Nigeria, Lagos Urban Transport Master Plan

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1. Introduction

1.1 Background and Purpose

1.2 Scope and Outline

Chapter 1. Introduction

1.1 Background and Purpose

- The Ministry of Land, Infrastructure and Transport is establishing an annual plan for international construction projects in order for the development of international construction projects and to penetrate the international construction market.
- As part of the Korean Ministry of Land, Transport and Infrastructure's Packaged Infrastructure Export Strategy, the "Lagos Urban Transport Master Plan Project in Nigeria" was selected at the Overseas Construction Promotion Committee meeting in June, 2013.
- The Packaged Infrastructure Export Strategy is a method which connects soft infrastructure projects, such as master plans, with follow-up contracts for hard infrastructure projects, which started the development of government-to-government cooperation between Korean government and the governments which it supports.
- Out of 15 countries with potential for overseas construction cooperation, three countries were selected on the basis of a demand survey with respondents from public enterprises, national research institutes, and related institutes.
- Upon Nigeria being selected as one of these three countries, an MOU was signed between the Nigerian Federal Ministry of Transport and the Korean Ministry of Land, Transport and Infrastructure in August, 2013. This MOU was the basis for and gave way to this project.
- Lagos, Nigeria is a central city in Africa's economic activities, with a population of at least 20 million people. However, due to its rapid growth,

Lagos needs a systemic and comprehensive urban transportation system in order to combat motorization and traffic congestion.

- As a result, this Master Plan is to supplement the Lagos Metropolitan Area Transport Authority's 2009 Strategic Transport Master Plan.

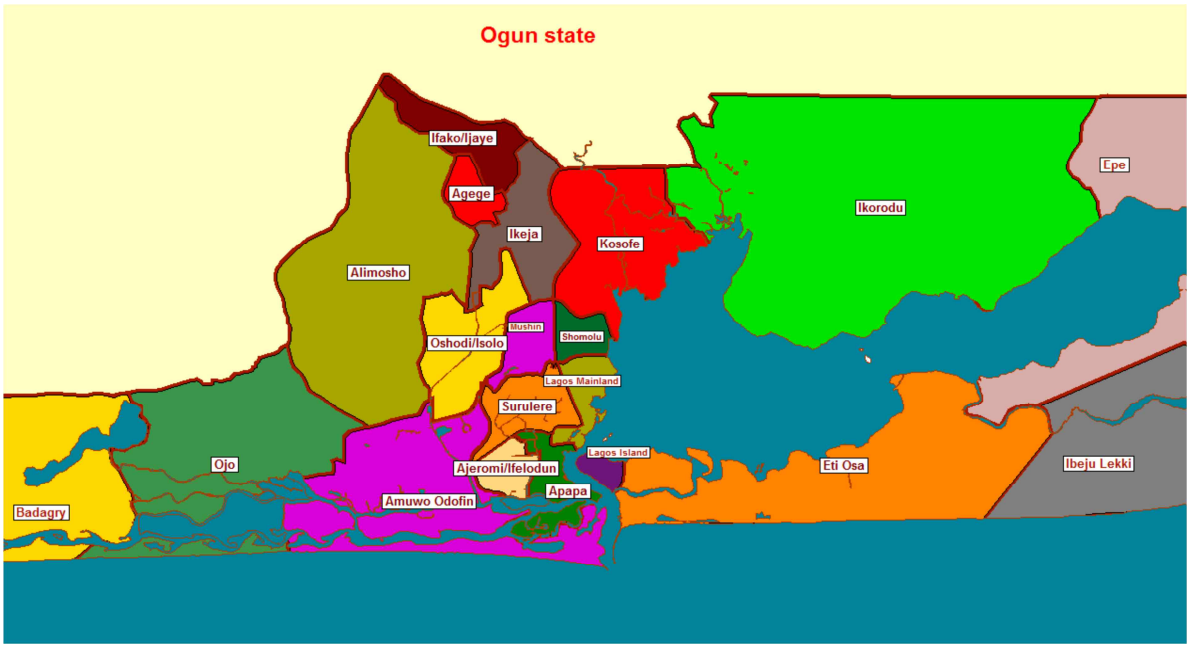
1.2 Scope and Outline

1.2.1 Time Frame

- Time frame of plan: 2015 ~2030
- Medium-term and final target years: 2020/2030

1.2.2 Spatial Boundary

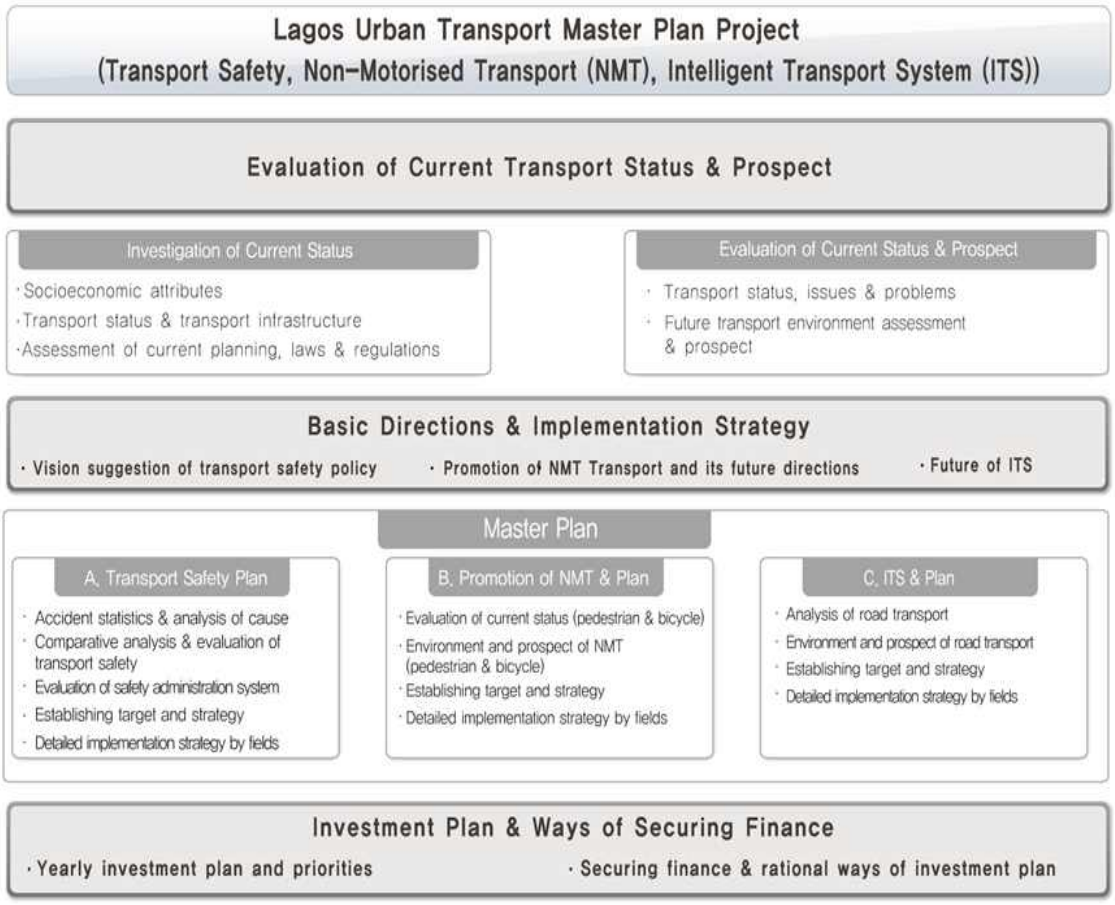
- Lagos State Government, and its 20 Local Government Areas (with the exception of Badagry, Ikorodu, Epe and Ibeju- Lekki) in the Lagos Metropolitan Area



[Figure 1-1] Spatial boundary

1.2.3 Scope of Contents

- Investigation of Lagos' general and transportation conditions in order to assess Lagos' future transportation situation and identify prospective outcomes.
- Upon understanding the transportation situation and prospective outcomes, the Study Team proposed a general direction and strategy for each project area and established the Master Plan. In order for the implementation of these projects, the Study Team also established an investment plan and strategy for securing financial resources.



[Figure 1-2] Scope of Contents

2. Current Status and Problem Analysis

2.1 General Status

2.2 Status and Issues for Transportation Infrastructure

2.3 Status and Issues for Legislation and Policy

2.4 Status and Issues for Relevant Authorities

Chapter 2. Current Status and Problem Analysis

2.1 General Status

2.1.1 Current status of Nigeria

- The Federal Republic of Nigeria is located in West Africa where the south lies on the Gulf of Guinea in the Atlantic Ocean and borders with Cameroon in the east, Niger and Chad in the north, Republic of Benin in the west.
- After Nigeria gained independence from the British colonization, it underwent political instability by regime changes due to several military coups. However, owing to the country's oil reserves, large population, and economy, the country managed to lift its international status to a considerable level in the world stage, and has been identified as predominant in political and economic force in west/central Africa. Nigeria consists of 36 states and 1 Federal Capital Territory.

[Figure 2-1] Map of Nigeria

Source : http://www.vbmap.org/africa-maps-4/map-nigeria-404/

- The Nigerian economy and industrial structure had changed drastically from development and production of petroleum, placing them as the 7th largest producer of petroleum in the world which covers 98.8% (in 2000) of its total exports and accounting for 80% of Government earnings.
- From 1979, the country produced approximately 2.3 million barrels per day placing the 6th largest producer of petroleum from OPEC.
- With approximately 168 million inhabitants, Nigeria is the second most populous country in Africa and is about 4.2 times the size of Korean Peninsula making it the 32nd largest territory in the world. About 33 percent of the land mass is arable.
- With the high oil price from 2003, the country maintained high economic growth rates as the most energy-rich country in Africa. According to the UN, Nigeria was ranked 23rd in the world in terms of GDP in 2012 and it has the highest growth potential from extensive domestic market. However, poor infrastructure, large diffusion of corruption, security issues, etc. cause considerable setback from growing economy and eradicating poverty.

[Table 2-1] National features of Nigeria

Classification	Description
Country	○ Federal Republic of Nigeria
Area	○ 923,768 km^2 (32nd, Approximately 4.2 times of Korean Peninsula) ○ Rate of arable land : 33.02% (2005) ○ Most populated in Africa, land borders with Niger, Benin, Cameroon, Chad
Population	○ Approximately 168.8 million (2012)
Capital	○ Abuja (capital relocated from Lagos in December 12,1991), Area: 7,315 km^2
Foreign Policy	○ Pro-Western open-door policy
GDP	○ US$ 522,000 million (UN figures in 2012, 23rd), Monetary Unit : Naira (N)
Exchange Rate	○ 155.0 NGN(Nigerian Naira) per 1 dollar
Characteristic of State	○ As the most energy-rich country in Africa, possess 37.2 billion barrels of oil (end of 2010, 10th) and 5.3 trillion m^3 of natural gas (9th) maintaining high rate of economic growth from high oil price since 2003 ○ High growth potential by having large domestic market due to abundancy of natural resources but poor infrastructure, large spreads of corruption, security issues are great setback for economic growth and lessen poverty.

Source: Nigeria National Cooperation Strategy 2013-2015, Prime Minister's Office and 20 other ministries (2013)

2.1.2 General Status of Lagos, Nigeria

a. Current status of Lagos

- Lagos is the second largest city in Africa with its population of 17 million (2006). Lagos was the capital of Nigeria until it was relocated to the city of Abuja in 1991. The area of Lagos is about 6 times that of Seoul and the UN anticipates that Lagos would become one of the top three mega cities along with Tokyo and Mumbai in 2015.
- The Lagos Metropolitan Area (LMA) covers approximately 37% of Lagos State, but 85% of the inhabitants are concentrated in the LMA. Constant influx of the population into the city is ongoing and the transport infrastructures are at saturation point to facilitate such a high density of population.
- The State Government has 5 administrative divisions, 20 separate municipalities, and 57 local governments decentralized.

[Table 2-2] Current status of Lagos

Classification	Description
Population	◦ 2006 National Population Census of Lagos State: 17.5million (estimate 21 million in 2015) ◦ (UN Projection) Top 3 Mega City in 2015, 1) Tokyo, Japan 2) Mumbai, India
Area	◦ 3,577 km² (6 times of Seoul, approx. 1/3 of metropolitan area)* * Metropolitan area 11,751 km² - (Seoul) 605 km², (Gyeonggido) 10,136 km², (Incheon) 1,010 km²
Administration	◦ 5 Administrative Divisions*, 20 separate municipalities, 54 local governments * Administrative Divisions (5): Ikeja, Badagry, Ikorodu, Lagos Island, and Epe
State Government	◦ One of the 36 States of Nigeria (Smallest State in Area)
Title	◦ Metropolitan Lagos is approx. 37% of Lagos State having 85% of population concentrated.
Governor	◦ Mr. Babatunde Raji Fashola, SAN ◦ Lagos native born in 1963, Lawyer/politician, elected as governor in 2007 (reelected 2011)

Source: http://www.lagosstate.gov.ng

b. Administration of Lagos

- Among the 24 administrative ministries of the Lagos State Government, ministries related to transportation are the Lagos State Ministry of

transportation, the Motor Vehicle Administration Agency, and the Ministry of Works and Infrastructure.

- The Federal Road Safety Corps as state agency of central government is located at each state, and the Lagos Metropolitan Area Transport Authority, and Lagos State Traffic Management Authority, which are the partner agencies for this project, are transportation authorities under the State of Lagos.

[Table 2-3] Administration of Lagos

Classification	Current Status
Relevant Authorities	◦ 24 administrative ministries & 19 relevant authorities (total of 43) ◦ Transportation related ministries : Ministry of Transportation (LSMT), Motor Vehicle Administration Agency (MVA), Ministry of Works and Infrastructure (LSMWI)
Local Government	◦ 20 LGAs, 54 local administrative units
Transportation Authorities	◦ 80 authorities including LAMATA (Lagos Metropolitan Area Transport Authority) ◦ Transportation related authorities: Lagos State Traffic Management Authority (LASTMA)

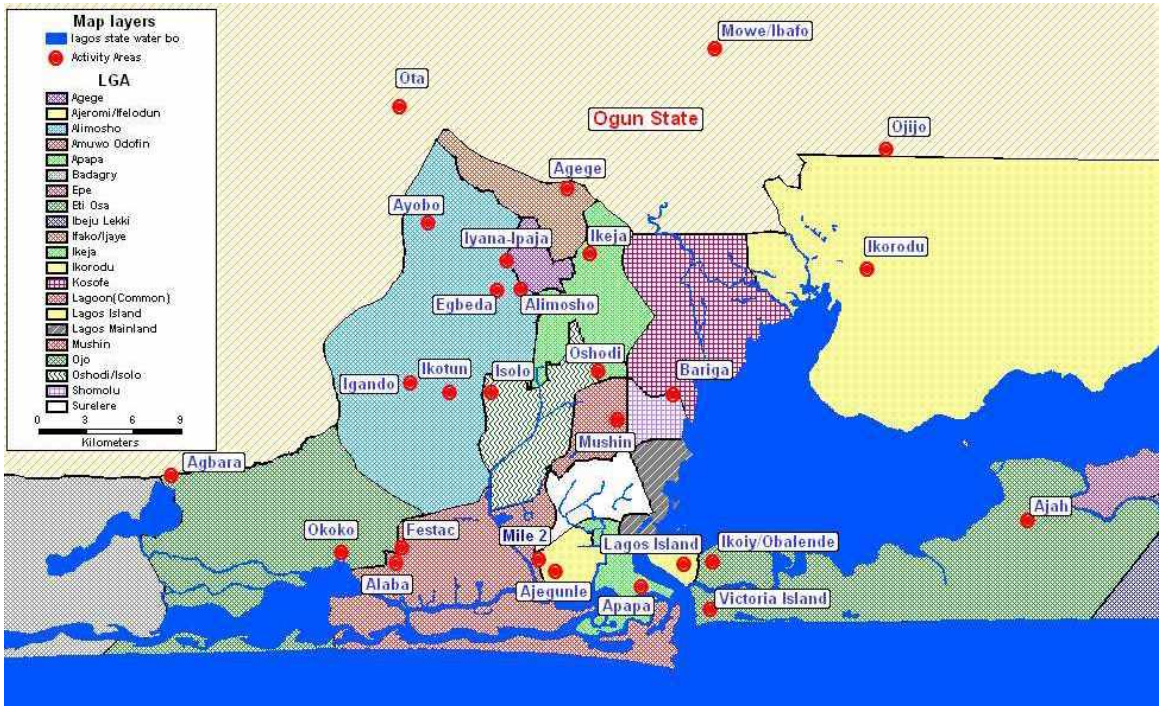
Source: http://www.lagosstate.gov.ng

- 20 Local Government Areas (LGAs) and central area for each zone in Lagos are shown in the figure below.

c. Local Government Areas of Lagos

[Figure 2-2] Metropolitan Lagos State Area Division

Source: LAMATA, The proposed strategic Transport Master Plan for Lagos Metropolitan Area, 2009. 12



[Figure 2-3] Metropolitan Lagos Central Area for Each Area

Source: LAMATA, The proposed strategic Transport Master Plan for Lagos Metropolitan Area, 2009. 12

- The rate of population increase between 2010 and 2011 was 3.2 percent. This figure indicates annual migrating population into the city of Lagos is about 0.64 million and such a constant growth indicates rapid urbanization phenomenon, including especially the severe problems with overloading of transport infrastructure.

[Table 2-4] Socioeconomic index change in Lagos (2010-2011)

No	Classification	2010	2011
1	The State Size	3,577.82 ㎢	3,577.28 ㎢
2	Land Mass	2797.72 ㎢	2797.72 ㎢
3	Water Area	779.56 ㎢	779.56 ㎢
4	Population Figure(Estimated)	19,909,883	20,546,999
5	Population Density	5,566 people/㎢	5,744 people/㎢
6	Annual Population Growth Rate	3.20%	3.20%
7	Average Household Size	5 people/household	5 people/household
8	GDP Per Capita ($)	$80.61	-

Source: Lagos Bureau of Statistics, Ministry of Economic Planning and Budget

2.1.3 Socio-economic indices of Lagos

a. Population

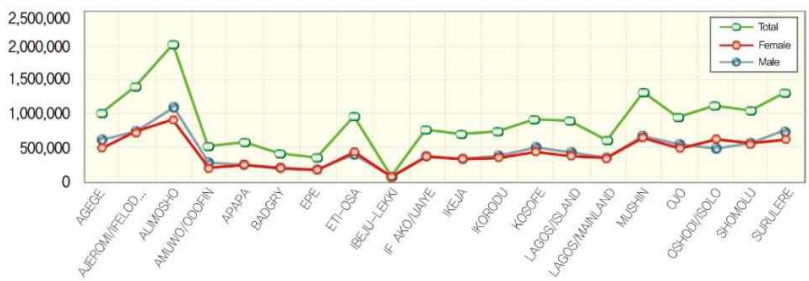
1) Census data

- The latest official 2006 Census figure of Lagos State is 17.5 million and Alimosho is the most populated LGA among 20 LGAs of Lagos which accommodate 11 percent of the total population, and such afigure is 20 times more than that of Ibeju-Lekki.
- Ikeja is concentrated with government offices and commercial areas relatively low inhabitant rate of 3.7 percent of total population but it shows heavy inflow/outflow movement from other regions[Table 2-5] Population Census for each LGA of Lagos State (2006)

(Unit: person)

S/N	Lagos Government Area(LGA)	Male	Female	Total	Proportion
1	AGEGE	564,239	468,825	1,033,064	5.9 %
2	AJEROMI/IFELODUN	723,644	711,651	1,435,295	8.2 %
3	ALIMOSHO	1,099,656	947,370	2,047,026	11.7 %
4	AMUWO/ODOFIN	301,012	223,959	524,971	3.0 %
5	APAPA	264,728	257,656	522,384	3.0 %
6	BADAGRY	187,427	192,993	380,420	2.2 %
7	EPE	153,360	170,274	323,634	1.8 %
8	ETI-OSA	460,124	523,391	983,515	5.6 %
9	IBEJU-LEKKI	49,613	49,927	99,540	0.6 %
10	IFAKO/IJAIYE	380,112	364,211	744,323	4.2 %
11	IKEJA	328,778	319,942	648,720	3.7 %
12	IKORODU	364,207	324,838	689,045	3.9 %
13	KOSOFE	527,539	407,075	934,614	5.3 %
14	LAGOS/ISLAND	461,830	398,019	859,849	4.9 %
15	LAGOS/MAINLAND	326,433	303,036	629,469	3.6 %
16	MUSHIN	684,176	637,341	1,321,517	7.5 %
17	OJO	507,693	433,830	941,523	5.4 %
18	OSHODI/ISOLO	514,857	619,691	1,134,548	6.5 %
19	SHOMOLU	517,210	507,913	1,025,123	5.8 %
20	SURULERE	698,403	575,959	1,274,362	7.3 %
TOTAL		9,115,041	8,437,901	17,552,942	100.0 %

Source: Lagos Bureau of Statistics (2013)



2) Future population

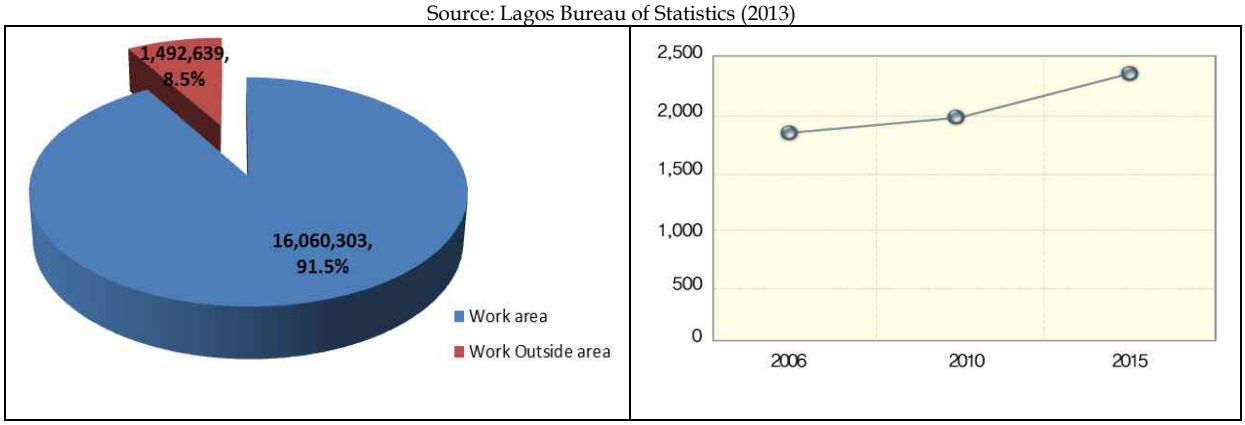
- Lagos State Statistical office projected the population to be 23.3 million by 2015 on their assumption that the annual average rate of population growth of 3.2 percent. This suggests approximately 5.7 million increases in 10 years from 2006 Census, creating various urban issues including rapid housing problems due to explosive population growth.

[Table 2-6] Population Forecast for Each LGA of Lagos State

(Unit: Person)

Local Government Area(LGA)	POPULATION										Growth rate (%)
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
AGEGE	1,033,064	1,066,122	1,100,238	1,135,446	1,171,780	1,209,277	1,247,974	1,287,909	1,329,122	1,371,654	
AJEROMI/IFELODU	1,435,295	1,481,224	1,528,624	1,577,540	1,628,021	1,680,118	1,733,881	1,789,365	1,846,625	1,905,717	
ALIMOSHO	2,047,026	2,112,531	2,180,132	2,249,896	2,321,893	2,396,193	2,472,871	2,552,003	2,633,667	2,717,945	
AMUWO/ODOFI	524,971	541,770	559,107	576,998	595,462	614,517	634,181	654,475	675,418	697,032	
APAPA	522,384	539,100	556,351	574,155	592,528	611,489	631,056	651,250	672,090	693,597	
BADAGRY	380,420	392,593	405,156	418,121	431,501	445,309	459,559	474,265	489,442	505,104	
EPE	323,634	333,990	344,678	355,708	367,090	378,837	390,960	403,471	416,382	429,706	
ETI-OSA	983,515	1,014,987	1,047,467	1,080,986	1,115,578	1,151,276	1,188,117	1,226,137	1,265,373	1,305,865	
IBEJU-LEKKI	99,540	102,725	106,012	109,405	112,906	116,519	120,247	124,095	128,066	132,165	
IFAKO/IJAIYE	744,323	768,141	792,722	818,089	844,268	871,284	899,165	927,939	957,633	988,277	
IKEJA	648,720	669,479	690,902	713,011	735,828	759,374	783,674	808,752	834,632	861,340	3.2
IKORODU	689,045	711,094	733,849	757,333	781,567	806,577	832,388	859,024	886,513	914,882	
KOSOFE	934,614	964,522	995,386	1,027,239	1,060,110	1,094,034	1,129,043	1,165,172	1,202,458	1,240,936	
LAGOS/ISLAND	859,849	887,364	915,760	945,064	975,306	1,006,516	1,038,724	1,071,964	1,106,267	1,141,667	
LAGOS/MAINLAN	629,469	649,612	670,400	691,852	713,992	736,839	760,418	784,752	809,864	835,779	
MUSHIN	1,321,517	1,363,806	1,407,447	1,452,486	1,498,965	1,546,932	1,596,434	1,647,520	1,700,240	1,754,648	
OJO	941,523	971,652	1,002,745	1,034,832	1,067,947	1,102,121	1,137,389	1,173,786	1,211,347	1,250,110	
OSHODI/ISOLO	1,134,548	1,170,854	1,208,321	1,246,987	1,286,891	1,328,071	1,370,569	1,414,428	1,459,689	1,506,399	
SHOMOLU	1,025,123	1,057,927	1,091,781	1,126,718	1,162,773	1,199,981	1,238,381	1,278,009	1,318,905	1,361,110	
SURULERE	1,274,362	1,315,142	1,357,226	1,400,657	1,445,478	1,491,734	1,539,469	1,588,732	1,639,572	1,692,038	
TOTAL	17,552,942	18,114,636	18,694,305	19,292,522	19,909,883	20,546,999	21,204,503	21,883,047	22,583,305	23,305,971	

Source: Lagos Bureau of Statistics (2013)



b. Vehicles

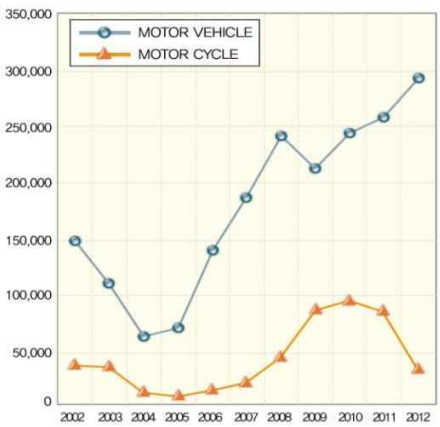
1) Total number of vehicles

- The number of motorcycles continue to reduce due to reduction policy, but the entire number of vehicles increased sharply along with explosive population growth indicating approximately 1 million vehicles registered in 2012 (3 times that of 2002).

[Table 2-7] Total number of vehicles in Lagos State

YEAR	NEW REGISTRATION			RENEWAL			GRAND TOTAL
	MOTOR VEHICLE	MOTOR CYCLE	TOTAL	MOTOR VEHICLE	MOTOR CYCLE	TOTAL	
2002	150,620	33,452	184,072	153,624	3,331	156,955	341,027
2003	111,833	31,776	143,609	112,441	5,843	118,284	261,893
2004	67,376	11,549	78,925	158,694	2,519	161,213	240,138
2005	81,078	8,022	89,100	181,456	4,539	185,995	275,095
2006	141,265	11,846	153,111	205,927	6,461	212,388	365,499
2007	187,442	18,906	206,348	438,649	12,356	451,005	657,353
2008	239,922	42,754	282,676	497,657	14,810	512,467	795,143
2009	210,798	80,414	291,212	577,638	16,762	594,400	885,612
2010	240,963	84,666	325,629	695,641	20,481	716,122	1,041,751
2011	259,473	73,411	332,884	758,958	22,587	781,545	1,114,429
2012	293,864	27,713	321,577	723,595	3,636	727,231	1,048,808
'02 ~ 12 Average Annual increase (%)	6.9	-1.9	5.7	16.8	0.9	16.6	11.9
'02 ~ 12 Increase rate for 10yrs(%)	95.1	-17.2	74.7	371.0	9.2	363.3	207.5

Source: Motor Vehicle Administration Agency and Lagos Bureau of Statistics



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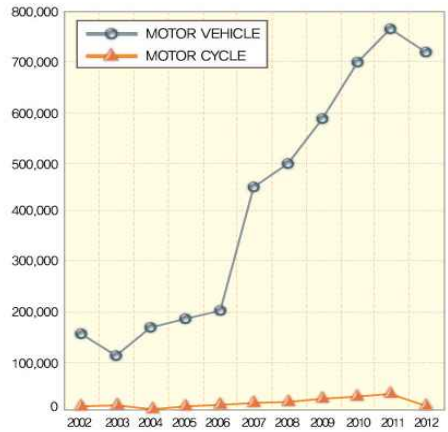


< RENEWAL>

- The rate of registration for used vehicles is 16.8% which is more than twice that of the newly registered vehicles of 6.9%, which leads to anticipate transport safety issues related to deterioration of the aged vehicles in the future.

2) Annual newly registered vehicles

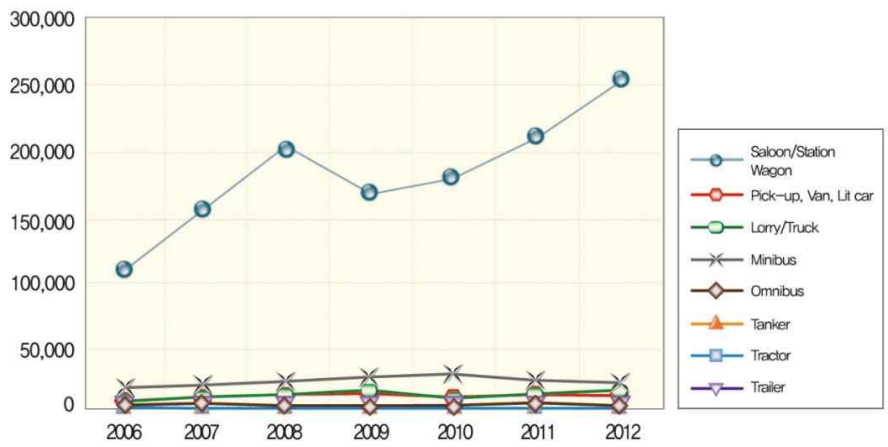
- The newly registered vehicles in Lagos State show rapid increase in parallel to economic and population growth indicating 13% of annual increase for registration of new vehicles from 2006 to 2012.
- The sedan covers most numbers of vehicles with an average increase rate of 13.6%, but it showed steep increase in the last 4 years indicating a high demand to vitalize public transportation. By comparison, industrial vehicles such as lorry/truck (21.7%) and tanker (24.2%) continue to increase rapidly.

