668
Total	1,069,286	217,264	1,286,550
Shipped	**Full**	**Empty**	**Total Landed**
Deep sea	668,669	358,524	1,027,213
Coastwise	13,345	18,074	31,419
Transhipped	225,600	71,383	296,983
Total	907,634	447,981	1,355,615
Grand Total	**1,976,920**	**665,246**	**2,642,165**

Source: TPT, Ports Authority of RSA

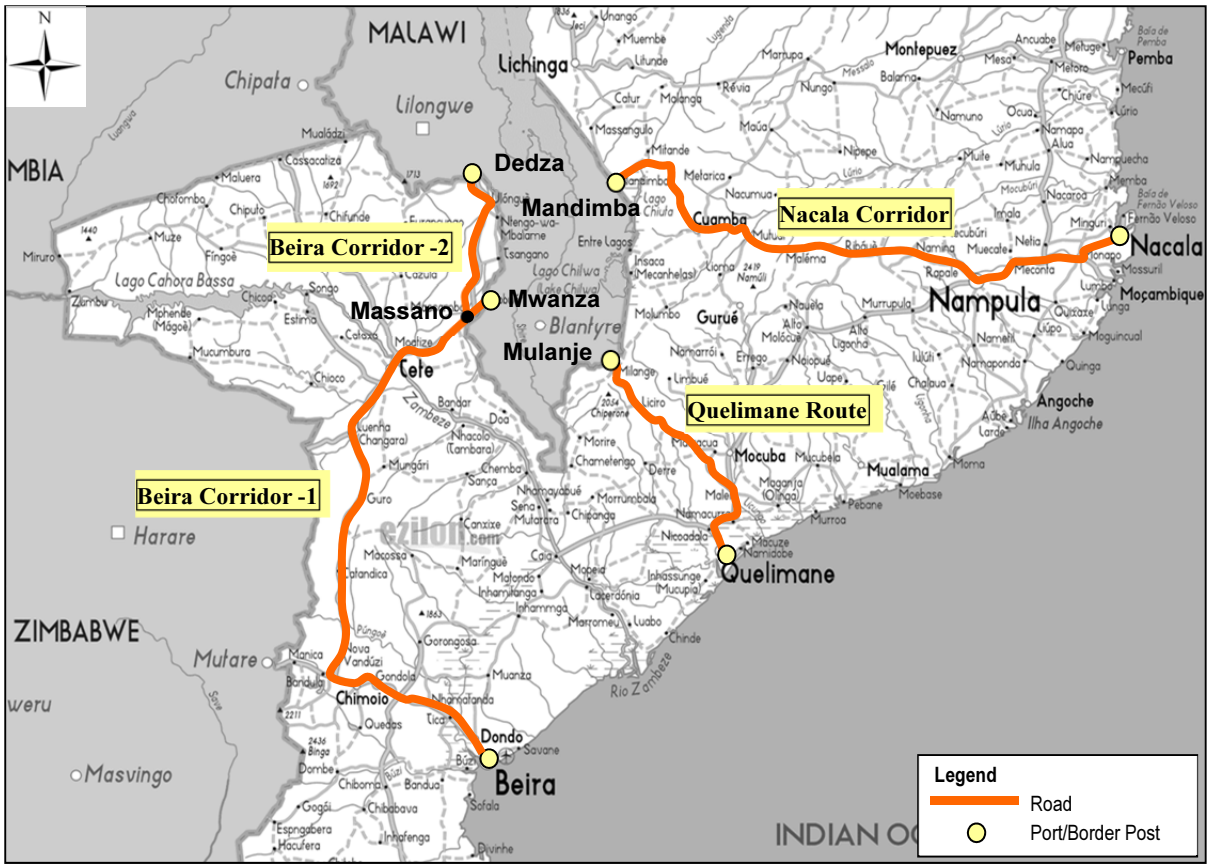
b) Roads

The Durban Corridor is actually a network of roads, linking southern Malawi via the border post of Mwanza and to the Central Region of Malawi via the border post of Dedza through Mozambique to Zimbabwe and RSA. The route is Durban–Johannesburg–Beitbridge–Harare–Tete–Mwanza, and it merges into the Tete Corridor just before Tete City. This road corridor accounts for more than half of the road transport to/from Zimbabwe, Zambia, and Malawi.

The distances are around 600 km to Harare, 1,600 km to Johannesburg and 2,000 km to Durban. Durban is the main intercontinental shipping hub of southern Africa and from there Malawi cargo is destined for Europe, America and the Far East is shipped. Durban is accessible from Malawi either by road transport or by feeder shipping through the corridor ports of Beira and Nacala. The transit time for the South African run is about 7 days.

3.4.2 Development Plan for the Beira and Nacala Corridors

The location and road length of the corridors connecting with the study area are shown in Figure 3-30 and Table 3-37, respectively.



Source: Study Team

Figure 3-30 Location of Road Corridors

Table 3-37 Length of Corridor Road between Border Posts and Ports

Route	Section				Length (km)
		Port	Border Post		
Beira Corridor	1	Beira	Mwanza Zobue	(Mw) (Mz)	713
	2	Beira	Dedza Ulongwe	(Mw) (Mz)	138
Nacala Corridor	-	Nacala	Chiponde Mandimba	(Mw) (Mz)	678
Quelimane Route	-	Quelimane	Muloza Mulanje	(Mw) (Mz)	314

Source: Study Team

(1) Beira Corridor

a) Port

According to *Cornelder de Mozambique* at Beira Port, following the dredging project, a rehabilitation and construction project for the port facilities such as procurement of additional gantry cranes and construction of new terminals for handling fertilizer and sugar will be implemented from 2011 to 2012, investing US$25 million.

b) Roads

1) Tete Route

According to *Administracao Nacional de Estradas* (ANE: National Road Administration) of Mozambique, construction of the New Tete Bridge (1,500 m) has already commenced and will take 36 months to complete by 2013 (see Figure 3-31). When the New Tete Bridge is completed, it will be possible to bypass Tete City to avoid congestion in the city centre. After completion of the New Tete Bridge, the GoMZ will sign a concession contract with *Mota-Engil Engenharia e Construcao SA* for operation and maintenance of the road section to Mwanza, Dedza, and border posts with Zimbabwe.

Source: Study Team

Figure 3-31 Approximate Location of New Tete Bridge

2) Sena Route

The Sena Road route defined in the Study in Mozambique is partly composed of the National Highway N1 (primary road), N322 (Mutarara road: secondary road), and N300 (secondary road). These roads pass through the Mutarara District of Tete Province (see Figure 3-32).

ANE has no plan to improve the road section between *Vila Nova de Frontela* (border with Malawi) and the junction where N322 connects with N1, including N300 because of the missing bridge linkage over the Shire River on N322. ANE also has no intention of constructing a road bridge across the Zambezi River connecting *Vila de Sena* and *Dona Ana*.

c) Railways

1) Sena Line (Dondo to Moatize)

The Moatize coal mine will start operations in July 2011. The transportation demand is estimated at 12 million tonnes after completion of the Moatize Phase II Project. Although the transportation capacity of the Sena Line is 1.2 million tonnes per year, it could be expanded to 5–6 million tonnes after completion of the rehabilitation works. It would also be possible to increase the capacity by up to 6 million tonnes.

According to CFM-Central, when coal transportation starts, 8 to 12 trains per day will run on the Sena Line. Trains hauling 45 wagons of coal are planned.

2) Branch line from *Dona Ana* to *Vila Nova de Frontela*

According to the Ministry of Transport and Communication of Mozambique, they are interested in developing a dry port in Mutarara linking to Beira Port by railway to expand trade. The initial survey on this development plan was carried out by CCFB.

Source: Road Sector Strategy 2007-2011, ANE

Figure 3-32 Road Network in Tete and Zambezia, Sofala Province of Mozambique

(2) Nacala Corridor

a) Port

The Nacala Port Development Study by JICA is ongoing, which is studying the minimum improvement plan for the general cargo terminal.

b) Roads

A number of feasibility studies, detailed designs, and construction for developing this route are ongoing with the assistance of JICA, AfDB, EU, and the Export-Import Bank of Korea. Among these projects, the Nacala Road Corridor Project led by AfDB and involving the other development partners covers most of the expected road development work. However, there are still some road sections between Cuamba and Mandimba/Chiponde in poor condition for which no financing source is currently available.

According to ANE, they have already contracted *Mota-Engil Engenharia e Construcao SA* to improve the road section between Milange and Mocuba. When this section has been improved, access to Quelimane Port will be improved and this road will provide alternative road access to Beira and Nacala Ports.

c) Railways

Vale is going to construct a new coal terminal and port facility at Nacala-a-Velha, opposite the existing Nacala Port because they put top priority on Nacala in their logistics strategy. At present, CDN is waiting for an improvement programme of the Nacala Railway by Vale.

3.4.3 Border Posts with Malawi

According to the Malawi Customs Data in 2010, there are custom offices at 19 border posts in Malaw. Within those border posts, 6 border post, i.e., Mwanza (38.1%), Dedza (25.6%),

Songwe (10.9%), Mchinji (10.7%), Nayuchi (7.3%) and Muloza (6.8%) account for 99.6% of the total loading (2,369,907 tonnes) of exports and imports. Mwanza and Dedza handled 903,667 tonnes and 607,213 tonnes, respectively, suggesting that these two border posts linking to Mozambique, Zimbabwe and RSA are the key transit functions for Malawi's international trade at present.

Table 3-38 Handling at Border Posts in 2010

Border Posts		Exports		Imports		Total	
Malawi	Mozambique	tonnes	ratio	tonnes	ratio	tonnes	ratio
Mwanza	Zobue	220,408	37.5%	683,259	38.4%	903,667	38.1%
Dedza	Calomwe	197,027	33.5%	410,187	23.0%	607,213	25.6%
Songwe *1	-	71,201	12.1%	186,665	10.5%	257,866	10.9%
Mchinji *2	-	43,263	7.4%	211,393	11.9%	254,656	10.7%
Nayuchi	*Entre Lagos*	51,506	8.8%	120,973	6.8%	172,480	7.3%
Muloza	Milange	3,935	0.7%	157,434	8.8%	161,369	6.8%
Chiponde	Mandimba	586	0.1%	4,579	0.3%	5,165	0.2%
Kamuzu Int. Airport	-	170	0.0%	3,958	0.2%	4,128	0.2%
Lilongwe	-	0	0.0%	1,461	0.1%	1,461	0.1%
Chileka	-	139	0.0%	1,034	0.1%	1,174	0.0%
Liwonde	-	63	0.0%	539	0.0%	602	0.0%
Mzuzu	-	47	0.0%	0	0.0%	47	0.0%
Biriwiri	-	0	0.0%	29	0.0%	29	0.0%
Chisenga	-	21	0.0%	0	0.0%	21	0.0%
Chitipa *3	-	13	0.0%	0	0.0%	13	0.0%
Dwangwa	-	0	0.0%	6	0.0%	6	0.0%
Marka	*Vila Nova de Frontela*	0	0.0%	5	0.0%	5	0.0%
Lilongwe Int. Airport	-	1	0.0%	2	0.0%	4	0.0%
Salima	-	0	0.0%	0	0.0%	0	0.0%
Total		588,382	100.0%	1,781,525	100.0%	2,369,907	100.0%

Note: *1- Border with Tanzania, *2 and *3 - Border with Zambia
Source: 2010 Customs Data

3.4.4 Major Issues of Beira and Nacala Corridors

(1) Functions of Nacala and Beira Corridors

a) Ports

The amount of international transit at Beira Port in 2008 was 2.9 times that at Nacala Port and Beira Port handled 1.8 times as many containers than Nacala Port (see Table 3-39). However, it is possible that demand for Nacala Port will grow strongly through development programmes for the port itself and access routes. Regarding the amount of international transit at Beira and Nacala Ports by country, Malawi's share is substantially higher than those of Zimbabwe and Zambia.

On the other hand, Beira Port is very important to Malawi at present: the shares of Malawi's cargoes handled in 2010 by the ports of Beira, Nacala, Durban and Dar es Salaam were 59%, 14%, 23% and 5%, respectively (see Table 3-40). However, these ratios could change in future in the light of 1) increasing demand for the transport of natural resources from Mozambique and Zimbabwe to ports, 2) the continued high growth rate of Zambia's containers (which is

8.3% higher than Malawi's 2.2%) handled at Beira Port and 3) the Nacala Corridor development programmes by donors.

Table 3-39 International Transit at Beira and Nacala Ports in 2008

Item	Beira Port			Nacala Port		
Total Cargoes (1000 tonnes)	3,037	100%	-	1,046	100%	-
International Transit	1,896	62%	100%	288	28%	100%
Malawi	829	-	44%	253	-	88%
Zimbabwe	875	-	46%	0	-	0%
Zambia	190	-	10%	0	-	0%
Others	2	-	0%	35	-	12%
Total Containers (TEU)	85,716	100%	-	47843	100%	
International Transit	38,284	45%	100%	-		
Malawi	25,463	-	67%	-		
Zimbabwe	5,651	-	15%	-		
Zambia	7,170	-	19%	-		
Others	0	-	0%	-		

Source: Annual Port Statistical Book 2008, Ministry of Transport and Communications of Mozambique

Table 3-40 Malawi's Cargoes Handled by Major Ports in 2010

Item	Total	Beira	Nacala	Durban	Dar es Salaam
Malawi's Cargoes (1000 tonne)	1,261	741	171	291	58
Ratio (%)	100%	59%	14%	23%	5%

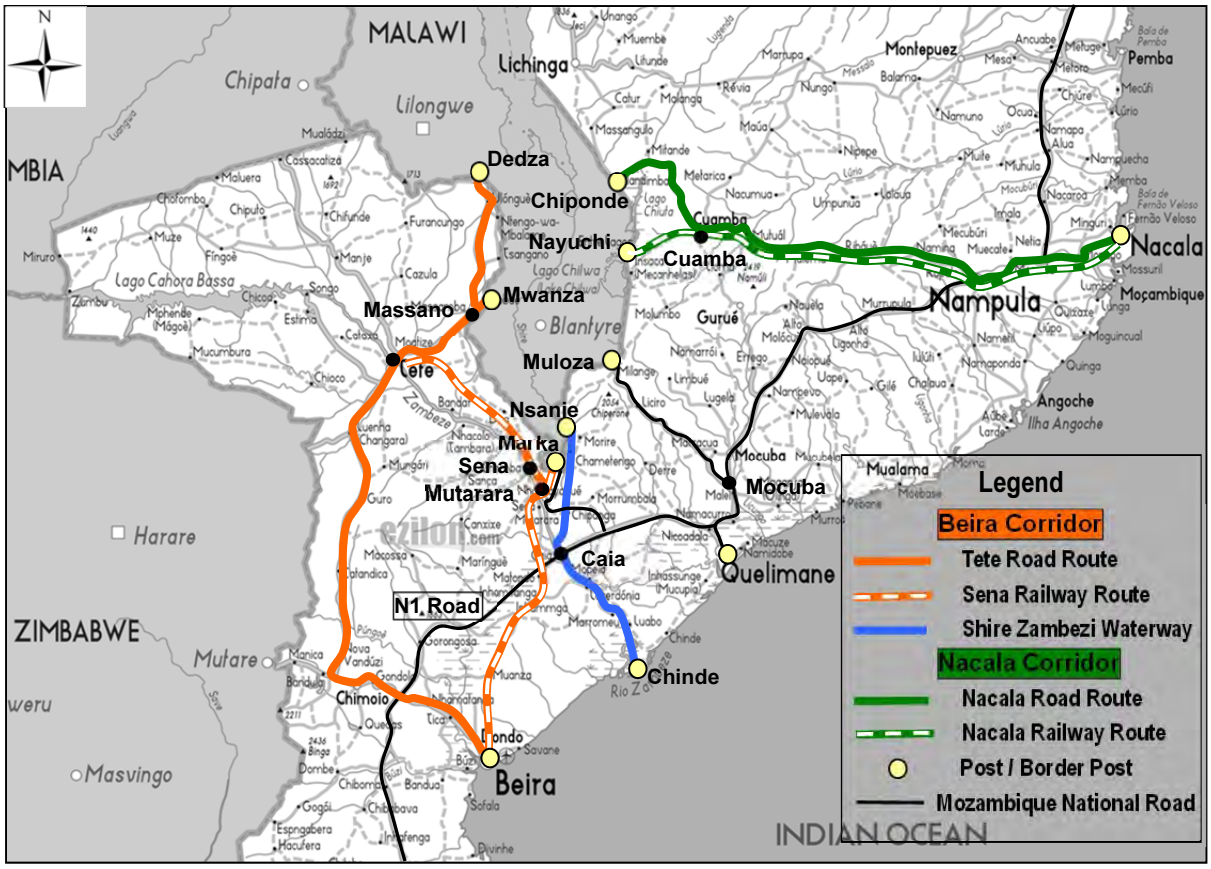
Source: 2010 Customs Data

b) Corridors and their Routes

The Beira Corridor and the Nacala Corridor are international transit routes connecting with Malawi. The Beira Corridor is composed of the Tete road, the Sena road, the Sena railway and the Shire-Zambezi waterway. The Nacala Corridor is composed of the Nacala road and the Nacala Railway (see Figure 3-33 and Table 3-41). Of these routes, the Tete road, the Nacala road, the Nacala railway and the Quelimane road provide international transit services. Being below the international standard because the road network has not been improved in the past, the Sena road is used only by local communities. Both the Sena railway and the Shire Zambezi waterway have been abandoned and are not operating because the civil war in Mozambique resulted in inadequate maintenance and lack of investment from both the public and private sectors.

c) Corridors and Their Transit Cargoes

Malawi's export and import cargoes in 2010 by transit route, i.e. the Tete road, Nacala road, Durban road and Dar es Salaam road were 806,000 tonnes, 172,000 tonnes, 1,021,000 tonnes and 258,000 tonnes, respectively. The cargoes on the Durban road imported from RSA to Malawi included 730,000 tonnes so the transit share of this route is higher at 45% compared to the 36% of the Tete road. The total share of both the Tete road and the Durban road accounts for 81%. The Durban road has two transit routes: one linking to Malawi through the Mwanza and Dedza Border Posts via Tete, and the other through the Mchinji Border Post via Lusaka.