[Table 2-8] Distribution of vehicle types in Lagos State

(Unit: Vehicle)

VEHICLE TYPE	2006	2007	2008	2009	2010	2011	2012	Increase rate (%)
Sedan/Station Wagon	118,099	156,858	202,042	166,207	179,841	218,528	253,404	13.6
Pick-up, Van, Lit car	3,616	6,149	7,084	6,995	6,873	6,155	5,817	8.2
Lorry/Truck	4,175	6,357	9,987	13,296	11,152	12,478	13,578	21.7
Minibus	14,290	17,124	19,244	22,351	28,841	20,420	19,424	5.2
Omnibus	485	116	392	434	1,472	611	583	3.1
Tanker	30	61	94	83	38	62	110	24.2
Tractor	50	73	77	81	93	88	52	0.7
Trailer	216	172	157	322	746	36	32	-27.3
Tipper	304	532	845	1,029	823	1,095	864	19.0
TOTAL	141,265	187,442	239,922	210,798	229,879	259,473	293,864	13.0

Source: Lagos State Motor Vehicle Administration Agency (MVAA)



3) Registration of new vehicles by ownership and year

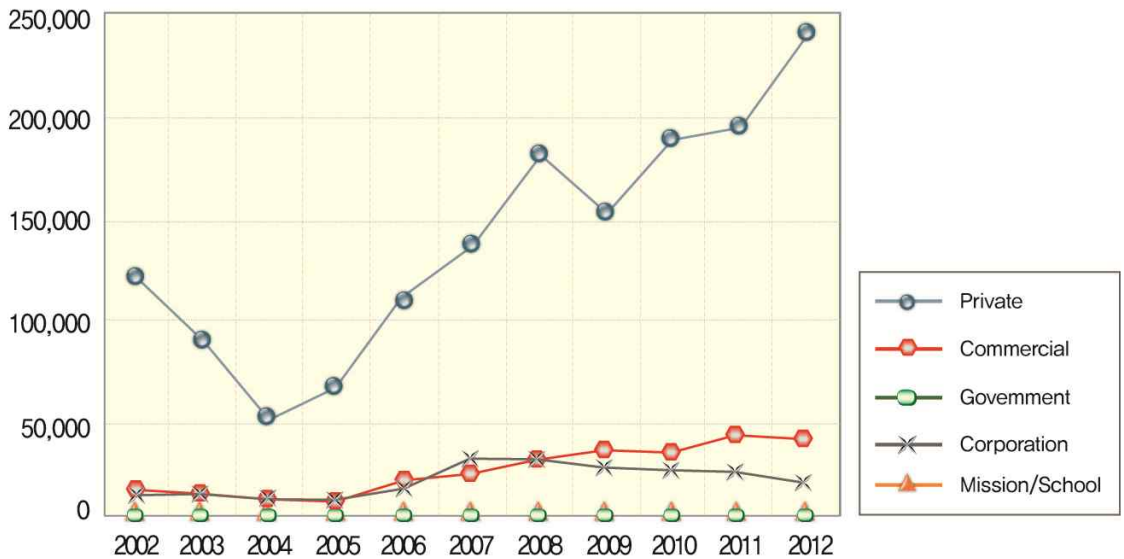
- Commercial vehicles including the mini-buses had increased by more than 10 percent annually over the last 10 years, reflecting its demand due to influx of the population to the LMA.
- Registration rate of the new vehicles is constantly increasing which doubled the rate in the past 10 years.

[Table 2-9] Number of vehicles for each owner in Lagos State

(Unit: Vehicle)

YEAR	Private	Commercial	Government	Mission/ School	Corporation	Total
2002	121,646	15,651	373	419	12,531	150,620
2003	91,669	9,700	148	365	9,951	111,833
2004	53,322	5,879	216	258	7,701	67,376
2005	67,246	5,766	268	235	7,563	81,078
2006	109,436	17,446	571	332	13,480	141,265
2007	138,592	19,484	1,061	1,097	27,208	187,442
2008	181,632	28,425	651	843	28,371	239,922
2009	153,781	32,490	1,170	890	22,467	210,798
2010	186,429	32,978	892	875	19,789	240,963
2011	196,987	43,641	445	747	17,653	259,473
2012	237,697	40,758	618	910	13,881	293,864
'02 ~ 12 Increase Rate (%)	6.9	10.0	5.2	8.1	1.0	6.9

Source: Motor Vehicle Administration Agency and Lagos Bureau Of Statistics



c. Education

1) Schools in each LGA

- In general, the number of schools is proportional to the distribution of population in the region. However, there are also several LGAs with inadequate number of schools relative to the population such as Eti-Osa.
- This can be interpreted as over-crowded schools or high demand to attend schools outside their LGAs of residence.
- On the contrary, Ibeju-Lekki has only 0.6% of population distribution having 37 primary schools relatively large in number.

[Table 2-10] Number of schools in Lagos State (2011/2012)

(Unit: EA)

Local Government Area (LGA)	Primary School	Secondary		College of Education	Technical College	Lagos State Polytechnic	Lagos State University	Population Distribution (%)
		Junior	Senior					
AGEGE	50	8	8	-	-	-	-	5.9 %
AJEROMI/IFELODUN	71	19	20	-	-	-	-	8.2 %
ALIMOSHO	74	25	21	-	1	-	-	11.7 %
AMUWO-ODOFIN	43	20	20	-	1	-	-	3.0 %
APAPA	24	6	6	-	-	-	-	3.0 %
BADAGRY	53	14	13	-	-	-	-	2.2 %
EPE	78	26	25	1	1	-	-	1.8 %
ETI-OSA	35	20	17	-	-	-	-	5.6 %
IBEJU-LEKKI	37	9	9	-	-	-	-	0.6 %
IFAKO/IJAIYE	25	8	7	-	-	-	-	4.2 %
IKEJA	30	13	11	-	1	-	-	3.7 %
IKORODU	57	26	27	-	1	1	-	3.9 %
KOSOFE	41	14	14	-	-	-	-	5.3 %
LAGOS/ISLAND	32	10	10	-	-	-	-	4.9 %
LAGOS/MAINLAND	58	14	9	-	-	-	-	3.6 %
MUSHIN	76	16	15	-	-	-	-	7.5 %
OJO	52	16	15	1	-	-	1	5.4 %
OSHODI/ISOLO	54	25	22	-	-	-	-	6.5 %
SHOMOLU	48	9	13	-	-	-	-	5.8 %
SURULERE	63	28	29	-	-	-	-	7.3 %
TOTAL	1,001	326	311	2	5	1	1	100.0 %

Source: Lagos Bureau of Statistics (2013)

2) Students

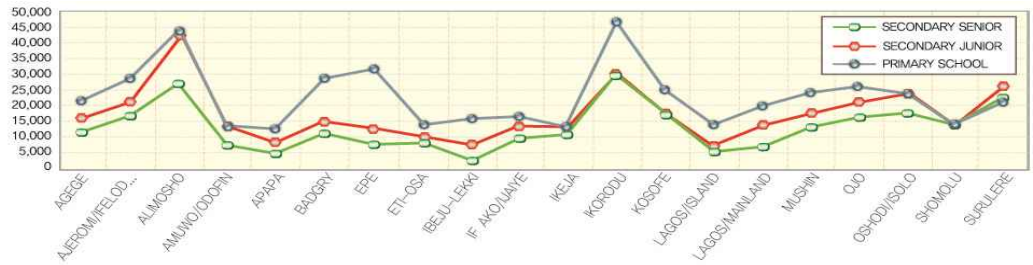
- In general, the number of students in each LGA is proportional to the population, but some regions have more students compare to population (3.9) such as Ikorodu creating unbalanced distribution. It is assumed that this correlates with average age per household for each region.
- On the whole, students from primary schools, junior/senior secondary schools are well proportionate, but there are some regions with more primary schools (Epe) and significantly few primary schools (Shomolu), and such figures need to be taken into account when formulating traffic safety policies for students.

[Table 2-11] Number of students in Lagos State (2011/2012)

(Unit: Person)

Local Government Area (LGA)	Total Students	Population Distribution (%)	Primary School	Secondary	
				Junior	Senior
AGEGE	48,215	5.9 %	21,394	15,960	10,861
AJEROMI/IFELODUN	68,022	8.2 %	29,001	21,861	17,160
ALIMOSHO	113,732	11.7 %	44,037	42,353	27,342
AMUWO-ODOFIN	35,809	3.0 %	14,424	13,793	7,592
APAPA	24,278	3.0 %	11,990	7,707	4,581
BADAGRY	55,311	2.2 %	28,889	15,222	11,200
EPE	51,422	1.8 %	32,065	12,015	7,342
ETI-OSA	32,486	5.6 %	13,655	10,204	8,627
IBEJU-LEKKI	26,649	0.6 %	16,058	7,993	2,598
IFAKO/IJAIYE	39,621	4.2 %	16,249	13,622	9,750
IKEJA	37,555	3.7 %	13,873	13,554	10,128
IKORODU	106,756	3.9 %	46,021	31,117	29,618
KOSOFE	60,926	5.3 %	24,857	18,411	17,658
LAGOS/ISLAND	27,279	4.9 %	13,880	7,786	5,613
LAGOS/MAINLAND	41,400	3.6 %	19,808	14,541	7,051
MUSHIN	55,683	7.5 %	24,121	17,888	13,674
OJO	63,568	5.4 %	26,678	20,657	16,233
OSHODI/ISOLO	65,025	6.5 %	23,046	23,638	18,341
SHOMOLU	42,842	5.8 %	14,729	13,808	14,305
SURULERE	70,029	7.3 %	21,756	25,399	22,874
TOTAL	1,066,608	100.0 %	456,531	347,529	262,548

Source: Lagos Bureau of Statistics (2013)



d. GDP

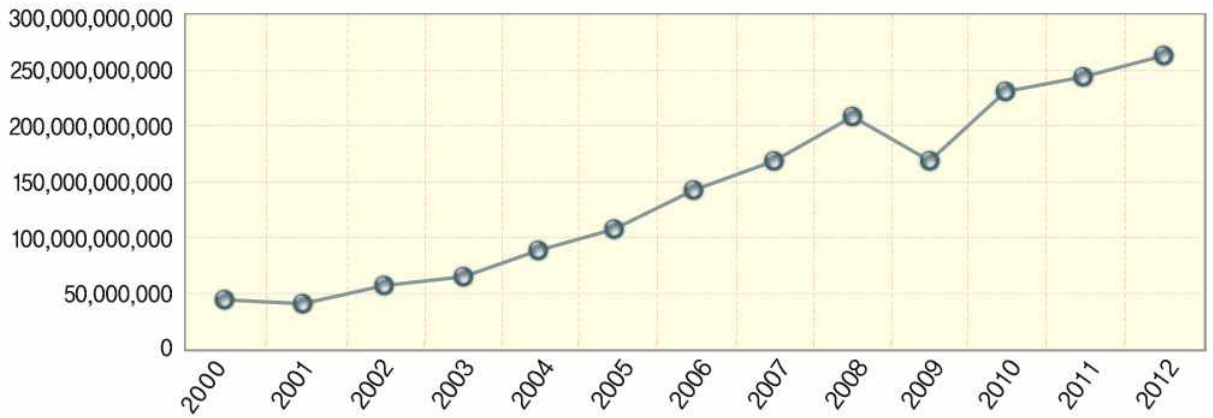
- GDP growth between 2000 and 2012 recorded steep increase of 15.54 percent which is almost entirely resulted from oil price surge in 2000.
- Apart from the drop in GDP during the global financial crisis in 2009, it showed a rapid increase rate on every year, and as of 2014, Nigeria was ranked at the 23rd in the world with total GDP of $552 billion as projected by the World Bank. However, Nigeria ranked the 125th in the world with GDP per capita of $5,746, which reflects its unequal distribution of wealth in scale.

[Table 2-12] Annual GDP of Nigeria

(Unit: $US)

Year	GDP of Nigeria
2000	46,385,996,027
2001	44,138,014,092
2002	59,116,868,250
2003	67,655,840,108
2004	87,845,403,978
2005	112,248,324,603
2006	145,429,802,542
2007	166,451,202,370
2008	208,064,724,514
2009	169,481,270,115
2010	229,507,890,739
2011	245,682,418,219
2012	262,597,405,488
Increase Rate	15.54%

Source: http://data.worldbank.org/indicator/NY.GDP.MKTP.CD



2.2 Status and Issues for Transportation Infrastructure

2.2.1 Traffic Condition in Lagos

a. General traffic in Lagos

- Average Daily Traffic (ADT) in LMA is a typical indicator of migration of people and accessibility of transportation, and the ADT in Lagos is about 10,500,000. This figure is substantially lower than other metropolises in developed countries and only half of ADT of Seoul and Paris. These statistics do not include non-motorized transportation means such as walking. If non-motorized transportation traffic were included, ADT would become higher to a certain degree.

[Figure 2-4] ADT in Lagos (2008)

Source: LAMATA, The proposed Strategic Transport Master Plan for Lagos Metropolitan Area, 2009. 12

- The public transportation in Lagos State consists of unregulated buses such as Yellow Bus, Omnibus, etc. BRT_LITE, and urban rail system are under operation. Also new lines of BRT and railway are under construction or planned. Lagos is served by Murtala Muhammed International Airport which operates both international and domestic terminals.
- When reviewing the transportation mode share, unregulated buses (yellow bus, omnibus) have the highest modal share rate, compared with officially operated public transportation such as BRT.

[Table 2-13] Transportation infrastructure of Lagos

Transportation	Current status
BRT	◦ BRT-LITE (22 km, under operation) & 9 new lines of BRT (planning)
Railway	◦ Blue (27.5 km, 2015), Red (30 km, 2015) & 5 new lines (planning)
Airport	◦ Murtala Muhammed International Airport (Nigeria 4 international air routes, 20 domestic air routes)

[Table 2-14] Modal share of Lagos (2011)

Unregulated bus	Car	BRT	Motorcycle	Water transport	Total
68%	19%	3%	9%	1%	100%

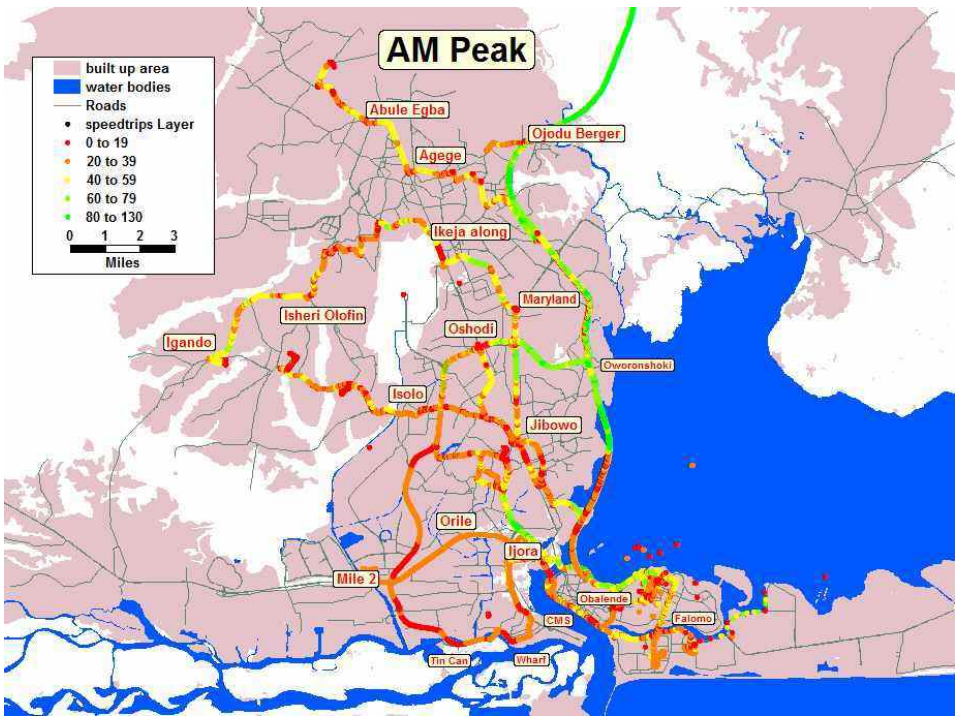
- When studying the roads in LMA, it consists 6.2 percent of arterial roads, 16.9 percent of collector roads, and 76.9 percent of local roads, indicating that arterial roads in urban area are insufficient and establishment of road infrastructure is necessary to secure urban mobility.

[Table 2-15] Roads in Lagos (LMA) (2008)

Classification	Total length (km)	Ratio (%)
Arterial road	468	6.2
Collector road	1,287	16.9
Local road	5,843	76.9
Total	7,598	100.0

Source: LAMATA, The proposed Strategic Transport Master Plan for Lagos Metropolitan Area, December 2009.

- The average speed on arterial roads during AM peak hours of traffic congestion is under 19 mph (peak direction) or 39 mph (opponent direction) for each section. As a result of this, countermeasures shall be taken on road operation and improvement in facilities.



[Figure 2-5] Status of traffic congestion at AM peak hour (2008)

Source: LAMATA, The proposed Strategic Transport Master Plan for Lagos Metropolitan Area, December 2009.

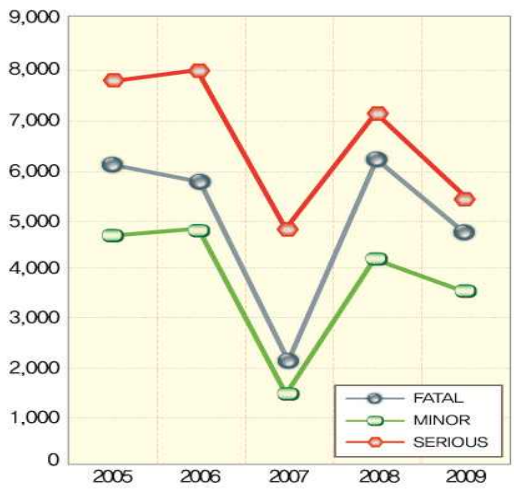
b. National statistics for traffic accident casualties

- When tracking the trends on traffic accidents, data fluctuates between years. For example, traffic accident counts in 2005 are 6,132, while it decreases to 2,162 in 2007, which is 1/3 of 2005. By looking at this, it is assumed there were problems due to data management.
- Reducing such traffic accidents to half takes a very long period of time even for developed countries. In addition, even with such drastic reduction of accidents, higher rate of death fatalities was recorded in 2007 than in 2005 in Nigeria.
- Although the traffic accident data are officially published by Federal Road Safety Commission, it seems to expose problems on data collecting and management system.

[Table 2-16] Traffic accidents in Nigeria

YEAR	CASES				CASUALTY		
	FATAL	SERIOUS	MINOR	TOTAL	KILLED	INJURED	TOTAL
2005	6,132	7,849	4,678	18,659	8,980	16,888	25,868
2006	5,806	8,052	4,804	18,662	9,131	19,200	28,331
2007	2,162	4,812	1,530	8,504	9,390	17,412	26,802
2008	6,345	7,258	4,252	17,855	9,572	19,495	29,067
2009	4,663	5,450	3,571	13,684	5,661	11,055	16,716

Source: Nigeria Police Force/Federal Road Safety Commission



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2.2.2 Transportation Infrastructure in Lagos State

a. Road networks extension

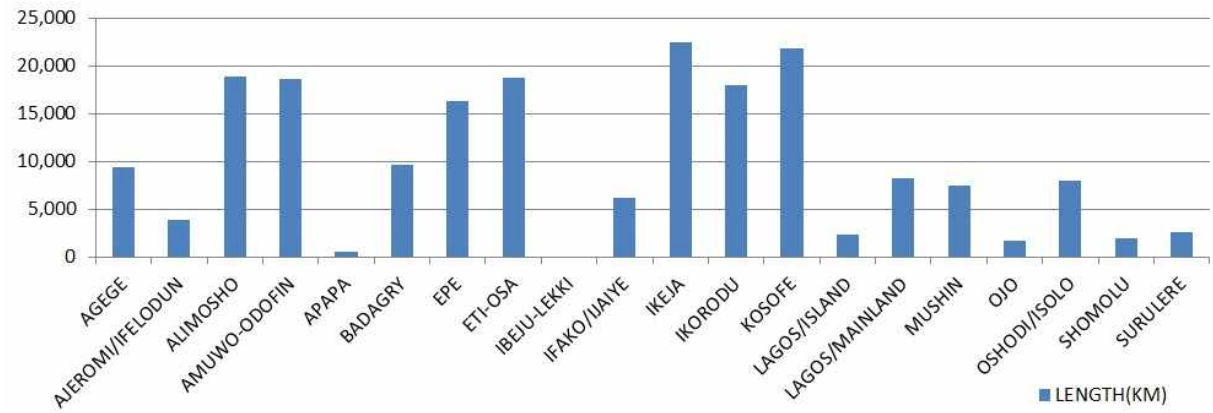
- Based on reviewing the extension of road networks of Lagos State, Ikeja has the most extensive road networks with 22,410 km and Apapa has the shortest road network with 500 km. This can be interpreted there is stronger correlation elements between LGA surface areas with road extension, rather than the population distribution.

[Table 2-17] Road extension on each LGA (2010)

(Unit: km)

Local Government Area (LGA)	Length (km)	Population distribution (%)
AGEGE	9,335	5.9 %
AJEROMI/IFELODUN	3,850	8.2 %
ALIMOSHO	18,890	11.7 %
AMUWO-ODOFIN	18,610	3.0 %
APAPA	500	3.0 %
BADAGRY	9,590	2.2 %
EPE	16,255	1.8 %
ETI-OSA	18,730	5.6 %
IBEJU-LEKKI	N/A	0.6 %
IFAKO/IJAIYE	6,215	4.2 %
IKEJA	22,410	3.7 %
IKORODU	17,990	3.9 %
KOSOFE	21,820	5.3 %
LAGOS/ISLAND	2,300	4.9 %
LAGOS/MAINLAND	8,289	3.6 %
MUSHIN	7,410	7.5 %
OJO	1,740	5.4 %
OSHODI/ISOLO	8,010	6.5 %
SHOMOLU	2,000	5.8 %
SURULERE	2,640	7.3 %
TOTAL	196,584	100.0 %

Source: Lagos State Public Works Corporation



b. Bus rapid transit (BRT)

- Since 2008 Lagos State operates single route of BRT_lite which runs 22 km with 220 buses per day from 6:00 am to 10:00 pm (16 hours), transporting an average of 200,000 passengers per day.
- Single bus transports 800 passengers per day and shuttle operates 5 times a day for each bus (15 minutes of allocation interval, average speed of 30 km/h).

Source: LAMATA Lagos BRT Lite Success Story

[Figure 2-6] BRT in Lagos State

c. Railway

- On behalf of Lagos State Government, Lagos Metropolitan Area Transport Authority appointed CCECC (Chinese Civil Engineering Construction Company) as the contractors for Lagos Mass Rail Transit System (Red and Blue lines) Project which is under construction.
- Construction of the stations for Red line is nearly completed with 30 km in length. The last two stations are Marina and Agbado stations, which use Nigeria Railway Corporation Corridor. Blue line connects Okokomaiko and Marina with 27 km in length.
- Total 23 stations exist for Blue and Red lines. Each line has 13 stations and 3 stations in southern part are shared in both lines.
- The electric trains (H-series), used in Toronto, Canada, are expected to serve with maximum capacity of 300 passengers connecting 4-9 passenger compartments. The operation plan is 3-5 minutes intervals during peak hours and 10-15 minutes interval during off-peak hours. Planned maximum transit capacity is to accommodate 645,000 passengers per day by 2040.

[Figure 2-7] Railway route map of Lagos State

Source: LAMATA Internal Material

2.2.3 Issues

- The estimated ADT in Lagos is remarkably low considering Lagos' population and economical scale in comparison with other similar sized cities. Such a phenomenon means current traffic capacity, transportation infrastructure, and services need to be expanded by twice in scale in a macroscopic estimation.
- Arterial roads suffer from heavy traffic congestion and 2/3 of the road section shows average speed less than 19 km/h during peak hours containing most tangible and endemic problem. Traffic congestion can be occurred by several reasons. Lagos' major cause is overall absence of efficient traffic management and maintenance system for road infrastructure.
- Traffic accident statistics contains extreme fluctuations. Particularly the safety data between the years seems to have poor reliability which can only be used as rough indicators, but not accurate enough to apply as basis to determine target values in such a traffic safety master plan. The reason for such failure derives from lack of coherence in collection system, method, management by professional management agency.
- Currently the intervals for the operated BRT (single route) are infrequent and bus station facilities are saturated with capacity. Therefore, unregulated buses, which managed by private owners, cover 68 percent of modal share and create major traffic problems such as passenger safety, traffic congestion, roadside parking, etc.
- Beside the above mentioned problems, absence of safety trainings to raise traffic consciousness, road maintenance & management and repair system, systematic vehicle inspection, regulatory system etc. are potential problems of overall traffic conditions.

2.3 Status and Issues for Legislation and Policy

2.3.1 Legislation and Policy

- The first recorded National traffic law of Nigeria is "Road Traffic Ordinance of Lagos Colony and Southern Protectorate of Nigeria," enacted in 1920 and was amended to "National Road Traffic Act" in 1949. Since then, various laws, systems and guidelines were established. In present day, the most commonly practiced laws and guidelines are as follows.

[Table 2-18] Principle laws and guidelines

Classification	Title
Law	- <Lagos State of Nigeria Official Gazette>(or 'Lagos State Road Traffic Law') - <Federal Highway Act> - <National Emergency Management Agency (NEMA) Emergency Response Standard Operating Procedure>
Guidelines	- <Nigeria Highway Code> - <LAMATA Social/Environmental Management Guide for Civil Works> - <The Art of Driving> - <Household Database Manual>

- "Lagos State Road Traffic Law" is the current law which contains fundamental traffic regulations composed of 43 clauses, and the latest amendment was updated in 2012. In comparison to other developed countries such as the UK, the Lagos Road Traffic Law lacks details, but it is the most comprehensive law currently applied in Nigeria.
- The acts address traffic control, vehicle control, restrict highways, restrict bridge traffic, scrap vehicles, parking, vehicle inspection, traffic accident protocol, BRT lane violation, over-speeding, and drunk driving as part of the fundamental traffic regulations.
- "Nigeria Highway Code" is the most basic and essential guidelines for all drivers and road users, published by Federal Road Safety Commission. This guideline includes fundamental requirements of safe driving skills and

vehicle operating knowledge for drivers. It is used as a guidebook for written test of driver's license.

- Other relevant guideline is "LAMATA Social/Environmental Management Guide for Civil Works" for an in-depth instruction of traffic management plans during major civil constructions.

2.3.2 Issues

- Road traffic laws of Nigeria lack concreteness compared to those of other developed countries, and one of the typical provisions missing from road traffic laws is design criteria for safe road facilities and infrastructure. Due to such non-existence of design criteria in Nigeria, the country applied the standards from several other countries which induce potential hazards for the drivers and road users
- There are various reasons for violating legal system but poor road infrastructure without proper warning signs and road markings cause significant amount of traffic violations. For example, warned-out road markings are found on most roads which make difficulty to overtake vehicles by changing the lanes lawfully and safely.
- Fundamental law and order of road traffic depends on how the road users understand and are aware of the laws, systems and guidelines, but the issue arises from high illiteracy rate of Nigeria. Based on the National Bureau of Statistics, the adult illiteracy rate is 42.1 percent as of 2010. Such a significant proportion of the road users will experience difficulties in understanding various written laws and regulations and can pose potential risk to the road safety.

2.4 Status and Issues for Relevant Authorities

- The organizations, related with this project, "The Lagos Urban Transport Master Plan," are the Nigerian government, Lagos State Government, and National Police Agency.

2.4.1 Lagos State Government and Ministry of Transportation

- Information for Lagos State Government and Ministry of Transportation are as follows.

Classification	Description
Lagos State Government	• As the federal government of Lagos State, handles all administrative works for whole state. - Lagos Sate Governor: Mr. Babatunde Raji Fashola • Lagos state Government is one of 12 states and has the largest population in Nigeria after Kano state (Population : 17,500,000 / Area : 3,577km^2, 2006) • Lagos state Government has Executive, Legislative, Judiciary Controlling the 54 local governments 20 affiliated Local government area • It is composed of 24 Ministries including the Ministry of Transportation. other related departments : - Ministry of Housing - Ministry of Physical Planning & Urban Development - Ministry of Works and Infrastructure • Having 54 affiliated organizations including the Lagos state university
Ministry of Transportation	• Transportation department in Nigerian authority - Minister: Mr. Idris Audu Umar) - Servant Commissioner: Mr. Kayode Opeifa) • Handling overall policy for transportation: Roads, Railroad, Marine. • Major 5 departments: - Transport Engineering - Transport Operation - Transport Policy and Coordination - Lagos State Traffic management Authority (LASTMA) - Lagos State Waterways Authority (LASWA) Affiliated organization: - Nigeria Railway - Nigeria Ports Authority - Nigeria Maritime Administration and Safety Agency - Nigeria Shippers Council - National Inland Waterways Authority - Nigeria Institute of Transport Technology

Source: Webpages of respective organization and ministry

2.4.2 LAMATA, LASTMA, and FRSC

- Information for Lagos Metropolitan Area Transport Authority (LAMATA), Lagos State Traffic Management Authority (LASTMA) and Federal Road Safety Corps (FRSC) are as follows.

Classification	Description
LAMATA (Lagos Metropolitan Area Transport Authority)	• As the traffic agency in Lagos state, handle the overall plan and management work for Transportation. • Affiliated organization : 1 Motorway Avenue, Alausa, Ikeja, Lagos • Servant Commissioner: Dr. Dayo Mobereola (Managing Director) • a person in charge of this project: Dr. Frederic Oladeinde (Technical Advisor) Heavy Investment field: - LRMT, Lagos Rail Mass transit - BRT, Bus Rapid Transit - Cable car - Traffic Management - Roads • Main business: Plan and management for Transportation project, providing traffic
LASTMA (Lagos State Traffic Management Authority)	• Lagos State Traffic Management Authority (established in 2000) • Governor: Lagos Sate Governor: Mr. Babatunde Raji Fashola • Object of organization : Promoting the smooth traffic flow in Lagos state and improving the social economy activity • As the organization specializing in traffic, LASTMA has the authority for traffic control with policeman and can collect the information for traffic. Also LASTMA only exists in Lagos state, Nigeria
FRSC (Federal Road Safety Corps)	• Federal Roads Safety Corps (established in 1988) Federal Road safety Corps National Headquarters, No.3 Maputo Street, Zone 3 Wuse, Abuja Nigeria Head of • Lagos state: Mr. C.B. Nkwonta • As the Federal authority-affiliated organization, headquarters is located in Abuja and branch is located in every states • FRSC conduct the 'Decade of Action for Road Safety' with having object to reduce in half the victim of roads accident until 2020 • Main works : - Administration and management for road safety - Permission and management for transportation business - Education for Driver - Executing the roads safety policy - Collecting the roads accident data, management and analysis • Although some of works are overlapped with LASTMA's work, FRSC has national strategy and conduct mostly work for expressway safety.

Source: Webpages of respective organization and ministry

2.4.3 Issues

- Because the responsibilities overlap between Federal authorities and the relevant state government authorities in some transport fields, drawing lines of duty is not straightforward. For example, the Federal Road Safety Authority is responsible for collecting the safety data of the Federal roads, and the Lagos Traffic Management Authority is responsible for safety data of the State roads. However, both roads are often shared, and the data on those shared roads are missing from both datasets from FRSC and LASTMA.
- Such a duty separation is deemed inefficient with respect to data collection and management. It also makes the bureaucratic procedures more complex, so that data access by investigators or the public is very time consuming.
- Considering that accurate data collection and analysis are considerably important to mid- and long-term safety planning, the data management issue between the Federal agencies and the State agencies needs to be addressed with urgency.

3. Review of Related Plans

3.1 National Development Strategy: Vision 20:2020

3.2 National Cooperation Strategies 2013-2015

3.3 Strategic Transport Master Plan

3.4 The Lagos Urban Transport Project

3.5 Other Plans Related to NMT

Chapter 3. Review of Related Plans

3.1 National Development Strategy: Vision 20:2020

- "Report of the Vision 2020" written by the National Technical Working Group on Transport in 2010 presents overall transport plans and programs for Nigeria, by establishing strategic plans and goals of each sector, specifically classifying a short-term, medium-term, and long-term plans. In addition, the report analyzes the reasons of inactive investment caused by the current economic conditions in Nigeria and seeks ways for Nigeria's transport investment in various sectors such as roads, railways, ports with diverse financial schemes including Public-Private Partnerships (PPP).
- Mid/Long-Term Strategies for Road and Railway Expansion:

Goal	Strategy	Plan		
		Short term	Medium term	Long term
Transformation of Urban and Regional Transport System	Increase in road density "0.12km/km² → 2.0km/km²"	Increase in road density "0.8km/km²"	Increase in road density "1.4km/km²"	Increase in road density "2.0km/km²"
	Modernization and Increase in railway network density "87.94 → 184.2 km/10,000km²"	Replacement of existing narrow rail track "up to 6,000km"	Expansion of the network "up to 12,000km"	Expansion of the network "up to 17,000km"

3.2 National Cooperation Strategies 2013-2015

- In the last 5 years in Nigeria, the Official Development Assistance (ODA) projects have been mostly carried out at the request of Nigerian government, as a recipient and/or beneficiary country; and their components were supported in accordance with the priority of Nigerian national development plans and

comparative advantage of Korea. However, it was difficult to attract investors to participate in the project due its small scale. Also, the project delays occurred frequently during the project implementation because of the complicated customs process and the difficulty of inland transportation in Nigeria. Among the completed aid projects in Nigeria, the Nigeria's Elementary School Construction Project was favorably reviewed by the Nigerian government as a good practice of ODA Project in the education sector.

- These strategies intend to enhance effectiveness and specialty in the project under close cooperation between the public and the private sectors in order to invigorate PPP projects; and particularly plan to consolidate cooperation between public & private sectors, and national companies which have extensive experiences and relevant capacities, and connection with NGOs with local experiences. For aid harmonization, those aim to strengthen efficiency of the project by sharing information through the participation in donor counties' conference related to development and looking for connected-cooperation method.

3.3 Strategic Transport Master Plan

- "Consultancy Services for the Extension of the Strategic Transport Master Plan and Travel Demand Model to cover the Mega City Region" were carried out to establish a 2020 Strategic Transport Master Plan for the Lagos Metropolitan Area (LMA). This Master Plan was developed in 2014 under the Lagos Metropolitan Area Transport Authority (LAMATA)'s responsibility, financed by the International Development Association (IDA).

- Road Plans

- Composed of a road network on the basis of the existing urban development plan and new development plan

- Consider capacity and connectivity of road network, improvement of regional accessibility in order to connect the sub-regions of urban areas

- Contain road network of intra downtown Lagos and road networks for long-distance traffic

Public Transport Plans

- Incorporate public transport plan for new development area(s)

- Propose a new corridor (connection route) of LRT which reaches Lekki International Airport

o Transport Plan for the Developing and Growing Urban Area

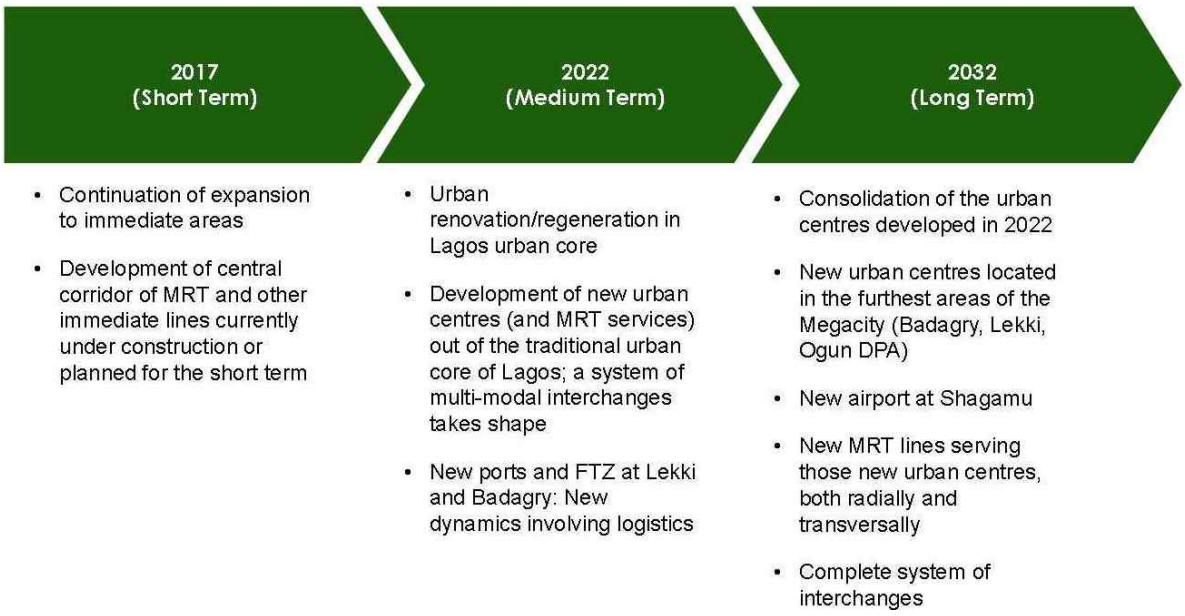
- Focus on the major commercial zones where main markets and stores are distributed

- Include Main Transport Hubs

- Include Areas of High Commercial/Industrial activity (in location related to airport, port etc.)

o Proposed Initiative Plan by Stage

- More than 40 projects were planned by three stages: Short Term (2017), Medium Term (2022), and Long Term (2032), respectively.

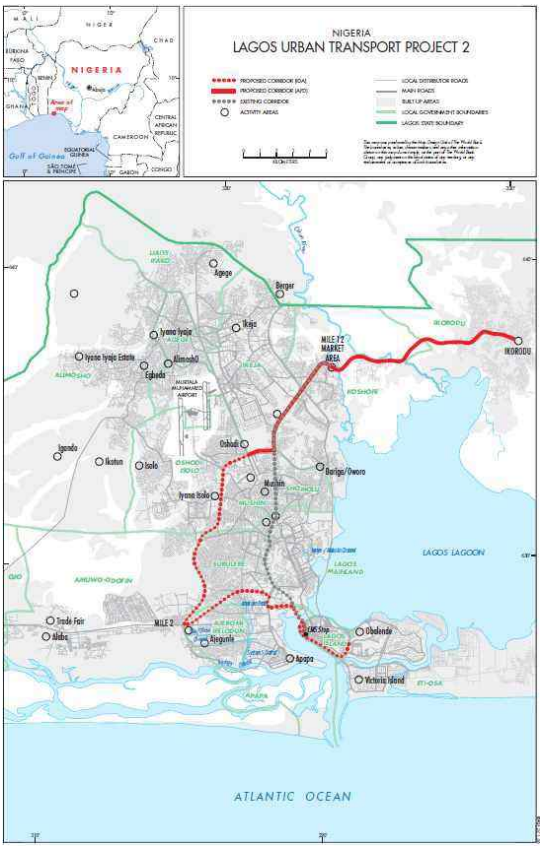


[Figure 3-1] Main criteria for the distribution of the harmonized proposal in the three stages

- Plan 2017 focuses on East (Lekki), West (Badagry) and North (Ota conurbation and Ogun Development Area) regions; and the surrounding key developing areas.

3.4 The Lagos Urban Transport Project

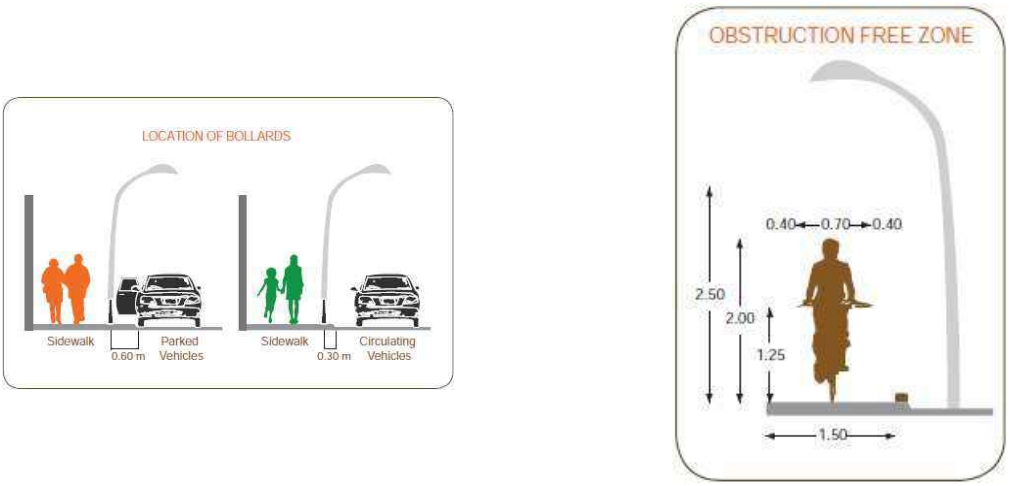
- "Lagos Urban Transport Project (LUTP)" was carried out for the target year 2012 to increase transport capacity of Lagos Metropolitan Area (LMA) with particular reference to the public transport network.
- The project LUTP was procured by the World Bank and implemented by Lagos Metropolitan Area Transport Authority (LAMATA) with the project cost of US$130 million, of which $100 million was provided by IDA. The Board approved US$50 million of the additional financing to the project in 2007 due to the unanticipated cost overrun for scaling up the bus services enhancement component. Based on the best practices in Bogota (Colombia) and Curitiba (Brazil), the 22-km BRT-Lite corridor has generated considerable demand for the additional mass transit services in the LMA.



[Figure 3-2] BRT route map (planned)

3.5 Design Criteria for Non-Motorized Transport in Africa

- "Share the Road" developed by the United Nations Environment Program (UNEP) was planned to secure road safety and provide guidelines for urban non-motorized transport environment for developing countries, especially in Africa.
- Although the majority of citizens in developing countries use Non-motorized Transport (NMT), the roads are mostly designed for automobile. In this regard, "Share the Road" addresses the importance of safe promotion of NMT with an objective to separate NMT users from dangerous road traffic.



[Figure 3-3] Proposed design criteria for pedestrian and bicycle path

4. Urban Transport Master Plan

4.1 Transport Safety

4.2 Non-Motorized Transport

4.3 Intelligent Transport Systems

Chapter 4. Urban Transport Master Plan

4.1 Transport Safety

4.1.1 Background

- Lagos was the capital of the Federal Republic of Nigeria until the capital was relocated to Abuja, and Lagos is still the largest city of Nigeria with respect to its scale of socio-economic index and population.
- Currently, in Lagos State, a number of plans related traffic have been continuously established including 「Consultancy Services for the Extension of the Strategic Transport Master Plan and Travel Demand Model to Cover the Mega City」, 「The Lagos Urban Transport Project Ⅰ and Ⅱ」, etc. Also, there are investment plans for construction of traffic infrastructure facilities.
- Road traffic safety, however, is the area that is relatively less addressed in the extant plans thus far. This part of the chapter identifies the issue of road traffic safety in the Lagos Metropolitan Area with objectives to establish and propose a variety of road safety projects that will address those safety issues to eventually reduce the road traffic accidents and casualties in LMA.

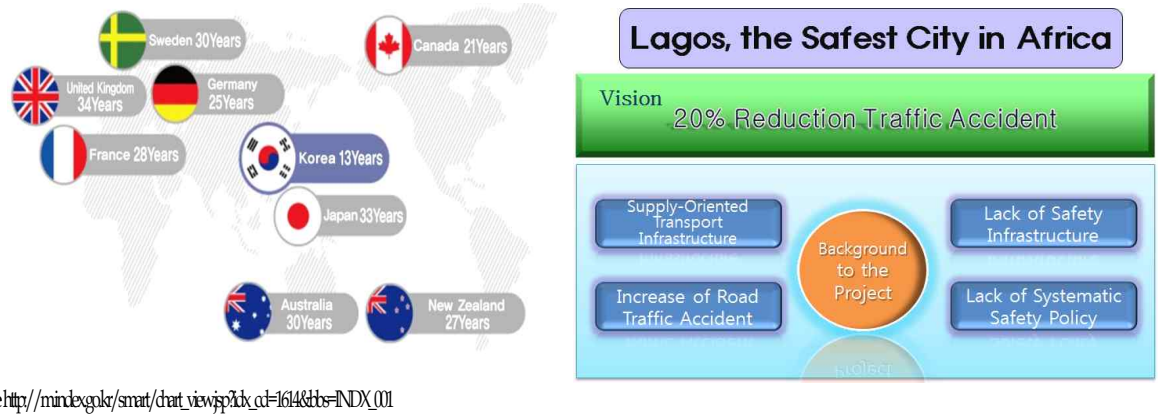
4.1.2 Necessity of Plan

- The population and number of vehicles have continuously increased in LMA, and are also expected to further increase in the future with the current rate of economic growth and migration to the city. Accordingly, as the capacity of the current transport infrastructure is investigated, the road traffic safety is one of the directing transport problems in LMA.
- Improving road safety statistics is a time-consuming process, and costly. For example, the traffic safety education to settle safety practices in road users' living habits requires plans for education materials, policy formulations, and education course development. Each process needs time for plan and execution. Therefore it is important to start planning as early as possible.

- The child population counts for 41.83% (National Population Commission. 2006), which is a considerably significant proportion, and is a clear indication that the significant emphasis in road safety policy needs to be focused on children safety and education in a longer term perspective for the fact that they are vulnerable road users and become future drivers and road users.

4.1.3 Direction

- Establishment of the Road Traffic Safety Master Plan is based on the traffic safety observation and investigation of transport infrastructure and environment. In order to establish improvement methods and countermeasures, the current safety status and problems need to be clearly identified.
- The main objective of the Master Plan is to identify solutions to reduce traffic accidents. Its key elements for countermeasures include re-engineering of the road infrastructure, re-organization of traffic safety related agencies, education for school children as well as adults, improvement of the laws and regulations.
- As for a realistic vision to estimate traffic accident reduction target, we pay our attention to the performance of the advanced western countries in terms of their efforts to reduce road accident fatalities. The indicative scale of the reduction target was established on the basis of the period of half-life (i.e., time it took to reduce roads fatalities by half) and the target year of this master plan. The average half-life of the 8 countries considered is 28.5 years (excluding South Korea since it was exceptionally short 13 years) (Figure 4.1-1). Considering that the target year of the master plan is 15 years and the fact that the traffic volume is expected to increase due to continuous construction of roads and railways, the achievable reduction rate in 15 years would be 20% reduction in the total number of road accident fatalities in LMA. This figure indicates an annual reduction rate of 1.3% which is slightly lower than 1.7% applied in the advanced countries.



Source:http://mindex.go.kr/smart/chart_view.jsp?idx_cd=1614&idx=INDX_001

[Figure 4.1-1] Status on half-life of traffic accident in the advanced countries

4.1.4 Analysis on Status and Problem

a. Status and Problem of Traffic Accident in the Metropolitan Area of Lagos

1) Monthly/yearly traffic accident status

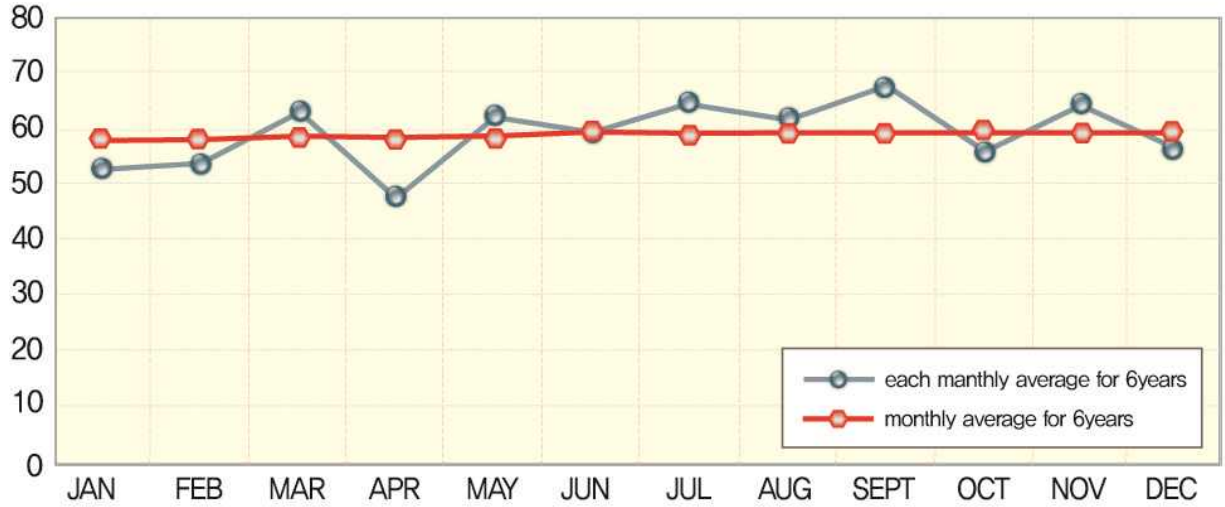
- Despite of lacking clear pattern, the number of traffic accidents decreased during years 2008 and 2011 before significant increases in 2012 and 2013.

[Table 4.1-1] Status on traffic accident on a monthly/yearly base in Lagos

(Unit: number)

Classification	2008	2009	2010	2011	2012	2013
JAN	65	8	52	40	18	139
FEB	51	25	31	34	81	102
MAR	68	59	17	54	41	138
APR	50	41	24	33	29	114
MAY	72	63	36	54	55	96
JUN	90	77	41	25	60	58
JUL	49	62	47	42	81	95
AUG	59	73	69	35	71	65
SEPT	93	53	86	26	90	65
OCT	24	62	40	40	93	72
NOV	16	61	56	15	155	84
DEC	19	27	69	55	87	82
TOTAL	656	611	568	453	861	1,110

Source: Data provided by Lagos State Traffic Management Authority (LASTMA)



2) Number of Vehicles involved in Traffic Accidents

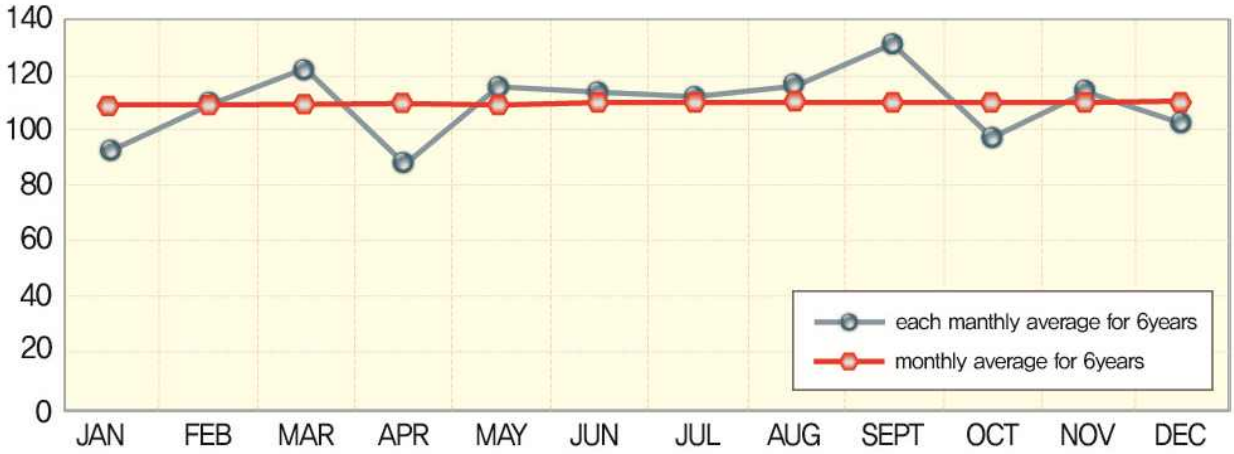
- According to the data on the number of the annual traffic accident, similar pattern as the number of accidents: decreasing during years 2008~2011 but it tends to increase significantly from the year 2011.
- The peak for the accidents is the October, 2012. Three months from January to March were shown as the peak in 2013.

[Table 4.1-2] Number of monthly/yearly traffic accident in Lagos

(Unit: car)

Classification	2008	2009	2010	2011	2012	2013
JAN	111	14	53	83	38	249
FEB	107	50	77	67	153	203
MAR	116	137	35	111	77	257
APR	87	61	52	74	63	197
MAY	133	104	72	110	96	184
JUN	166	112	91	50	136	127
JUL	108	81	90	85	141	171
AUG	91	116	147	75	142	137
SEPT	144	90	185	58	174	138
OCT	54	74	76	77	184	118
NOV	34	46	118	31	302	156
DEC	33	33	139	122	135	155
TOTAL	1,184	918	1,135	943	1641	2,092

Source: Data provided by Lagos State Traffic Management Authority (LASTMA)



3) Casualties

- According to the data on the monthly/yearly fatality by traffic accidents, inconsistent fluctuation is shown annually. 87 fatalities have been analyzed to be the highest in August, 2010.
- In addition, it has been shown that fatalities increased significantly in 2011 and 2012. This shows similar trend to the traffic accident transition.

[Table 4.1-3] Number of casualty by monthly/yearly traffic accident in Lagos

(Unit: person)

Classification	2008	2009	2010	2011	2012	2013
JAN	26	2	7	0	0	10
FEB	25	6	3	8	11	9
MAR	11	23	1	8	22	15
APR	7	5	2	5	7	17
MAY	11	8	6	10	6	9
JUN	8	8	8	4	10	6
JUL	12	6	15	5	17	21
AUG	10	18	87	13	13	2
SEPT	29	24	13	5	17	4
OCT	6	1	5	4	21	8
NOV	5	7	7	4	19	11
DEC	3	0	19	3	28	23
TOTAL	153	108	173	69	171	135

Source: Data provided by Lagos State Traffic Management Authority (LASTMA)

4) Casualty

- Also, monthly/yearly casualties fluctuate. The peak for the casualty during the analysis period is June, 2008 which is 206.
- Although the number of casualties has been reduced in 2008 and 2009, it has been highly increased in 2012.

[Table 4.1-4] Casualty of monthly/yearly traffic accident in Lagos

(Unit: person)

Classification	2008	2009	2010	2011	2012	2013
JAN	112	7	36	24	10	83
FEB	111	53	36	21	37	60
MAR	68	64	11	74	44	92
APR	38	32	26	15	21	59
MAY	124	56	44	91	46	88
JUN	206	56	20	13	48	49
JUL	112	16	55	23	58	74
AUG	166	50	144	41	99	46
SEPT	168	71	82	27	45	50
OCT	51	20	27	48	73	36
NOV	27	44	50	13	155	65
DEC	22	12	79	53	72	84
TOTAL	1,205	481	610	443	708	786

Source: Data provided by Lagos State Traffic Management Authority (LASTMA)

5) Accident Severity (1995~2012)

- When simply comparing the data of 1994 to 2012 in each accident severity category, it has been shown that heavy accidents, fatality and light accident have been reduced by -11.61%, -9.34% and -6.63% respectively.

- In addition, according to data for the year 2004 and 2011, a sharp drop is observed in 2011 after a long spell of missing data. This shows the kind of data management issue experienced when one encounters large part of missing data. This also raises the issue of data collection mechanism which will be discussed in the latter part of the report.

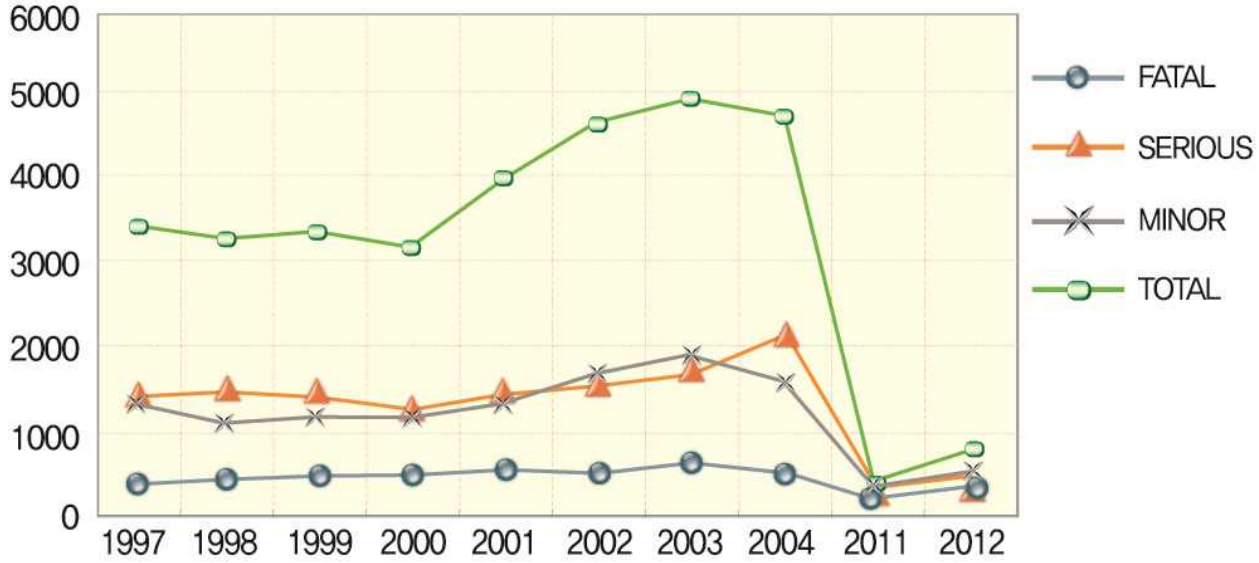
[Table 4.1-5] Number of Accident Type in each Year in Lagos State

(Unit: number)

Classification	Accident Type			
	Fatality	Heavy Accident	Light Accident	Total
1995	544	1,533	1,492	3,569
1996	-	-	-	-
1997	505	1,529	1,413	3,447
1998	510	1,571	1,174	3,255
1999	529	1,543	1,247	3,319
2000	523	1,400	1,263	3,186
2001	677	1,726	1,531	3,934
2002	683	1,837	2,007	4,527
2003	837	1,935	2,229	5,001
2004	686	2,121	1,943	4,750
2011	47	143	263	453

2012	116	240	505	861
Growth rate('97~'12)	-9.34%	-11.61%	-6.63%	-8.83%

Source: Lagos State Traffic Management Authority (LASTMA)



6) Number of Traffic Accidents by Severity and Vehicles involved

- As the data analysis result of the average annual rate in years between 2008 and 2013, it is observed that the number of accidents and the number of accident related vehicles have increased over the years, while the numbers of fatalities and injuries have reduced.
- As the analysis result on the recent 3-year data, the numbers of fatalities and injuries have increased in comparison with the year 2011.

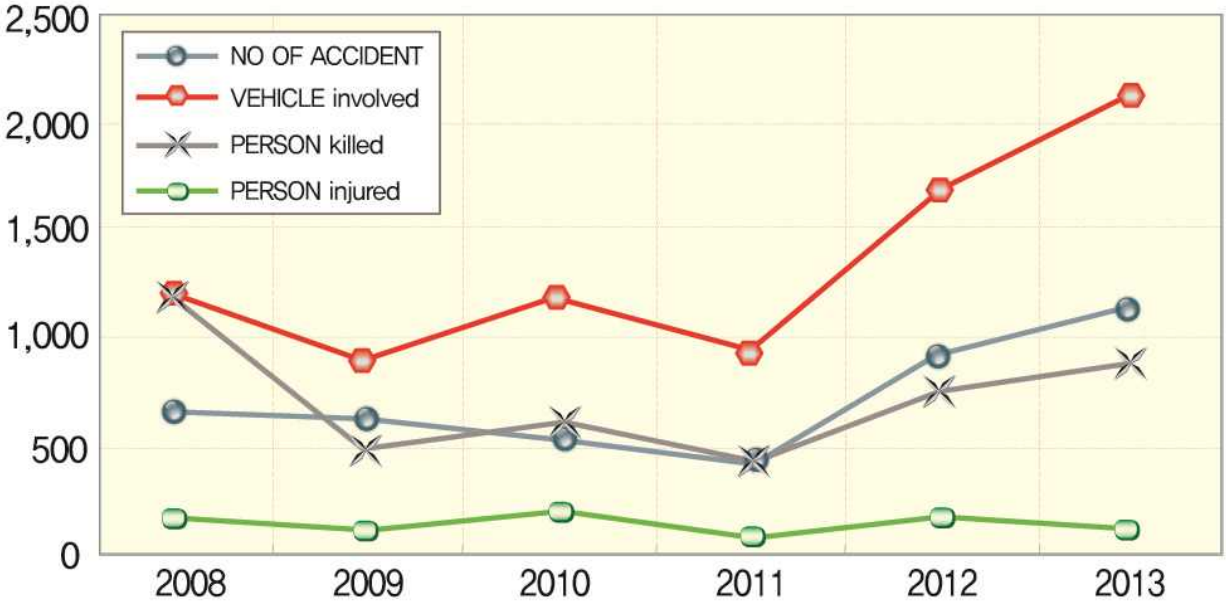
[Table 4.1-6] Number of traffic accidents by severity and vehicle involvement

(Unit: number)

Each Year	2008	2009	2010	2011	2012	2013	Average Annual Growth Rate (%)
NO OF ACCIDENT	656	611	568	453	861	1,110	11.09
VEHICLE involved	1,184	918	1,135	943	1641	2,092	12.06
PERSON killed	153	108	173	69	171	135	-2.47

PERSON injured	1205	481	610	443	708	786	-8.19

Source: Data provided by Lagos State Traffic Management Authority (LASTMA)



7) Number of Monthly Average Accident for 6 Year Total

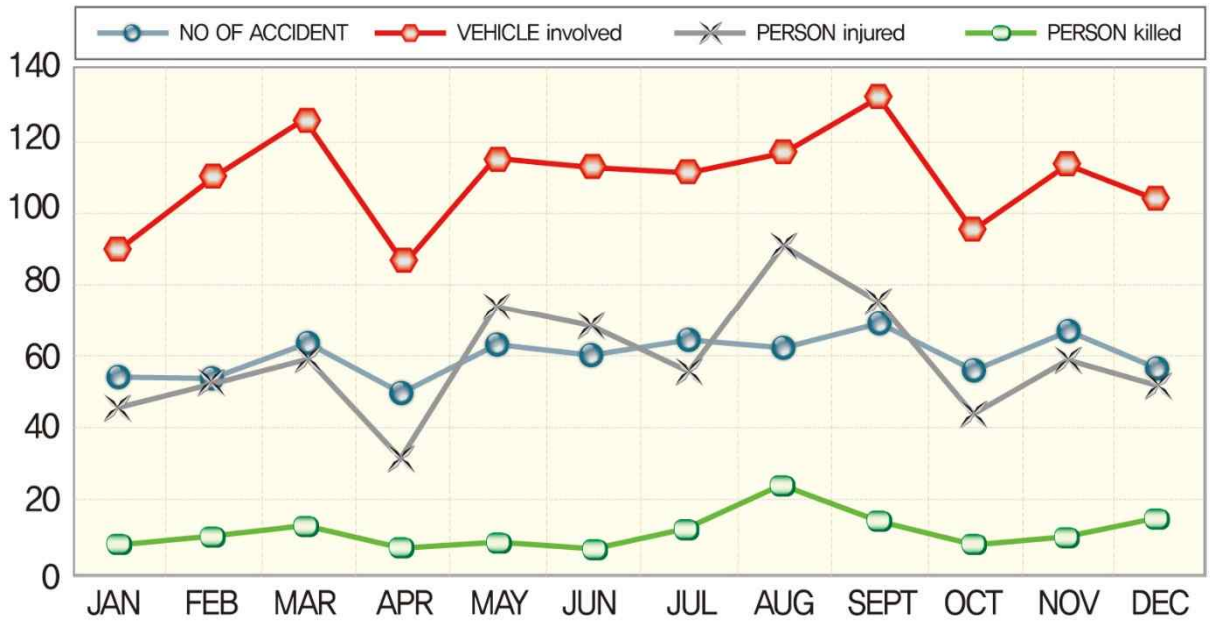
- According to the monthly average incident rate, it shows that traffic accidents occur considerably in August and September, which is deemed related to the rainy season and road flooding.
- As a whole, it shows that the traffic accidents occur less in December and January. According to the 4 analyzed accident indices, the number of the accidents is less in April and October.