Source: Study Team

Figure 3-33 Beira and Nacala Corridors Network

Table 3-41 Length and Current Functions of Beira and Nacala Corridors

Corridor	Border Post	Access Point (Port or Existing Route)	Route	Length (km)	Current Functions
Beira	Mwanza	Beira Port	Tete Road	713	International Service
	Dedza	Massano *4	Tete Road	138	International Service
	Marka	N1 Road	Sena Road	*1 140	Local Service
	(Moatize)	Beira Port	Sena Line	553	International Service
	Marka	Mutarara (Dona Ana)	Sena Branch Line	44	No Operation
	Nsanje	Chinde Port	Shire Zambezi Waterway	238	No Operation
Nacala	Chiponde	Nacala Port	Nacala Road	*2 678	International Service
	Nayuchi	Nacala Port	Nacala Railway	*3 611	International Service
	Muloza	N1 (Mocuba)	Quelimane Road	170	International Service

Note: *1 Marka-N1 Road is composed of the Marka-Mutarara Road (45 km) and Mutarara-N1 Road (95 km)
*2 The section between Mandimba and Cuamba of the Nacala road is in poor condition
*3 The section between Nayuchi and Cuamba (77km) of the Nacala Railway is in poor condition
*4: Massano, a town in Mozambique, is located at the turnoff for Dedza and Mwanza on the Tete Road
Source: Study Team

Table 3-42 Malawi's Cargoes Handled at Ports, at Cities and on Routes

Port	BP in Malawi	Route	Malawi's Export & Import Cargoes Handled					
			at Ports		at Cities		on Routes	
			1000 t	%	1000 t	%	1000 t	%
Beira	Mwanza/Dedza	Tete Road	741	59%	65	7%	806	36%
Nacala	Nayuchi	Nacala Rail	171	14%	1	0%	172	8%
Durban	Mwanza/Dedza/Mchinji	Road	291	23%	730	73%	1,021	45%
Dar es Salaam	Songwe	Road	58	5%	200	20%	258	11%
Total			1,261	100%	997	100%	2,258	100%

Source: Prepared by Study Team based on 2010 Customs Data

d) Sena Routes

The Sena routes include road, railway and inland-waterway. Only the Sena Railway between Beira Port and Moatize provides international transit services which will start in 2011. Although the section (44 km) between *Vila Nova de Frontela* (Marka) and Mutarara as a part of the Sena railway network is abandoned at present, Malawi could have a link to Beira Port with the shortest distance if this section were to be reconstructed. In addition, the road from Malawi could connect with the Sena Railway network at Mutarara if the section (45 km) between Marka and Mutarara were to be developed.

(2) Major Issues of the Beria and Nacala Corridors

The major issues for both the Beira and Nacala Corridors are summarised below.

- To develop domestic transport networks which will strengthen export routes to Nacala Port, in consideration of increasing traffic capacity and logistics efficiency owing to the Nacala development programmes.
- To promote a modal shift to change the transit system which depends heavily on roads, because traffic demand will grow for the Nacala road due to large-scale mineral products coming from neighbouring countries to Nacala Port by railway, and also for the Tete road in accordance with Malawi's economic growth.
- To establish an efficient logistics system by developing a modern railway system and minimising transhipment time and cost. In practice, transit costs by road are similar to those by railway for a distance of around 700 km because transhipment is required.
- To build alternative routes to secure and strengthen access to Beira Port, because Malawi's regional socio-economic activity would struggle to continue if its only transport route to/from Beira Port were to be cut, and because it is also difficult to guard against unforeseen situations outside Malawi. For instance, a traffic obstacle on the Tete Bridge in 2010 resulted in prolonged fuel shortages throughout the country.
- To strengthen and improve internal access to border posts, especially those which are positioned as the Southern Gateway, in accordance with future traffic demand.

  To communicate and formulate a comprehensive Sena Corridor co-development programme for the development of the Sena routes bilaterally involving state governments, regional initiatives, donors and the private sector.

CHAPTER 4

FUTURE TRAFFIC DEMAND FORECAST

Chapter 4 Future Traffic Demand Forecast

4.1 Results of Traffic Surveys

4.1.1 Contents of Traffic Surveys

The traffic survey aims to assess the present traffic situation related to the Sena Corridor and to formulate origin and destination (O/D) matrices of passenger trips and freight trips related to the Sena Corridor. In order to obtain the necessary data and mentioned information, the following traffic surveys were carried out at each survey station:

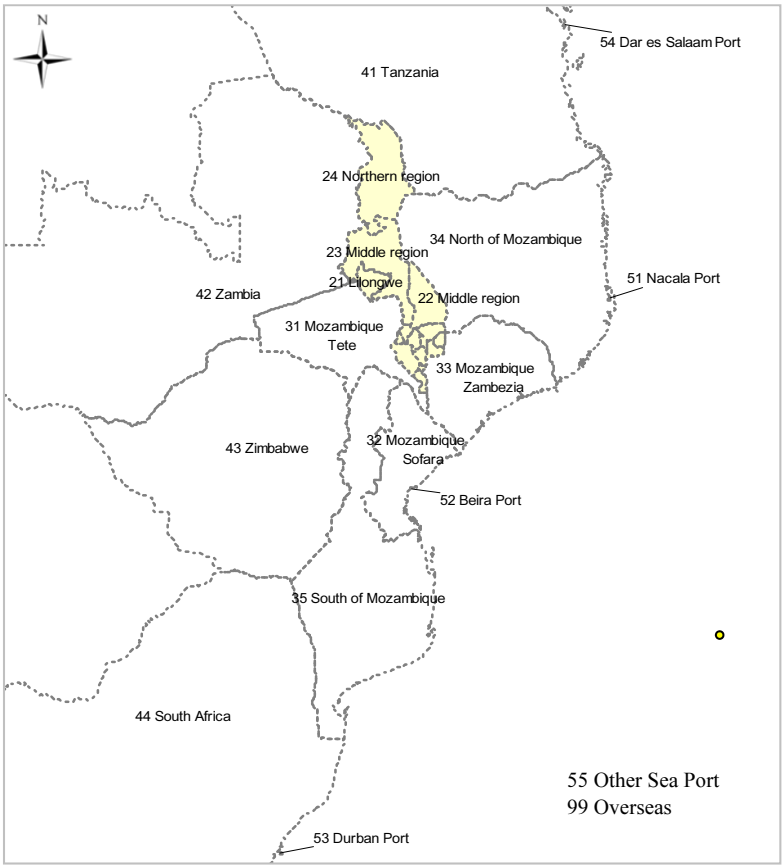
- Traffic Volume Count Survey
- Roadside O/D Interview Survey

4.1.2 Zoning

To forecast the traffic demand, traffic zones are defined in the Study for both Malawi and neighbouring countries, as shown in Figures 4-1 and 4-2, respectively, and the zone code table is shown in Table 4-1. Origin and destination information obtained by the roadside O/D interview survey was converted into zone codes. In the Study Area, traffic zones are divided according to district boundaries, except for Nsanje District, where TA Mlolo on the eastern side of the washaway section and the rest of Nsanje District are divided into two zones. For Mozambique, five zones are set according to the locations of ports as well as direction from Malawi. Tanzania, Zambia, Zimbabwe and RSA are each considered as one zone.

Source: Study Team

Figure 4-1 Zoning in Malawi



Source: Study Team

Figure 4-2 Zoning outside of Malawi (Southeastern Africa)

Table 4-1 Zone Code Table

Zone	Zone Name	Zone	Zone Name
01	Neno District	31	Mozambique, Tete Province
02	Mwanza District	32	Mozambique, Sofara Province (except Beira Port area)
03	Blantyre District	33	Mozambique Zambezia Province (except Nacala Port area)
04	Zomba District	34	North of Mozambique (Cabo Dulgado, Nampula and Niassa Provinces)
05	Chiradzulu District	35	South of Mozambique (Manica, Inhanbane, Gaza and Maputo Provinces)
06	Phalombe District	41	Tanzania, except Dar el Salaam Port area
07	Mulanje District	42	Zambia
08	Chikhwawa District	43	Zimbabwe
09	Thyolo District	44	South Africa, except Durban Port area
10	Nsanje District (TA Mlolo)	51	Nacala Port Area
11	Nsanje District (Except TA Mlolo)	52	Beira Port Area
21	Lilongwe District	53	Durban Port Area
22	Other Southern Region (Balaka, Machinga and Mangochi Districts)	54	Dar-es Salam Port Area
23	Central Region except Lilongwe District (Dedza, Dowa, Kasungu, Mchinji, Nkhotakota, Ntcheu, Ntchisi and Salima Districts)	55	Other Ocean Sea Ports
24	Northern Region (Chitipa, Karonga, Likoma, Mzimba, Nkhatabay and Rumphi District)	99	Overseas

Source: Study Team

4.1.3 Results of Traffic Surveys

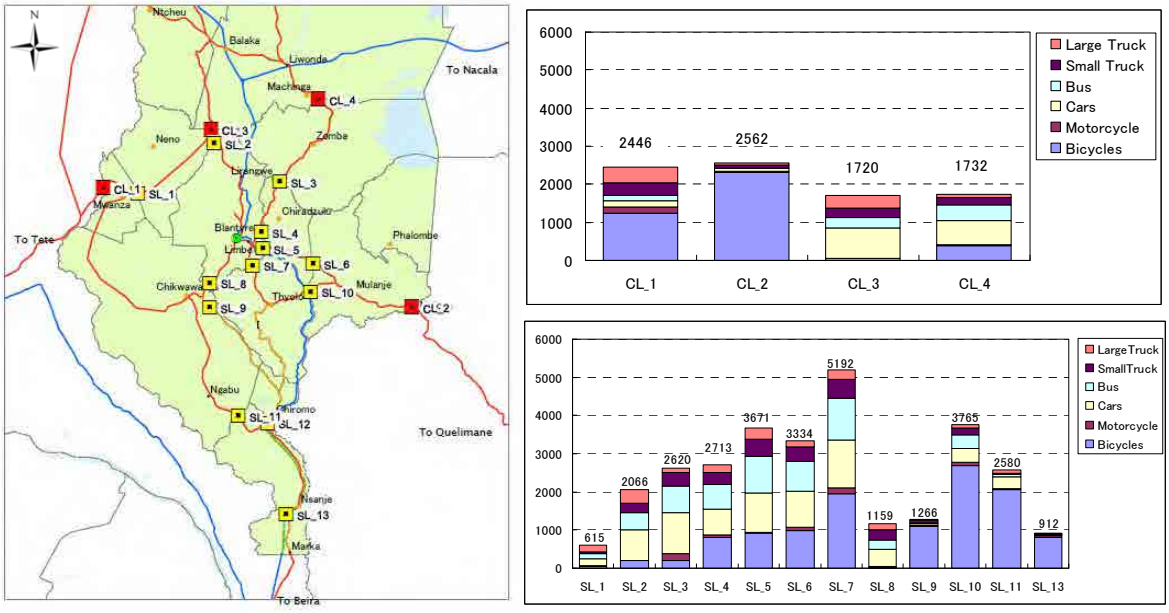
(1) Results of Traffic Volume Count Survey

a) Traffic Volume of All Vehicle Types

The results of the traffic volume count survey are shown in Figure 4-3. This shows the total volume of all types of vehicles, including bicycles and motorcycles, converted into the 24 hour equivalent volume.

- The traffic volume at CL-1 (Mwanza Border Post on M6) was 3,989 veh./day, which was the highest among the cordon line survey points.
- The traffic volume at SL-7 (boundary of Blantyre and Thyolo Districts on M2) was 5,192 veh./day, which was the highest among the screen line survey points.
- The ratio of bicycles was higher at the survey points in the southern areas of Blantyre such as CL-2, SL-9, 10, 11 and 13.

(Unit: veh./day)



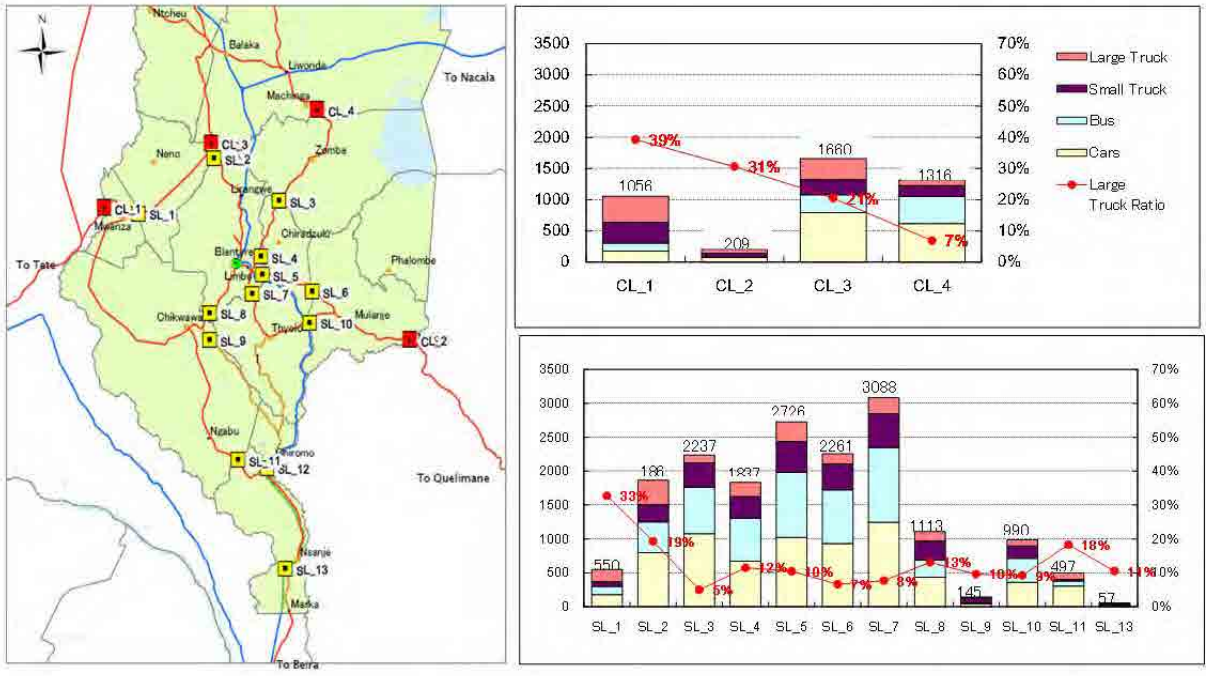
Source: Study team

Figure 4-3 Results of Traffic Volume Count Survey (All Vehicle Types)

b) Traffic Volume of Motorised Vehicles (see Figure 4-4)

- Traffic volume was 1,056 veh./day at the Mwanza Border Post on M6 which is an arterial road on the Beira Corridor. The traffic volume at Muloza Border Post toward Quelimane Port was 209 veh./day, which was very small compared with other survey points.
- Regarding the screen survey point, traffic volume of over 3,000 veh./day was observed only at SL-7 located near Blantyre on M2 to Thyolo, followed by SL-2 to Lilongwe on M1 and SL-3 to Zomba on M3.
- Traffic volumes at CL-2, SL-11 and SL-13 in the southern part of the Study Area were less than 500 veh./day.

(Unit: veh./day)

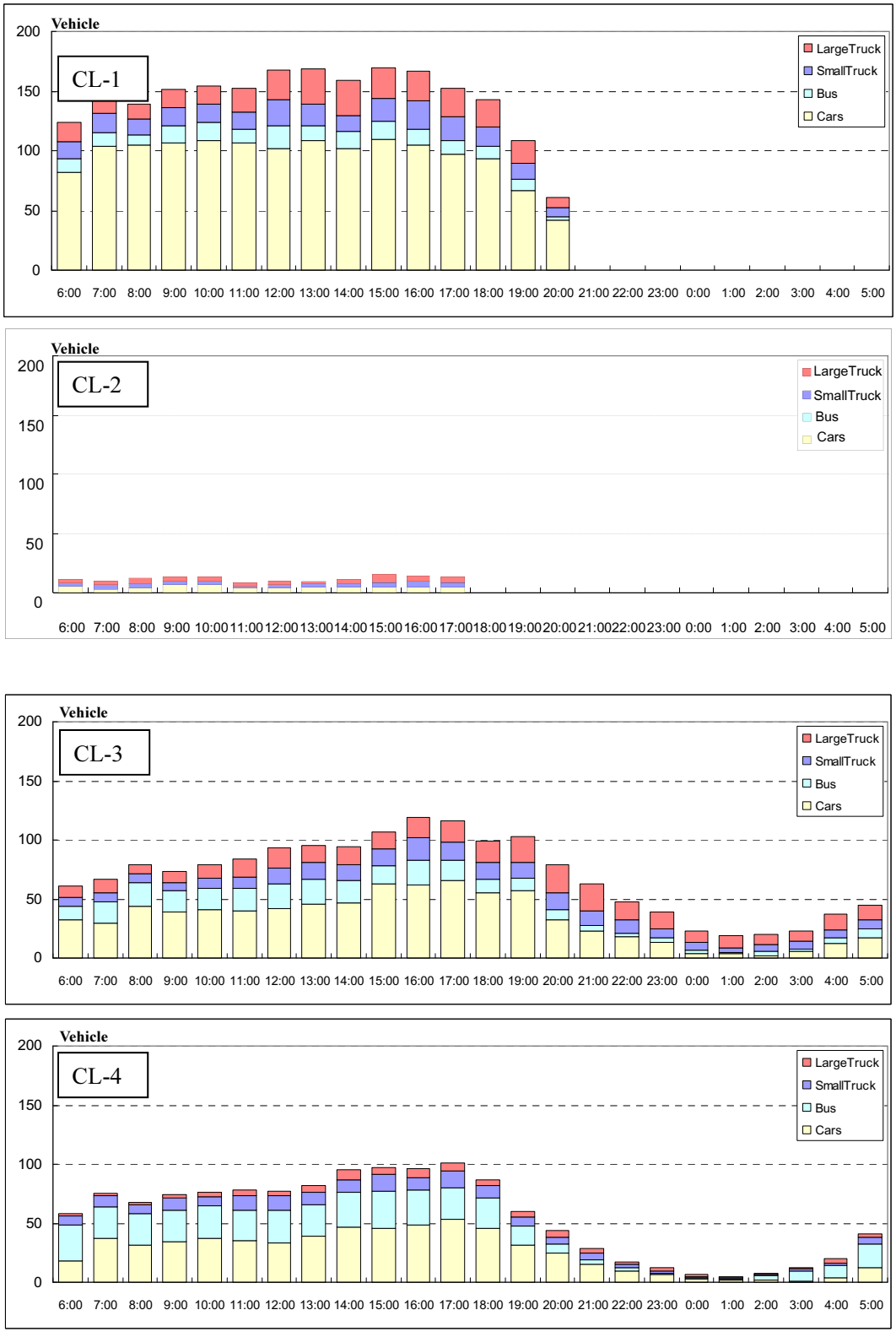


Source: Study team

Figure 4-4 Results of Traffic Volume Count Survey (Motorised Vehicles)

c) Hourly Fluctuation of Traffic Volume

Figure 4-5 shows the hourly fluctuation of traffic volume at the cordon line survey stations. At CL-1, CL-3 and CL-4, traffic volume was higher in the afternoon.