[Table 4.1-7] Monthly average accident rate

(Unit: number)

Classification	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL
NO OF ACCIDENT	54	54	63	49	63	59	63	62	69	55	65	57	710
VEHICLE involved	91	110	122	89	117	114	113	118	132	97	115	103	1,319
PERSON killed	8	10	13	7	8	7	13	24	15	8	9	13	135
PERSON injured	45	53	59	32	75	65	56	91	74	43	59	54	706

Source: Data provided by Lagos State Traffic Management Authority (LASTMA)



8) Analysis of FRSC Accident Data

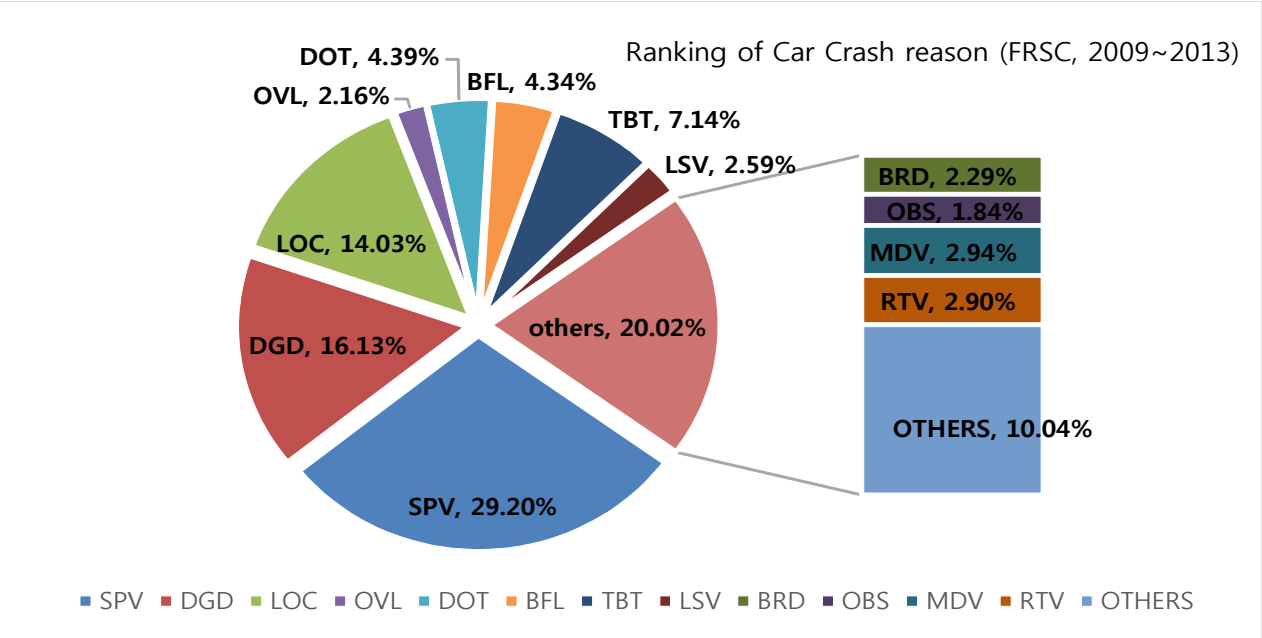
- The FRSC (Federal Road Safety Corps) classifies the causes of the road traffic accidents into 12 categories as shown in the table below. From the FRSC dataset between 2009 and 2013, the most critical cause of the road traffic accident in LMA was speeding followed by reckless driving and driver distraction.
- These causes are related to driver's behavior, which accounts for 66.7% by comparison to other categories of causes including vehicle defects and road conditions.

[Table 4.1-8] Analysis of accident cause between 2009 and 2013

Accident Cause		No. of Accidents	Accident Rate
SPEEDING (SPV)	Speeding	19,213	29.20%
DANGEROUS DRIVING (DGD)	Reckless Driving	10,616	16.13%
LOSS OF CONTROL (LOC)	Driver Distraction	9,231	14.03%
OVERLOADING (OVL)	Overload	1,421	2.16%
DANGEROUS OVERTAKING (DOT)	Dangerous Overrunning	2,889	4.39%
BRAKE FAILURE (BFL)	Brake	2,854	4.34%
TYRE BURST (TBT)	Tire Failure	4,699	7.14%

LIGHT SIGN VIOLATION (LSV)	Infringement of Street Sign etc.	1,706	2.59%
BAD ROAD (BRD)	Poor Condition of the Road	1,509	2.29%
STATIONARY VEHICLE/OBSTRUCTION (OBS)	Stationery Vehicle / Obstacles	1,213	1.84%
MECHANICALLY DEFICIENT VEHICLE (MDV)	Vehicle Defect	1,934	2.94%
ROUTE VIOLATION (RTV)	Infringement of Lane	1,911	2.90%
OTHER	Miscellaneous Items	6,609	10.04%

Source: Federal Road Safety Corps (2009~2013) Data

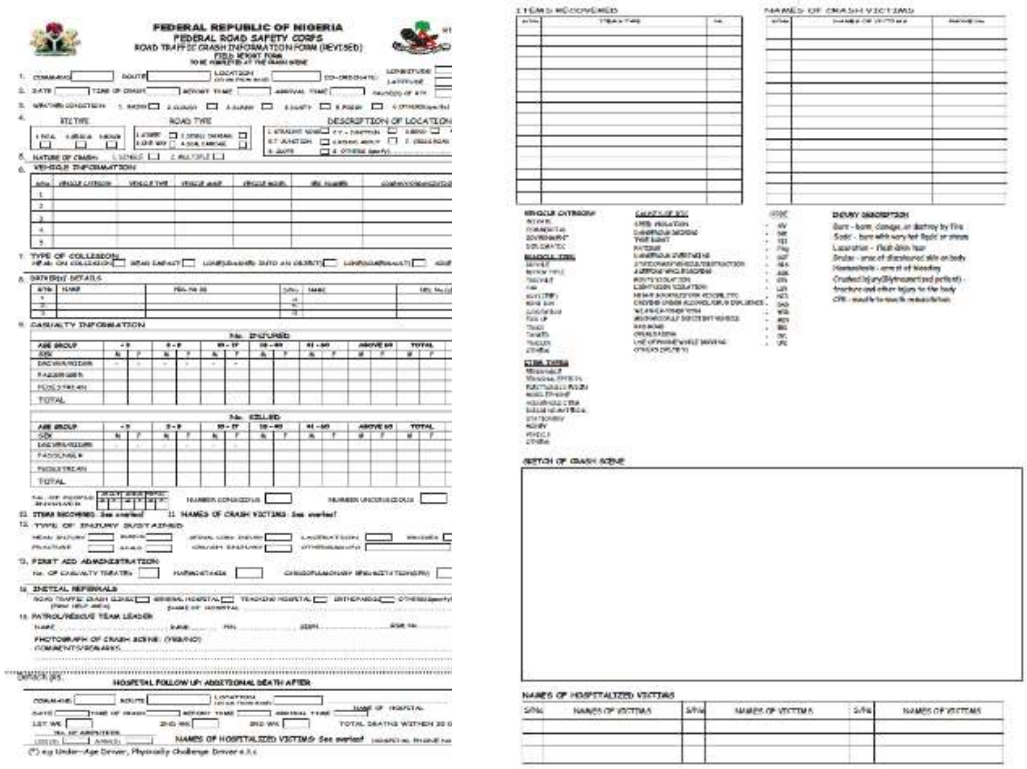


9) Result and Problem for Analysis on Accident Data

- A number of problems were experienced while analyzing the accident dataset including missing data and severe year-to-year fluctuation. And their causal factors are largely unknown. The numbers they present seem rather unreliable by commonsense judgment and they require reliable data management system.
- Between years 2002 and 2012, the number of vehicles rapidly increased by 3 times. However, traffic control devices such as lane marking and traffic signs, pedestrian crossings are rarely found in most urban roads.

[Figure 4.1-2] Urban road status in Lagos

- Accurate analysis on the cause should be carried out in order to reduce the traffic accidents and the improvement methods should be accordingly planned and executed. Therefore, the traffic accident database system should be established to collect, analyze, and make easily accessible to the public. Furthermore, the collected data should be configured in such a way to figure out the accident causes in a straightforward way for both professionals and the general public, if one needs to analyze them.



[Figure 4.1-3] Accident index Table of FRSC

b. Organization Status and Problem for Traffic Safety

- There are five main organizations for transport in the Lagos State, which are connected to one another in terms of the administration and duty allocation as the Federal Ministry for Transport is the central one.
- The five organizations are Ministry of Transportation (MOT), Motor Vehicle Administration Agency (MVAA), Lagos State Traffic Management Authority (LASTMA), Logos Metropolitan Area Transport Authority (LAMATA), and LAGBUS Assets Management Company Limits (LAGBUS). Three of the five, which are MOT, LAMATA and LASTMA, are the most relevant ones that administer the traffic safety in LMA.
- Others relevant bodies include Federal Road Safety Corp (FRSC) and Lagos State Safety Commission (LSSC). The FRSC is the federal government organization and is in charge of the safety regarding the inter-region connection roads while the LSSC is under operation since May, 2009 with missions to promote safety culture, construct statistics on safety and enforce the improvement method on safety.
- LASTMA is in charge of the accidents on the inner-city roads of the LMA including the connection roads between regions. FRSC manages traffic accident data for the connection roads between regions and LASTMA does for the Lagos inner roads. Therefore, quantity of the data collected from both organizations should be sufficient, but because the duties and areas in charge by both organizations somewhat overlap in a number of ways. Therefore a strategic way of integrating the data management system is required for a more efficient data collection/management system.

[Figure 4.1-4] Lagos State Safety Commission Homepage

c. Status and Problem of Traffic Safety Education

- 'The School Traffic Safety Advocacy Program' is under operation in Lagos State. The education aims to improve the understanding of the road traffic safety and minimize the damage by the road traffic accidents.
- The program consists of four elements: (1) Traffic Safety Clubs, (2) Traffic Safety Labs, (3) School Driver Safety Education, and (4) Annual Road Safety Awareness Program. According to the traffic safety club activities, a quiz festival was hold to provide concession to winners for visiting the transport museum and transport-related institutes in England in 2009 and 2010.
- Although the students are attracted to voluntarily participate in the program in Lagos Metropolitan Area, the irregularity of the event prevents it from having a sustainable effect, hence is in need of consistent investment and promotion.
- To continue such a program, it should be supported by legally binding framework such as "Traffic Safety Education Act", and education specialists need to be nurtured.

[Figure 4.1-5] Competition on Nigerian traffic safety and case of London visit

d. Status and Problem on Legal System in Traffic Safety

- Three major traffic acts have been applied in the Lagos Metropolitan Area. The contents of each act are summarized below.

[Table 4.1-9] Major Traffic acts applied in the Lagos Metropolitan Area

Classification	Main Contents
Lagos state road traffic law	·General items are proposed regarding the road operation. Contents on regulations like drunk driving etc. ·Contents on punishment in case of infringement of the regulations
Federal Highway Act	·Contents on construction, use of federal expressway, etc.
NEMA Emergency Response Standard Operating Procedures	·Contents on organization and operation of an emergency team, handling method in each emergency situation, etc.

- As we look into the foregoing status, the articles of 'Lagos State Road Traffic Law' specifying general items regarding the road operation of the 3 Acts is made of 43 articles. In comparison to other laws, for example the Korean Road Traffic Act, its coverage of the safety aspects including protection of children on the road, an

exclusive lane for pedestrians and their protection are insufficient. Such elements of road safety articles need to be further added to be effectively applied to implementation of road safety.

- The traffic safety-related acts should be additionally introduced in order to implement the systematic traffic safety policy.
- For example, the Korean Road Traffic Act was first enacted in 1961 to secure safe traffic by removing risks and obstacles on the road traffic. As the Traffic Safety Law regulates the policies on the traffic safety, the Act boosts systematic and planned proceeding. Accordingly, the Traffic Safety Law was established in 1979 to contribute to the improvement of the public welfare.
- As 'Traffic Safety Law' was established in 1979, 'Traffic Safety Basic Plan" and 'Traffic Safety Policy Deliberative Committee' have been established to proceed overall and long term traffic safety plan in Korea.
- The traffic-related acts should be complemented to have legal background on the detailed proceeding projects specified in the master plan on the traffic safety area.

e. Analysis of Survey Result

1) Objective and Method of Survey

- The survey has been conducted in order to ascertain the current status of the traffic safety in the Lagos Metropolitan Area by asking the opinions of the general public and the professionals. The contents of the survey consisted of the status of the traffic safety, problems, priority of the improvement methods, etc.
- It has been carried out with two target groups of polices and specialists in LAMATA, FRSC and LASTMA.

2) Characteristic of Target

① Gender distribution

- According to the distribution of a gender, 287 males and 212 females have been analyzed to account for 57.5% and 42.5%, respectively.

- According to the classification of the resident and specialists, all the respondents were 418, which composed of 220 males and 418 females, accounting for 52.6% and 47.4%.

- In case of specialists, of the total 81, 67 (82.7%) were male and 14 were female (17.3%) so that proportion of a male was by far higher than the one of a female.

② Age

- Persons in the age of thirties were the highest portion as 37.3%, followed by those in twenties as 36.5%.

- For respondents consisting of residents, those in twenties were the highest portion as 39.7%, followed by those in their thirties as 37.6%.

- For the specialist group, those in thirties and forties showed the same portion as 35.8%.

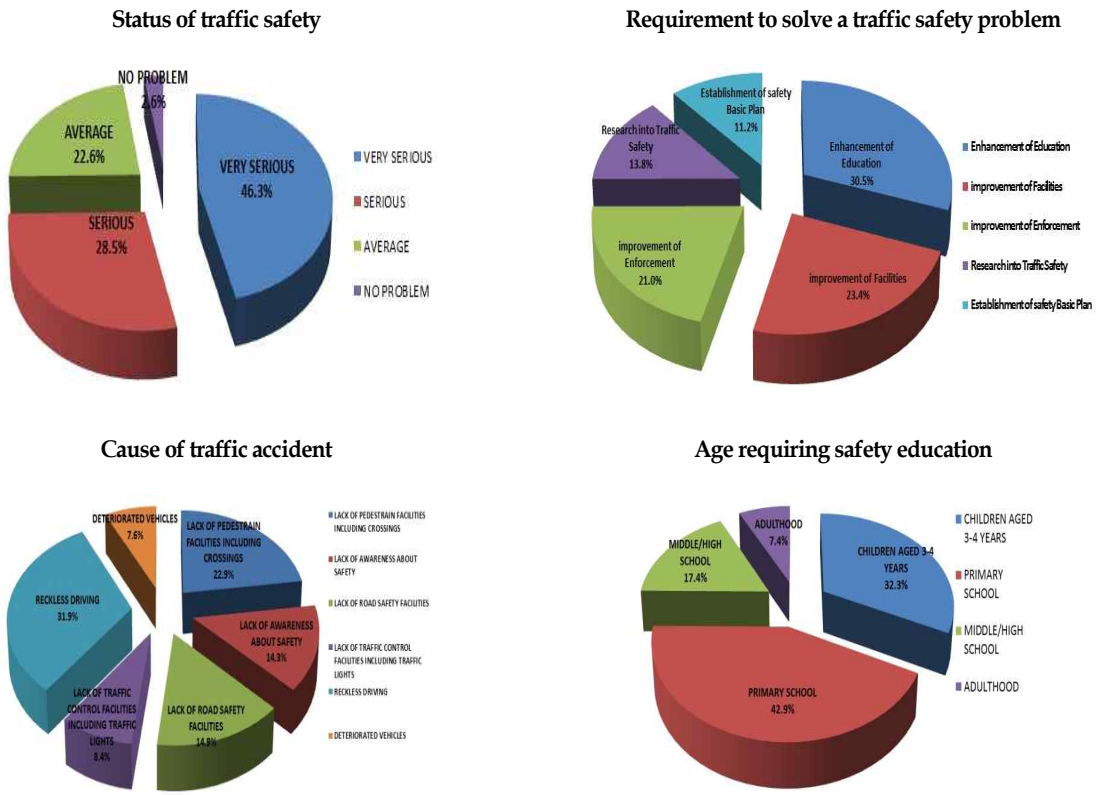
[Table 4.1-10] Analysis Result of the Survey Respondent in each Age

Age	Overall		Resident		Specialist	
	No. of Respondent	Percentage	No. of Respondent	Percentage	No. of Respondent	Percentage
10's	18	3.6	18	4.3	-	-
20s	182	36.5	166	39.7	16	19.8
30s	186	37.3	157	37.6	29	35.8
40s	80	16.0	51	12.2	29	35.8
50s	26	5.2	20	4.8	6	7.4
60s +	7	1.4	6	1.4	1	1.2
Total	499	100.0	418	100.0	81	100.0

3) Analysis Result of Survey

- According to the result on the Survey in each major item, the level of the traffic safety showed severe status, and hence requires its improvement. For the traffic safety, residents and specialists responded the enforcement of the traffic safety education and extension of the safety facilities as a high priority, respectively.

- Although the respondents answered that the education should be carried out from elementary school in the item on the traffic safety education, 64.7% gave their actively positive response on the education from the infant (at the age of 3~4).
- For the questionnaire on the cause of a traffic accidents, respondents answered reckless driving, lack of safe facilities for pedestrians, lack of road safety facilities as the main causes of accidents in order.
- As a result of the survey, it has been analyzed to require improvement method on the drivers and facilities which are the main causes for the accidents (for details, see the Appendix).



[Figure 4.1-6] Result of Survey

4.1.5 Review of International Cases

- Cases for reducing traffic accidents in advanced countries on the traffic safety are reviewed in view of potential adoption of their experiences into the road traffic safety in LMA.

1) Cases of Traffic Safety Policy

- The traffic safety policies are formulated corresponding to each country's circumstances. Although the enforcement of those policies had gone through trials and errors in each country, continuous complementation and strong traffic safety policies lead to fruition.
- For the traffic safety policy, the Korean "National Traffic Safety Basic Plan" showing chronicled traffic safety policies is reviewed followed by more advance cases of road transport policies in Sweden, England, Japan, and Netherlands. Accordingly, the traffic safety policy method has been proposed corresponding to circumstances in those metropolitan regions.

① Korean Traffic Safety Basic Plan

- The policy and regulation of the traffic safety are the vital factors to provide safe traffic environment. In particular, the National Traffic Safety Basic Plan was established in 1983 in Korea and it was the critical initiation trial to settle the road traffic safety culture. The Korean case is particularly of interest to many developing countries because the process from the beginning of the motor age to the transport advanced society is remarkably a short one (largely in line with the industrialization process). The brief history of the traffic safety and related laws are as described below.
- According to the process of the enactment on the safety policies and regulations, the traffic accidents became a social problem and a directing issue at the national level. To solve this problem, the traffic safety law was established, which was the basic law to eradicate it, followed by the establishment of the administrative system on the traffic safety. The first traffic safety basic plan was started in 1983 and the steps were divided into approximately five steps.

  - Firstly, establishment stage of the traffic safety proceeding system before 1983;

- Secondly, the increase stage from 1984 to 1991 which showed the highest fatalities;

- Thirdly, the reduction stage of fatalities from 1991 to 2004 reducing half of the fatalities;

- Fourthly, the initial stage arriving at the traffic safety advanced counties from 2005 to 2009;

- Fifthly, the enforcement stage of continuous traffic safety policies since 2009.

- The main contents in each stage are described below.

- Establishment stage of the traffic safety proceeding system: due to the economic development plan since 1962, the transport environments have been changed by increasing the road traffic facilities and various road traffic modes of vehicles. Since then, the laws and systems were started to improve and meet the social, economic and transport requirements.

- Increase stage of fatalities: the Traffic Safety Countermeasure Committee was established in the Office of the Prime Minister in Feb, 1987. Then, the "Traffic Safety Countermeasure" was confirmed in Aug, 1987 based on deliberation of various specialists to implement the policies in each department. The statistics work on the traffic accidents has been computerized since 1988 and since then, omission of the road accident statistics database has been eliminated.

- Reduction stage of fatalities: 'Traffic Accident Reducing Campaign' has proactively proceeded with governmental initiative by establishing 'Traffic Safety Countermeasure' mainly in the Office of the Prime Minister. This was motivated by the fact that the number of accident fatalities had reached its peak in 1991. The Traffic Safety Bureau (1 Bureau and 5 Departments of 47 staff) in the Ministry of Land, Transport and Maritime Affairs performing the Secretariat function of the Traffic Safety Policy Deliberative Committee was downsized into the Traffic Safety Department (10 in 1 Department) when restructuring the Government Organization. In other words, the priority on traffic safety policies for the human resources and organization was to be downsized after reaching a certain level control on the road traffic safety.

- Initial stage of reaching the traffic safety status of advanced country: the Government Policy Coordination set up the target reducing 3.2 fatalities per 10,000

vehicles in 2005 (reduced 898 compared to the previous year) with active cooperation and coordination of a few key organizations and bureaus, municipalities, civic organization, Ministry of Government Administration and Home Affairs, Ministry of Construction & Transportation (MOCT), and Korean National Police Agency (KNPA).

- Enforcement stage of continuous traffic safety policies: the Government established the 6th National Traffic Safety Basic Plan and the 7th National Traffic Safety Basic Plan to continuously execute the traffic safety policy.
- In summary, the main contents and investment budget as a whole, the budget has continuously increased for investment. At the initial stage, low budget-project was carried out including public education and campaign promotion. However, the project increased the investment budget for hazardous road improvements in the mid-stage of the project. Recently, projects relating to the strategy using cutting-edge technology including the ITS technology are being heavily featured in more recent efforts.

[Table 4.1-11] Main Policies for Each Traffic Safety Basic Plan

Classification	Main Contents	Budget (Unit: 100 million won)
1st (1983~ 1986)	• Extension of the road construction equipment • Enhancement and extension of signboard and signal facilities • Education of drivers and staffs • Enhancement of the People's traffic safety promotion • Safety related industry • Other safety facility project	2,922,862
2nd (1987~ 1991)	• Extension of road construction equipment • Extension of road sign and signal facilities • Facilities improving the vehicle safety level • Promotion of the People's traffic safety enhancement • Safety management project • Other safety facility project	984,880
3rd (1992~ 1996)	• Betterment/extension of safety facilities • Betterment and extension of roads • Improvement on transport equipment safety level • Other equipment extension etc.	2,170,792
4th (1997~ 2001)	• Promotion of advanced education enlightenment of traffic safety consciousness • Environment Betterment of road traffic • Betterment and extension of traffic safety facilities • Improvement of vehicle safety level • Other equipment extension etc.	6,918,380
5th (2002~ 2006)	• Betterment and extension of traffic safety facilities • Securing safety of vehicles • Establishment of traffic safety consciousness and establishment of advanced traffic culture • Effective control and enhancement of the traffic regulation breaking • Technology promotion and development on traffic safety • Betterment of traffic safety system • Betterment of traffic accident handling system	6,989,225
6th (2007~ 2011)	• Betterment of road facilities in risky road, points where traffic accident frequently occurs, etc. • Betterment of road safety facilities signal/safety signboard, median strip, etc. • Improvement and extension of safety facilities in railway / airport / harbour • Replacement and repair of heavy traffic means such as train / rolling stock / ships etc. • Education / promotion / event etc. on traffic safety	7,367,830
7th (2012~ 2016)	• Improvement of deeds of traffic users • Construction safety traffic infrastructure • Operation of smart traffic means • Advanced emergency handling system • Re-establishment of traffic safety proceeding system • Enhancement of responsibility on traffic safety by municipalities • Campaign conducted with the People	16,840,931

→ Investment Status on Traffic Safety Basic Plan in Korea

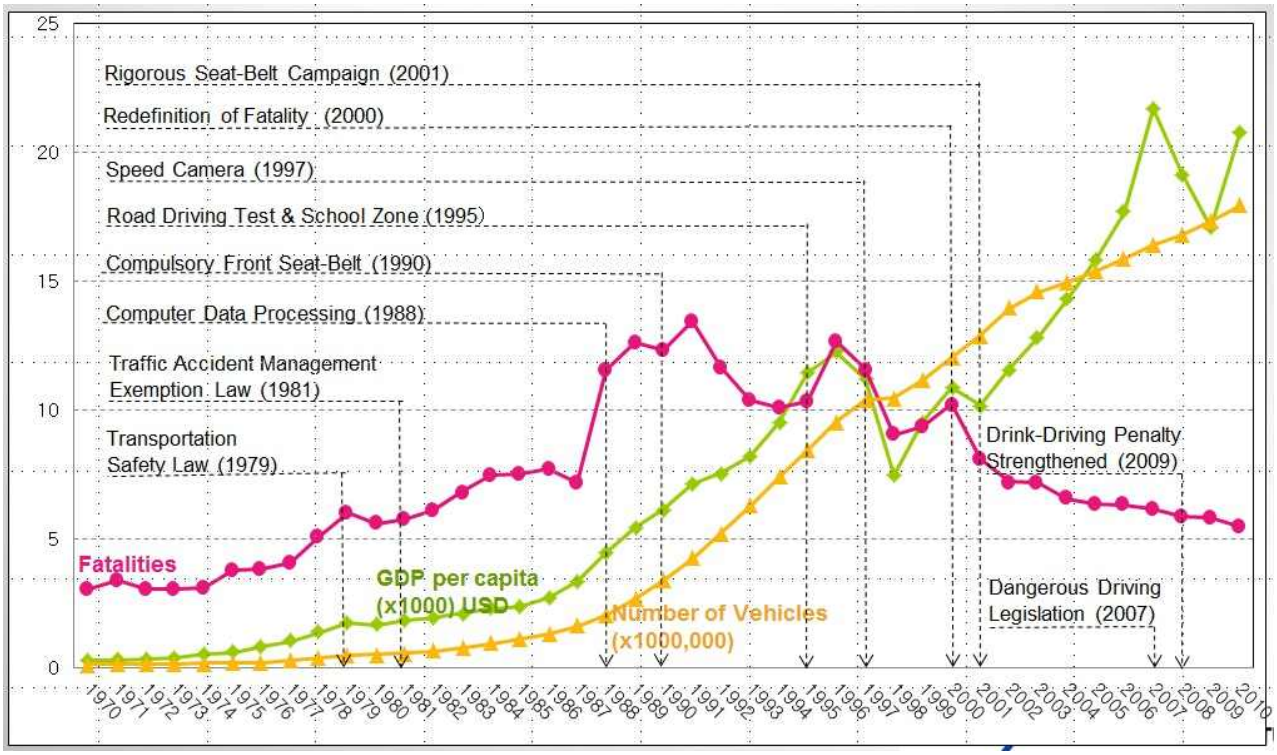
o In order to plan the investment allocation of the traffic safety basic plan in the Lagos Metropolitan Area, the status on the budget investment in each year of the Korean Traffic Safety Basic Plan was reviewed as shown below.

[Table 4.1-12] Yearly investment ratio of our traffic safety basic plan

Classification	Year	Investment Amount (Unit: Million won)	(Unit: Billion won)	Annual Average (Billion won)	Compared to Investment Amount during Planned Period	Compared to Investment Amount during Planned Period
First	1983	2,922,862	66,685	82,291	3.6%	0.9%
	1984		76,524			
	1985		85,699			
	1986		100,254			
Second	1987	984,880	117,938	167,979	0.6%	0.1%
	1988		140,525			
	1989		158,620			
	1990		191,383			
	1991		231,428			
Third	1992	2,170,792	263,993	356,667	0.6%	0.2%
	1993		298,762			
	1994		349,973			
	1995		409,654			
	1996		460,953			
Forth	1997	6,918,380	506,314	562,199	1.2%	0.3%
	1998		501,027			
	1999		549,005			
	2000		603,236			
	2001		651,415			
Fifth	2002	6,989,225	720,539	817,706	0.9%	0.2%
	2003		767,114			
	2004		826,893			
	2005		865,241			
	2006		908,744			
Sixth	2007	7,367,830	975,013	1,094,988	0.7%	0.2%
	2008		1,026,452			
	2009		1,065,037			
	2010		1,173,275			
	2011		1,235,161			
Seventh	2012	16,840,931	1,272,460	-	1.3%	-

Note: GDP is the Nominal Market Price / Source: The Bank of Korea

→ Evolution of Road Traffic Related Variables in Korea



- The foremost and obvious correlation is the GDP, the economic indicator (green) and the car ownership (yellow), the phenomenon of which is identified in most developing countries. Apart from the two economic downturns in 1998 and 2008, GDP have steadily increased together with the number of vehicles, and this trend continues until 2010.

- The number of road accident fatalities showed similar upward trend until it reached the peak in 1991 at approximately 13,000 road deaths. Up to this point two laws were enacted: Transportation Safety Law (1979) and Traffic Accident Management Exemption Law (1981). Computer database system was first introduced in 1988, immediately after which the fatalities figure increased sharply. This indicates the large amount of missing data when the accident statistics were managed manually. After the fatalities figure reached 10,000, wearing of seat-belt on the front seats was made compulsory to counteract the rising road fatalities.

- These measures started taking effects after the early 1990s when the road accident fatalities started decreasing, but continuous efforts were made with respect to laws and regulations. Those efforts include School Safety Zones and Road Driving Test

(1995), introduction of Speed Enforcement Camera System (1997), Redefinition of Fatalities (2000) (death as a result of road accident up to 30 days after the accident is counted as road fatality), rigorous Seat-belt campaign (2001), Dangerous Driving Legislation (2007), and harsh penalties for Drink-Driving (2009).

- These measures have managed to bring the road death statistics more than half in 2010. The process shown in the figure is about 40 years, indicating that in a motorized developing country, bringing the road deaths to a tolerant level of the western advanced countries is a time-consuming process with continuous efforts with respect to rigorous safety policy measures.

② Foreign traffic safety policy

- To make an efficient, if not a drastic impact on the traffic safety level, it is necessary to look into the experiences from the main advanced countries in the safety field which are maintaining the highest level of road traffic safety.
- The advanced countries on the traffic safety field implemented a variety of traffic safety policies and have undergone a process of accident reduction period since all countries suffered road safety problem in the beginning of the motorization. Although they went through trial and errors for a period, national policies have been continuously implemented a critical and major source to reduce the traffic accidents.
- Assuming that the developing countries need to eliminate such trials and errors, errors could be reduced based on the application of experiences of the advanced countries on the traffic safety. Also, the most recent Korean experience suggests that it can lead to the most effective policy because experiences weigh more heavily than theories with respect to counter-measuring road traffic safety.
- In the project, the traffic safety policies in England, Germany, Japan, Netherlands, and Sweden are both thought-provoking and proved effective.
- Japan acknowledged the severity of the traffic accident since 1970s, and therefore has continuously implemented the traffic safety policies. In the initial stage of the policy, general policy to reduce fatalities was implemented, and more recently as

the fatalities figure settles, the policy focuses on the vulnerable road users such as children and elderly.

- Sweden raised the level of road traffic safety on the basis of strict regulations. Many of the regulations currently adopted in many other countries were first introduced in Sweden, including mandatory sobriety test, speed limit (30km) in street network of congested traffic, maximum speed limit, mandatory fastening of seatbelt, and extension of no parking zones.
- For the traffic safety counterplan, England implemented traffic calming project in the 1990s with engineering methods limiting the speed. In addition, it enhanced the level of safety education so that both children and adults are aware of road safety rules and regulations to apply routinely in daily life.
- The first safety policies introduced by Netherlands include 30km/h and 60km/h zones, redesign of unsafe road types, crackdown of drink and drug driving, promotion of safety cultures as a national agenda.

[Table 4.1-13] Major traffic safety policy of advanced countries on traffic safety

Countries	Major policies
England	Speed limit in expressway Mandatory installation of speed limit device in Express Bus Introduction of speed limit regions in cities (20mph) Mandatory seat belt fastening in the back seats Enactment and enforcement of the Traffic Calming Act Mandatory installation of speed limit devices in buses and freight vehicles Introduction of observation duration to beginners (2 years) Reinforcement of children safety education Reinforcement of a sobriety test Extension of the speed sensor extension Improvement of vehicle safety devices Restriction of vehicle traffic in the center of down town
Germany	Legalization of Zone 30 Policy Give the fine in case seat belts are not fastened for back seats In case of children under the age of 12, they should be settled in the backseat. Mandatory helmet wearing Introduction of the children safety education Control of speeding and regulation of speed limit Reinforced standard of the sobriety test (less than 21) (0.00%) Additional installation of parking lot for 5,500 freight cars and pavement of lane sensing vibrations
Japan	Establishment / execution of traffic safety basic plan Introduction of children protection district system Introduction of observation period after achieving a license by driving beginners Mandatory lesson when renewing the license by the aged Mandatory fastening of protection device for the infants under the age of 6 / execution of driving campaign on the advanced traffic safety Betterment of road signboard for the aged / fostering traffic safety instructors

	Indication of 'safe pedestrian district' for the safe passing by pedestrians and users for bicycles Mandatory fastening of all seat bests in vehicles Establishment of functional test system before renewing the license over the age of 75 Development of traffic circumstance for bicycle, enactment of regulations and education of safety
Netherlands	Installation of local road safety committee Mandatory wearing of helmet (but, excluding a moped with less than 25km/h) Evaluation of road safety level Increase of visibility of vehicle (light, reflection board, etc.) Execution of Traffic Calming with 30km/h and 60/km/h Management of risky groups for traffic accidents Separation of road users (vehicle/bicycle/pedestrian) Extension of the roundabout intersection Extension of crackdown cameras (speeding, signal, etc.)
Sweden	Mandatory fastening of seat belts in the backseat Speed control within 30km in the street network of the congestion road Enhancement of the standard for the sobriety test (0.02%) Installation of crackdown camera for speeding all over the nation Restriction of 110km/h maximum speed in expressway Separation of the road for pedestrians and bicycles from the vehicle road by barriers Evaluation of road safety level

→ Cases for Developing Country: Indonesia

- One of the developing countries that are similar to Nigeria, with respect to the motorization process, population, and the number of vehicles, is Indonesia, and some of the brief road safety statistics introduced in this section are extracted from "A Report from Indonesia Country Report on the Road Safety Initiatives in Indonesia Gede Pasek Suardika, Dept. of Safety Management, MOT, 2012"
- These figures are data based by the National Police and the Motor Vehicle Insurance database that shows a consistently increasing trend in the total number of accidents with particularly sharp increase in fatalities in 2004 and 2005. It is also noted that the number of fatalities per 10,000 vehicles continue to decrease. Considering the increasing number of registered vehicles during this period, measures to control the road traffic accidents and fatalities have been effective during this period.

[Table 4.1-14] Road Traffic Accident Status in Indonesia

Year	No. of registered vehicles	Road extension (Km)	No. of accidents	Fatalities			Population
				Fatalities	Per 10,000 vehicles	Per 100,000 population	
1996	14,532,095	336,377	15,291	10,869	7.479	5.481	198,320,000

1997	16,535,119	342,700	17,107	12,227	7.395	6.072	201,353,100
1998	17,644,885	355,400	15,097	11,778	6.675	5.799	203,100,000
1999	18,224,149	356,000	12,769	9,954	5.462	4.867	204,500,000
2000	18,975,344	409,881	12,649	9,356	5.025	4.634	205,800,000
2001	21,201,272	418,200	12,791	9,522	4.491	4.435	214,700,000
2002	22,467,113	427,400	12,267	8,762	35.515	4.038	217,000,000
2003	32,774,929	429,912	13,399	9,856	3.007	4.367	225,680,000
2004	41,986,814	486,623	17,732	11,204	2.668	4.952	226,241,355
2005	47,664,826	483,962	91,623	16,115	3.381	7.305	220,572,713
2006	50,112,423	506,444	87,020	15,762	3.145	6.937	227,220,000
Increase (%)	13.2	4.2	19.0	3.8	-8.3	2.4	1.4

Source: Indonesia National Police

- Key target policies in the 10 years: Reduction of fatalities by 20%, Reduction of serious injuries per 100,000 population by 15 %, Establishment of a "Road Safety Management organization", Seat belt use rate 80%., and helmet use rate 80%.
- Other key strategies: Establishment of Committee for Road Safety; Enhancement of safety culture through safety education; Planning and evaluation by data collection and information system; Enhancement of safety culture through regulation and enforcement; Securing finances for road safety; Traffic management and blackspot improvement; and Encouragement of public transport.

③ Comments on the International Cases

- It is commonly noted that in the initial stage of the policies, the enhancement of regulations led to the reduction of the traffic accidents. The investment in the education has been continuously enhanced to routinize the traffic safety in the daily life. The key areas to concentrate as a country that undergoes an initial stage of safety planning should include speed regulation, vehicle maintenance of the transport industry, and enhancement of safety education as priority, followed by an infrastructure engineering approach requiring heavier investment such as improvement of hazardous roads.

[Table 4.1-15] Main policies of advanced countries

Classification	Main policy
Enhancement of speed limit	• In order to prevent the traffic accidents, the crackdown and fine were properly applied and accordingly the traffic accidents were reduced. • In order to increase the effectiveness and efficiency of the crackdown, the unattended crackdown was increased and the attended crackdown was carried out irregularly.
Protection of car passengers	• Wearing seat belts were compulsory and car seats for children were compulsory. Therefore, injuries were minimized. • In case of motorcycles and bicycles, wearing helmet was compulsory.
Enhancement of the crackdown for drunk driving	• Applied different standards by separating the standards in each age and each vehicle in detail • Regulation enhancement to prevent drunk driving for the drivers working in the commercial field / applied strong drunk driving standard for the young drivers
Management of heavy vehicles	• In order to manage buses and freight cars leading to the heavy accidents, a speedometer and speed limit device were compulsorily installed in the heavy vehicles and the driving hour was limited within a certain hour. • Additional education targeting the drivers for heavy vehicles and application of strict drunk driving standard etc.
Limit of vehicles in metropolitan area/calming	• Speed limit less than 50km/h in metropolitan areas • Designated the zone requiring protection like children protection district etc. to Zone 30 • Active speed down of the vehicles by installing the traffic calming facilities in resident areas
Enhancement of safety education	• Enhancement of safety education for children (provided various curriculum and education place) • Additional management and education for drivers working in risky fields for the traffic accident like heavy freight cars etc. • Additional management of the aged drivers
Utilization of IT technology	• Crackdown using cutting edge Unattended Enforcement Equipment • Paid the fine with a credit card at site and constructed automatic traffic crackdown system (France)

2) Cases for Traffic Safety Education

- It is the most widely held view that the most critical factor in traffic safety is the human. Nurturing safe road users who are routinely accustomed to safe practices in daily life are the most effective ways of reducing traffic accidents.
- Therefore, in order to achieve the maximum effect and reduce the traffic accidents, the road traffic safety education is the most effective as well as cost-effective method and should be invested in continuously.

- As cases on the traffic safety education in those advanced countries for the transport, education cases of France, Sweden, England, Japan, Germany were reviewed and to identify what aspects of them will be adoptable and applicable for the Lagos Metropolitan Area.

① France

- In France, accreditation system for the education is under operation. In case a child enters the 1st grade in the elementary school, the activity scope is widen and therefore the risk level of the traffic accident is increased. In case preschool children are trained in certain hours before entering the elementary school and passing a test, accreditation certificate on the education is provided. The accreditation certificate should be submitted to enter the school just like the submission of the inoculation confirmation letter. This means that residents are trained from the early age on the traffic safety education.
- Also, various walking safety educations are carried at the target age of 8~9. In case trainees pass the test, the license is provided. The National Gendarmerie has controlled the system since October, 2006 and General Insurance Company sponsors it.

[Figure 4.1-7] Pedestrian License

- In France, the fifth grade students take a test on the traffic safety in Elementary School. Only the students who passed the traffic safety exam are qualified to test an exam for the Mopads (bicycles with a motor). The education is connected to

the lecture of the subjects, National Language, Mathematics, Society, etc. for their traffic education.

- In addition, the traffic safety education is mandatory from the kindergarten to the middle school in accordance with traffic safety education of Act 57-831. Students in the 2nd grade and 4th grade of the middle school are tested on the traffic safety. Only the students that passed are qualified to achieve the licenses for small motorcycles and vehicles.
- The traffic safety is also exerted to be promoted together with the education. Since the accidents increased, the French Government informed the students in the middle and high schools of the status of traffic accident for the children, type of accident, cause and characteristic of accidents, a preventive method of accidents, severity of accidents, etc. Also, it holds the idea contests to prevent the traffic accidents targeting the juvenile and award prizes to the winners or groups submitting the best ideas. Such a participation leads to the interest in traffic safety.

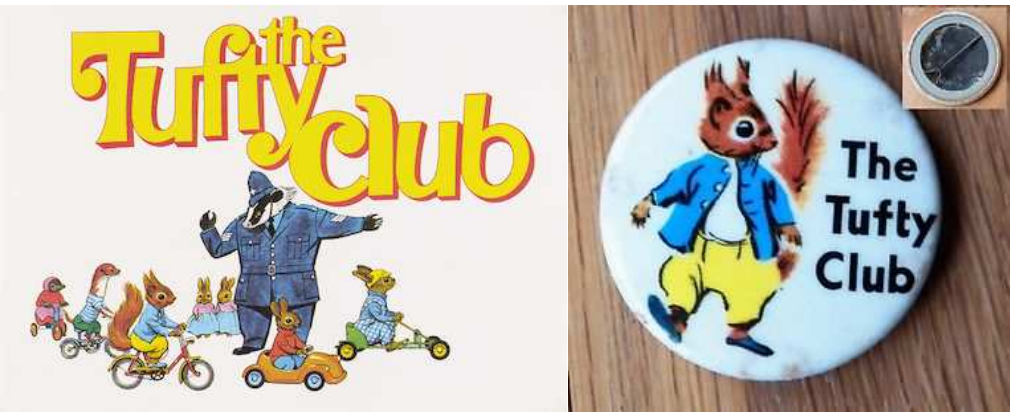
② Sweden

- In Sweden, the bill on 'Vision Zero of Traffic Accident' was passed at the parliament. It is the country to have the best case tremendously reducing the traffic accidents by enacting strict policies on the traffic safety.
- The traffic safety in Sweden is related to the social welfare. The lifelong safety education system "from cradle to grave" was established. Municipalities provide free car seats to the households giving a birth. Also, it provides the households having children at the age of 3 with various books relating to figure data, game, rides, etc. free of charge for the traffic safety education. In addition, parents and children at the age of 3 apply for registration in the Safe Kids Club which gathers in each region to educate the safety at such a young age.
- The traffic safety education is legally compulsory in kindergartens and schools.
- The NTF (National Society for Road Safety), a private organization is actively serviced in Sweden. The NTF is sponsored by the government budget to propagate a variety of traffic safety education. In particular, three evils causing

traffic accidents were selected: the drunk driving, no wearing of seat belt//helmet, and speeding/reckless driving. It continues to campaign to eliminate the three evils.

③ England

- To avoid children's traffic accident, the Royal family has taken the lead of the prevention activities. Since fatalities by children's traffic accident reached 1,600 in the 1940s, the Royal family recognized the severity of the situation. The ROSPA (Royal Society for the Prevention of Accidents) actively started to lead the activities on the education.
- The Tufty Club, an education institute, was organized in each region. Kerb drill, Green Cross Code propagation and systematic traffic safety education were carried out. Therefore, fatalities were 69 in 2009 based on the effort on the safety education. This means that 96% was reduced compared to the year 1940.
- Traffic safety education was carried in each age and each individual through play, game and actual experiences for the education on Key stage 1 (at the age of 4~7). There are Tufty Club, Green Cross Code, Pilot pedestrian Scheme, etc. in representative walking programs.
- The traffic safety in the Elementary School is educated focusing on the practical education. The education of Key stage 2 (at the age of 8~11) is to improve capability that they can decide and judge their behaviors by themselves in dangerous and complex traffic status. The education on the traffic safety in the middle school is carried out focusing on the bicycle and as a preliminary driver. The education of Key Stage 3 (at the age of 11~14) is focused on safe walking and riding bicycles. For the education of Key stage 4 (at the age of 14~17) is focused on a two-wheeled vehicle, traffic behavior required as preliminary drivers, characteristic of vehicles, etc.



[Figure 4.1-8] Tufty Club

Source: https://cyclestuff.wordpress.com/2012/03/05/wheres-tufty-when-you-need-him/

http://www.scarysquirrel.org/tufty/tuftyclub/

④ Japan

- In Japan, mothers led to the traffic safety education. Since fatalities reached at 2,094 caused by the traffic accidents and the severity of the accidents hit the maximum. Mothers in Japan gathered together to establish the 'Traffic Safety Mother Committee' and currently all the municipalities support to establish the Committee. The number of member is over 6 million.
- The 'Traffic Safety Mother Committee' fostered instructors on the traffic safety for mothers and enhanced parents' education. It provides various data to prevent the traffic accidents. In addition, the 'Traffic Safety Mother Committee' launched the family meeting campaign on the traffic safety which the mother leads the meeting every Sunday morning. The title of the meeting is the children's traffic accident occurring in the vicinity of the area where the family lives. The number of fatalities in 2009 was 116 which 95% of accidents was reduced compared to the year 1970.

⑤ Germany

- In Germany, the education on the traffic safety was legally carried out. In 1950, the traffic safety is obliged to be educated in the kindergarten, elementary school, and middle school in accordance with the Federal Act.

- The education curriculum on the traffic safety consists of three steps, the kindergarten, elementary school, and middle school. The contents are focused on the self-decision making by children in any traffic circumstances.
- It makes a rule to educate the 1st grade and 4th grade of the elementary school on the traffic safety for 40 hours a year.
- In the 5th grade of the elementary school, the license can be achieved for the bicycles under the presence of policemen. In Frankfurt, the playground in approximately 600 m^2 was prepared to achieve the license for bicycles, which is used to educate the license achievement and practice the license test.
- The age of 17 is the stage right before achieving the driver's license. Therefore, the age is trained to recognize various traffic safety such as the severity of the traffic accidents, importance for giving ways to other cars and pedestrians, human nature required as a driver, etc.
- In order to achieve the driving license, the education has been enhanced as much as 72-hour education required including subjects, functions, road driving, etc. 2-year temporary license is supplied to the beginners achieving the driving license since 1986.
- For 2 years for observation period, the infringement is divided into type A infringement such as speeding, invasion of central line, signal violation, infringement of overtaking, etc. and type B, light infringement. Central automated license control system is thoroughly managed.

⑥ Comments on the international cases

- According to the cases in the advanced counties on the traffic safety, the safety education has been enhanced for the children. In case of the adults, the effect on the traffic education for adults familiar with their own habits is little compared to children. Since children will become the future drivers in the country, the education to the children will lead to larger effect than that to adults.

- One of the important things is to enhance driver's license test. The education is reinforced when the driver is tested for acquiring the license and the driving license is issued. Also, the drivers just acquiring the license are controlled during a certain period to be safe drivers.
- In case of the Lagos Metropolitan Area, it is considered that the safety education enhancement for children and extension of the safety education facilities (such as community training centers or institutes) should be carried out.

4) Legal System on Traffic Safety

① U.S.A.

- The 'Vehicles and Traffic Act' consists of 7 parts: the definition of terms, vehicles, driving license, accidents, road act, effectiveness by the States and municipalities, punishment, etc.
- In Chapter 1, the terms are defined within the Enforcement Act. Chapter 2 describes the duties of the director in Vehicle Department and its designation method. Chapter 3, driving license, includes the process and regulations of the driving license. Behaviors and regulations during accidents are included in Chapter 4. The method and regulations passing through roads are specified in Chapter 5. Chapter 6 mentions the observance of the Act made in Vehicle Department and regulates how the acts are applied, made by the States and Municipalities.
- The drivers infringing the process handling traffic accidents can be arrested in accordance with the USA act. If the drivers commit the infringement once again, severe punishment can be sentenced. In particular, the infringement of the school zone can lead to the detention.
- The crackdown on drink driving is differently applied in each usage of vehicle and each age. In case the infringement is committed again, 2~3 punishments are to be sentenced. The standard for the drink driving crackdown for the blood alcohol concentration was reduced from 0.1% to 0.08%.

- In School Zone, the surveillance cameras are always in operation and speeding violation within the school zone results in fines that are 2-3 times higher than the basic fine.
- Young drivers undergo additionally training based on specific systems.

② Japan

- In Japan, Acts related to the traffic consist of 'Road Traffic Act', 'Enforcement Decree of Road Traffic Act' and 'Enforcement Regulation of Road Traffic Act'. The 'Road Traffic Act' includes contents that all the risks and obstacles occurring on roads are prevented and removed to secure safe and smooth transport.
- The ‘Enforcement Decree of Road Traffic Act' and 'Enforcement Regulation of Road Traffic Act' are sub-directory ordinance. In addition, 'Summary Case Proceeding Act on Traffic Event' helps to follow up the case
- Speeding is highly fined compared to the other traffic infringements. For the safety of the users of bicycles, 20,000 Yen is fined for parking infringement.

③ Germany

- In Germany, there are 'Road Traffic Act', 'Road Traffic Ordinance', 'Approval Regulation for Individual License', etc. in the Road Traffic Safety Authority. Vehicles and processes relating to driving licenses are described in the 'Road Traffic Act'. The 'Road Traffic Ordinance' specifies the method passing through the roads and regulations. Means and the type of vehicles in the road traffic are stated in the 'Approval Regulation for Individual License'.

④ England

- In order to review the traffic safety related acts in England, 'Road Traffic Act' and 'Road Traffic Ordinance' were reviewed. Driving infringement is defined in the 'Road Traffic Act' which includes the process of the driving license achievement and requirements. The 'Road Traffic Ordinance' regulates rules on pedestrians, scooter for the disabled, animals and drivers of bicycles. The British Ordinances describes indications of behaviors in great detail.

- In case no street light exists in the road, the speed is limited within 30 miles. Maximum 7 times are fined depending on the speed.
- Pedestrians at night should wear the cloths or textiles made of reflected materials to secure visibility from vehicles.
- Approximately 3,250 euros are fined to the drunken driver. In case of over 2-time infringements, the license is to be suspended and drivers are detained for 6 months. In case of speeding, maximum 50 times can be fined. If the pedestrians can use the street, the pedestrians should have the first priority. Heavy vehicles cannot overtake in case less than 50m visibility range. Also, parking is allowed at the area only if the parking is marked. 500 euros and 1,000 euros are fined to drunken driver and re-commitment, respectively.

⑤ Sweden

- Swedish 'Road Traffic Act' is executed, dividing into general vehicle, locomotive vehicle, off-road vehicle, bicycle, scooter, pedestrians, etc. It describes the maintenance of the road, traffic control, rights and responsibilities, etc. In particular, the Act is differentiated from the other countries' Acts by composing additional contents on regulations securing the safety for pedestrians in footway and parts and regulations on locomotive and off-road vehicles.

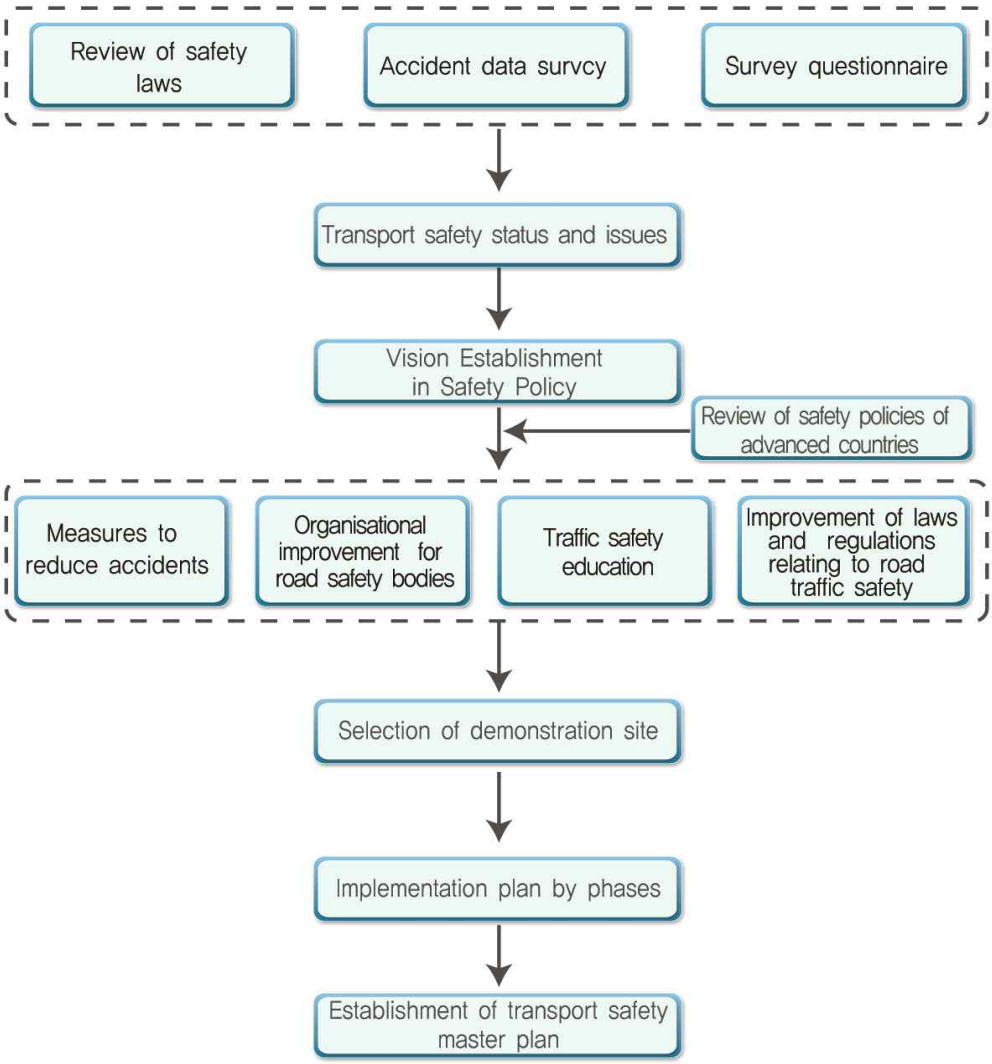
⑥ Comments

- There are「Lagos State Road Traffic Law」as traffic related acts in Lagos State. The safety contents include drink-driving, overloading vehicle, duties during accidents, etc.
- In case of the advanced countries, punishment relating to the traffic accidents is heavily sentenced. In particular, the special acts for speeding, drink-driving, school zone violation, etc. were enacted and therefore the drivers face stern punishment against committing the traffic infringements.
- Application and execution of such a strict legal system should not have an exception in the Lagos Metropolitan Area.

4.1.6 Follow-up Process of the Improvement Measures

a. Process of the Selecting Improvement Measures

- The improvement measures are derived by status on the traffic safety, analysis result of the problem, review on related plan, the traffic safety policy of the traffic advanced countries, review on the education.
- The determined work is divided into the method of the traffic accident reduction, betterment of the traffic safety related organization, enhancement of the traffic safety education, improvement of the traffic safety related acts, etc. to follow up the detailed assignments.



[Figure 4.1-9] Process of assignment

b. Selection of tasks by sector

- We have selected tasks to undertake for each sector in consideration of the following: the current status discussed in the previous part of this report, results of the problem analyses and surveys, case studies of developed countries.
- The tasks selected based on the cause of accident by FRSC are provided in the table below.

[Table 4.1-16] Tasks by cause of accident

Cause of accident	Tasks depending on cause of accident
Speeding	Installation of an automated traffic enforcement system (collectable type)
Reckless driving	Strengthening of traffic safety education
Careless driving	
Dangerous overtaking	
Violation of signals	
Standstill vehicles / Obstructions	
Lane violation	
Overloading	Establishment of a traffic safety management system and implementation a traffic safety diagnosis of for transportation companies
Break	Enforcement of vehicle performance tests
Flat tire	
Mechanical defect of vehicles	
Poor road	Improvement of areas or spots where traffic accidents frequently occur and structural improvement of road with high accident risks
Others	Establishment of a traffic safety infrastructure

- The sub-tasks selected by sector are described in Chapter 6 in detail and in addition, we have selected "establishment of a traffic accident data system" as one of our sub-tasks to resolve the lack of urban traffic safety related data of Lagos.

[Table 4.1-17] Selected sub-tasks by sector

Classifications	Selected sub-tasks by sector
Establishment of traffic accident reduction measures	- Establishment of a traffic safety management system for transportation companies - Implementation of traffic safety diagnoses for transportation companies - Enforcement of vehicle performance tests - Designation of Children Protection Zones - Improvement of the areas/spots where traffic accidents frequently occur - Installation of an automated traffic enforcement system (collectable type) - Structural improvement of roads with high accident risks - Designation of Pedestrian Priority Zones - Establishment of a traffic safety related data collection system
Reorganization of transport related organizations/agencies	- Strengthening of traffic safety policy enforcement
Implementation of traffic safety education	- Support for experience education for workers working in the transportation business - Implementation of customized education for children/the elderly
Improvement of traffic safety related laws and regulations	- Reorganization of traffic safety related laws and regulations - Establishment of guidelines for traffic safety design - Establishment of guidelines for urban traffic related planning

4.1.7 Detailed Tasks by sector

a. Establishment of traffic accident reduction measures

- There are several sub-tasks to carry out for reducing traffic accidents.
- First, we have selected a task of strengthening management efficiency of transportation companies by establishing a traffic safety management system and a traffic safety diagnosis policy for transportation companies. That is because based on the Federal Road Safety Corp's (FRSC) accident data analysis, there are many accidents caused by careless driving, overloading and mechanical defects of vehicles, and also because workers working in the transportation industry are likely to be exposed to accidents for a long time.
- Second, as for general vehicles, we have selected a task of enforcing vehicle performance tests so as to minimize accidents which may be caused by mechanical defects of vehicles.

- Third, we have selected a project to designate Children Protection Zones as one of our sub-tasks to implement. According to the [2013 Traffic Accidents] published by the FRSC, the age groups are divided into 11 and the first age group is ranged from age 18 to 22. That is, there have been no systematic records of traffic accidents concerning the children under 18, which can be regarded as the lack of interest on children's traffic safety. In many developed countries, there are great interest and investment in children's traffic safety as they regard children as the transportation vulnerable. The urban areas of Lagos also require endeavoring to secure traffic safety for children and to achieve this, we have selected a project to designate Children Protection Zones as one of our tasks.
- Fourth, we have selected a project for improving the areas/spots where traffic accents frequently occur (Blackspots) and for structurally improving roads with high accident risks so as to reduce accidents which may be caused by poor roads.
- Fifth, we have selected a task of installing an automated speed enforcement camera system. That is because of the high rate of traffic accidents caused by speeding, as shown in the FRSC's accident data.
- Finally, we have selected a task of designating Pedestrian Priority Zones for the purpose for education and public awareness of the importance of safe pedestrian environment and a task of establishing a system enabling efficient traffic accident data collection & analysis and easy access to the data, considering that such data are the most important data for traffic safety policy making.

1) Establishment of a traffic safety management system for transportation companies

① Background

- Workers in the transportation business tend to spend relatively long time on the roads, as being exposed to more accidents accordingly. Therefore, it is necessary to reduce traffic accident occurrence rates for both the present and the future by carrying out traffic safety inspection and maintenance, targeting transportation companies.

- Currently in Lagos state, experts are supposed to check the safety related items for vehicles operated by transportation companies. However, since the inspections often take place as a mere formality, it is necessary to complement the current practice. In addition, a system using traffic accident video recorders has not been introduced in Lagos yet.
- In terms of the prevention of transportation companies' traffic accidents, it is difficult to have a great effectiveness by a single organization's effort alone. In order to create a synergy effect, it is therefore required to establish and expand 'Governance' among relevant organizations executing their own traffic safety projects.

② Details of task

- Planning of traffic safety inspections for transportation companies
  - Ensure that inspections are carried out on traffic safety conditions by relevant transport administrative organizations either a regular or occasional basis, targeting passenger/freight transportation companies, construction machinery companies and passenger/freight terminal owners.
  - Make sure to identify overall traffic safety conditions including transportation means, transportation facilities in charge.
- Implementation of traffic safety inspections for transportation companies
  - Implement inspections in collaboration with traffic safety specialized organizations.
  - Inspect traffic safety risks for vehicles and drivers.
  - Check whether targeted companies violate traffic safety related acts.
  - Check whether targeted companies conform to traffic safety maintenance regulations.
- Promotion of Installing traffic accident video recorders
  - A traffic accident video recorder is an equipment used to record all the information related to vehicle driving (e.g., speed, direction, location, sound, image inside and outside vehicle and impact at the time of accident) so as to identify situations of an accident based on the records.

- Besides digital recording of vehicle driving, it records steering wheel's angle for dozens of seconds before and after an accident and also records whether a break, accelerator pedal, engine RPM and headlight were in proper operation at the time of the accident.

- Since the records can act as a conclusive evidence to determine the liability of an accident without a witness, drivers' law-abiding should be induced.