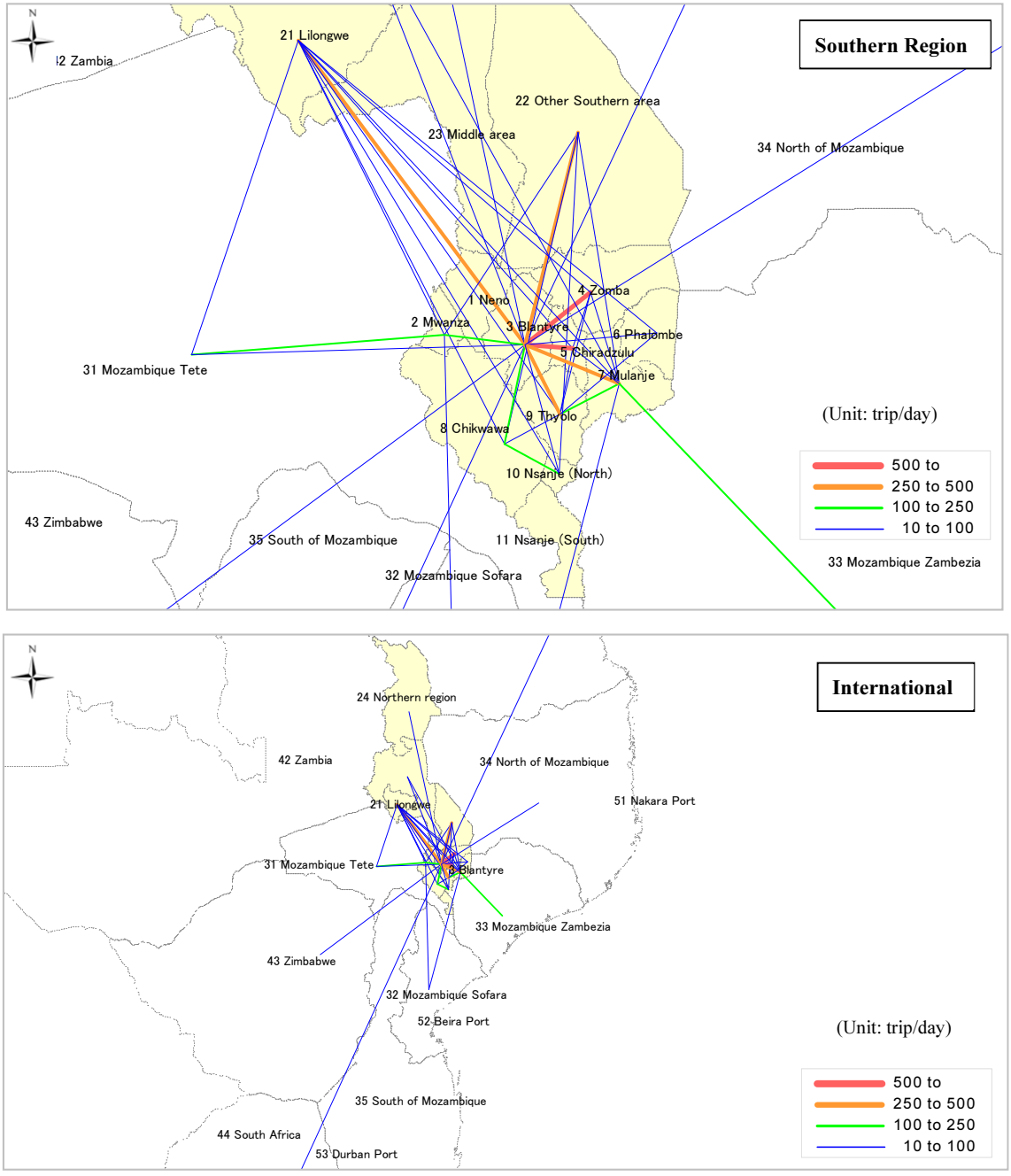
Source: Study team

Figure 4-5 Hourly Fluctuation of Traffic Volume at Cordon Line Stations

(2) Results of Roadside O/D Interview Survey

a) Current O/D Distribution Pattern

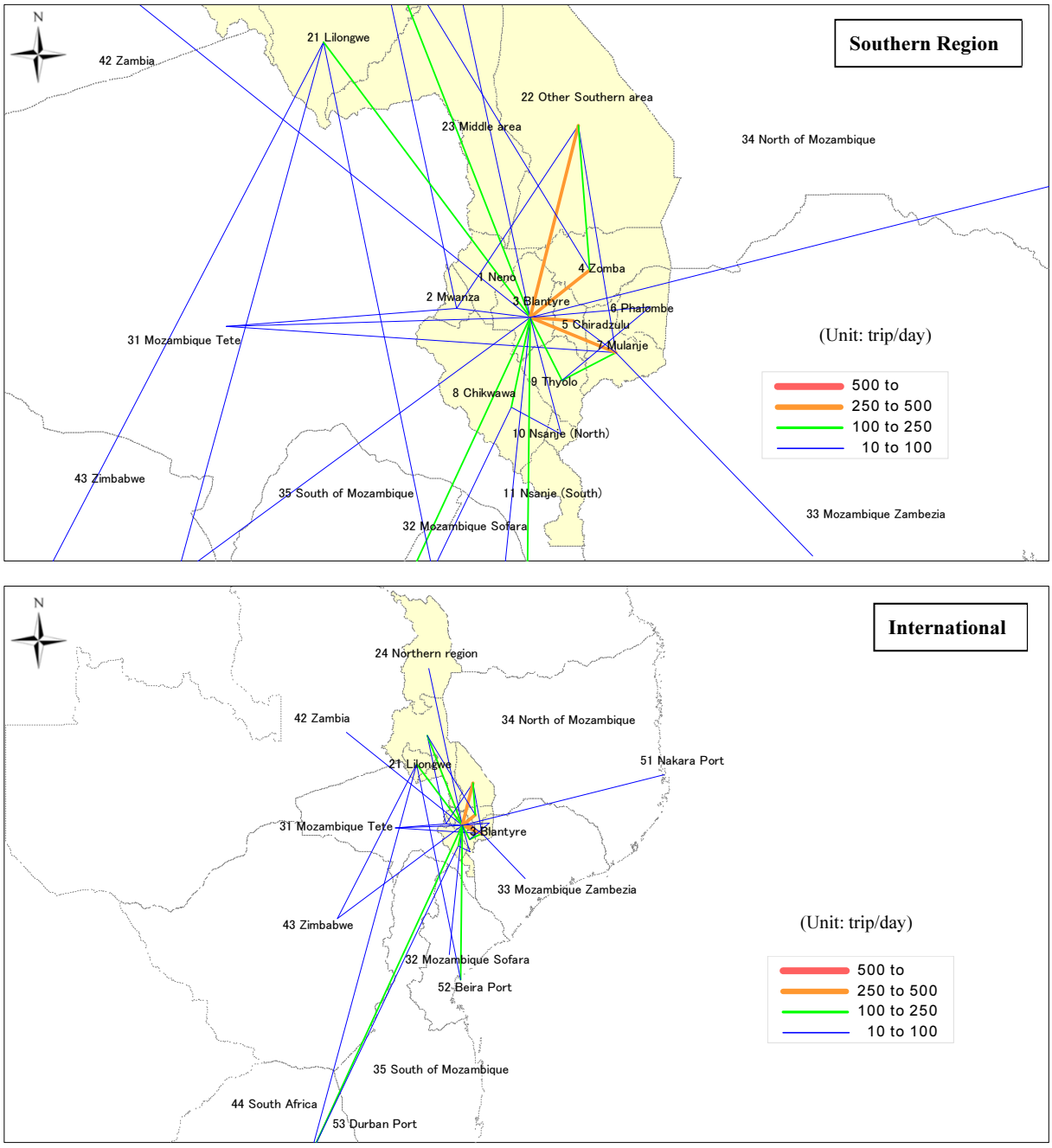
The O/D distribution pattern of passenger cars (sedan, 4x4, pick-up) is illustrated in Figure 4-6. Passenger car trips are mainly concentrated around Blantyre. Major O/D trip pairs are between Blantyre and Zomba or Chiradzulu. On the other hand, trips across borders are limited compared with in the Southern Region.



Source: Study team

Figure 4-6 O/D Distribution Pattern of Passenger Cars

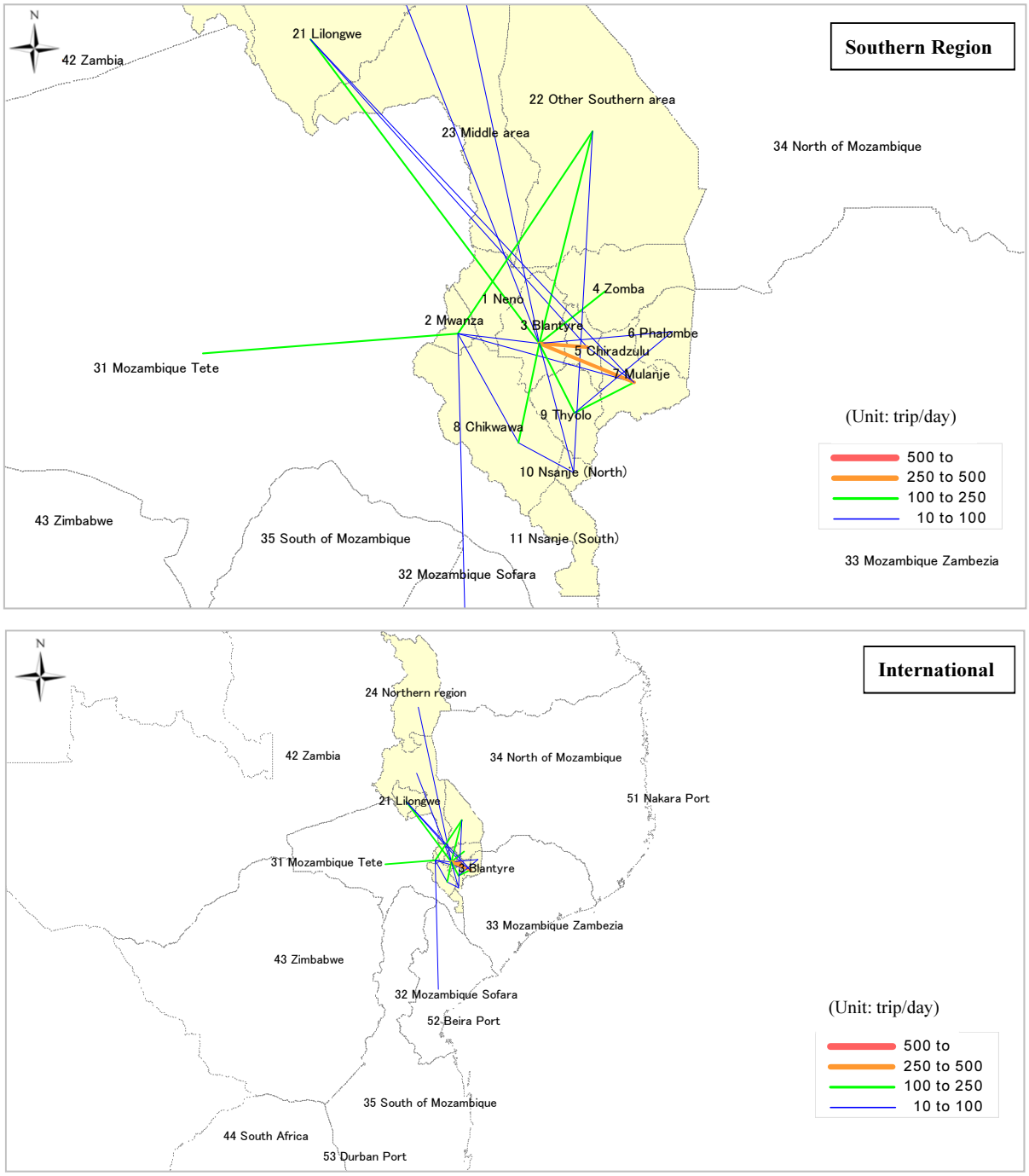
The O/D distribution pattern of freight traffic is shown in Figure 4-7. Freight traffic trips are spread over a wide area. Especially, trips to Nacala and Beira Ports as well as to RSA are predominant. This means that freight traffic in the Southern Region extended over a wide area.



Source: Study team

Figure 4-7 O/D Distribution Pattern of Freight Traffic

The O/D distribution pattern of bus traffic is shown in Figure 4-8. Almost all of the bus trips are made within Malawi, except for a few buses travelling to/from Mozambique and RSA.



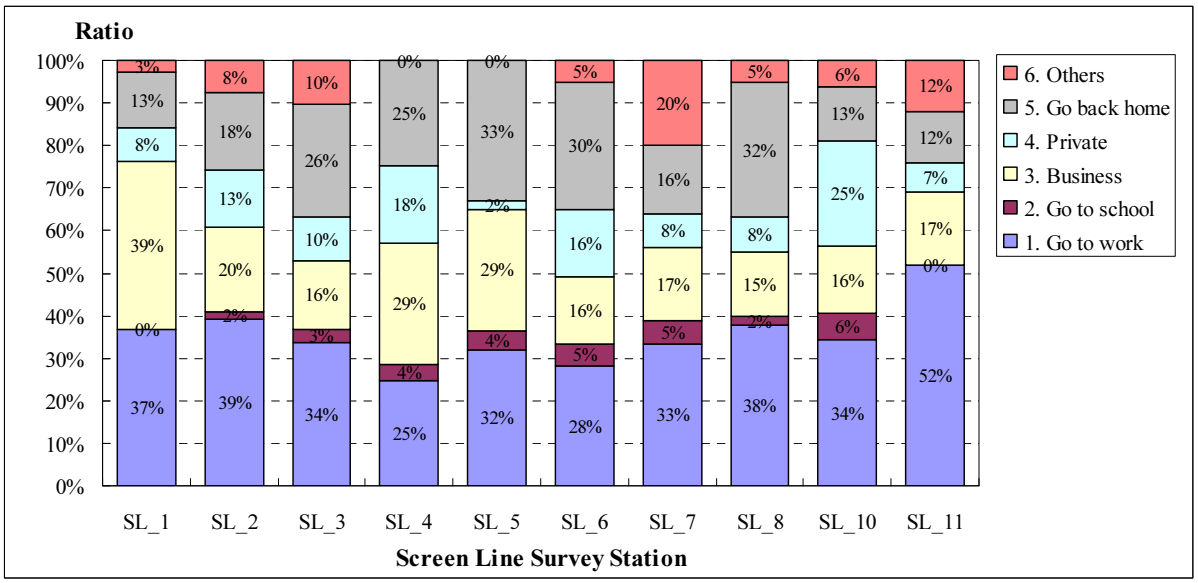
Source: Study team

Figure 4-8 O/D Distribution Pattern of Bus Traffic

b) Trip Purpose

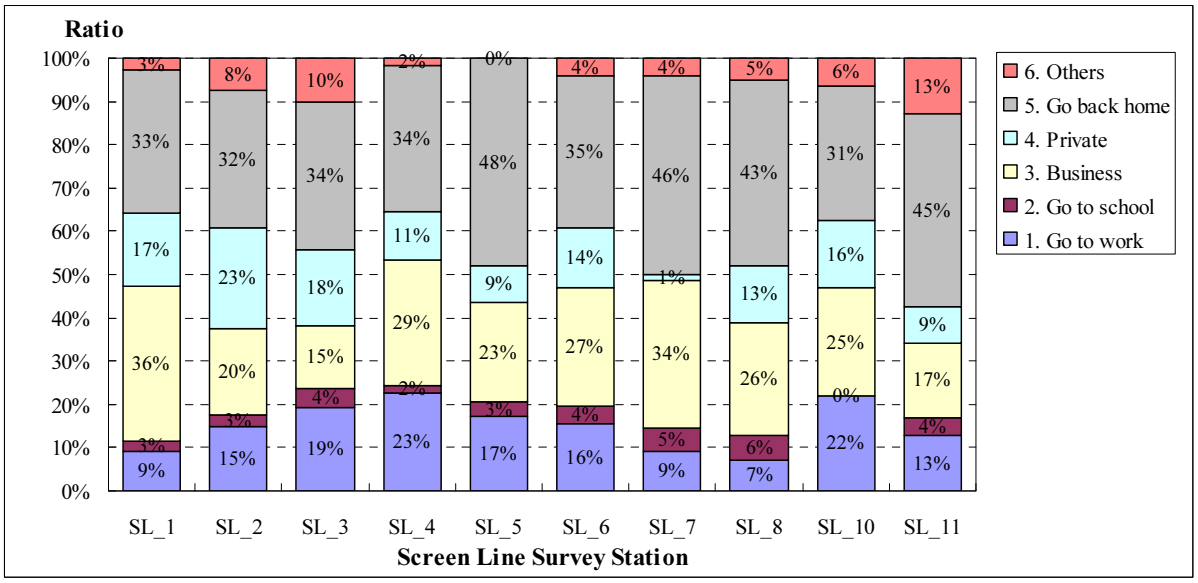
The breakdown of trip purpose by vehicle drivers and bus passengers at each screen line survey point is shown in Figure 4-9 and Figure 4-10, respectively.

The main purposes of drivers of passenger cars are “go to work (commuting)” and “business”. Particularly, the share of “business” purpose is higher at stations near Blantyre such as SL-2 and SL-5. On the contrary, the main purpose of bus passengers is “go back home”.



Source: Study team

Figure 4-9 Trip Purpose of Passenger Car Drivers



Source: Study team

Figure 4-10 Trip Purpose of Bus Passengers

c) Vehicle Occupancy Ratio

Occupancy ratios of passenger cars, minibuses and conventional buses are summarised in Table 4-2.

- The occupancy ratio of passenger cars was 52% and the average number of passengers was 2.5 persons/veh.
- The occupancy ratio of minibuses was 79% and the average number of passengers was 12.3 persons/veh.
- The occupancy ratio of conventional buses was 76% and the average number of passengers was 52.1 persons/veh.

Table 4-2 Occupancy Ratio

Vehicle Type	Average No. of Passengers (A)	Capacity (B)	Occupancy Ratio (A/B)	No. of Sample
Passenger car	2.5	4.8	52%	648
Minibus	12.3	15.5	79%	659
Conventional bus	52.1	68.9	76%	104

Source: Study Team

The load factors of freight vehicles are summarised in Table 4-3. These load factors include empty vehicles and so are between 33% and 74%.

Table 4-3 Load Factors of Freight Vehicles

Vehicle Type	Average Volume of Goods (tonne) (A)	Loading Capacity (tonne) (B)	Load Factor (A/B)	No. of Samples
Pick-up	0.5	1.6	33%	126
Light goods vehicle	1.3	2.7	48%	366
Medium goods vehicle	5.4	10.6	51%	1,173
Heavy goods vehicle	18.1	31.9	57%	1,199
Tanker lorry	24.2	32.9	74%	178

Source: Study Team

d) Average Volume of Goods by Commodity

Table 4-4 summarises the average volume of cargo by commodity carried by goods vehicles.