- Video recorders (or also known as Black boxes) are effective in restraining reckless driving as drivers get conscious of it as well as in investigating responsibility of an accident.

- In some states of the USA, a discount of auto insurance is applied for trucks and taxies equipped with black boxes, as part of encouraging its use.

[Figure 4.1-10] Automatic traffic accident recorder (Black box)

- It is also required to promote a reduction in traffic accident occurrences of transportation companies by notifying the advantages of installation of a recorder and provide support for some of the intra-city buses unequipped with such a recorder to equip it.

o Transportation industry traffic safety inspection result check and follow-up management

- Amend traffic safety related laws and regulations and have inspections carried out conforming to the amended laws and regulations. After that, recommend items requiring improvement, take administrative measures, and order performance of traffic safety diagnoses.

- Conduct a yearly analysis of efficiency and performance the inspection through continuous data management.

o Establishment and expansion of governance to improve safety of transportation companies

- Relevant organizations: local government, police, public company, transportation companies, NGOs, etc.

- Establish a "council for safety of transportation companies" among relevant organizations and hold regular council meetings

- Ensure each relevant organization sets project goals and seeks a method to connect the projects.
- Discuss measures to secure driving force for traffic safety projects of Lagos and enhance their effectiveness
- Roles of the council

・ Share on-going accident prevention related works among the relevant organizations.

・ Promote traffic safety education and discuss how to improve safety facilities.

・ Strengthen cooperation among relevant organizations to establish traffic order.

・ Share information on traffic policies and announce various traffic policies.

・ Promote and support specialization of works of relevant organizations to improve safety of transportation companies.

・ Establish a traffic accident data sharing system for transportation companies.

・ Provide special education for workers working in the transportation industry.

・ Manage risks of traffic accidents according to causes of accidents (e.g., overloading).

・ Provide transportation companies with counseling.

・ Devise measures to deal with particular weaknesses of each transportation company.

・ Manage drivers who have frequently caused traffic accidents.

③ Directions

o It is necessary to amend relevant laws and regulations and establish a council in consultation with relevant organizations. Because such measures may evoke strong opposition from transportation companies, it is required to persuade them, by introducing some measures beneficial to them. For example, it is worth to consider creating a window through which transportation companies can make recommendations/proposals to the government.

o With regard to the establishment of a traffic safety management system for transportation companies, it is desirable to continue to complement the system in consultation between transportation companies and relevant organizations, rather than expect establishment and operation of a perfect system from the beginning.

2) Implementation of traffic safety diagnosis for transportation companies

① Background

- There is a need for a traffic safety diagnosis for each transportation company for the purpose of reducing traffic accident rates.
- Furthermore, there is a need for promoting transportation companies' active involvement by informing them of the advantages of a traffic safety diagnosis (e.g., advantage of reducing costs of traffic accidents).

② Details of task

a) Traffic safety diagnosis

- Carry out a traffic safety diagnosis after establishing proper diagnostic criteria for automobile, railway, and maritime transportation companies.
- Set diagnostic criteria on a traffic accident frequency basis and then, provide results of a problem analysis based on a traffic safety diagnosis to transportation companies exceeding the criteria and instruct them how to improve.

b) Follow-up management

- For the purpose of persistent traffic safety management, check whether transportation companies which have undergone a traffic safety diagnosis implement the instructed improvement measures.
- After carrying out a safety diagnosis with the use of a quantitative and qualitative checklist, arrange transportation companies to report their performance of the improvement measures on a regular basis and get feedback.

③ Directions

- After enacting relevant laws/ordinances and assigning an appropriate department, make the department identify traffic accident frequency/status of each transportation company.

- Prepare administrative expenses of safety diagnoses by collecting penalties from the companies with problems based on the results of the diagnoses carried out on them.
- Enact laws and regulations legalizing implementation of traffic safety diagnoses as a legal basis and stipulate targets, executing agency, procedures and others of the diagnoses by law.
- For a reference, it is stipulated in the [Traffic Safety Act of South Korea] that transportation companies shall undergo a traffic safety diagnosis in case they exceed a certain limit defined by the law.
- The following is an abstract from the [Traffic Safety Act of South Korea] related to traffic safety diagnoses.

Case Study [Traffic Safety Act of South Korea)

-Traffic Safety Act -

Article 36 (Special Traffic Safety Diagnostics)

① Transportation Administration Authority may order that the transport operator has commissioned a special traffic safety diagnosis agency allows the transport operators corresponding to the first call when receiving a traffic safety diagnosis, transport operators claim when for the No. 2 cause the traffic operators to ask for general traffic safety diagnosis agency or special traffic safety diagnosis agency may order him to receive the traffic safety diagnosis.

1. When deemed Presidential Decree determining if there is a standard means of transportation than a car accident causes traffic accidents related to the art and need transportation or traffic safety diagnosis for the transportation system

2. When the traffic safety inspection results in accordance with the relevant transportation and transportation facilities and transportation systems deemed critical due to the risk factors causing traffic accidents Article 33 of Regulation

② Transport operators shall receive traffic safety diagnosis according to paragraph (1) submit a general traffic safety diagnosis agency or special traffic safety diagnosis agency has been created and issued by the competent traffic report traffic safety diagnosis administrations.

③ Required for such specific targets and diagnostic procedures and methods of traffic safety instruction conducted in accordance with the provisions of paragraph (1) shall be prescribed by Presidential Decree.

3) Enforcement of vehicle performance tests

① Background

- As a result of analyzing traffic accident data of Nigeria prepared by FRSC, it has been found that one of the main causes of accidents is automobile defects.
- Although currently in Lagos, automobile owners are supposed to get an automobile inspection once a year and receive a relevant certificate (Road worthiness), there are many people not conforming to the regulation. It is therefore required to ensure that automobile owners have their automobiles inspected on a regular basis through rigid enforcement of the automobile inspection regulation. In addition, it is necessary to make the inspection as precise as possible to minimize the rates of traffic accidents resulted from automobile defects such as break malfunction, tire wear, etc.

② Details of task

- Modify laws and regulations legalizing regular automobile inspections.
- Arrange automobile inspections to be executed by organizations authorized by the Government (e.g., LASTMA) and disallow, through rigid enforcement of regulation, driving of automobiles which have not undergone such inspections.
- Especially for vehicles requiring maintenance, it is required to have them inspected after the completion of the maintenance so as to promote complete restoration of vehicles.
- In addition, it is necessary to actively promote scrapping old vehicles, and it is required to have freight vehicles and heavy vehicles inspected using more strict standards.

4) Designation of children protection zones

- The urban areas of Lagos also require securing traffic safety for children and to achieve this, we have selected a project to designate Children Protection Zones (hereinafter referred to as "Children Protection Zone Designation Project") as one of our tasks.

① Background

- There is a need for Children Protection Zones designated for safe use by children who are venerable to traffic accidents.
- Most of the traffic accidents involving children occur at residential areas due to the characteristics of children's activities and the most representative area among the residential areas is school zones.
- It is therefore necessary to change and complement existing facilities near and in the school zones for safe commuting of children who are venerable to traffic accidents, and secure safe school walkways for them by introducing developed countries' traffic calming schemes with necessary modifications to suit regional conditions of Lagos.
- Currently in Lagos, although there are some schools providing traffic guidance at school zones, there is no on-going project for installation of safety facilities or implementation others measures.

② Details of task

- After enacting Children Protection Zones and selecting model area(s), carry out a pilot project at the area(s) and promote the project.
- Conduct case studies of Children Protection Zones designated in developed countries and set up guidelines making necessary modifications to suit regional conditions of urban areas of Lagos.

③ Directions

- Execution of the Children Protection Zone Designation Project requires detailed action plans. In this report, action plans are proposed referring to the Korean cases.
- Above all, specific guidelines are required such as designation subject/standards/procedures and necessary facilities for Children Protection Zones, which are proposed as follows.

a) Designation subject

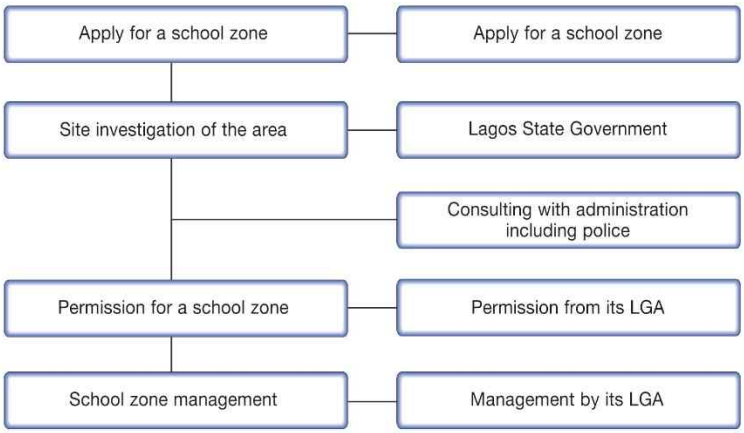
- In principle, the areas to be designated as Children Protection Zones should be within 300~500 m of main gates of schools so that relevant facilities can be concentrated by setting the minimum range. The areas should be selected after conducting surveys and having discussions among relevant authorities/organizations.
- Since there are a number of schools, in order to prioritize them, it is necessary to take note of some considerations as listed in the table below.

[Table 4.1-18] Considerations for designation of Children Protection Zones (Exemplary)

Classification	Considerations
Qualitative assessment items	Pedestrian volume
	Traffic volume
	Traffic accident occurrence for the past 3 years
	Difficulty in installing parking space
	Current status of installation of traffic safety facilities and road appurtenances

b) Designation procedures

- The followings are exemplary procedures to designate Children Protection Zones. The authority to designate Children Protection Zones is given by the Lagos State Government. When a designation request goes to Local Government Areas (LGA), local governments designate Children Protection Zones in consultation with police agency and commence the Children Protection Zone Project.

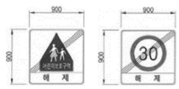


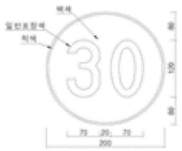
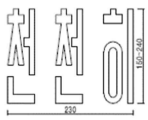
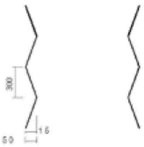
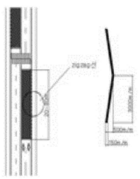
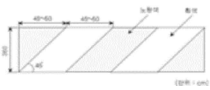
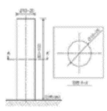
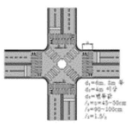
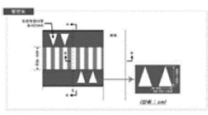
[Figure 4.1-11] Children Protection Zone Designation procedures (Exemplary)

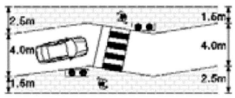
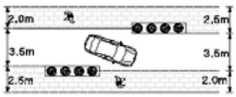
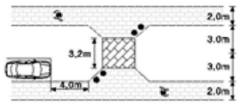
c) Facilities

o Some facilities are required for Children Protection Zones. These are traffic signs, pavement marking, traffic enforcement equipment, speed reduction facilities, etc. The table below provides some of the examples.

[Table 4.1-19] Facilities required for Children Protection Zones (Exemplary)

Items		Descriptions	Examples
Sign	Protection Zone sign	•Place a sign at the right pedestrian way or at the roadside where a protection zone starts.	
	Protection Zone (Instruction)	•Place within the protection zone. •Apply an integrated sign(road sin후 + instruction sign) in case the sign is to be placed at the starting point of the zone.	
	Protection Zone (Warning)	•Use restrictively only in case that the sign at the starting point has poor visibility.	
	Integrated sign	•Horizontal type: place at the starting point only. •Vertical type: place at starting point and other points within the protection zone.	
	Cancellation sign	•End of protection zone: place at the end point. •End of speed limit: place at the point where speed limit is lifted.	
Pavement marking	Protection zone pavement marking	•Mandatory installation required for each lane of pedestrian ways at the starting point or adjacent to main gates, at a distance of 20~80m from pedestrian ways •Overlapping installation required considering visibility of the marking, at a distance of less than 100m from each other	

	Speed limit	•Place a speed limit sign for each lane at the starting point, near main entry and in front of main pedestrian ways in projection zone. •In case that it is difficult to place a sign because of a lack of space and/or visibility, represent the starting point with speed limit pavement marking and protection zone pavement marking only.	
	Marking (Slow down)	•Place slow marking within the projection zone at the places requiring slow-down, especially considering places in front of pedestrian ways in the protection zone or near main entry for the purpose of complementing sign and pavement marking.	
	Slow marking (Zigzag)	•Place at road sides within the zone at the places requiring slow-down, especially considering places in front of pedestrian ways in the protection zone or near main entry. •Place in areas prohibiting parking and stopping (gold line), not placing at the area allowing parking and stopping (gold dotted line).	
Unmanned traffic enforcement equipment		•Traffic enforcement camera for speeding and traffic signal violation: Place where traffic accidents and speeding & other traffic signal violation occur frequently. •Traffic enforcement camera for illegal parking or stopping: within 50m of the upper and lower parts of pedestrian ways in the projection zone, near front and back gates of schools and in the parking and sopping zone where pedestrians come and go frequently. •CCTV: Install after gathering opinions of experts and related parties through a public hearing, presentation for residents, survey, public opinion poll, etc. •Install an unmanned traffic enforcement sign and supplementary sign(traffic enforcement notices)	
Red pavement		•Pave with dark red skid proof pavement materials if necessary in consideration of local conditions. •Pave restrictively in consideration of maintenance and repair need, durability, paving cost, etc. •Do not pave in case of a backside road or 30km/h speed limit.	
Speed bump		•Install at the places requiring speed limit less than 30km/h due to the risks of children traffic accidents. •Do not install within 15m of intersections, 20m of crosswalks, 20m of bus stops and at dark places.	
Bollard		•Install restrictively at places where billboards are absolutely necessary because they can be a sort of obstructions to passage of pedestrians and the transportation venerable.	
Crossing facility	Diagonal crosswalk	•Install based on engineering judgment of pedestrian movement, pedestrian and vehicle volume, sign intervals, distance between interchanges, etc.	
	Highland crosswalk	•Place together with relevant facilities, at roads requiring a speed limit of less than 30km/h. •Secure sound environment for pedestrian passage by placing at a height similar to that of the curbstone.	

Signal activated by pedestrians		•Install at pedestrian ways within the projection zones having small pedestrian volume at ordinary times. •Install together with guide signs and acoustic signals for the visibly handicapped.	
Pedestrian way	Slalom	•Place a slalom with curves.	
	Crank	•Place a crank applying a linear alignment change.	
	Pinch point	•Place a pinch point of which the middle part is narrowed down.	

Source: Integrated Guideline for Children, Elderly and Disabled, Ministry of Administration and Security, 2011

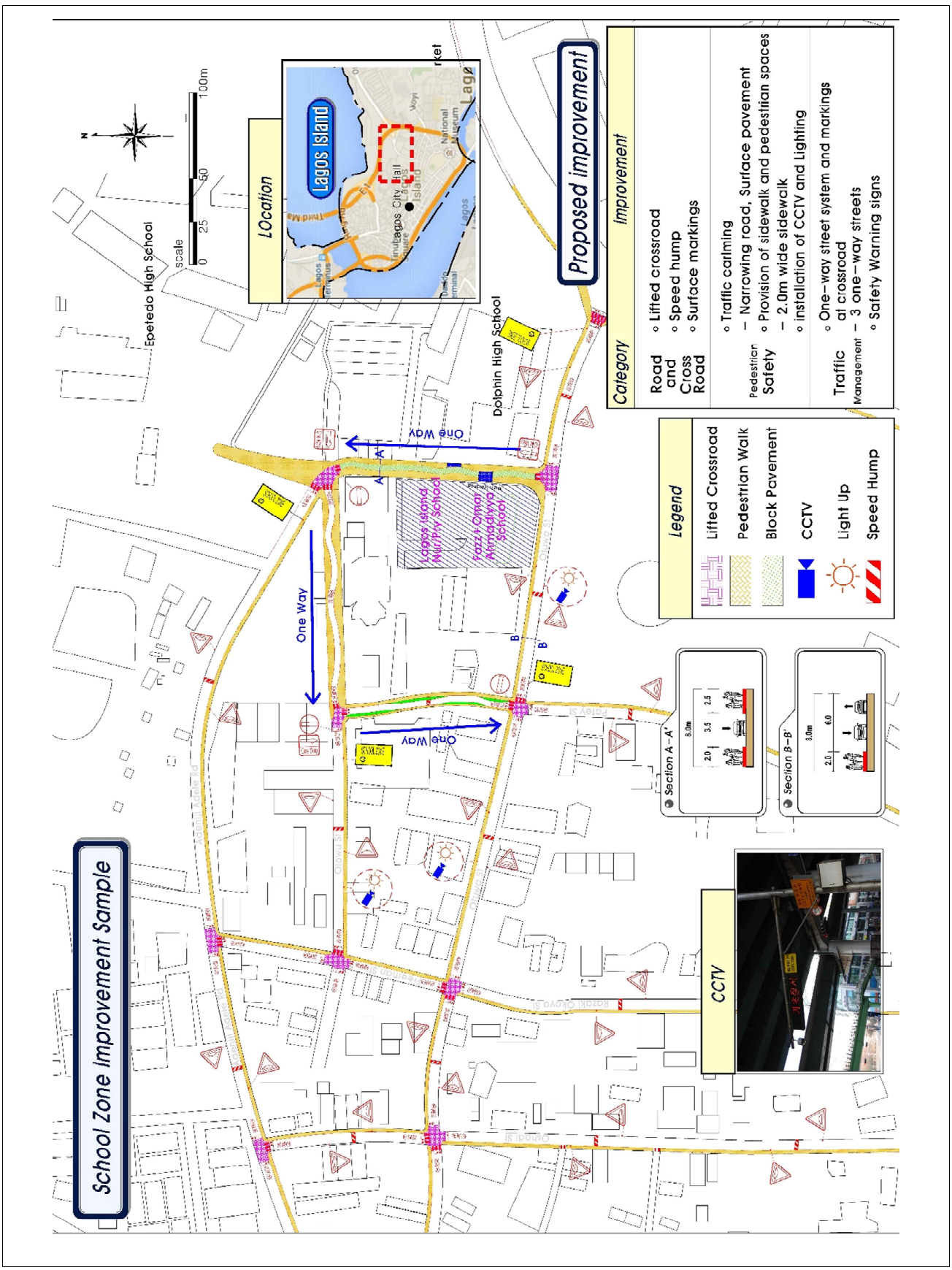
- According to statistical data of 2013, there are 1,001 primary schools in Lagos and Epe area has 78 primary schools, which is the highest among the areas of Lagos.
- Since the Children Protection Zone Project is a project aiming safe commuting of children, it would be desirable to implement for all primary schools in the urban areas of Lagos. However, since it is difficult to implement the project at once for all primary schools, it should be done stepwise with several stages. At the first stage, it is necessary to implement a pilot project and then, analyze and promote the effects.
- Regarding the areas subject to such a pilot project, it is necessary to exclude the followings four peripheral areas: Badagry, Epe, Ibeju-Lekki, and Ikorodu. Also although the area with the highest traffic accident rate is Ikeja, it is considered more desirable to select Lagos Island Area as the pilot project location because the area is expected to show relatively good promotion effects because promotion is of great importance as far as a pilot project is concerned.

[Table 4.1-20] Number of primary schools by areas of Lagos (2011/2012)

(Unit: EA)

LOCAL GOVERNMENT AREA	PRIMARY SCHOOL	FRSC Accident Data	
		No. of areas where traffic accidents occurred from 2010 to 2013	No. of areas where more than 5 traffic accidents occurred
AGEGE	50	15	1
AJEROMI/IFELODUN	71	-	-
ALIMOSHO	74	6	-
AMUWO-ODOFIN	43	16	1
APAPA	24	63	6
BADAGRY	53	190	10
EPE	78	39	4
ETI-OSA	35	93	7
IBEJU-LEKKI	37	17	1
IFAKO/IJAIYE	25	-	-
IKEJA	30	141	9
IKORODU	57	-	-
KOSOFE	41	86	5
LAGOS/ISLAND	32	62	6
LAGOS/MAINLAND	58	21	1
MUSHIN	76	2	-
OJO	52	39	3
OSHODI/ISOLO	54	19	2
SHOMOLU	48	2	-
SURULERE	63	44	3
TOTAL	1,001	-	-

Source: Lagos Bureau of Statistics (2013), FRSC Accident Data



[Figure 4.1-12] Example of a Children Projection Zone

5) Improvement of frequent accident roads (blackspots)

① Background

- There is a need for safety passage as reducing accident rates by analyzing causes of accidents and devise countermeasures, focusing on the areas where traffic accidents frequently occur.
- ◦n the urban areas of Lagos, there are many roads with undivided/unclarified lane markings and jaywalking occurs frequently, becoming the main causes of accidents. Moreover, the standards of one road are often different from those of others, causing confusions to drivers, hence accidents. Therefore, areas with such issues require substantial improvement.

② Details of task

- Minimize accidents by improving traffic environment through a scientific and systematic analysis on causes of accidents at the areas where traffic accidents frequently occur.
- Set criteria for selection of high accident frequency locations. For example, in South Korea, the criteria for selection of such locations change depending on administrative jurisdiction and road characteristics.

[Table 4.1-21] Criteria for selection of high accident frequency locations

Classification			Selection criteria (For 3 years)
Administrative districts	Metropolitan city		Over 7 times
	Large city		Over 7 times
	General city		Over 5 times
	Others		Over 3 times
Road types	Intersection		Within 150m from the rear of a stop line
	Crosswalk		Within 150m from the rear of a stop line
	Other road sections	Built-up area	600m section length
		Expressway and others	1,000m section length

Subject of accidents	People + Things

- For the urban areas of Lagos, we propose to select locations where over 5 times of accidents have occurred for the past 4 years as high accident frequency locations. These figures are determined on the basis of the reliability of the existing accident data for LMA.
- Through systematic collection of accident data and a detailed analysis of causes of accidents, measures to improve the situation should be established and improvement should be made.
- Because of the limited budget in executing improvement works at all the surveyed areas, it is recommended to prioritize some locations and establish more detailed action plans.

③ Directions

- After selecting project areas/spots through a traffic accident data, prioritize some project locations, giving priority to high accident frequency locations and locations where the main cause of accidents is the poor road environment.
- Analyze project effects after completing a pilot project for initial 1~2 years.
- As a result of analyzing FRSC traffic accident data for the purpose of designating a model area, it has been found that high accident frequency areas are Badagry (190 locations), Ikeja, etc. Among them, we have selected Ikeja as the model area for the pilot study because it is an urban area.
- In Ikeja, traffic accidents occurred at 141 locations from 2010 to 2013. The locations where over 5 times of accidents occurred are 9 in total.
- Thus, we have studied the 9 locations; in this report, problems are identified and improvement measures are established.

[Table 4.1-22] Results of analyzing traffic accident data for each area of Lagos

Serial No.	Name of area	Traffic accident occurrence locations within the area	Locations where over 5 accidents occurred
1	Agege	15	1
2	Ajeromi-Ifelodun	-	-
3	Alimosho	6	-
4	Amuwo Odofin	16	1
5	Apapa	63	6
6	Badagry	190	10
7	EPE	39	4
8	ETI-OSA	93	7
9	Ibeju-Lekki	17	1
10	Ifako-Ijaiye	-	-
11	IKEJA	141	9
12	Ikorodu	-	-
13	Kosofe	86	5
14	Lagos-island	62	6
15	Lagos-mainland	21	1
16	Mushin	2	-
17	Ojo	39	3
18	Oshodi-Isolo	19	2
19	Somolu	2	-
20	Surulere	44	3

Source: FRSC Traffic Accident Data (2010~2013)

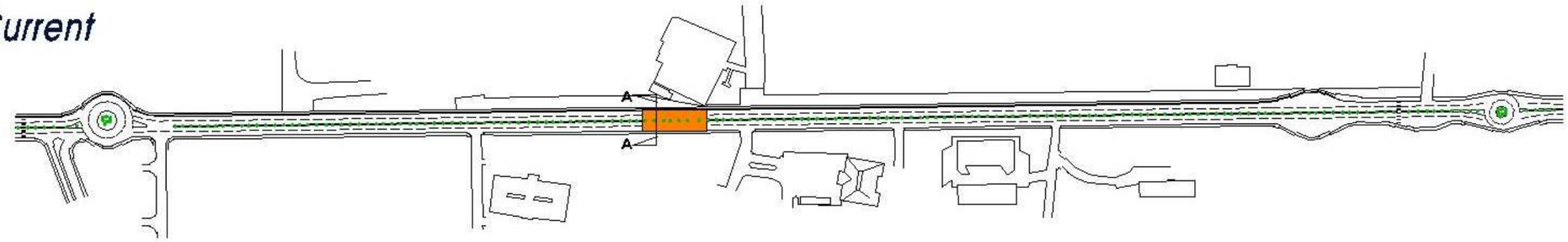
- Although we have analyzed causes of accidents for 9 high accident frequency locations and devised some improvement measures, we have not been able to collect detailed data of the accidents occurred. Therefore, we propose improvement measures, focusing on the current road problems through a review of the current road conditions.
- In order to put the improvement measures into practice, it is considered essential to conduct detailed reviews of traffic volume, pedestrian volume, accurate geometrical structure, etc. and have consultations with relevant authorities.

[Table 4.1-23] Nine high accident frequency locations in IKEJA

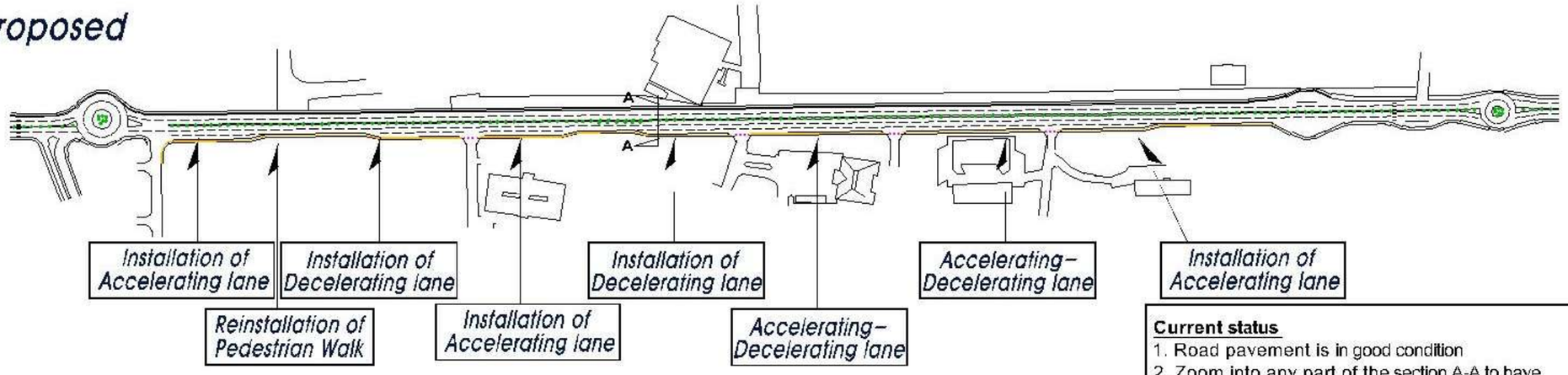
LGA	Traffic accident frequencies	Locations	Main causes of accidents	Improvement measures
IKEJA	AIRFORCE BASE (7)	MM1-MM2 ROAD	Car to car crash	Place acceleration/deceleration lanes at entry and exit.
	ALAUSA (6)	LA-IB	Jaywalking	Place a pedestrian way crosswalk, jaywalking prevention facility
	BERGER (10)	IB-LA	Jaywalking	Place a pedestrian way and crosswalk.
	FRSC GATE/SOLID ROCK (7)	URBAN	Car to car crash	Adjust lane width Place an intersection for smooth entrance to adjacent areas.
	IKEJA ALONG (7)	IKJ-ABK EXP	Jaywalking	Move a pedestrian bridge and install a guard fence
	ILE ZIK (6)	IKJ-ABK EXP	Jaywalking	Install a pedestrian way and pedestrian bridge.
	MMIA (13)	Airport road	Car to car crash	Improve the geometric structure of roundabout
	OTEDOLA SLOPE/BRIDGE (31)	LA-IB	Speeding at slop way	Implement skid proof pavement and install an automated traffic enforcement camera
	TOLL GATE/7 UP (13)	LA-IB	Car crash	Place a lane for waiting for U-turn and an acceleration lane for joining the main lanes

Airforce Base, IKEJA – Current & Proposed

Current



Proposed



Current status

1. Road pavement is in good condition
2. Zoom into any part of the section A-A to have a wider view.
3. The accident is usually vehicle-to-vehicle.
4. Vehicles coming of the facility (Air force Base always drive against traffic to access the roundabout.)