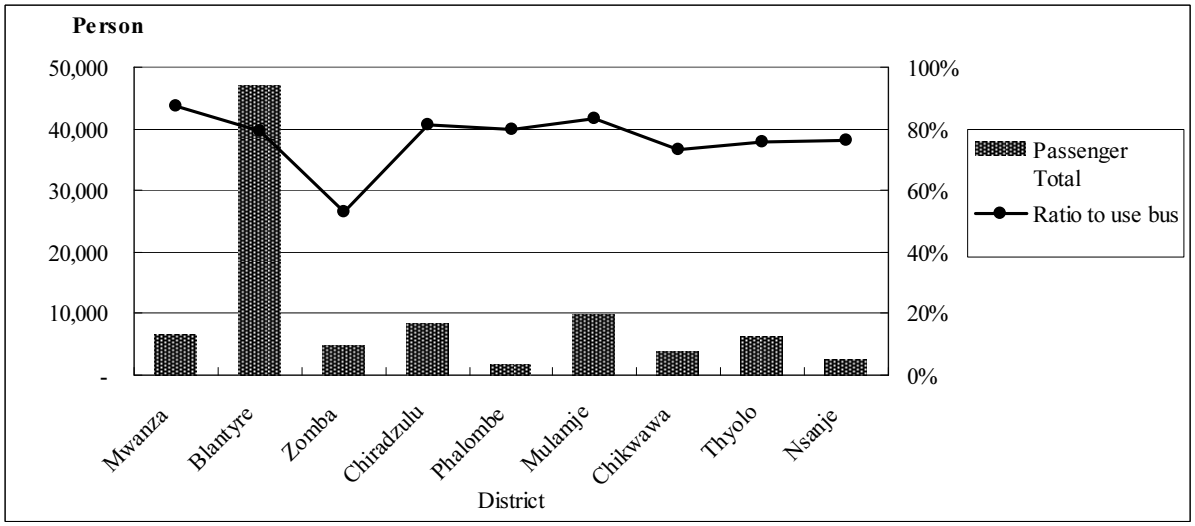
Table 4-4 Average Volume of Goods by Commodity

Commodity	Volume (tonne)	Commodity	Volume (tonne)
Tobacco	18.9	Animals	12.1
Sugar	22.6	Clothes	9.5
Tea	21.2	Other agricultural products	12.9
Maize	13.0	Fertilizer	24.8
Cotton	17.0	Petrol, diesel	26.3
Rice	4.6	Daily goods	15.6
Coffee	11.0	Construction material	15.7

Source: Study Team

4.1.4 Present Characteristics of Traffic and Logistics

- The result of the traffic volume survey indicates that bicycle traffic is quite high, while many pedestrians also walk along roadside. The primary means of transportation for local residents is by foot or by bicycle: carriages or carts towed by livestock such as cows are rare.
- The flow of passengers across district borders is concentrated in Blantyre regarded as the central city of the Southern Region as shown in Figure 4-11. The bus usage rate by passengers crossing district boundaries is nearly 80% except for Zomba District, showing that bus is a vital mode for local residents.



Source: Study Team

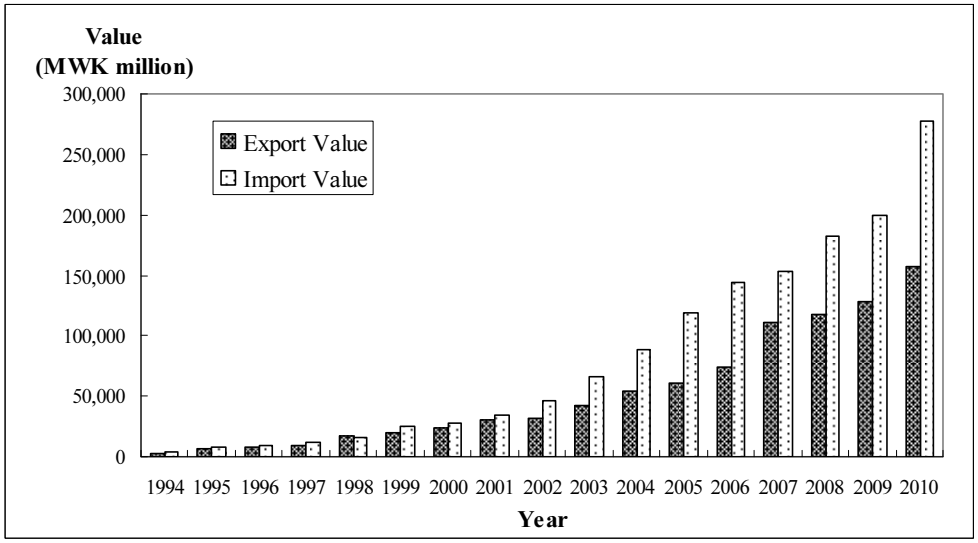
Figure 4-11 Trip Generation Rate and Ratio of Using Bus among Inter-District Passengers

4.2 Results of Logistics Survey

4.2.1 Summary of Export/Import

(1) Trend of Export/Import

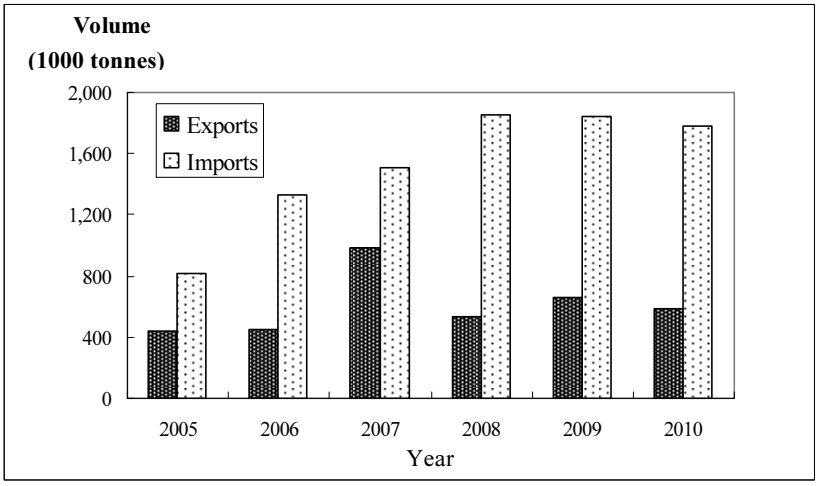
Figure 4-12 shows the value of exports and imports for Malawi from 1994 to 2010. The value has been increasing for both import and export.



Source: Reserve Bank of Malawi

Figure 4-12 Export and Import Value

Figure 4-13 shows the export and import volume of Malawi for the last 6 years based on the custom data from the Malawi Revenue Authority (MRA). Exports have not increased by volume as much as by value, while the import volume has soared, especially from 2005 to 2008.



Source: Custom data, MRA

Figure 4-13 Export and Import Volume

(2) Main Export/Import Commodities (2010)

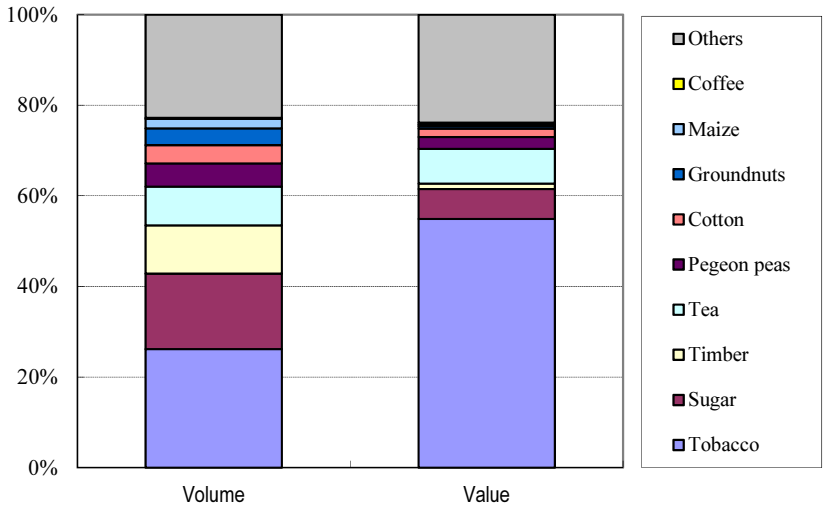
Tobacco has been Malawi's leading export for over 30 years and the situation has not changed. Sugar and tea occupy second or third place by value every year, swapping place every year. Timber was third by volume in 2010, but by value it accounts for only 1.2% of the total value of national exports (see Table 4-5 and Figure 4-14).

Regarding import, fuel (petrol, diesel oil and paraffin) is always in top place by volume. These are the main import commodities; other import items are varied, such as vehicles, spare parts, dairy products and machinery (see Table 4-6 and Figure 4-15).

Table 4-5 Main Export Commodities (2010)

Commodity	Volume		Value	
	Tonne	%	MWK million	%
Tobacco	154,010	26%	86,533	55%
Sugar	98,046	17%	10,396	7%
Timber	62,451	11%	1,878	1%
Tea	50,577	9%	12,094	8%
Pigeon peas	30,144	5%	4,110	3%
Cotton	23,726	4%	2,872	2%
Groundnuts	21,542	4%	889	1%
Maize	12,218	2%	514	0%
Coffee	1,443	0%	712	0%
Others	134,244	23%	37,556	24%
Total	588,401	100%	157,554	100%

Source: 2010 Customs data, MRA



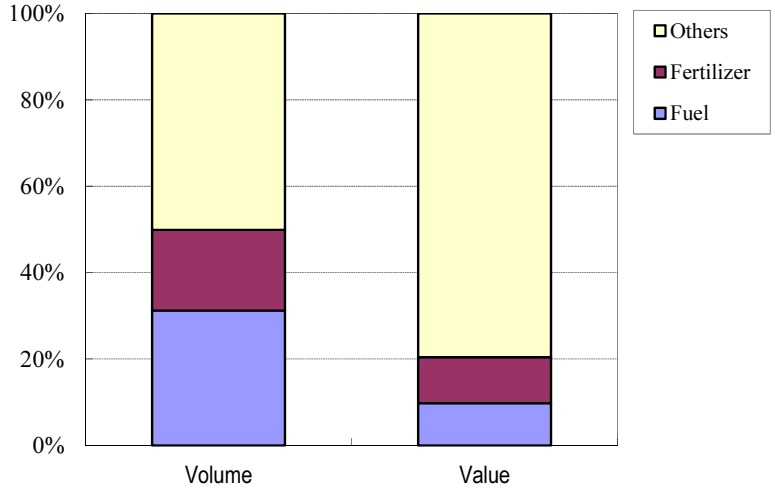
Source: 2010 Customs data, MRA

Figure 4-14 Main Export Commodities (2010)

Table 4-6 Main Import Commodities (2010)

Commodity	Volume		Value	
	Tonne	%	MWK million	%
Fuel	555,834	31%	27,077	10%
Fertilizer	332,815	19%	29,647	11%
Others	892,877	50%	220,956	80%
Total	1,781,525	100%	277,680	100%

Source: 2010 Customs data, MRA



Source: 2010 Customs data, MRA

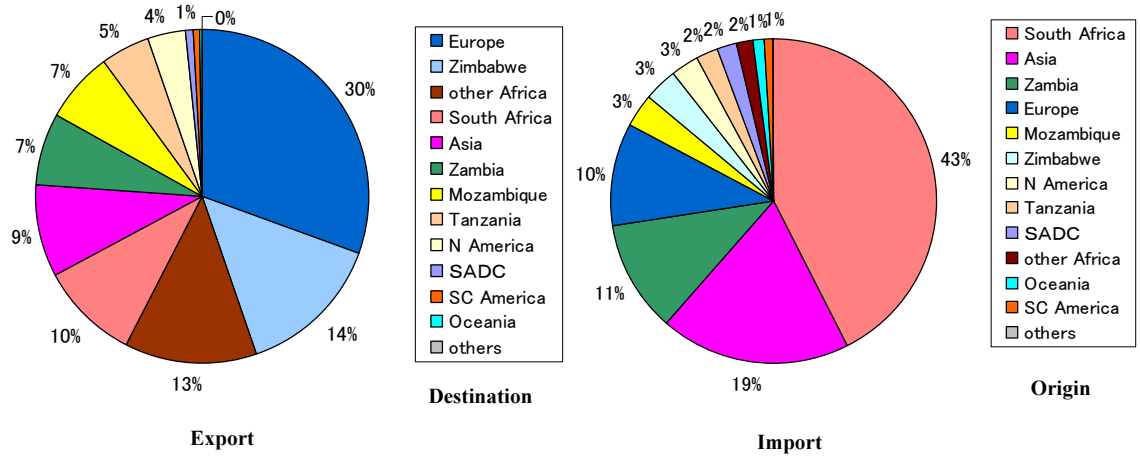
Figure 4-15 Main Import Commodities (2010)

(3) Export/Import Volume by Transport Mode

The main transportation mode is by truck/trailer with containers taking almost 90%, this shows the importance of roads for export/import. Railway accounts for less than 10% and export/import by air remains limited in Malawi.

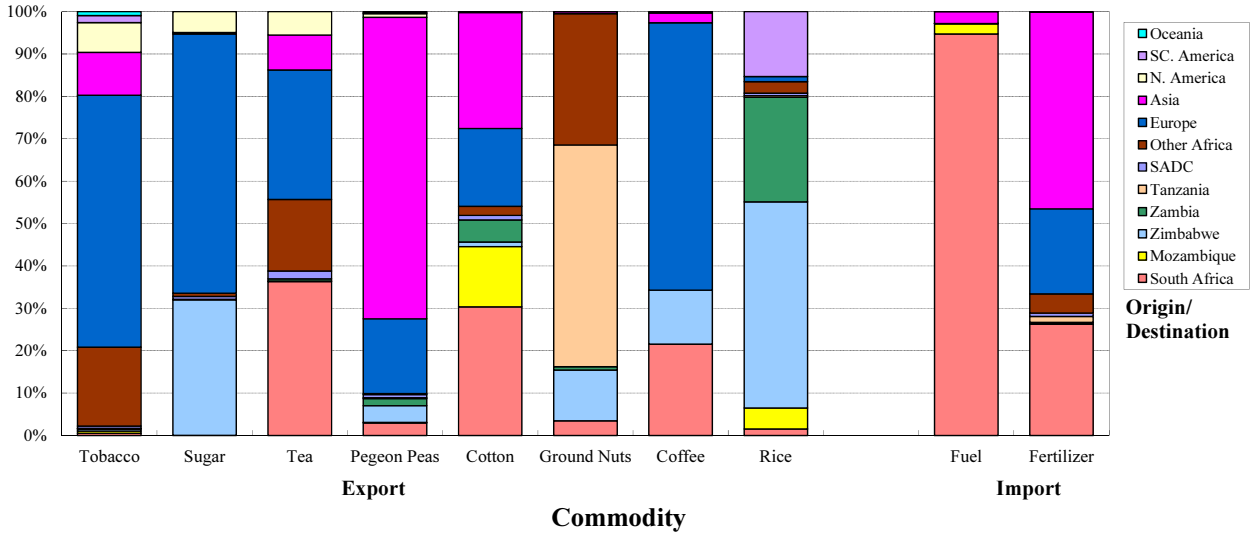
(4) Origin/Destination

Figure 4-16 shows the share of origin/destination of total import/export by volume in 2010. Europe accounts for the highest proportion of export at 30%, while RSA accounts for a dominant 43% of imports. The share by origin/destination of import/export by main commodities in 2010 is illustrated in Figure 4-17.



Source: 2010 Customs data, MRA

Figure 4-16 Origin/Destination of Total Import/Export (2010)

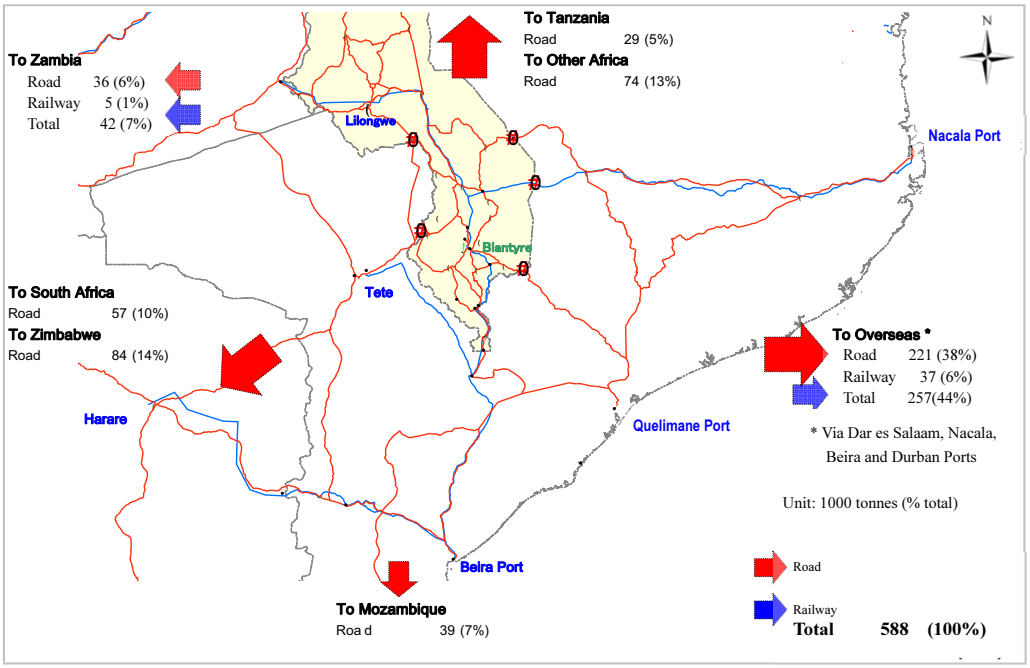


Source: 2010 Customs data, MRA

Figure 4-17 Origin/Destination of Import/Export by Main Commodities (2010)

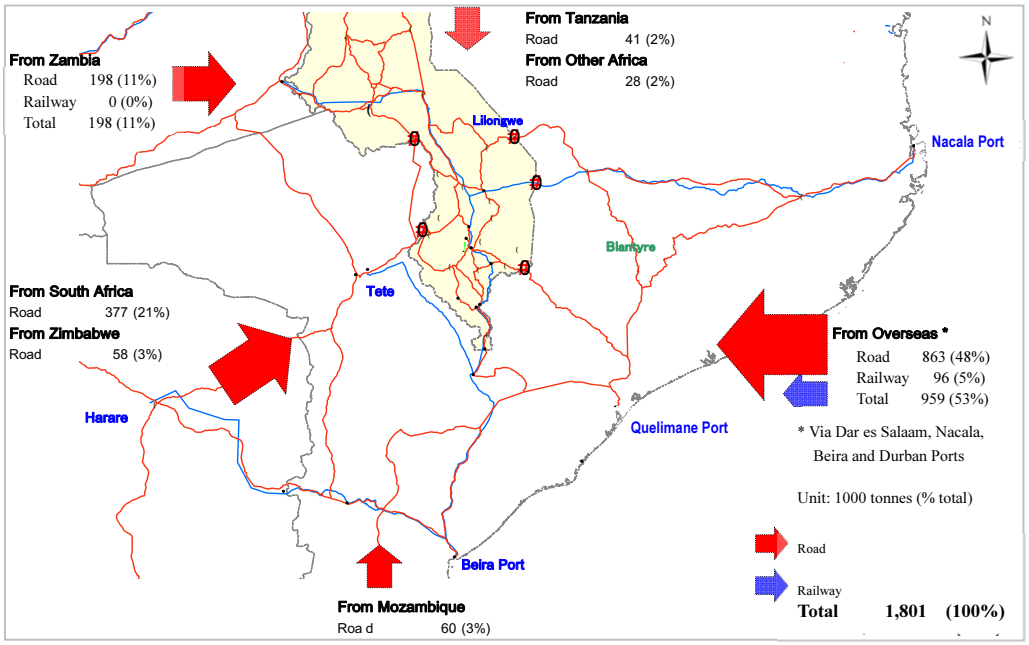
(4) Freight Flows

The export/import freight flow in 2010 is shown in Figures 4-18 and 4-19. At least 40% are exports that pass through the nearby ports of Nacala, Beira and Durban. Over 50% of imports are transported through these ports from overseas. Thus, ports play an important role in Malawi's import and export.