N

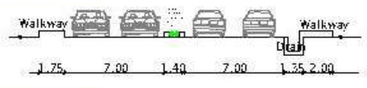
scale 0 100 200m

Location

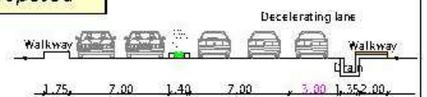
Legend

- Reinstallation of Pedestrian walk
- Blackspot
- Pedestrian crossing

Current



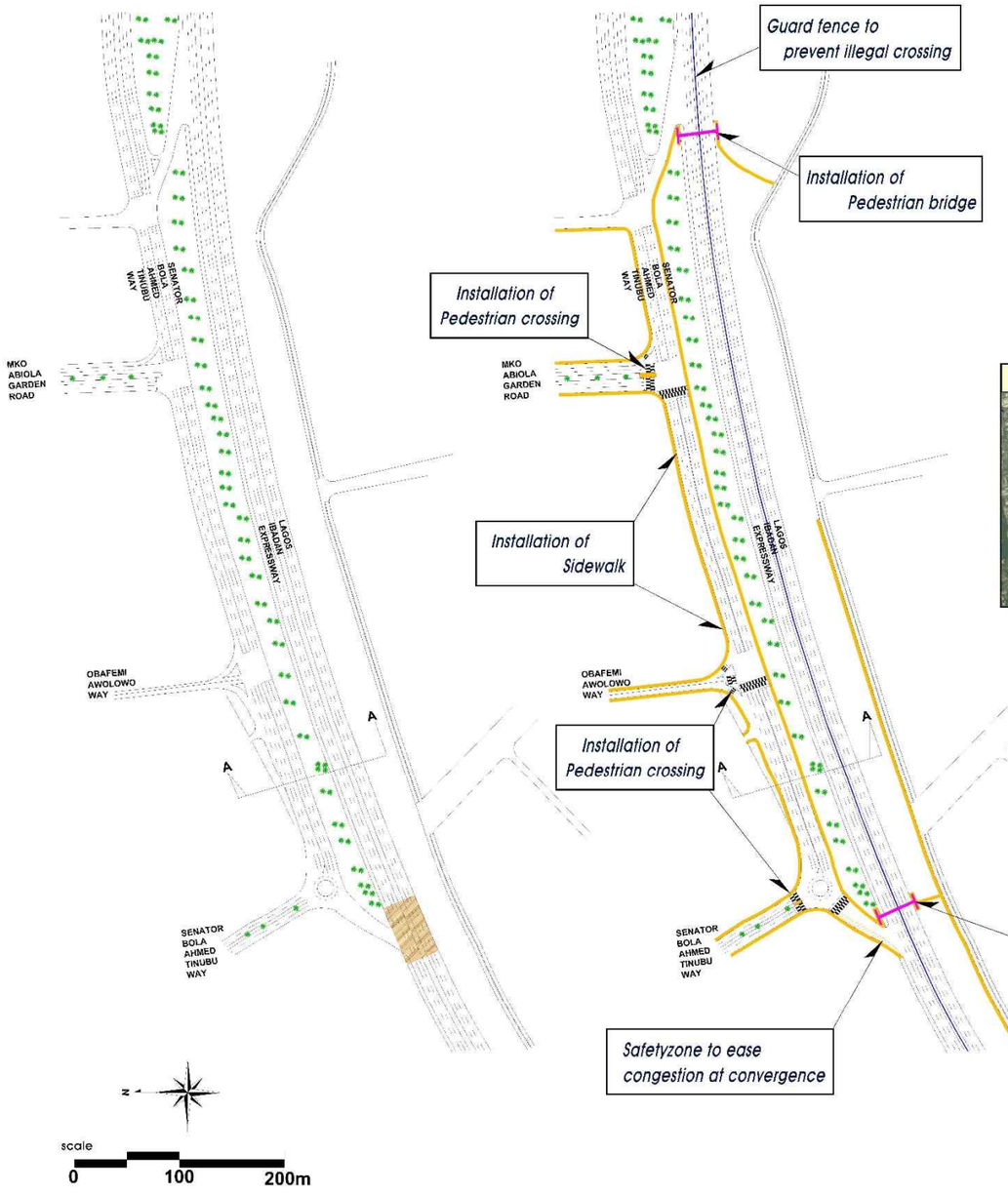
Proposed



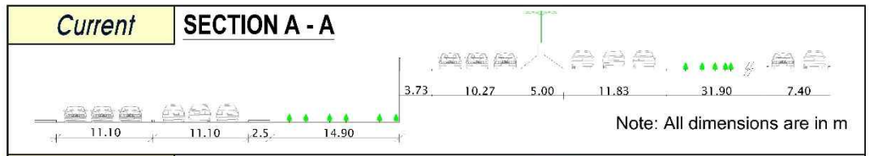
Proposed Improvement

Category	Improvement
Road	◦ Installation of Accelerating–Decelerating lane for safe entrance to the Airforce Base
Traffic safety	◦ Reinstallation of pedestrian side walk on the accelerating and decelerating lane ◦ Installation of Pedestrian crossing

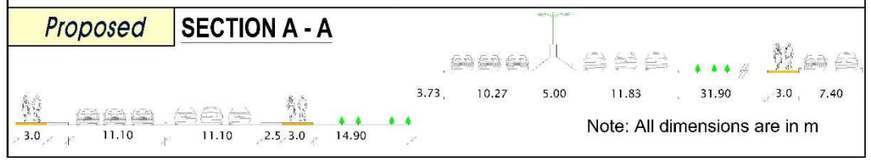
ALAUSA BLACK SPOT–Current & Proposed



Current — SECTION A - A



Proposed — SECTION A - A



Location

Current Status

1. The blackspot is along the Lagos-Ibadan Expressway detailed graphically with red lines.
2. There are street lights at the location
3. No traffic signals along Lagos-Ibadan Expressway
4. No road markings along the Expressway
5. Road pavement is in good condition
6. Shoulder of the Expressway is unpaved
7. The accident prone area is indicated with a red box and the conflict is mainly vehicle to person. A lot of pedestrians cross the 6-lane expressway, which often leads to fatalities.

Installation of Pedestrian Bridge(sample)

Jaywalk Prevention fence (sample)

Regend

- Pedestrian bridge
- Sidewalk
- Jaywalk Prevention fence
- Blackspot

Proposed improvement

Category	Improvements
Pedestrian	◦ Installation of Sidewalk
	◦ Installation of Pedestrian Crossing
	◦ Installation of Pedestrian Bridge
	◦ Installation of Jaywalking prevention fence

BERGER BLACKSPOT–Proposed Improvements

Current Status

1. The reconnaissance survey was carried out at an offset of 500meters from the Black Spot location in both directions of the road. Hence, a 1km length of the road is graphically represented & detailed herein.
2. Black Spot is indicated with a red box and the conflict is vehicle to vehicle and vehicle to pedestrian
3. The following were also observed along the 1km length;
4. Non functional traffic signals
5. No traffic signs
6. No road markings
7. Pavement condition is fair
8. Drainage as indicated on cross-section
9. Road median available
10. High pedestrian activity especially within the vicinity of the black spot

Current

scale 0 100 200m

Location

Proposed

Narrowing lane number to release congestion at the merge

Guard fence to prevent jaywalking

Lane alignment for smooth flow

Lane alignment for smooth flow

Sidewalk for pedestrian protection

Pedestrian footbridge

Pedestrian crossing

Lane alignment for smooth flow

Proposed Improvement

Isheri Road

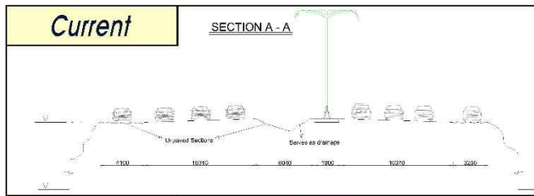
Lagos - Ibadan Expressway

Legend

- Pedestrian crossing
- Sidewalk
- Pedestrian Footbridge
- Median
- Blackspot

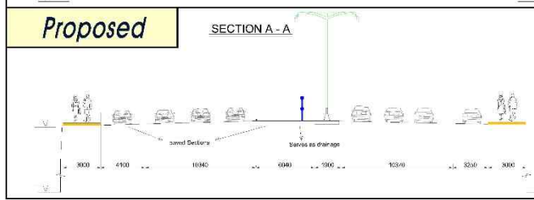
Current

SECTION A - A



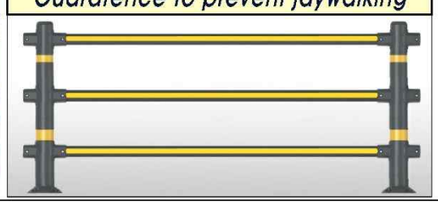
Proposed

SECTION A - A



Pedestrian FootBridge

Guardfence to prevent jaywalking



Category	Improvement
Pedestrian	◦ Safe sidewalk for pedestrian protection ◦ Pedestrian Foot Bridge for safe crossing ◦ Guard fence to prevent jaywalking ◦ Lane alignment

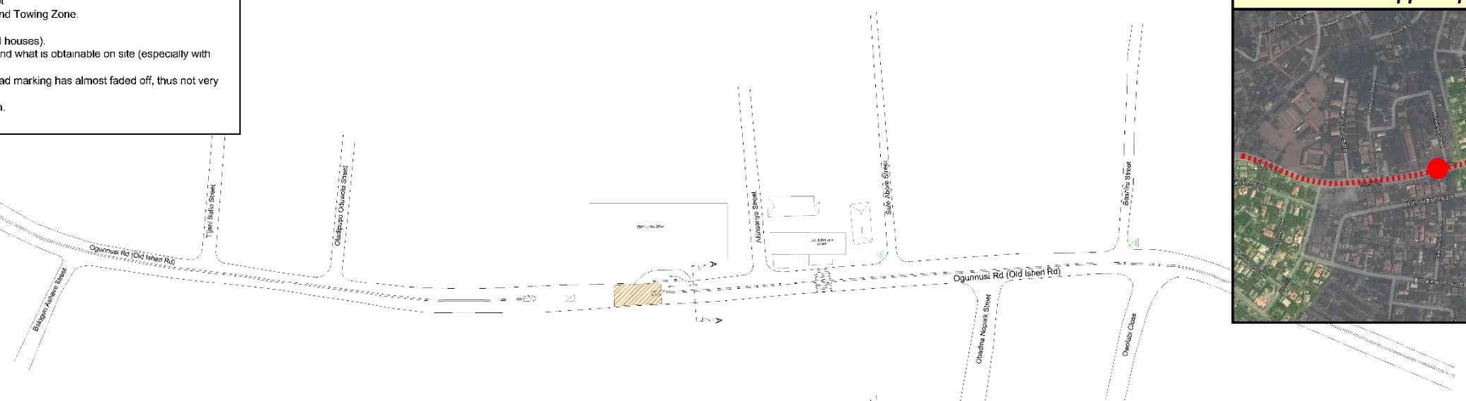
Current Status

1. The reconnaissance survey was carried out at an offset of 500meters from the Black Spot location in both directions of the road. Hence, a 1km length of the road is graphically represented & detailed herein.
2. The black spots is indicated with a red box and the conflict is mainly vehicle to vehicle.
3. The following were also observed along the 1km length;
4. No traffic signals
5. Pavement condition is fair
6. Drainage as indicated in cross-section
7. Low road median is available
8. No pedestrian activity especially within the vicinity of the black spot
9. Traffic signs available include; Pedestrian Crossing, No Parking and Towing Zone.
10. Road Marking available include; Zebra Crossing.
11. Ogunnusi Road provides direct access into premises (offices and houses).
12. I here is quite a discrepancy between the Google Earth image and what is obtainable on site (especially with street names and locations).
13. The Zebra Crossing indicated on plan herein depicts that this road marking has almost faded off, thus not very visible.
14. No parking is allowed anywhere along the 1km under observation.

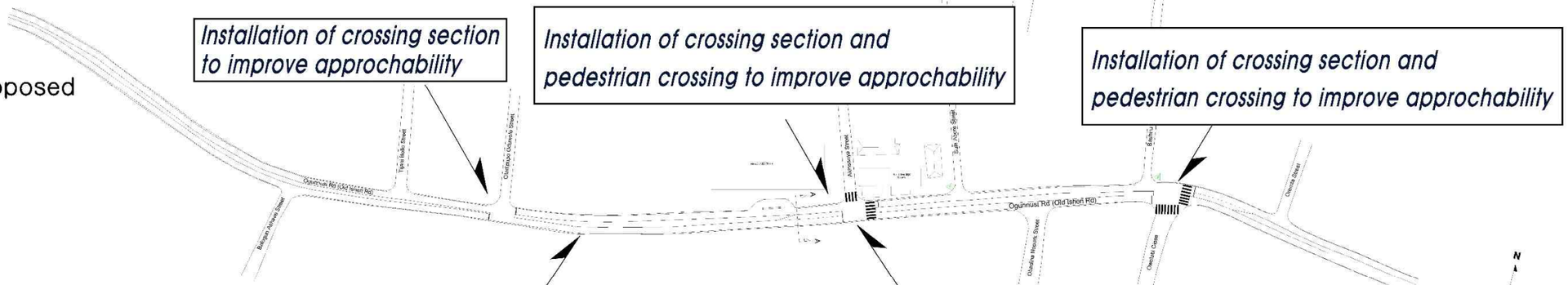
FRSC GATE BLACK SPOT, OGUNNUSI ROAD (OLD ISHERI ROAD)–Current & Proposed

위 치 도

Current



Proposed



Installation of crossing section to improve approchability

Installation of crossing section and pedestrian crossing to improve approchability

Installation of crossing section and pedestrian crossing to improve approchability

Adjustment of lane width

Pedestrian crossing near the cross section

N

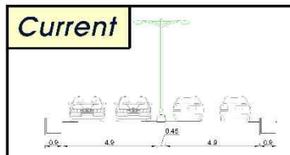
scale 0 100 200m

Proposed Improvement

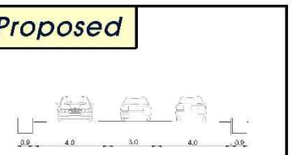
Category	Improvements
Road	◦ Installation of cross section to improve approchability – Enable U–turn lane the left–turn ◦ Readjustment of lane width (4.9m → 4.0m) ◦ Pedestrian crossing at cross section

SECTION A - A

Current



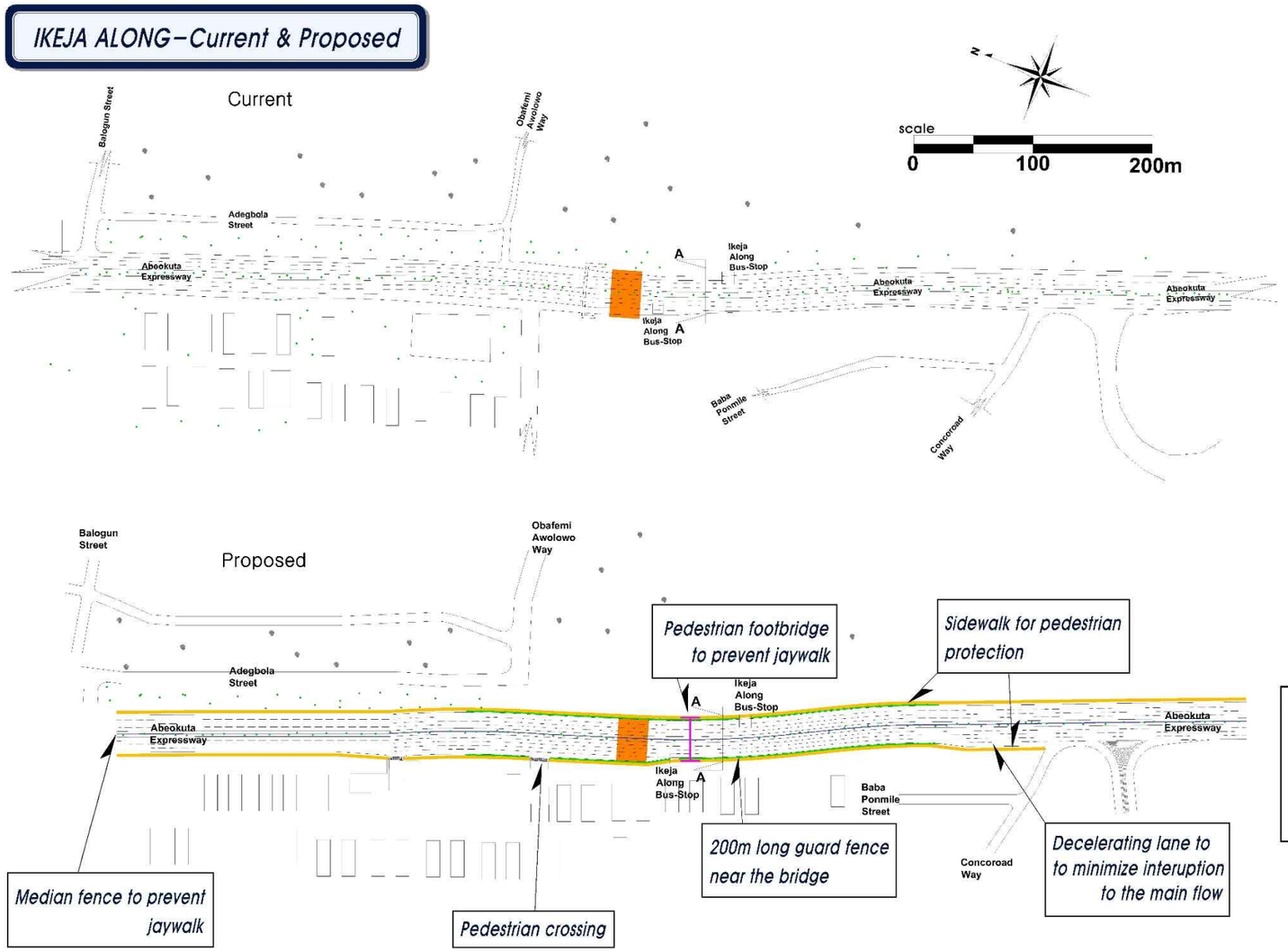
Proposed



Legend

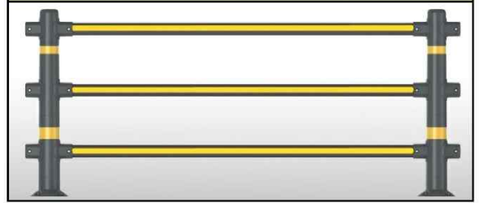
- Pedestrian crossing
- Blackspot

IKEJA ALONG–Current & Proposed



Location

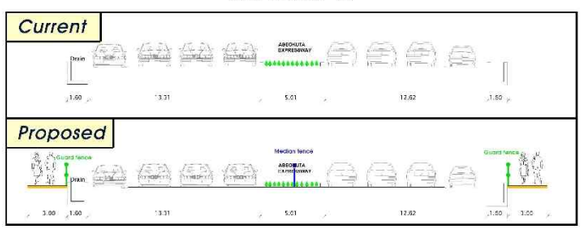
Median fencing to prevent jaywalk



Current Status

1. Road pavement is in good condition
2. Zoom into any part of the section A-A to have a wider view.
3. There is a pedestrian bridge at the Ikeja Along Bus-Stop but it is not being used. Pedestrians prefer to cross the road and this often leads to fatalities.
4. Accident prone area is graphically detailed with a red box

SECTION A - A



Guard fence

Legend

- Guard fence
- Side walk
- Median fence
- Pedestrian footbridge
- Blackspot

Proposed Improvement

Category	Improvements
Pedestrian	◦ Installation of sidewalk for pedestrian protection ◦ Installation of pedestrian crossing ◦ Median fencing to prevent jaywalk ◦ Pedestrian footbridge to prevent jaywalk ◦ 200m long guard fence near footbridge
Road	◦ Installation of decelerating lane to minimize disturbance to the main flow

ILE ZIK BLACK SPOT–Current & Proposed

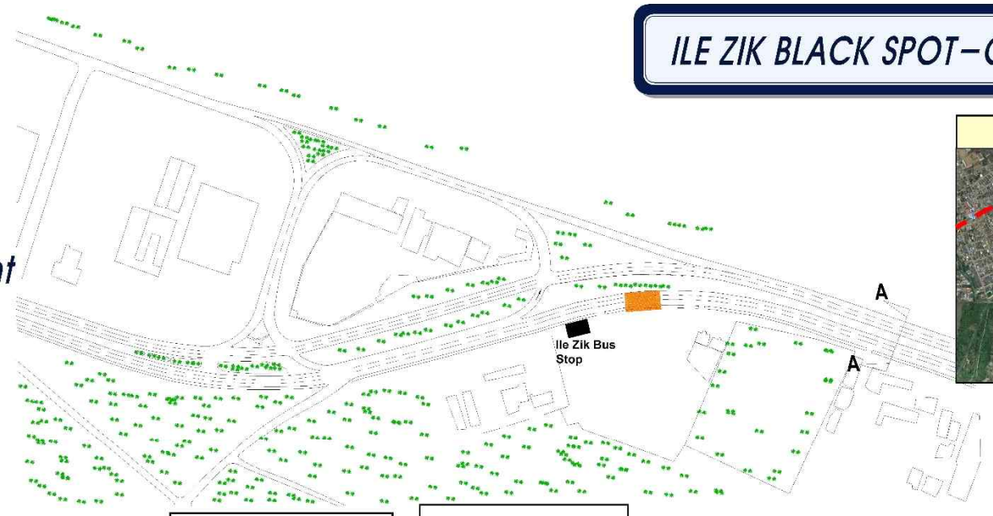
scale
0 100 200m

Proposed Improvement

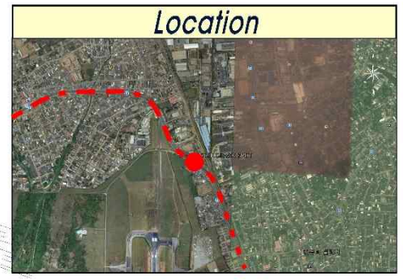
Category	Improvements
Road	◦ Installation of sidewalk for pedestrian protection ◦ Installation of guard fence to prevent jaywalk ◦ Installation of pedestrian footbridge for safe crossing ◦ Lane alignment for smooth flow of traffic ◦ Installation og pedestrian crossing

Legend
- Pedestrian footbridge
- Sidewalk
- median fence
- Blackspot

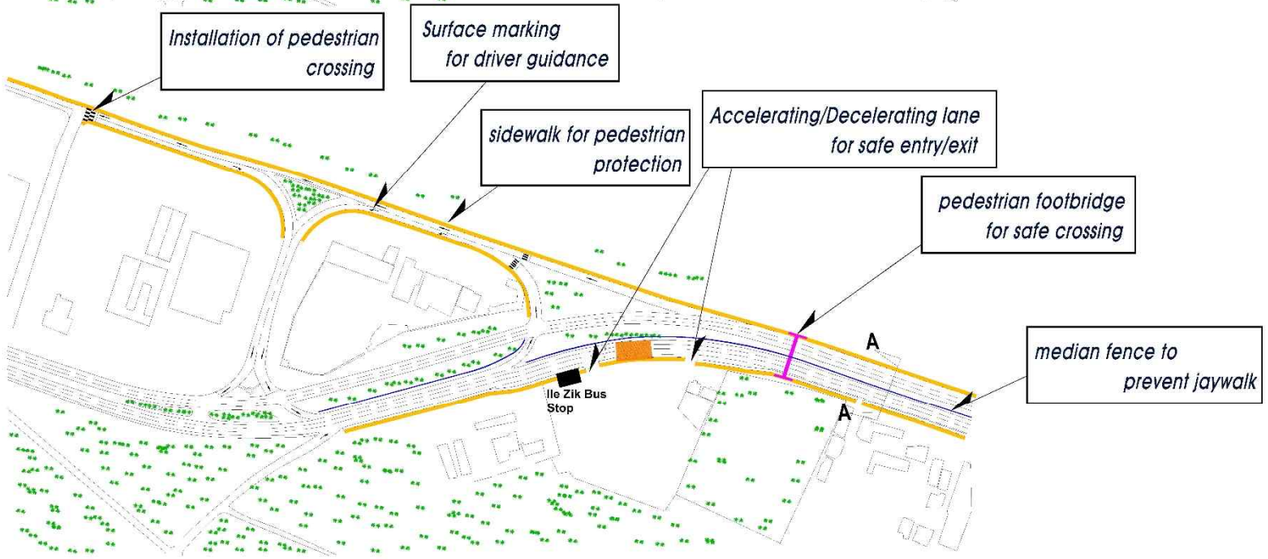
Current



Location



Proposed



Current status

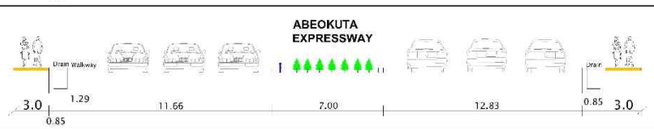
1. Road pavement is in good condition
2. Zoom into any part of the section A-A to have a wider view.
3. The accident prone area is indicated with a red box and the conflict is mainly vehicles to persons. Pedestrians cross the road at this location and this often leads to fatalities.

SECTION A - A

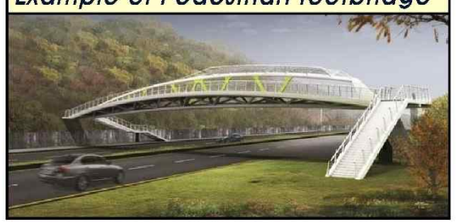
Note: All dimensions are in m

Current

proposed

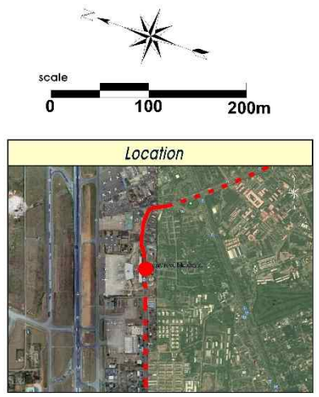


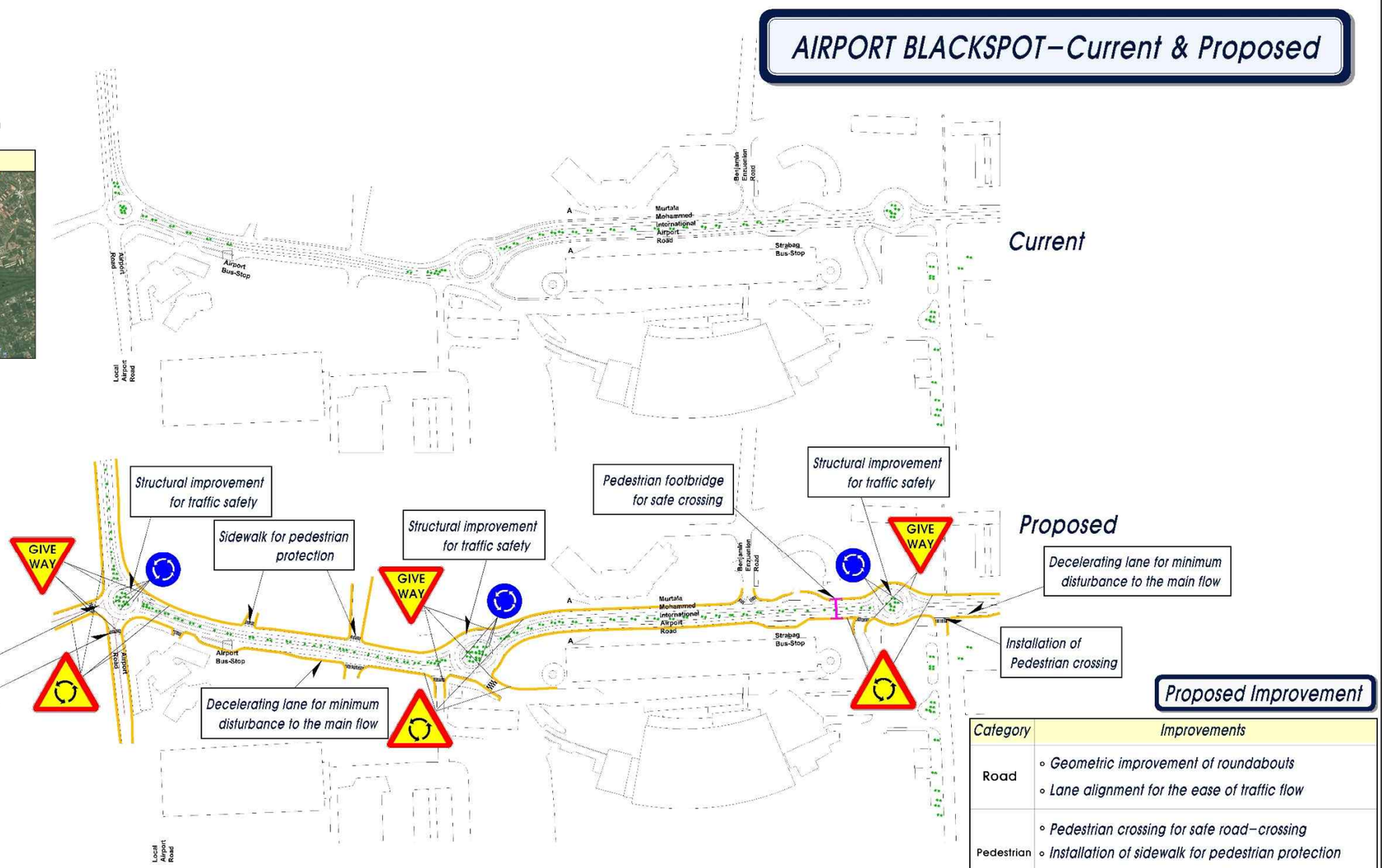
Example of Pedestrian footbridge



Median fence to prevent jaywalk

AIRPORT BLACKSPOT–Current & Proposed





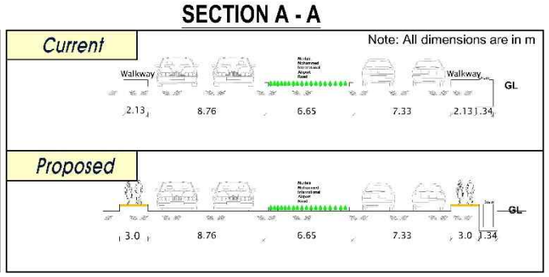
Proposed Improvement

Category	Improvements
Road	◦ Geometric improvement of roundabouts ◦ Lane alignment for the ease of traffic flow
Pedestrian	◦ Pedestrian crossing for safe road–crossing ◦ Installation of sidewalk for pedestrian protection ◦ Installation of pedestrian footbridge for safe crossing

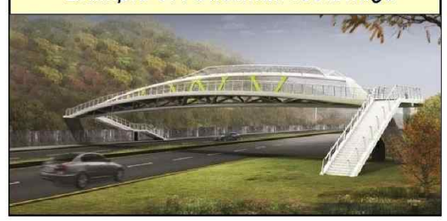
Current Status

1. Road pavement is in good condition
2. Zoom into any part of the section A-A to have a wider view.
3. The accident is usually vehicle-to-vehicle due to the geometry of the road network and volume of vehicles using it.
4. There is no particular spot as accidents often occur at various locations along the road network.