Source: 2010 Customs data, MRA

Figure 4-18 Export Freight Flow (2010)



Source: 2010 Customs data, MRA

Figure 4-19 Import Freight Flow (2010)

4.2.2 Present Export/Import Structure of Main Commodities

To identify the intention and demands of private companies in the Southern Region regarding the development plan for the Sena Corridor, the Study Team conducted a questionnaire survey and face-to-face interviews with trading companies and transport operators.

Target logistics companies with headquarters in Lilongwe, Blantyre or Limbe: 315

companies were chosen and an interview was conducted for 78 companies.

The following section describes the logistics status of the main export/import commodities based on the survey results.

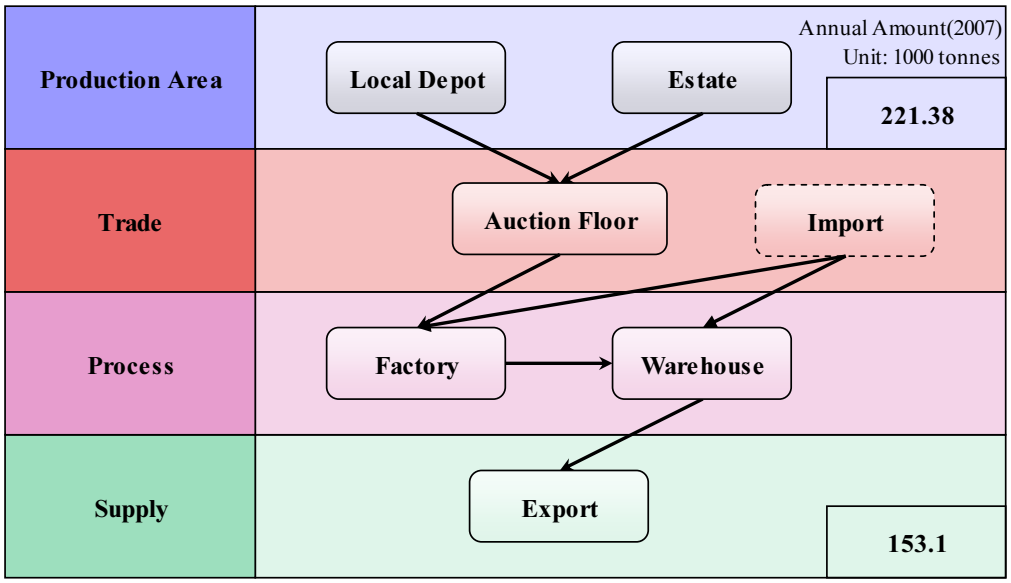
(1) Tobacco

Tobacco is mainly produced in the Central and Northern Regions of Malawi. Approximately 76% of tobacco farmland is located in the Central Region, especially in Lilongwe Rural, Kasungu and Dowa Districts, and 17% is in the Northern Region, mainly in Mzimba and Rumphi Districts. The Southern Region accounts for only 7% of all tobacco farmland in Malawi: the main production areas are Zomba Rural and Phalombe District.

Tobacco crops are mostly traded at four auction floors: Lilongwe, Limbe, Mzuzu and Chinkhoma. According to the website of the Limbe Leaf Tobacco Company, 50% of the national production is traded at the Lilongwe floor. The Limbe floor accounts for 17%, and the Mzuzu and the Chinkhoma for 25% and 8% respectively. To participate in auctions, growers must be registered with Auction Holdings Limited (AHL), the body that operates the auction floors, or must belong to clubs that are registered with AHL. From the local depots in each production area, tobacco leaves are conveyed to the auction floors by transport operators and individual truck owners. Transporters are required to be registered as well, but many trucks without registration cause congestion around the auction floors in the high season. Tobacco leaves traded at the auction floors are transported to the factories of tobacco companies to be processed and mostly exported overseas. Figure 4-20 shows the process flow and transportation structure of the tobacco industry in Malawi.

In 2007, Malawi's tobacco production was approximately 221 thousand tonnes. Tobacco is produced using not only domestic leaves; the country imports tobacco leaves as well, mainly from Mozambique and Zambia. Imported leaves are processed in Malawi and re-exported to other countries.

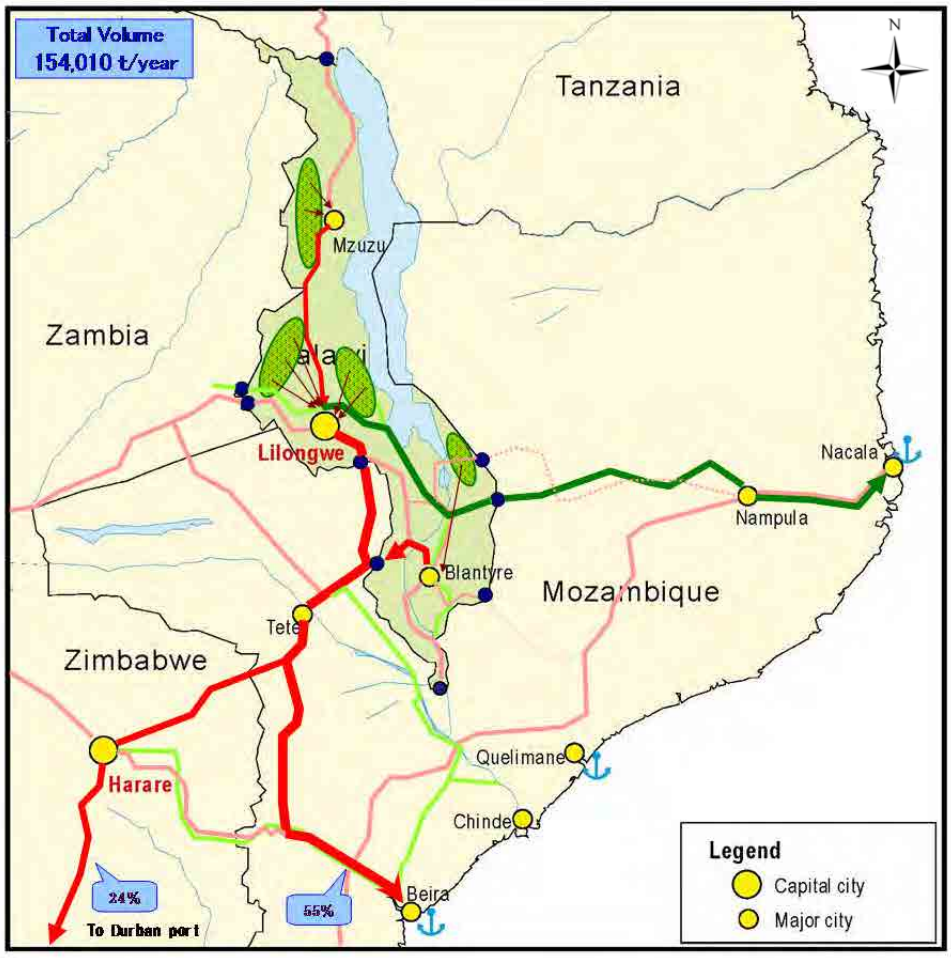
Most tobacco companies own their warehouses and factories near the train station in the Kanengo area of Lilongwe City. It would be much easier for the tobacco industry to transport its products by railway, but in practice less than 5% of total exports are transported by railway. The poor condition of the railway lines and inefficient operation of the railway company are huge problems for transportation in Malawi. For the tobacco industry, product freshness is crucial and the uncertainty of railway operation is a serious problem. Similarly, congestion at Beira Port is another serious threat to the logistics of tobacco companies.



Source: Study Team

Figure 4-20 Process Flow of the Tobacco Industry

The main logistics routes of tobacco production are illustrated in Figure 4-21. Red Purple arrows indicate domestic transportation from production area to the base of export, or the origin of export.



Source: Study Team

Figure 4-21 Main Routes of Tobacco Exports, and Exports in 2010

For reasons mentioned above, tobacco is mainly exported through Durban Port recently despite it taking twice as long compared to Beira Port which is the second port for tobacco export. Some tobacco companies prefer the ease of communicating with port facility operators at Durban Port. Regarding Nacala Port, it used to be one of the important ports for the tobacco industry before the bridge over the Rivi Rivi River in Balaka was washed away by flood in 2002. The transportation volume by railway has not yet recovered because of the inefficiency and uncertainness of its operation.

The Study Area in the Southern Region is insignificant in terms of production of tobacco leaves, processing and logistics, and is not playing the leading role in Malawi. Limbe Leaf Tobacco Company, the biggest tobacco company in Malawi, has been the leader in tobacco processing as well as exporting. Most of the tobacco companies in Malawi have their main facilities in Lilongwe but they outsource some processing (removing veins) to the Limbe Leaf Tobacco Company which has factories both in Limbe and Lilongwe. Tobacco leaves processed at the Limbe Leaf Tobacco Company are packed in Namadzi which is located between Limbe and Zomba, and then exported to countries all over the world. The main export destinations have been the USA, EU and Egypt, and recently the volume and a share exported to China has been growing rapidly. Table 4-7 shows the main export destinations in 2010.

Table 4-7 Major Destinations of Tobacco Exports (2010)

(Unit: 1000 tonnes)

	Destination	Export Volume
1	Belgium	32.52
2	Egypt	27.07
3	Germany	14.93
4	Netherlands	10.84
5	USA	10.25
6	Russia	5.23
7	China	4.89
8	Poland	4.57
9	Philippines	3.65
10	South Korea	3.14
Total Export Volume		154.01

Source: 2010 Custom data, MRA

(2) Tea

Since the 1980s, tea has been one of the most important export industries for Malawi as shown in Table 4-8. The annual export volume has remained relatively stable at 30-50 thousand tonnes for the last thirty years and in 2010 it was MWK12,069 million in value and 50 thousand tonnes in volume, putting it second and fourth in overall national export by value and volume, respectively.

Tea estates are mainly located in the southern part of Malawi, especially in Thyolo, a suburb of Blantyre, and Mulanje, the submontane area of Mount Mulanje. Over 80% of all tea estates are situated in the Study Area. Another major tea production area of Malawi is Nkhata Bay District near Mzuzu, the major city in the Northern Region of Malawi. Major tea companies

which export from Malawi generally own large-scale estates. The total area of tea estates in the country has remained almost unchanged since 1992 at around 18,800 ha, largely due to the major estate owners as might be expected as shown in Table 4-9.

Table 4-8 Annual Volume of Tea Exports (1980-2009)

(Unit: 1000 tonnes)

Year	Export Volume	Year	Export Volume	Year	Export Volume
1980	31.3	1990	41.0	2000	42.4
1981	31.0	1991	41.2	2001	36.1
1982	36.4	1992	37.1	2002	42.6
1983	36.0	1993	35.3	2003	39.0
1984	37.2	1994	38.7	2004	46.2
1985	37.8	1995	32.4	2005	44.6
1986	40.2	1996	32.4	2006	43.1
1987	33.4	1997	49.4	2007	46.6
1988	37.0	1998	40.8	2008	40.0
1989	38.3	1999	42.8	2009	44.0

Source: NSO

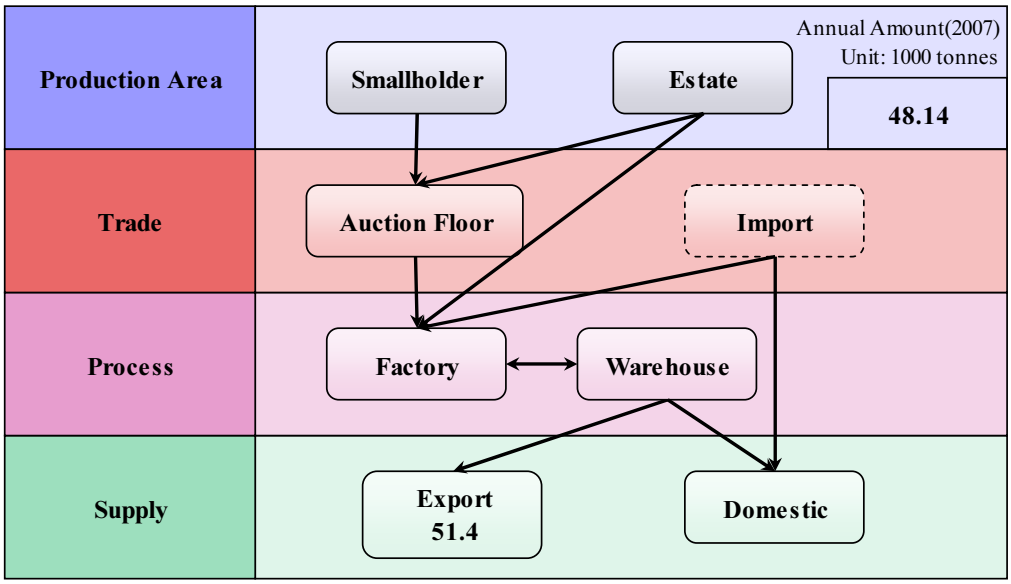
Table 4-9 Total Scale of Tea Estates and Production in Malawi

Year	Area (1000 ha.)	Production (1000 tonnes)	Sales (MWK million)
1992	18.6	28.1	-
1993	18.9	39.5	-
1994	18.7	35.1	-
1995	18.8	34.3	-
1996	18.6	34.8	-
1997	16.3	29.7	-
1998	18.8	40.4	8,024.2
1999	18.8	38.5	502.7
2000	18.8	42.1	782.6
2001	18.8	36.8	733.2
2002	18.8	39.2	794.4
2003	18.8	41.8	1,165.0
2004	18.8	50.1	1,485.0
2005	18.8	38.0	1,203.0
2006	18.8	45.0	2,922.0
2007	18.6	48.1	7,200.3

Source: NSO

However, owning an estate is not the only way to participate in the tea market. The only tea auction in the country is held in Limbe. Almost 30% of total sales in Malawi are traded at this auction floor and it attracts relatively high quality, pricey products such as black tea. Tea produced by over 7,000 smallholder farmers throughout the country is mostly sold by auction to customers. In Malawi, all smallholder farmers are registered with the Smallholder Tea Authority (STA)[2] which purchases all smallholder farmers' tea production and sells them at auction. Figure 4-22 illustrates the process flow of the tea industry.

[2] WB, "Diagnostic Trade Integration Study", 2002



Source: Study Team

Figure 4-22 Process Flow of the Tea Industry

Tea leaves harvested in Thyolo and Mulanje are processed on-site or transported to Blantyre. The products are packed and loaded in factories and then transported to ports where they are shipped to their final destinations. Durban Port is the preferred choice for the business, the same as for the tobacco industry mentioned in the previous section. Since tea leaves are sensitive and quality can easily become deteriorated, long transit time, the delay in shipping from Beira Port and the unstable operation of the railway to Nacala Port are of major concern for the tea industry.

Approximately 88% by volume (48 thousand tonnes in 2010) of all exports go through the Mwanza Border to Durban Port, Beira Port and RSA, which is the traditional counterpart of the tea trade. 10% of the total export is transported to Kenya, Africa's largest tea producer, to the auction in Mombasa in expectation of higher prices than at the Limbe auction, as shown in Figure 4-23.

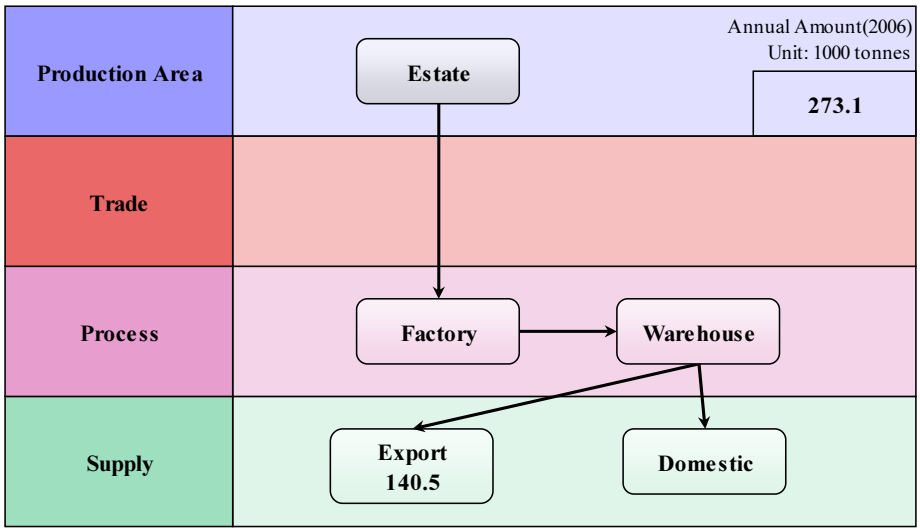
(3) Sugar

Sugar is the second largest export industry by volume. The sugar industry is dominated by Illovo Sugar Ltd., the biggest taxpayer in Malawi. Illovo Sugar Ltd. possesses its own estates in Nchalo and Dwangwa as well as refining mills and 15%–100% of total annual production is exported to other countries, as shown in Figure 4-24.

Sugar produced in Nchalo, Illovo Sugar Ltd.'s main production area, is exported to neighbouring countries such as Zimbabwe and Kenya, overseas such as the UK, which is the biggest longstanding client of Illovo Sugar Ltd., the USA and the EU, and is also delivered to the domestic market in the Southern Region of Malawi. Sugar produced in Dwangwa is mainly delivered to the domestic market in the Northern and Central Regions.

Source: Study Team

Figure 4-23 Main Route of Tea Sector Export and Export Volume in 2010

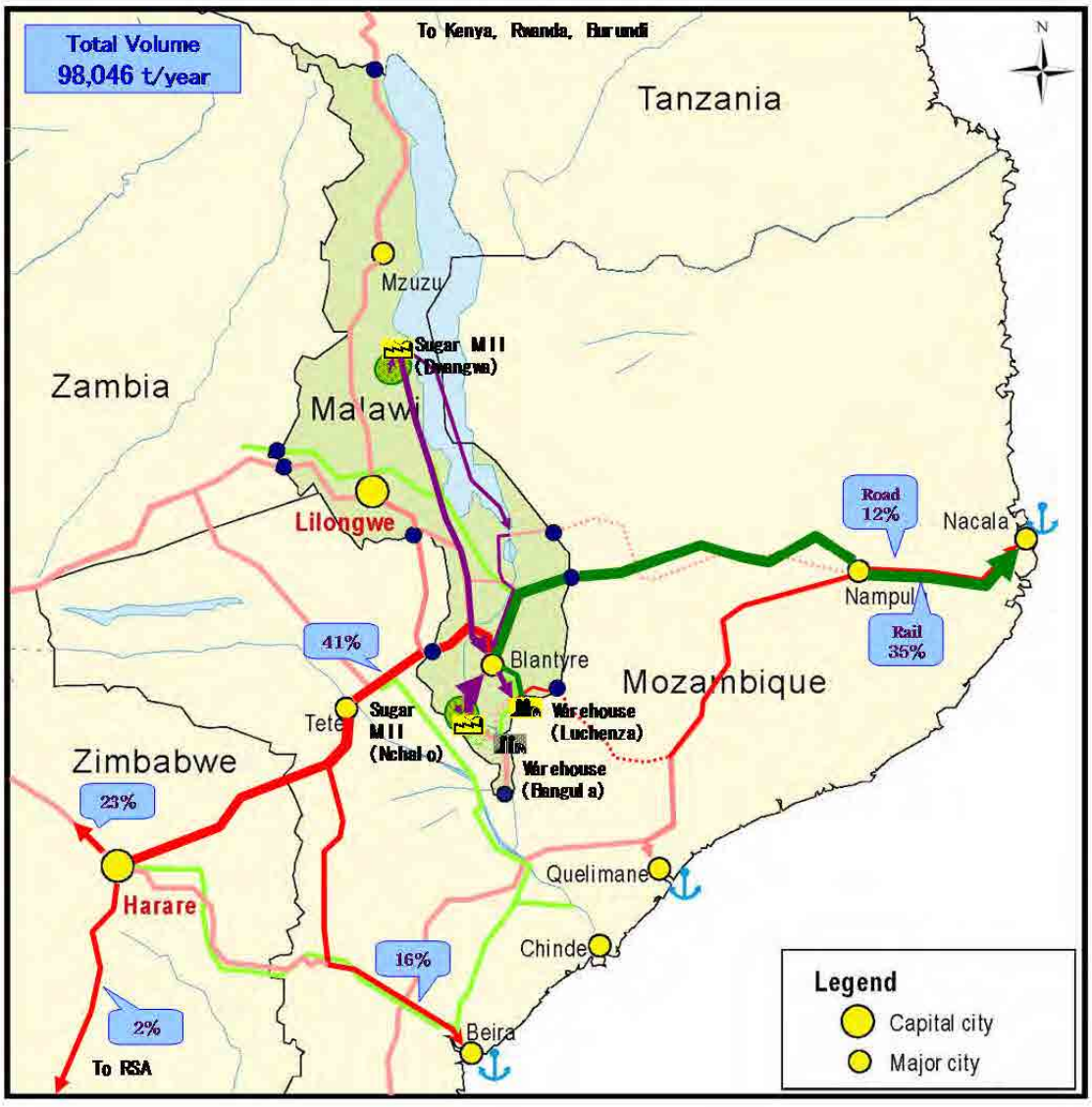


Source: Study Team

Figure 4-24 Process Flow of the Sugar Industry

Lately, the volume exported to neighbouring countries has soared to more than 60% of total export, but in 2007, Illovo Sugar Ltd. became an affiliated company of British Foods, and they are carrying out a plan to massively expand the estate and increase exports to the UK and other EU countries to 280 thousand tonnes in 2015, compared with the present annual shipping volume of 100 thousand tonnes in total.

Different from tobacco and tea, the main port used to export sugar is Nacala Port and railway is the main transport mode. Illovo Sugar Ltd. mainly uses the railway because of its cheapness, and also sugar is not as vulnerable to deterioration over time as tobacco and tea products. It should be noted that exporting companies other than Illovo Sugar Ltd. cannot use the railway at the same cheaper tariff. Illovo Sugar Ltd. contributes significantly to the income of CEAR, with their stable and considerably large volume of freight. Illovo Sugar also secures additional cargoes such as fertilizers and lime as the backhauls, as shown in Figure 4-25.



Source: Study Team

Figure 4-25 Main Routes of Sugar Exports, and Export Volume in 2010

Illovo Sugar Ltd. states that it intends not to change its main port and would consider Beira Port only as a second choice even if the export volume rises drastically in the future.

(4) Cotton

Recently, the cotton industry has become important in Malawi in view of the annual export volume. Table 4-10 shows that the volume of cotton exported has steadily increased in the last ten years.

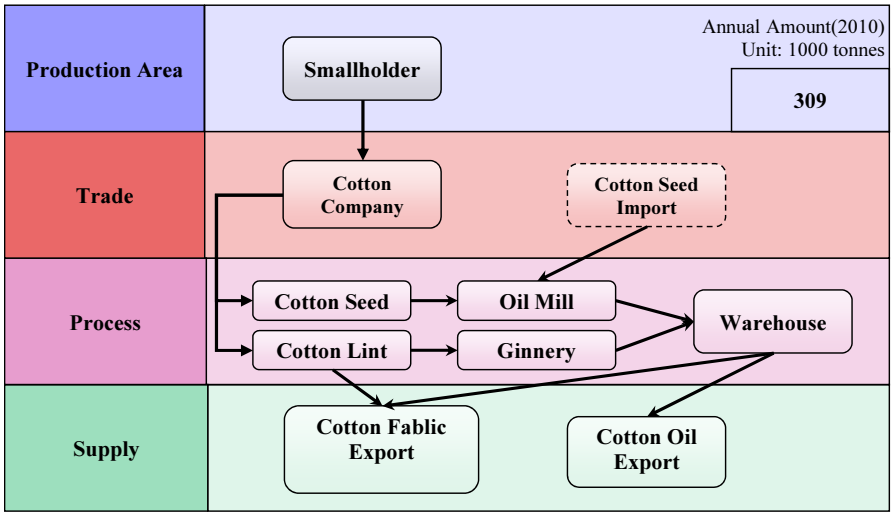
Table 4-10 Annual Volume of Cotton Exports (2000-2010)

(Unit: 1000 tonnes)

Year	Export Volume
2000	9.6
2001	6.0
2002	4.1
2003	5.7
2004	25.6
2005	14.7
2006	14.0
2007	18.8
2008	18.6
2009	30.0
2010	47.5

Source: (2000-2009) NSO, (2010) MRA

Cotton production is separated into the following three commodities: lint, oil and cotton cake. Cotton oil is made from cotton seed. Cotton cakes, the residue after cotton seed oil has been squeezed to extract the oil, is used as livestock food. The record low harvest of cotton in the 2008 season prompted the GoM to set minimum buying prices to ensure the earnings of domestic cotton producers. Then, the GoM banned the exportation of raw cotton in June 2009 to develop the domestic cotton processing industry. Figure 4-26 indicates the process flow of cotton products.

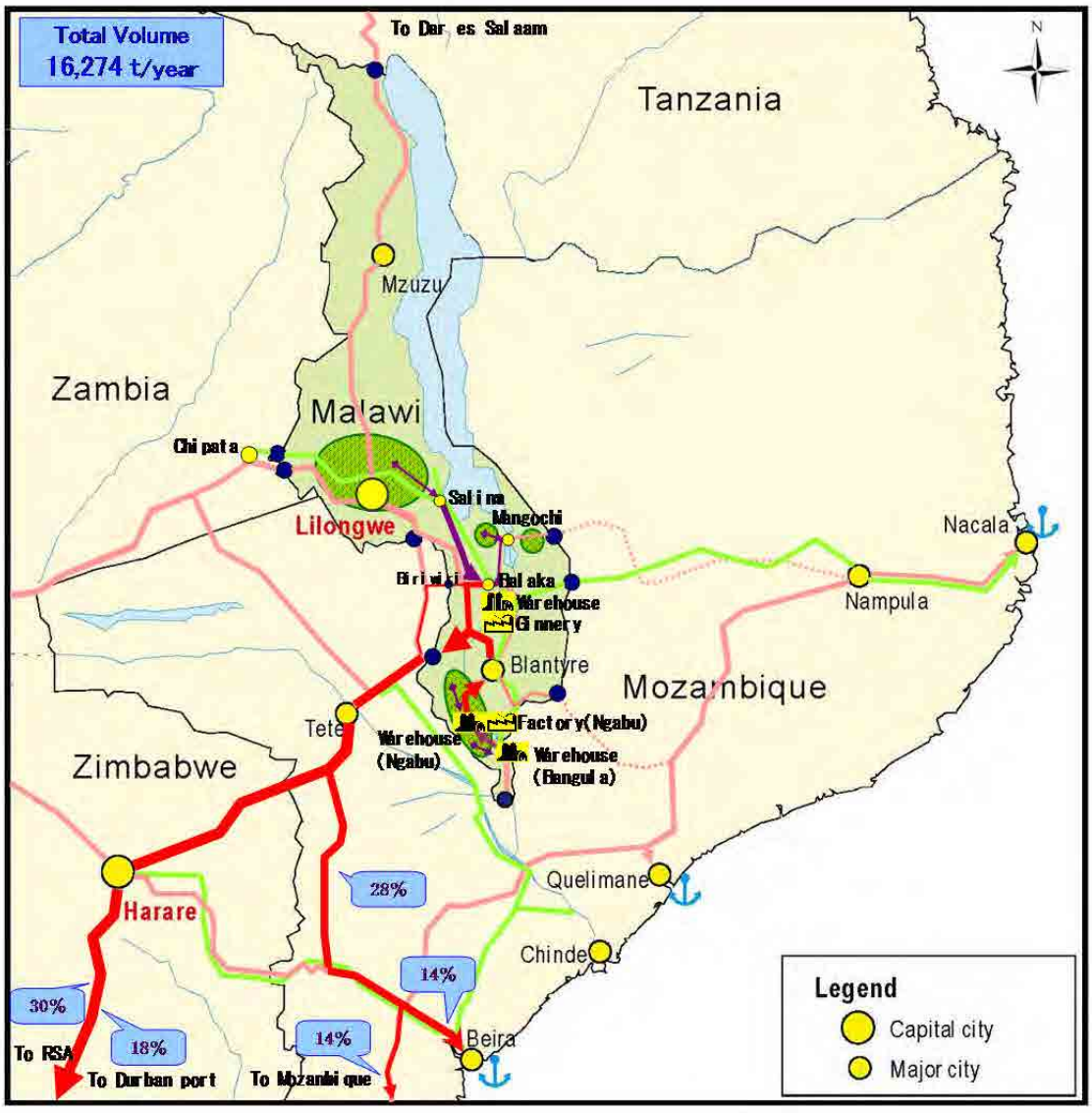


Source: Study Team

Figure 4-26 Process Flow of the Cotton Industry

Cotton companies in Malawi do not own their own estates; they purchase products directly

from smallholders mainly cultivated in the Central and Southern Regions. Major production areas are around Lilongwe and Salima in the Central Region, and Mangochi, Balaka and Chikwawa Districts in the Southern Region. Cotton companies make contracts with transport operators or individual truck owners to gather cotton products from villages into depots in Salima, Mangochi or Balaka, and then transport products to their factories (see Figure 4-27).



Source: Study Team

Figure 4-27 Main Routes of Cotton Lint Exports, and Export Volume in 2010

Cotton lint is processed in the factories located in Ngabu in Chikwawa District and Balaka District. Major destinations of cotton lint and fabric exports are shown in Table 4-11. China has become a major buyer of cotton: many Chinese-capital cotton companies are operating all over the continent to meet the demand of the garment industry in China and Malawi is no exception.

Main export routes of cotton seed are similar to those of cotton lint, but companies process cotton seeds to extract cotton oil at a factory in Chipata, Zambia. Therefore, some cotton seeds are exported to Zambia via the Mchinji Border Post and then transported to ports from Zambia,

as shown in Figure 4-28.

Table 4-11 Major Destinations of Cotton Lint and Fabric Exports (2010)

(Unit: tonne)

	Destination	Export Volume
1	Asia	5,865.2
2	EU	4,358.5
3	Mozambique	3,345.2
4	South Africa	1,359.2
5	Other Africa	505.3
6	Zimbabwe	263.5
7	SADC	257.4
8	Zambia	168.9
9	North America	50.5
Total Export Volume		16,173.8

Source: 2010 Custom data, MRA

Source: Study Team

Figure 4-28 Main Routes of Cotton Seed Exports, and Export Volume in 2010

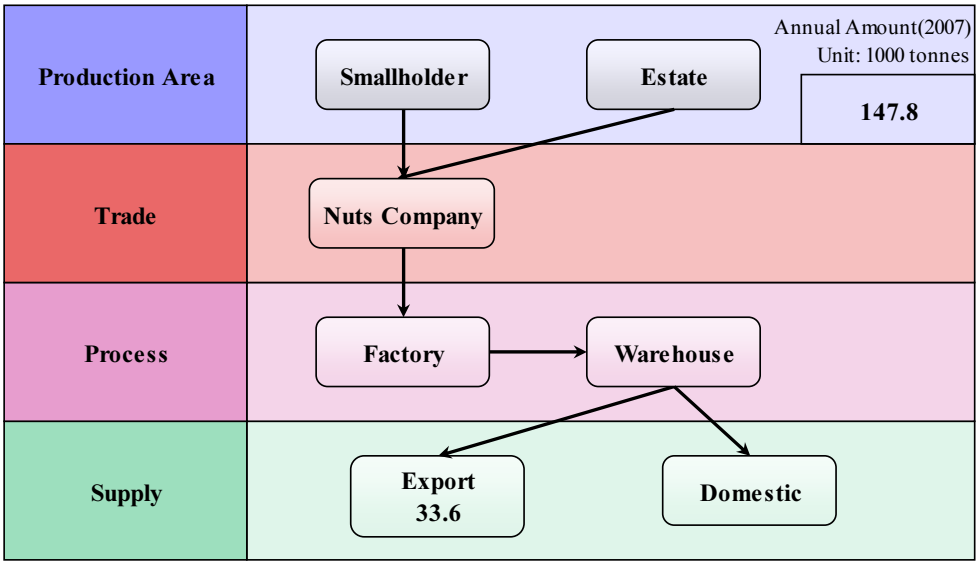
Great Lakes, Malawi's leading cotton-exporting company rents warehouses from other companies in Bangula through which the branch line of the Sena Railway ran and where a

station was located before the railway embankment was washed away by flood at Chiromo in 1997. Illovo Sugar Ltd. and Agriculture Development and Marketing Corporation (ADMARC) own their own warehouses to store commodities prior to transhipment to trains, but these warehouses have been of no use to them since 1997 and so they have leased them to Great Lakes.

Most cotton products are exported overseas from Beira and Durban Ports by road transportation at present. Some companies hope to use the railway to reduce transport costs.

(5) Nuts

Malawi produces various kinds of nuts and exports them. Especially, groundnuts, macadamia nuts and cashew nuts are the major varieties for export. Groundnuts are mostly exported to countries in the region such as Tanzania, Kenya, Zimbabwe and RSA, while other kinds of nuts are exported to the UK and the USA. Figure 4-29 shows the processing flow of groundnuts: the values in the figure do not include other types of nuts, but the industrial processing of other nuts is similar.



Source: Study Team

Figure 4-29 Process Flow of the Groundnuts Industry

The values in the figure show that domestic consumption accounts for a substantial proportion of total production. This trend is contrary to the export ratio of, for example, macadamia nuts, for which 1,371.8 tonnes of the total annual production of 1,472 tonnes were exported to other countries in 2010. Figure 4-30 shows the primary export route of the nuts industry. The green-shaded areas indicate where groundnuts are produced, while the blue areas denote where macadamia nuts are produced. Tea estates tend to plant nut trees along with tea trees, so especially in the Southern Region, tea production areas overlap with nut production areas.

Other than the 52% of total annual exports which go to Tanzania, almost all groundnuts are exported to neighbouring countries. A significant proportion of the export volume of groundnuts

(81.5% in 2010) is transported outside of the country across the Songwe Border. Moreover, the major production areas of groundnuts are clustered in the Central Region, such as Lilongwe Rural, Mchinji, Dowa, Kasungu and other districts neighbouring Lilongwe. Hence, transportation of groundnuts does not seem to influence logistics in the Study Area. On the contrary, the major production areas of macadamia nuts are located in the Study Area and the nuts are exported to countries on other continents. However, the total export volume of macadamia nuts is only around 1.5 thousand tonnes, which is a mere 1% of tobacco exports and 1.5% of sugar exports, and even is not more than 7% of groundnut exports. This means that the transportation of macadamia nuts can have little impact on the logistics of the Study Area.

Durban and Beira Ports are the main ports used for exporting nuts.

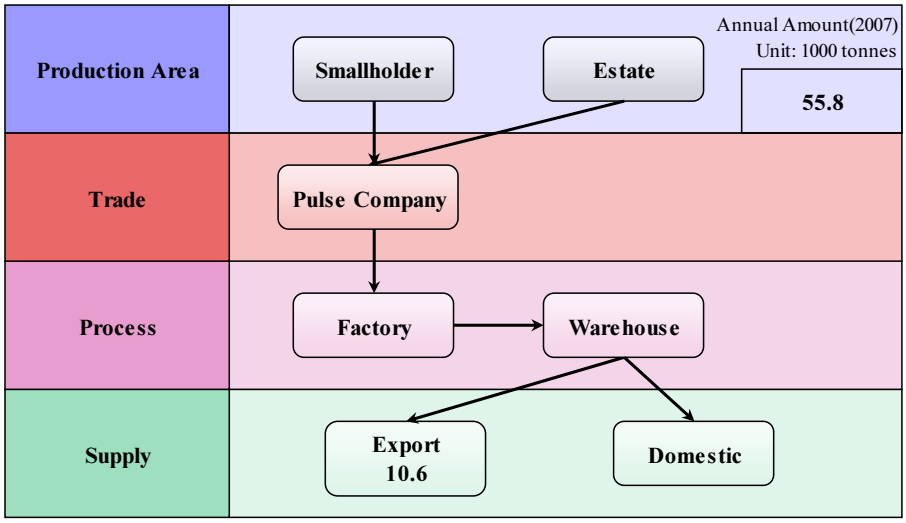
Source: Study Team

Figure 4-30 Main Routes of Nut Export, and Export Volume in 2010

(6) Pulses

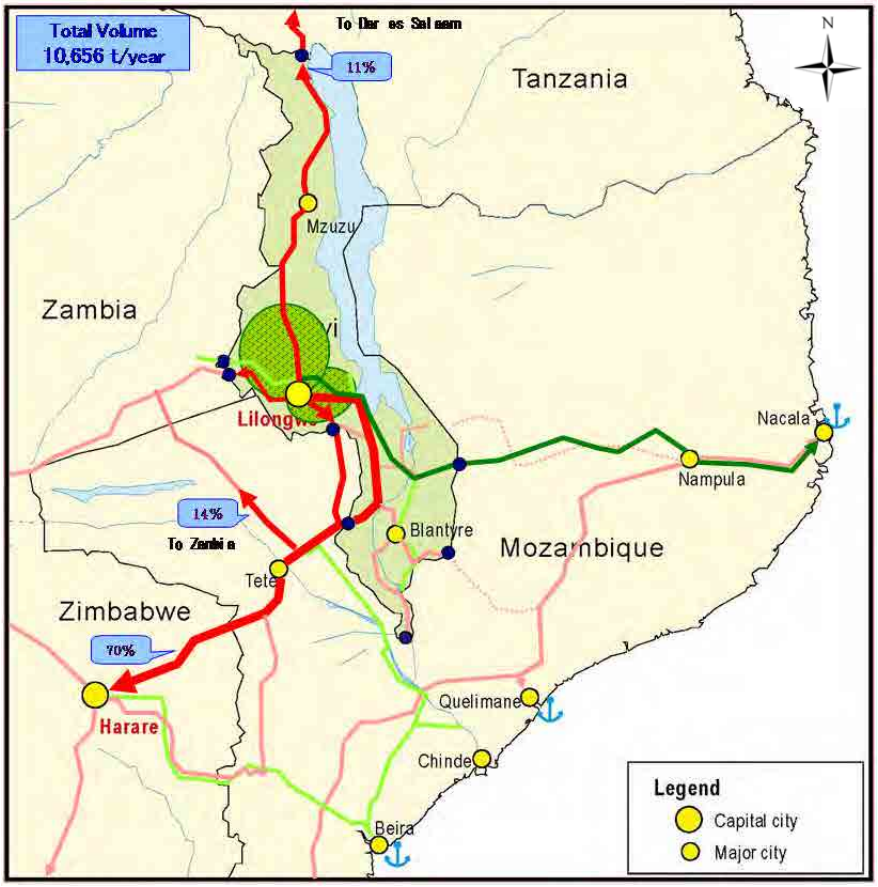
Pulses are an important agricultural product of Malawi with typical ones being ordinary beans, ground beans, soya beans, pigeon peas and cow peas. Figure 4-31 shows the process flow of the pulses industry. Among them, soya beans and pigeon peas are major exports, whereas others are mainly consumed within the country. The main production areas of soya beans are

clustered in the Central Region, and the beans are exported to neighbouring countries, especially to Zimbabwe which accounted for 70% of the total soya export volume in 2010. Figure 4-32 shows the main production areas and export routes.



Source: Study Team

Figure 4-31 Process Flow of the Pulses Industry



Source: Study Team

Figure 4-32 Main Routes of Soya Bean Exports, and Export Volume in 2010

Pigeon peas are regarded as a possible important export earner, as prospects for tobacco exports are bleak due to the world-wide campaign against smoking. Major production areas are

the Southern Region of Malawi, in particular Thyolo, Mulanje, and Phalombe Districts and Zomba Rural area as shown in Figure 4-33.

Source: Study Team

Figure 4-33 Main Routes of Pigeon Pea Exports, and Export Volume in 2010

The primary destination of pigeon peas is India. Pigeon peas are a vital ingredient of Indian cuisine (dal), and their consumption in India is expected to increase steadily with economic development. Major destinations of pigeon peas are shown in Table 4-12.

(7) Fuel

80% of all fuel imports to Malawi is conducted by Petroleum Importers Limited (PIL). This is a private consortium established in 2000 by five multinational petroleum companies operating in Malawi: BP, Mobil, Total, Caltex and Petroda. PIL is monitored by the government parastatal, Petroleum Control Commission (PCC), which had been entrusted to import fuel before it stopped handling direct importation in 2004.

Almost all fuel (petroleum, diesel oil and paraffin) and petroleum related products are imported from RSA. The major origins of imports are listed in Table 4-13.

Table 4-12 Major Destinations of Pigeon Pea Exports (2010)

(Unit: tonne)

Destination	Export Volume (tonne)
Asia	21,439.4
Europe	5,316.8
SADC countries	2,919.8
North America	250.4
Oceania	88.9
South America	69.3
Other Africa	59.4
Total	30,144.0

Source: 2010 Custom data, MRA

Table 4-13 Major Origins of Fuel Imports (2010)

Origin	Import Volume (1000 tonnes)	Percentage
RSA	526.4	94.7%
Middle East	15.6	2.8%
Mozambique	13.5	2.4%
Zambia	0.2	0.0%
Tanzania	0.1	0.0%
Total	555.8	100%

Source: 2010 Custom data, MRA

Since the main port used to import fuel is Beira Port, over 60% of fuel is transported by road from Beira Port through Mozambique to Malawi. Petroleum companies own their own fuel storage depots in Blantyre for distribution to the Southern Region of the country, and in Salima for the Central and the Northern Regions. As a result, 51.6% of the total quantity is imported via the Mwanza Border to Blantyre, and 14.9% is imported via the Dedza Border to Salima as shown in Figure 4-34. Dar es Salaam Port is a secondary port and used to be the main port for importing fuel during the civil war in Mozambique. Nacala Port accounts for only 4%. Before 2004, a small portion of fuel and jet fuel was also transported from Nacala Port, but now only diesel is carried by railway.

Lately, frequent shortages of fuel have become a serious problem in Malawi. The GoM insists that the congestion caused by rehabilitation of the Tete Bridge over the Zambezi River is the main cause of transportation delays, but PIL claims that the GoM's lack of foreign exchange is the main reason. The GoM accused PIL of failing to manage fuel imports and announced the establishment of National Oil Company, a new organisation for importing fuel.

(8) Fertilizer

Since Malawi is an agricultural country, fertilizer is an essential product for the national economy and industry. However, the fertilizer industry in the country is almost non-existent, so it must be imported from overseas as well. Major countries that supply fertilizer are listed in Table 4-14. Malawi imports fertilizer mainly from RSA, the Middle East, China, India and EU countries.

Source: Study Team

Figure 4-34 Main Routes of Fuel Imports, and Import Volume in 2010

Table 4-14 Major Origins of Fertilizer Imports (2010)

Origin	Import Volume (1000 tonnes)	Percentage
South Africa	87.4	26%
UAE	49.5	15%
China	46.9	14%
India	30.7	9%
Switzerland	25.7	8%
Egypt	13.1	4%
Belgium	9.9	3%
Netherlands	9.4	3%
Norway	9.0	3%
Bahrain	8.1	2%
Others	43.1	13%
Total	332.8	100%

Source: 2010 Custom data, MRA

Domestic demand for fertilizer has been increasing steadily, and the annual import volume in 2010 was 5.7 times that of a decade ago: 58.2 thousand tonnes in 2000.

The largest customer in this sector is the GoM, which supports poor farmers (most of the farmers living in the countryside) by providing coupons to purchase fertilizer at a government subsidized price.

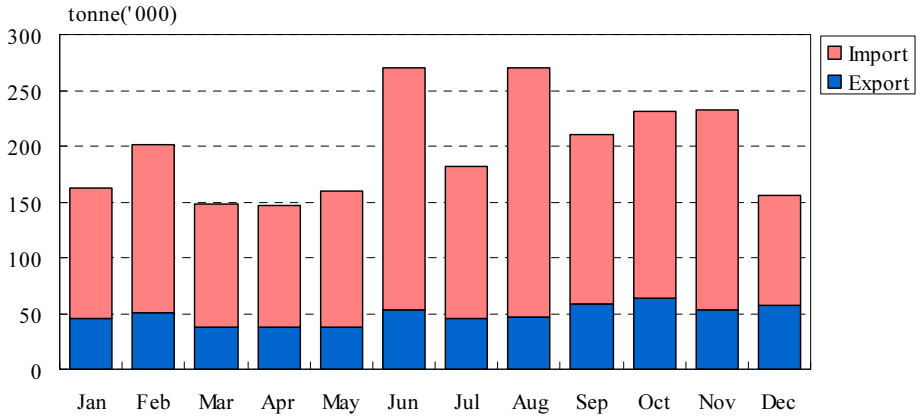
Fertilizer is imported mainly via Beira Port, while Nacala Port is also regularly used even though it accounts for a small proportion of the total volume, as shown in Figure 4-35. This is mostly because Illovo Sugar Ltd. imports fertilizers on its own account for its sugar estates from EU countries. On the contrary, the Smallholder Farmers Fertilizer Revolving Fund of Malawi, which is one of the major fertilizer importers, imports from Middle Eastern countries through Beira Port and RSA. It owns warehouses in Lilongwe (the biggest), Blantyre and Mzuzu where it stocks and blends imported fertilizer, then distributes the fertilizer all over the country.

Source: Study Team

Figure 4-35 Main Routes of Fertilizer Imports, and Import Volume in 2010

4.2.3 Monthly Export/Import Variation

The monthly export and import variation is shown in Figures 4-36 to 4-38, and Tables 4-15 to 4-17. The peak of the total amount is in June and August, the peak of exports is in October, and the peak of imports is in August.



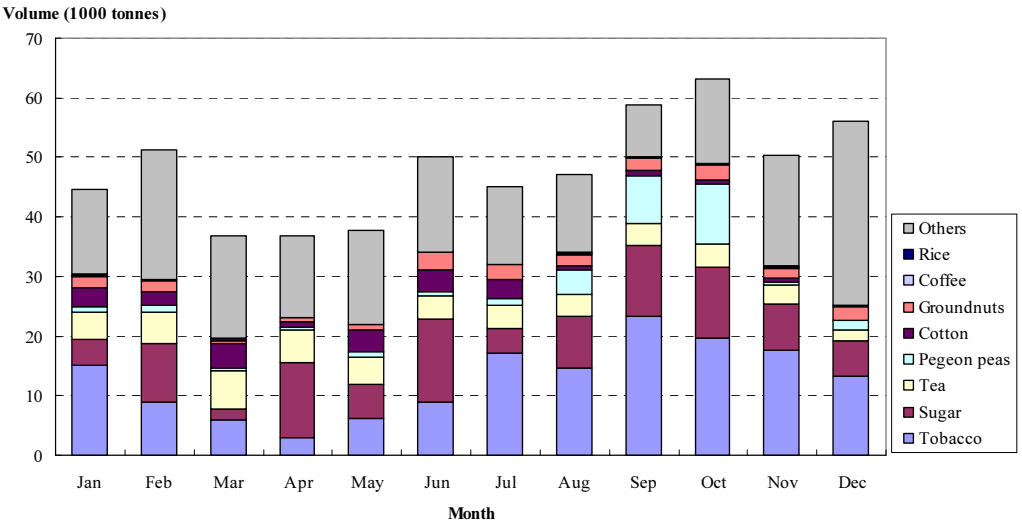
Source: 2010 Customs data, MRA

Figure 4-36 Monthly Export/Import Variation

Table 4-15 Monthly Export/Import Index

Month	Export	Import	Total
January	7.7%	6.6%	6.8%
February	8.7%	8.5%	8.5%
March	6.3%	6.2%	6.2%
April	6.3%	6.2%	6.2%
May	6.5%	6.8%	6.7%
June	9.0%	12.2%	11.4%
July	7.7%	7.7%	7.7%
August	8.0%	12.5%	11.4%
September	10.0%	8.5%	8.9%
October	10.9%	9.4%	9.7%
November	9.1%	10.0%	9.8%
December	9.8%	5.5%	6.6%
Total	100%	100%	100%

Source: 2010 Customs data, MRA



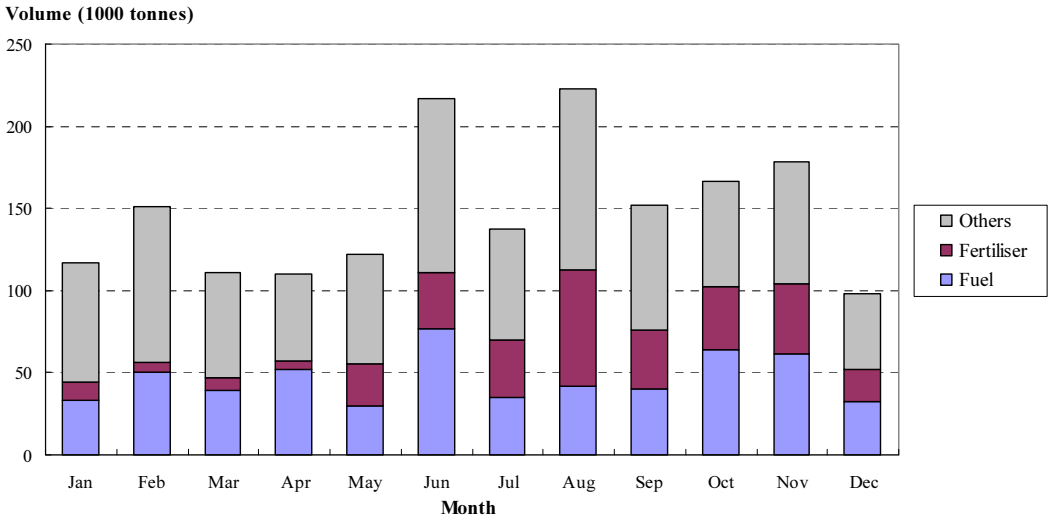
Source: 2010 Customs data, MRA

Figure 4-37 Monthly Export Variation by Main Commodity

Table 4-16 Monthly Export Variation by Main Commodity

Month	Tobacco	Sugar	Tea	Pigeon Peas	Cotton	Ground nuts	Coffee	Rice	Others	Total
January	9.9%	4.2%	9.4%	3.0%	13.0%	9.2%	11.5%	11.5%	7.3%	7.7%
February	5.8%	10.1%	10.5%	3.6%	9.4%	9.1%	1.6%	14.5%	11.0%	8.7%
March	3.9%	1.8%	12.6%	2.0%	16.7%	2.4%	4.9%	25.7%	8.8%	6.3%
April	2.0%	12.6%	10.9%	1.7%	4.1%	3.1%	1.3%	2.5%	6.9%	6.3%
May	4.0%	5.8%	8.9%	3.0%	15.3%	4.1%	0.1%	4.2%	8.1%	6.5%
June	5.8%	14.1%	8.1%	1.7%	15.5%	13.8%	0.0%	3.9%	8.2%	9.0%
July	11.1%	4.2%	7.6%	4.1%	13.5%	11.3%	0.0%	7.7%	6.6%	7.7%
August	9.5%	9.0%	7.2%	13.3%	3.3%	8.4%	21.9%	7.4%	6.7%	8.0%
September	15.2%	12.1%	7.4%	26.6%	3.8%	8.7%	9.4%	5.3%	4.4%	10.0%
October	12.8%	12.1%	7.6%	33.9%	2.4%	12.1%	11.7%	4.3%	7.2%	10.9%
November	11.5%	7.9%	6.0%	2.2%	2.3%	8.0%	17.6%	7.0%	9.4%	9.1%
December	8.6%	6.1%	3.8%	4.8%	0.6%	10.0%	20.0%	5.9%	15.6%	9.8%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: 2010 Customs data, MRA



Source: 2010 Customs data, MRA

Figure 4-38 Monthly Import Variation by Main Commodity

Table 4-17 Monthly Import Variation by Main Commodity

Month	Fuel	Fertilizer	Others	Total
January	6%	3%	8%	7%
February	9%	2%	11%	8%
March	7%	2%	7%	6%
April	9%	1%	6%	6%
May	5%	8%	7%	7%
June	14%	10%	12%	12%
July	6%	11%	7%	8%
August	7%	21%	12%	13%
September	7%	11%	8%	9%
October	11%	12%	7%	9%
November	11%	13%	8%	10%
December	6%	6%	5%	5%
Total	100%	100%	100%	100%

Source: 2010 Customs data, MRA

4.2.4 Transport Cost

(1) Road

Table 4-18 shows the transport cost by route according to an interview survey of private companies. Estimated costs are US$0.07–0.14/tonne/km though they vary to some degree. These values, similar to the results of the previous study, "Malawi Transport Cost Study", were reviewed taking into account the inflation rate. On average, the transport cost by road is US$0.12/tonne/km.

The results obtained from our interview survey are slightly higher than the values in the "EU Multimodal Transport Study".

Table 4-18 Transport Costs by Truck

(Unit: US$/tonne)

Item		Beira		Durban	
		*1	*2	*1	*2
Export	Tobacco	95-120	97	100-260	192
	Sugar	–	69	–	–
	Tea	76	128	200	198
	Cotton	–	–	100	–
	Coffee	–	–	150	187
	Food crops	110-150	–	150	–
	Other	–	–	–	357
Import	Fuel	123-175	189	–	–
	Fertilizer	110	94	110	–
	Other	50	–	–	–
Average		104	115	148	243
Distance (km)		797		2,053	
US$/tonne/km		0.13	0.14	0.07	0.12
EU report *3		79		127	

Source: *1: Interview survey by the Study Team
*2: Malawi Transport Cost Study
*3: EU Multimodal Transport Study

(2) Railway

According to the interview survey with CEAR, the transport cost for a container between Blantyre and Nacala Port is US$623 and the transport cost for general cargo is US$40/tonne as shown in Table 4-19. These results are generally consistent with the data from the "EU Multimodal Transport Study". The transport cost per kilometre is cheaper by railway than by road.

However, the transport cost by the railway between Blantyre and Nacala Port obtained by the interview survey conducted by the Study Team varies between US$86 and US$155 (see Table 4-20) by commodity, since this value includes the transhipment cost of the freight and the trucking cost from the train stations to the factories. Converted into cost per km, it is US$0.13/tonne/km, which is not so different from the cost by road.

Table 4-19 Transport Costs by Railway (1)

Type	Section	Costs	Distance (km)	US$/tonne/km
Containers	Blantyre-Nacala	US$623 (=US$35/tonne)	799	US$0.044
Bulk＆General Cargo	Blantyre-Nacala	US$41/tonne	799	US$0.051
EU report (US$/tonne)*	Blantyre-Nacala	US$36/tonne	–	–

Note: EU Multimodal Transport Study
Source: CEAR

Table 4-20 Transport Costs by Railway (2)

(Unit: US$/tonne)

Item		Blantyre - Nacala	
		*1	*2
Import	Fuel	86	148
	Fertilizer	155	62
	Other	90	95
Average		103	102
Distance (km)		799	
US$/tonne/km		0.13	0.13

Source: *1:Interview survey by JICA Study Team
*2:Review of Malawi Transport Cost Study 2005 by Inflation Rate

(3) Inland Waterway

The cost by inland waterways is uncertain because no data is available. The shipping cost by sea from Durban Port to Beira and Nacala Port should be investigated. The distance between Durban and Beira Port is 1,400 km, and that between Nsanje International Port and Beira Port via Chinde is 450 km. Based on these values, the cost by inland waterways is assumed to be about US$40/tonne, including the transhipment cost. For inland waterways, the distance does not influence the transport costs, as shown in Table 4-21.

Table 4-21 Inland Waterway Transport Cost

(Unit: US$)

Port	Fuel	Fertilizer	Average
Beira	38	87	63
Nacala	40	73	56
Average	39	80	60

Source: Review of Malawi Transport Cost Study 2005 by Inflation Rate

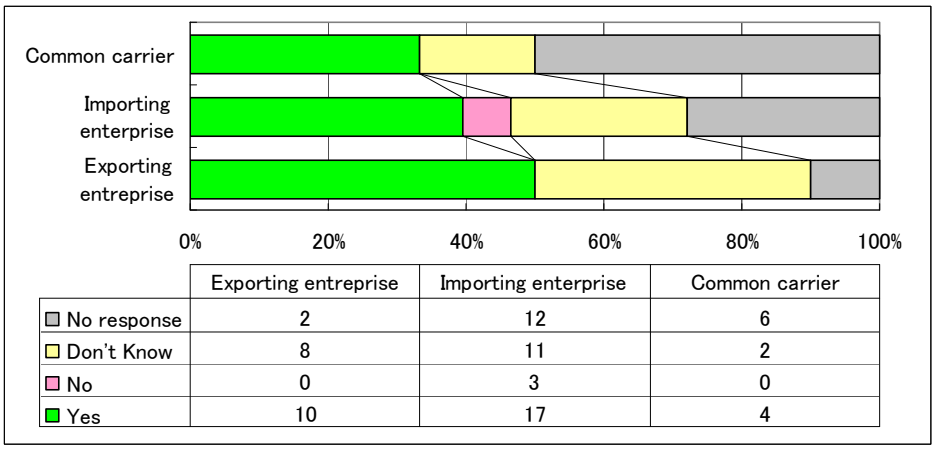
4.2.5 Intention to Change Transport Route and Mode

The GoM aims to develop a new transport route connecting Nsanje District with Beira Port or Chinde Port (does not yet exist) in Mozambique (the Sena Corridor) by road and railway, and inland waterway (the Shire-Zambezi Waterway). The Sena Corridor is approximately 260 km shorter than the existing transport route from Blantyre to Beira Port via the Mwanza Border Post.

To examine the necessity and effectiveness of this corridor, the results of a questionnaire survey of importers, exporters and transport operators regarding their intention to change transport route and mode are presented in the following section.

(1) Intention to Change Route by Business Category

Exporters are the most interested companies in using the Sena Corridor, followed by importers and transport operators in that order. However, the number of companies answering "No Response" or "Don't Know" is quite large in all categories, which leaves uncertainness. Only importers answered "No" (see Figure 4-39).



	Exporting entreprise	Importing enterprise	Common carrier
No response	2	12	6
Don't Know	8	11	2
No	0	3	0
Yes	10	17	4

Source: Study Team

Figure 4-39 Intention to Change Route

(2) Intention to Change Route by Commodity

Table 4-22 and Figure 4-40 summarize intention to change route by commodity and preferred transportation mode by commodity, respectively.

The majority of fertilizer and vehicle importers answered that they intend to change route. However, two food importers answered that they have no intention to change route, because food is mainly imported from RSA.

As for port selection, two transport operators carrying tobacco replied that Chinde Port is preferable while all tobacco exporters gave no response. A tea exporter preferred Beira Port. An exporter of cotton lint chose Beira Port but a transport operator selected Chinde Port for cotton lint export.

Tea and nut exporters as well as fertilizer and vehicle importers tended to choose the railway. Tobacco exporters, fuel importers, and apparel exporters and importers preferred road transportation.

(3) Intention to Change Route by Present Route

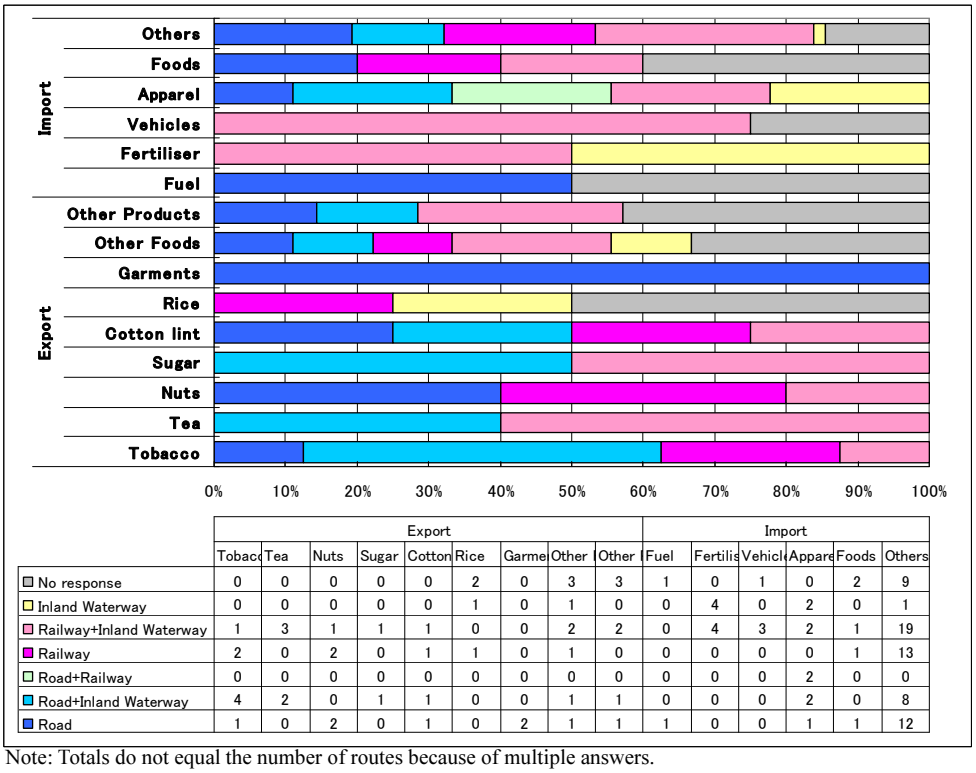
Table 4-23 and Figure 4-41 summarize intention to change route by present route and preferred transportation mode by present route, respectively..

Many companies presently using Beira Port intend to change route from via the Tete Corridor by road to railway if the branch line of the Sena Railway is reconstructed. As for Nacala Port users, all exporters intend to change to road transportation while most importers prefer to change to the railway. Among Durban Port users, exporters selected road and railway transportation at a similar level, although importers preferred railway transportation.

Table 4-22 Intention to Change Route by Commodity

Enterprise	Commodity		No. of Routes	Intention to Change Route				Preferred Port of Sena Corridor		
				Yes	No	Don't know	No response	Beira	Chinde	No response
Export & Import Enterprises	Export	Tobacco	6	2		1	3			6
		Tea	5	2		3		1		4
		Nuts	3	1		1	1	1	2	
		Sugar	1	1				1		
		Cotton lint	2	1		1		1		1
		Rice	3			3			1	2
		Garments	2			2				2
		Other foods	5			3	2		1	4
		Other products	7	3		4		1	1	5
		Fuel	2				2	1		1
		Fertilizer	4	4						4
	Import	Vehicle	5	4		1				5
		Apparel	4	2	1	1		1		3
		Foods	5		2	3		1	1	3
		Others	46	18	2	11	15	11	9	26
Common Carrier	Export	Tobacco	6	2		3	1		2	4
		Tea	4	2			2		2	2
		Nuts	1				1			1
		Sugar	2				2			2
		Cotton lint	2	1			1		1	1
		Rice	1				1			1
		Pulses	2				2			2
	Import	Fertilizer	1	1						1
		Other foods	3				3			3
		Other products	6	2		3	1	1	1	4

Source: Study Team



	Export									Import					
	Tobac	Tea	Nuts	Sugar	Cotton	Rice	Garme	Other	Other	Fuel	Fertilis	Vehicl	Appare	Foods	Others
No response	0	0	0	0	0	2	0	3	3	1	0	1	0	2	9
Inland Waterway	0	0	0	0	0	1	0	1	0	0	4	0	2	0	1
Railway+Inland Waterway	1	3	1	1	1	0	0	2	2	0	4	3	2	1	19
Railway	2	0	2	0	1	1	0	1	0	0	0	0	0	1	13
Road+Railway	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Road+Inland Waterway	4	2	0	1	1	0	0	1	1	0	0	0	2	0	8
Road	1	0	2	0	1	0	2	1	1	1	0	0	1	1	12

Note: Totals do not equal the number of routes because of multiple answers.

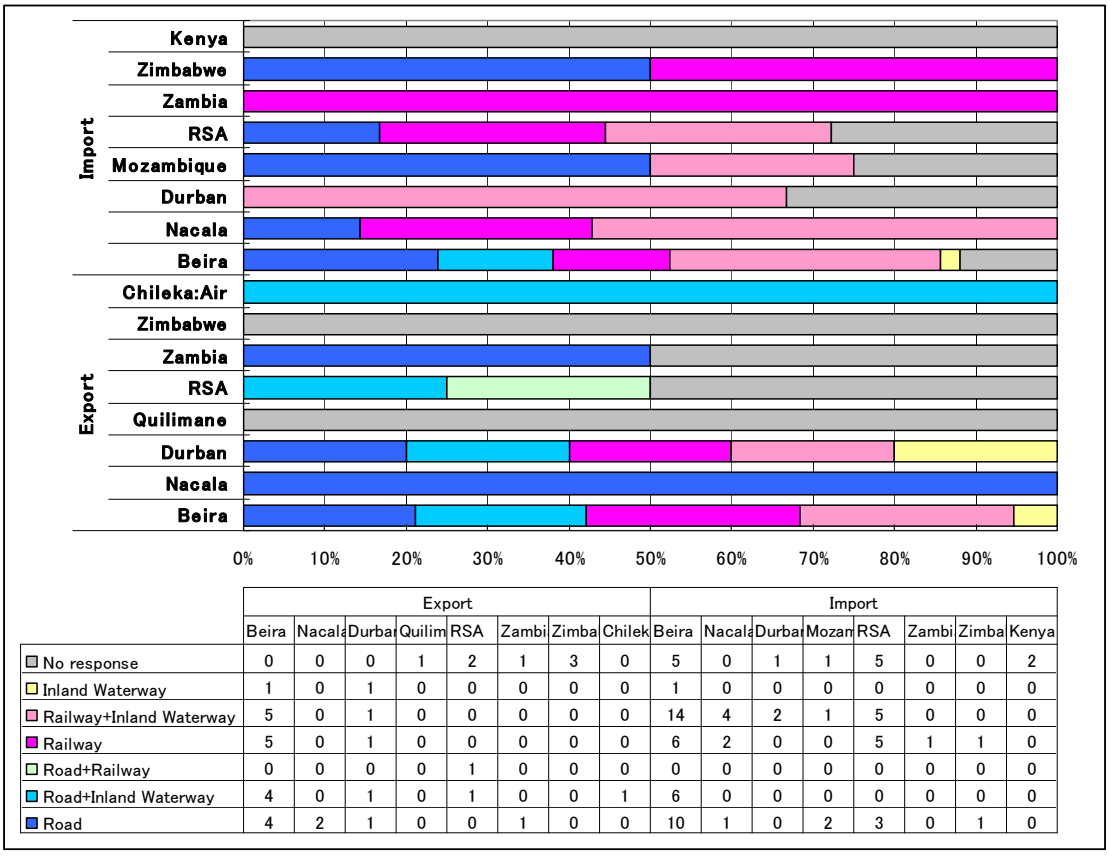
Source: Study Team

Figure 4-40 Preferred Transportation Mode by Commodity

Table 4-23 Intention to Change Route by Present Route

Enterprise	Commodity		No. of Routes	Intention to Change Route				Preferred Port of Sena Corridor		
				Yes	No	Don't know	No response	Beira	Chinde	No response
Export & Import Enterprises	Export	Beira	12	6		4	2	3	1	8
		Nacala	2	1			1			2
		Durban	3			2	1		1	2
		Quelimane	1			1				1
		RSA	4	2		2		1		3
		Zambia	2			2				2
		Zimbabwe	3			3				3
		Chileka: Air	1			1				1
	Import	Beira	33	19	1	5	8	8	6	19
		Nacala	6	4	1	1	1	1		5
		Durban	3	2			1	1	1	1
		Mozambique	3			3			1	2
		RSA	16	3	3	4	3	3	3	10
		Zambia	1			1	1	1		
		Zimbabwe	1						1	
		Kenya	2							2
Common Carrier		Beira	6	3		2			2	4
		Nacala	2			1				2
		Durban	4	1		2			1	3
		Dar es Salaam	2			1				2
		Quelimane	1	1					1	
		RSA	1							1

Source: Study Team



	Export								Import							
	Beira	Nacala	Durban	Quilim	RSA	Zambi	Zimba	Chilek	Beira	Nacala	Durban	Mozam	RSA	Zambi	Zimba	Kenya
No response	0	0	0	1	2	1	3	0	5	0	1	1	5	0	0	2
Inland Waterway	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Railway+Inland Waterway	5	0	1	0	0	0	0	0	14	4	2	1	5	0	0	0
Railway	5	0	1	0	0	0	0	0	6	2	0	0	5	1	1	0
Road+Railway	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Road+Inland Waterway	4	0	1	0	1	0	0	1	6	0	0	0	0	0	0	0
Road	4	2	1	0	0	1	0	0	10	1	0	2	3	0	1	0

Source: Study Team

Figure 4-41 Preferred Transport Mode by Present Route

4.2.6 Present Characteristics of Logistics

Based on the results of the logistics survey, the present characteristics of logistics are summarized as follows:

- The volume of import freight is more than that of export freight.
- Fuel and fertilizer dominate imports by volume, mostly from RSA. Both commodities are mainly transported to Beira Port and Nacala Port by feeder ship and then by road or railway from the ports.
- The main exports are mostly agricultural products and processed agricultural products, such as tobacco, sugar and tea.
- The largest freight volume is to/from RSA and Beira Port through the Durban and Beira Corridors, respectively, followed by the Nacala Corridor to Nacala Port.
- The time taken to Beira Port through the Beira Corridor is 3 to 5 days, and that to Nacala Port by railway is around 5 days.
- Some companies transport commodities to the distant Durban Port to avoid shipping delays at Beira Port due to heavy congestion. Some choose road transportation to avoid the unreliability and uncertainness of the Nacala Railway.
- Many companies interviewed answered that they expected the Sena Corridor to be developed as it would shorten the distance to Beira Port.
- Development of the Sena Corridor is expected to reduce costs by 20-30%, compared to the current transport cost to Beira Port, as shown in Table 4-24.

Table 4-24 Transport Cost by Corridor

Corridor	Port	Mode	Distance from Blantyre (km)	Inland Transport Cost		Cost Comparison
				US$/tonne/km	US$/tonne	
Nacala	Nacala	Railway	80	0.13	103.9	109
		Road	850	0.12	109.8	115
Tete	Beira	Road	825	0.12	95.6	100
	Durban	Road	2,340	0.12	246.2	257
Sena	Beira	Railway	575	0.13	75.4	79
		Railway+ Inland waterway	732 (182+450)	0.12	63.7	67

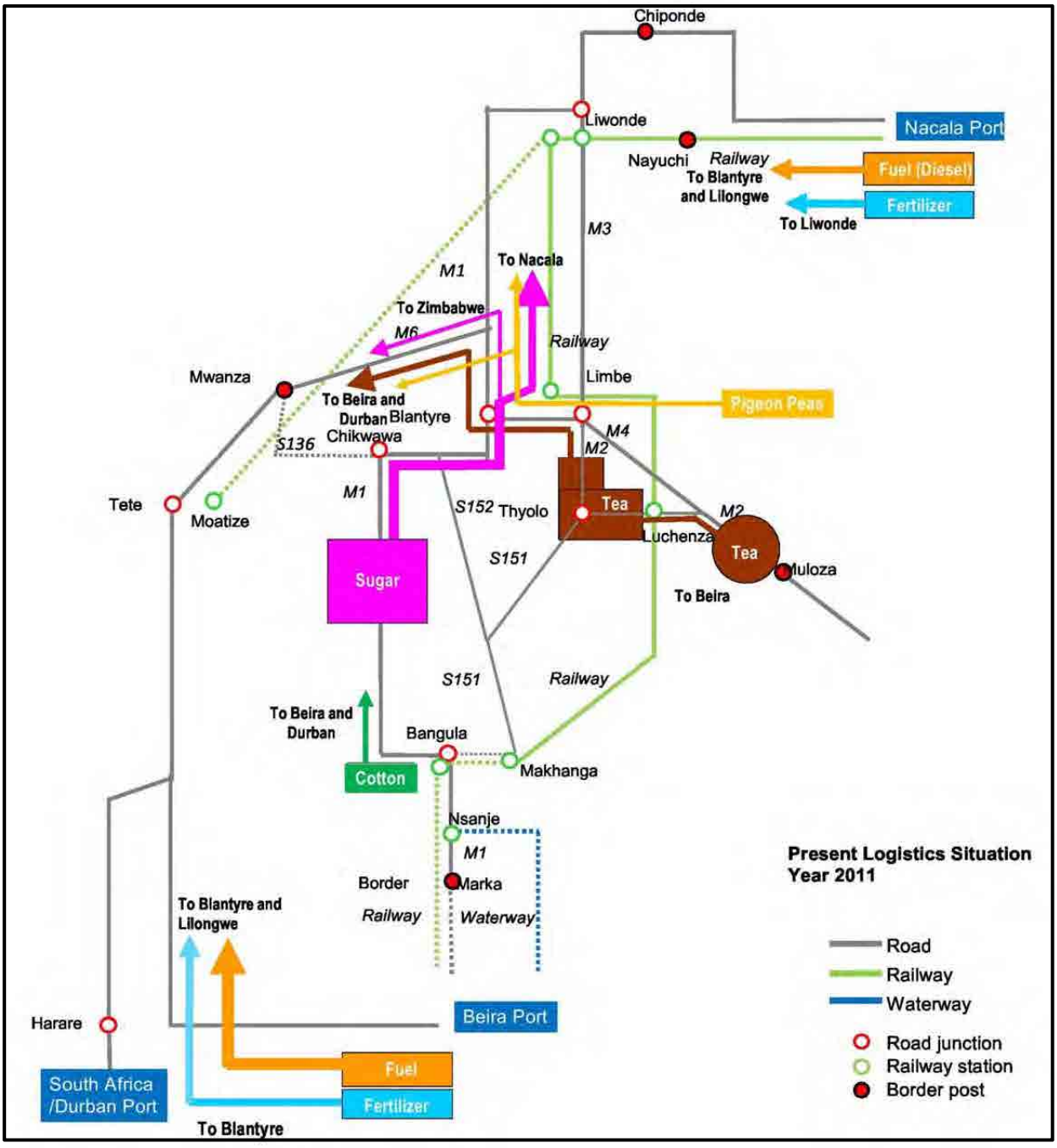
Source: Study Team

4.2.7 Cash Crop and Import Commodity Transport Routes

Cash crops cultivated in the Study Area are transported to ocean ports and major import commodities are transported from ocean ports by the following routes as shown in Figure 4-42:

- Products are mainly placed in containers at Blantyre or Limbe (Logistics centre).
- Sugar is mainly transported to Nacala Port by railway, except exports to Zimbabwe by truck (bulk).
- Pigeon peas are transported to Nacala (railway), Beira and Durban Ports (road).
- Longer transport routes to Durban and Beira Ports (Tea, Tobacco, Cotton, Pigeon Peas).

- Steep gradient sections between Blantyre and Thabwa hinder transportation by limiting the loading capacity
- Fuel is mainly transported from Beira Port.
- Fertilizer is transported from Beira Port by road and Nacala Port by railway.



Source: Study Team

Figure 4-42 Cash Crop Transport Routes