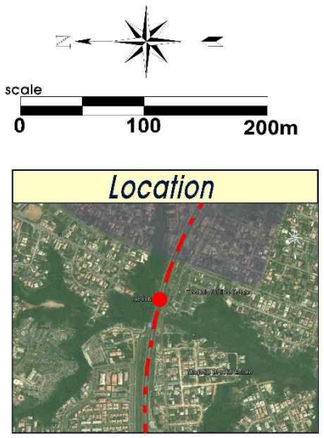
SECTION A - A



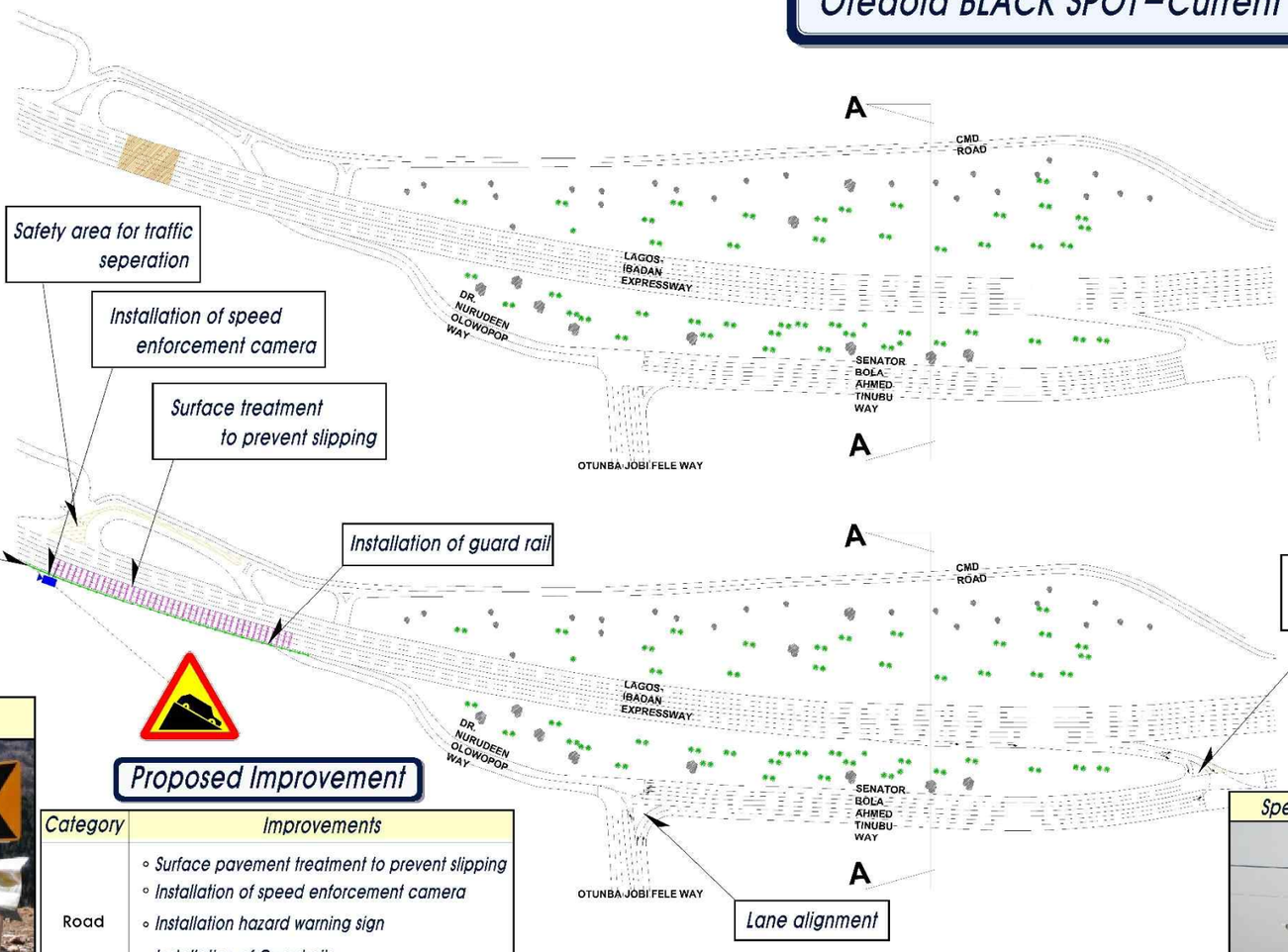
Example of Pedestrian footbridge



Otedola BLACK SPOT–Current & Proposed



Location



Example of guard rail

Proposed Improvement

Category	Improvements
Road	◦ Surface pavement treatment to prevent slipping ◦ Installation of speed enforcement camera ◦ Installation hazard warning sign ◦ Installation of Guardrails ◦ Lane alignment of side road

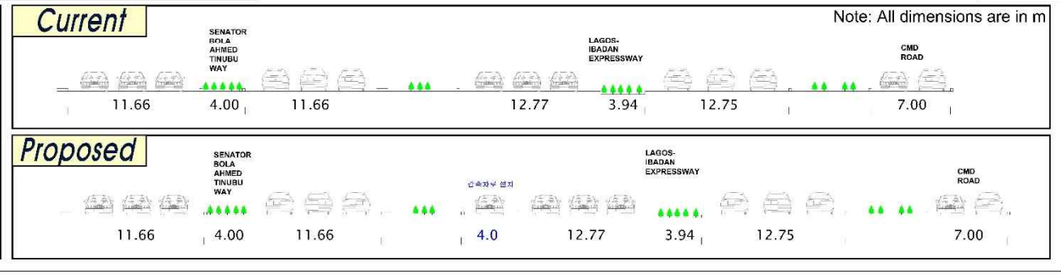
SECTION A - A

Speed enforcement camera

Current Status

1. The blackspot is along the Lagos-Ibadan Expressway detailed graphically with red lines.
2. There are street lights at the location
3. No traffic signals along Lagos-Ibadan Expressway
4. No road markings along the Expressway
5. Road pavement is in good condition
6. Shoulder of the Expressway is unpaved
7. Zoom into any part of the section A-A to have a wider view.
8. The accident prone area is indicated with a red box and the conflict is mainly vehicle to person. A lot of pedestrians cross the 6-lane expressway, which often leads to fatalities.

Note: All dimensions are in m

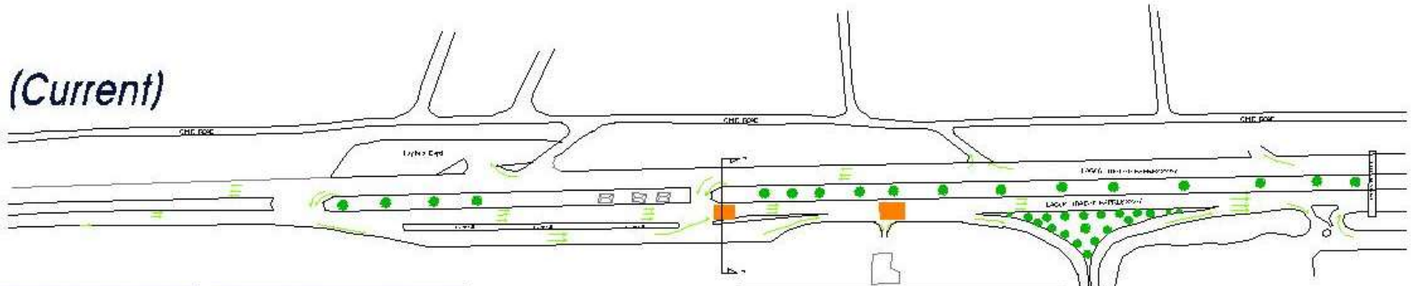


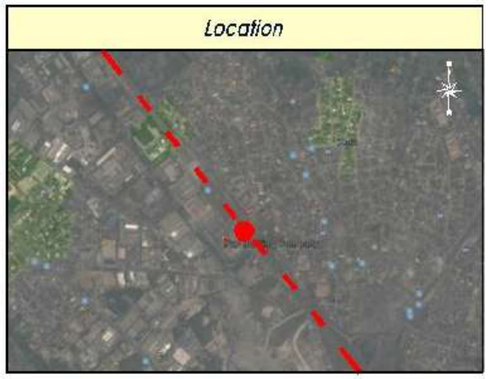
Regend

- Pavement to prevent slipping
- Hazard sign
- Speed Enforcement Cameras
- Blackspot
- Guard rail

Tollgate 7up Black spot–Current & Proposed

(Current)





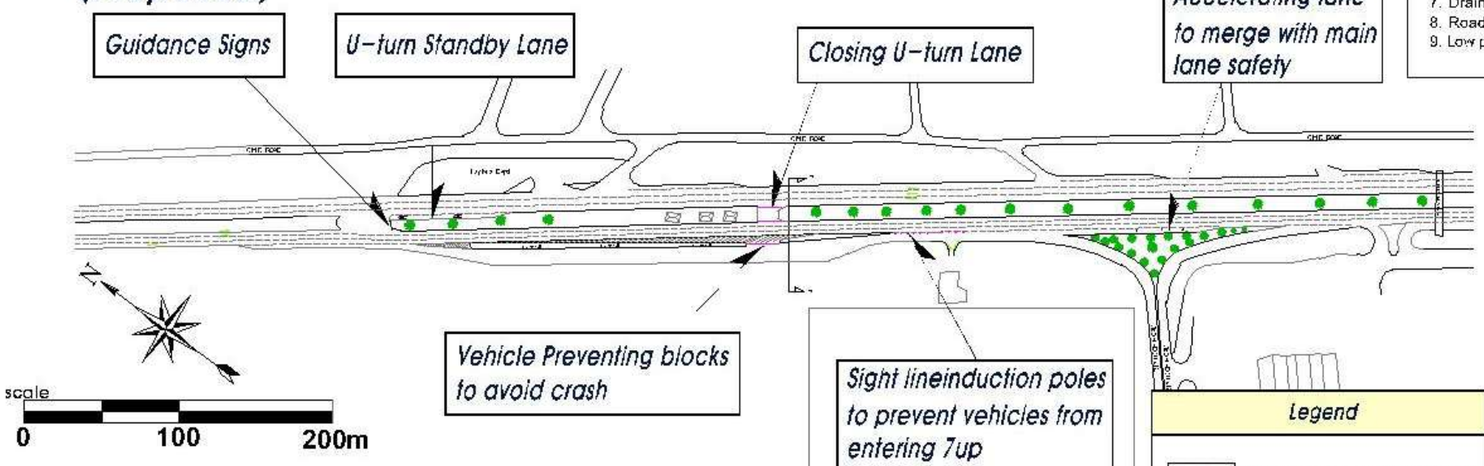
Sight line induction poles

Vehicle preventing blocks

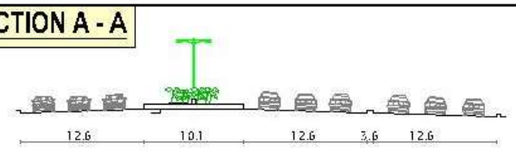
Current Status

1. The reconnaissance survey was carried out at an offset of 500meters from the Black Spot location in both directions of the road. Hence, a 1km length of the road is graphically represented & detailed herein.
2. Black Spots are indicated with a red box and the conflict is mainly vehicle to vehicle.
3. The following were also observed along the 1km length;
4. No traffic signs or signal
5. No road markings
6. Pavement condition is good
7. Drainage as indicated on plan
8. Road median available
9. Low pedestrian activity especially within the vicinity of the black spot

(Proposed)



SECTION A - A



Legend

- Vehicle preventing block
- Sight line induction poles
- Blackspot

Proposed Improvement

Category	Improvement
Road	Closing of dangerous U-turn location Provision of U-turn standby lane Accelerating lane at lane merge
Traffic Safety	Guigance signs Sight line induction poles to prevent vehicles from entering 7-up Poles to maintain lanes Vehicle preventing blocks for guidance

6) Establishment of an automated speed enforcement system (collectable type)

① Background

- As a result of analyzing the causes of accidents based on FRSC traffic accident data, it has been found that the main cause of traffic accidents is speeding. Therefore, establishment of an automated speed enforcement system is required at locations prone to speeding and locations where an accident can easily lead to a large accident, in order to control speeding vehicles.
- Currently in Lagos, there is no spot where such a system is in operation. Since there is a restriction on installation due to a lack of infrastructure such as electric power, use of solar power can be taken into account.

② Details of task

- Designate the highest speeding frequency locations for a pilot study.
- Operate an automated speed enforcement camera system (collectable type) by applying a photovoltaic plate because currently in Lagos there is a lack of stability in electric power supply.

[Figure 4.1-13] Example of installing an automated traffic enforcement camera

③ Directions

- Install automated speed enforcement cameras primarily at locations where traffic accidents caused by speeding occur frequently. The installation should be carried out in stages after prioritizing installation locations based on the accident frequency.
- Analyze project effects by conducting a pilot project at the initial project stage.
- Use project effect analysis data for further promotion..

7) Structural improvement of roads with high accident risks

① Background

- Since poor geometric structures of roads is one of the causes of accidents, it is necessary to draw up improvement measures.
- Because most of the urban areas of Lagos are located on a flat land, the land surface is sound in terms of inclination or curvature. However, there are many road sections with aged road facilities in urgent need of maintenance and repair. Therefore, we have reviewed in this report such structural issues as well.

② Details of task

- Execute a road improvement project after designating some entire sections of the roads where traffic accidents frequently occur.
- Minimize risks of traffic accidents due to the structural deformity of roads by executing the road improvement project.
- For the road sections where difficult to carry out structural improvement, implement other improvement measures (e.g., safety facility installation, channelization, etc.) into practice.

[Table 4.1-24] Dangerous road selection method and project scope (Interim plan)

- As for main arterial roads, dangerous road evaluation criteria consist of geometric structure of road (55), road environment (25) and investment and regional demand (20) with the total of 100 points. On the other hand, as for local roads, dangerous roads are selected if there have low cost effectiveness, high traffic accident rates, many civil complaints, sections not meeting road design standards, etc.

Dangerous road evaluation criteria (Main arterial roads)

Evaluation criteria	Points	
Total	**100**	
Geometric structure of road	Sub-total	55
	Radius of curve	20
	Front and back road situation	15
	Sight distance	5
	Longitudinal slop	5
	Width of lane	5
	Width and status of shoulder	5
Road environment	Sub-total	25
	Traffic accident	15
	Traffic volume	10
Others	Sub-total	20
	Investment Amount	10
	Regional demand	10

→ Project scope

- Areas with a poor road structure: areas with unfavorable radius of curve, width of lane, etc.
- Areas with a lack of road safety facilities: area requiring optical guidance devices, crash barriers, etc.
- Areas prone to speeding
- Areas prone to jaywalking

8) Designation of pedestrian priority zones

① Background

- Currently the urban areas of Lagos lack consideration for pedestrian passage as roads are fundamentally devoted to vehicles rather than pedestrians. In particular, the pedestrians are always exposed to automobile accidents because roads are being operated in a sort of automobile passage friendly way.
- It is necessary to make people aware of the importance of pedestrian space such as a Pedestrian Priority Zone and reduce traffic accident rates by creating pedestrian space.

② Details of task

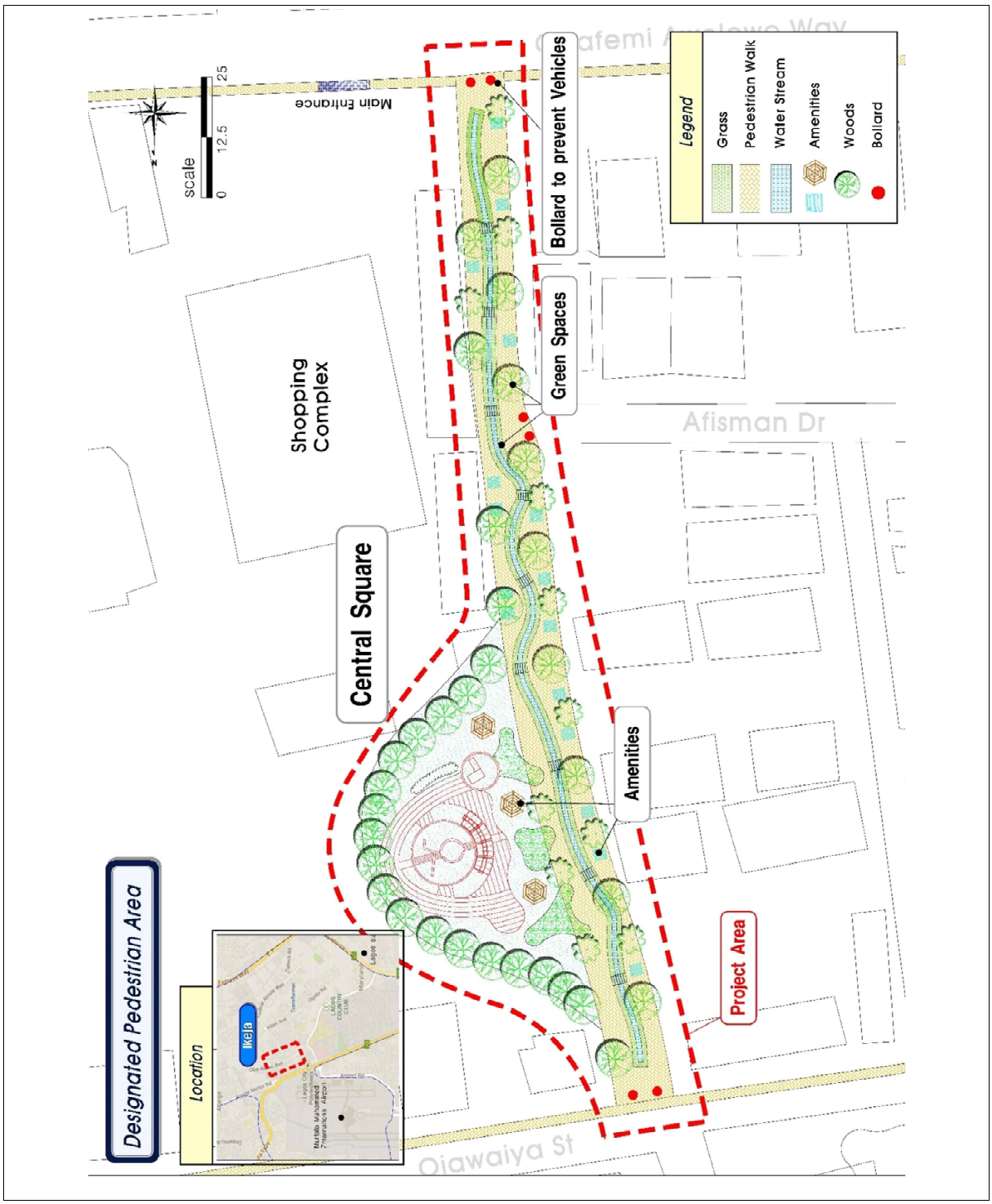
a) Designation of Pedestrian Priority Zone

- Promote the importance of pedestrian space and necessity as creating Pedestrian Priority Zones where pedestrians can come and go safely and pleasantly.
- Some countries, especially the European countries, have persistently strived to create a safe and pleasant pedestrian environment since the 1970s through road space maintenance.

[Figure 4.1-14] Photos of Pedestrian Priority Zones

③ Directions

- For designation of Pedestrian Priority Zones, receive proposals from respective LGAs of Lagos, especially from the shopping areas presently having many pedestrians or the shopping areas expected to have many pedestrians in the future. Prioritize the proposed areas through a comprehensive review of pedestrian volume, existence of a bypass lane, car to pedestrian accident rates, etc. and then execute the Pedestrian Priority Zone Designation Project.
- Since complaints are often raised by the affected merchants and residents, minimize complaints by holding a consultation with them and fully explaining the effects and advantages of the Pedestrian Priority Zone Designation Project during the consultation.
- Promote the project and identify problems as executing a pilot project for 1 or 2 sections in the initial 1~2 years of the project. And then, receive proposals from respective areas of Lagos, prioritize some areas and execute the project in line with NMT plan.
- Although designation of Pedestrian Priority Zones requires in-depth studies and full consultations, in this report, designating shopping area of Ikeja as a Pedestrian Priority Zone is described as an example.



[Figure 4.1-15] Example of Pedestrian Priority Zones

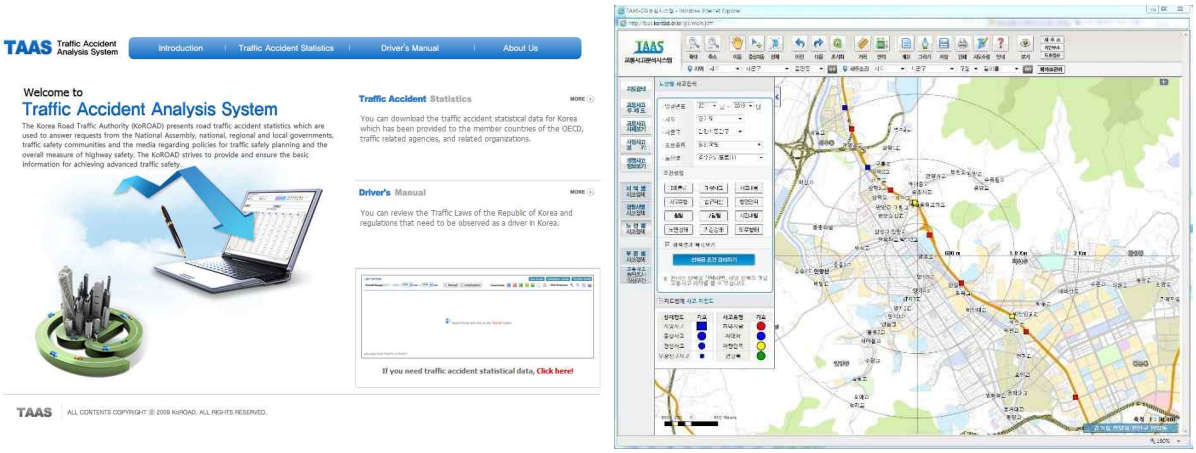
9) Establishment of a traffic safety related data collection system

① Background

- Since traffic accident data is the most principle data to establish traffic safety policies, it is imperative to establish a traffic accident data base for urban areas of Lagos.
- As an example, the traffic accident data base establishment case of South Korea is described below.

→ Traffic accident data base establishment case (South Korea)

- Korea's traffic accident data bases can be classified into Integrated DB and Police DB. On the one hand, the Integrated DB is a traffic safety information management system managing road traffic accident data given and treated by insurance companies, benefit association, etc., except data given by the police. It includes traffic accident data managed through Police DB if the accidents caused human injuries and treated by insurance companies, benefit association, etc.
- On the other hand, the Police DB which is traffic accident DB given and treated by police concerns both human and property damages caused by road traffic accidents stipulated in Article 2 of the Road Traffic Act.
- In Korea, traffic accident data are collected and provided online by the Road Traffic Authority, which is useful in identifying problems and devising improvement measures as well as establishing traffic safety policies.



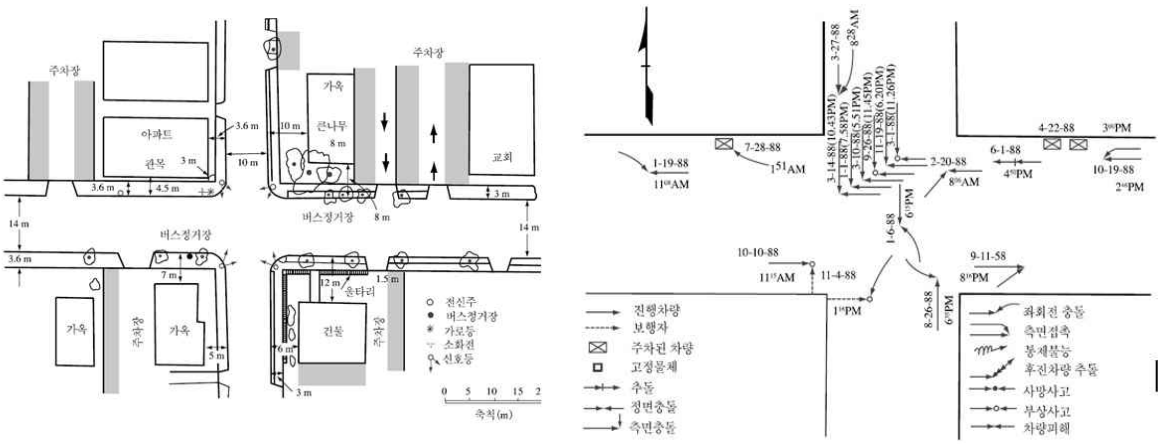
[Figure 4.1-16] Traffic accident data collection and provision (South Korea's case)

- Collection of traffic accident data covering a wide range of area requires support from various relevant organizations of direct and indirect interest. In Korea, traffic accident data are collected with support from many organizations as shown in the figure below including major insurance companies, NGOs, and media.

[Figure 4.1-17] Traffic accident related organizations in Korea

② Details of task

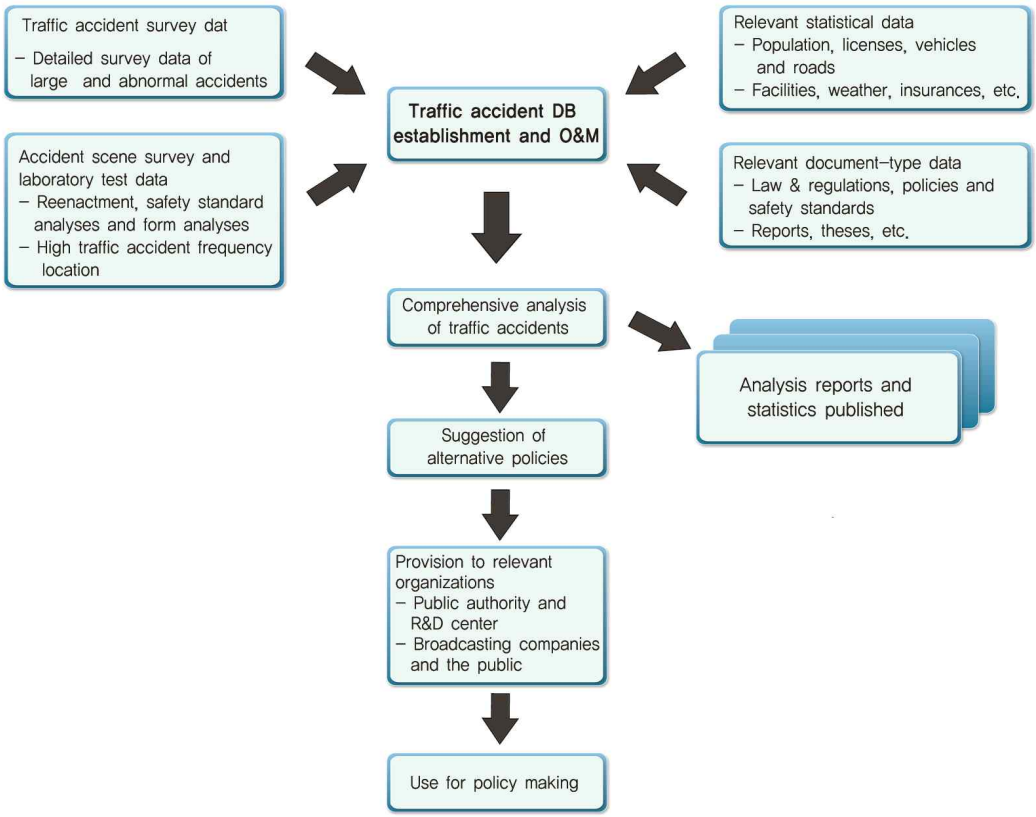
- In order to collect/analyze traffic accident data of the urban areas of Lagos, it is required to establish a council between public and private sector organizations.
- Currently in the urban areas of Lagos, traffic accident data are managed by two organizations; LASTMA and FRSC. It is therefore desirable to develop a system integrating data not only from the two sources but also from insurance companies and others.
- By establishing an integrated traffic accident data management system, it is necessary to assure that direct causes of accidents are identified, detailed analyses are conducted and the results are available for sharing.
- By converting collected traffic accident data into drawings, make it easy to recognize causes of traffic accidents.



[Figure 4.1-18] Drawings of traffic accidents circumstance and vehicle collision (Exemplary)

- After creating a traffic accident data base, it is required to make sure that a wide range of relevant data are collected and reviewed so as to be used when making traffic safety policies.

o The figure below presents an example of traffic accident DB establishment and O&M system. Such a system can improve the use of data as it can convert traffic accident data related safety standards, statistic data and documents into data.



[Figure 4.1-19] Traffic accident DB establishment and O&M system (Exemplary)

10) Reorganization of transport related organizations

o In most of the countries where traffic safety is secured, the central governments have played an important role as they uncompromisingly pushing traffic safety policies. In order for traffic safety related organizations to push traffic safety policies in urban area of Lagos, it is required to strength the traffic safety policy implementation system.

① Background

- For satisfactory results of traffic safety policies, persistent enforcement and complementation are required.
- For persistent enforcement, it is necessary to secure traffic safety experts and strengthen the traffic safety policy implementation system.

② Details of task

- For effective implementation of the traffic safety policies in Lagos, secure traffic safety experts for each urban area of Lagos and persistently enforce traffic safety plan established by the Lagos State Government.
- Designate a traffic safety committee member for each area, establish a traffic safety committee for Lagos urban areas and let the designated members become the members of the committee. The committee is supposed to hold regular meetings and function as a window for communication among the traffic safety committee members.
- The committee should assure that traffic safety plans reflecting the regional characteristics are established. The committee members for each area should devise detailed action plans and execute them for respective areas.
- The traffic safety plans of the state government should be able to improve traffic safety of Lagos by analyzing effects of the projects executed by area and reporting identified problems.

[Figure 4.1-20] Establishment of a traffic safety system for the urban areas of Lagos (Exemplary)

11) Support for experience education for workers in the transportation industry

① Background

- There is a need for traffic "experience education" for workers working in the transportation business to alter them to the danger of reckless driving and raise awareness of the importance of safe driving.

② Details of task

a) Establishment of safe driving experience education centers

- Establish centers for implementation of effective experience education equipped with simulators and simulation practice track.
- Establish a center of proper size - in consideration of the number of people to be educated - for each area with the aim of easy access to education

b) Provision of incentives for active experience education

- Devise measures to effectively provide incentive provision and provide incentives in order for workers working in the transportation industry to actively participate in experience education

  - Partial support of education expenditures, reward based on degree of participation, etc.

12) Implementation of customized education for children

① Background

- Provide safety education programs according to children's age so that children who are future drivers and transportation facility users can become desirable drivers and transportation facility users.

② Details of task

a) Preparation of education contents according to grades and securement of education time

- Prepare traffic safety contents customized to grades and provide education
- Enhance children's attention to traffic safety by selecting children transportation committee members from each grade
- Prepare education programs capable of promoting parents' participation and create associations such as a mothers' association for traffic safety (tentative name).

b) Establishment of children's traffic experience center

- Build a children's traffic experience center for each area because it is difficult to establish traffic experience center for each and every school in Lagos.
- Build a children's traffic experience center where comprehensive education on danger of traffic accidents, how to use traffic facilities, etc. can be provided.

[Figure 4.1-21] Children's traffic experience centers (Exemplary)

c) Designation/support and operation of traffic safety model schools in the urban areas of Lagos

- Provide children with differentiated traffic safety education and make traffic safety a way of life by designating traffic safety model schools in the urban areas of Lagos and supporting operation expenses.
- Build a simplified traffic safety experience education center within a school and provide necessary education materials and professional educators for systematic traffic safety education.

d) Improvement of traffic safety related laws and regulations

- We have selected "Improvement of traffic safety related laws and regulations" as one of the sub-tasks, which is able to provide a legal basis for other sub-tasks of each area.

13) Measurers to Amend Traffic Safety Related Laws

- In order for the sub-tasks of each area can be implemented with a legal basis, it is required to amend relevant laws and regulations.

[Table 4.1-25] Amendments of traffic safety related laws of Lagos

Items to be added to traffic safety related laws	Description of laws(guidelines)
Designation of Children Protection Zones	- Designation, Designator, discussion with relevant authorities and facilities to be installed
Designation of Pedestrian Priority Zones	- Subject of designation, facilities to be installed and evaluation method
Improvement of high accident frequency areas	- Criteria to select high accident frequency areas and project executor
Establishment of traffic accident data base	- DB scope and organization in charge of establishment
Implementation of traffic safety diagnoses for transportation companies	- Subject, items, method, time and follow-up management of safety diagnoses
Traffic safety education	- Subject, contents and time of education
Enforcement of vehicle performance tests	- Time and items of tests, punishment in case of no test and mandatory corrective measures
Installation of an automated traffic enforcement system	- Installation locations & specifications of system and administrative measures for enforcement

14) Establishment of guidelines for traffic safety design (positive guidance and traffic calming)

① Background

- Since the concept of "Positive Guidance" is based on a human driving behavior model, basically human related factors are treated as an important factor. In this regard, many terms are defined such as control, guidance, navigation, transportation system malfunction or road damage, decision sight distance, information distribution, positive guidance information, etc.
- In light of the current status of the urban areas of Lagos, since an immediate and large investment in safety is somewhat difficult, it is more desirable to actively take positive guidance strategy which is a cost-effective improvement measure. Although signs are relatively well-installed at the center of Lagos among the urban areas of Lagos, the situation is different in other areas of Lagos. Especially, the signs are rarely installed on the roads except for arterial roads, as

being in dire need of improvement. Also, at high accident frequency areas are in need of more consideration and works thorough precise technological analysis.

- Traffic calming was first introduced in Netherlands. It was originated from remodeling of a residential area in Delft in the early 1970s for improvement of the residential environment. At present, many countries have introduced the traffic calming scheme with necessary modifications to suit the respective conditions.
- Traffic calming is classified into two schemes: traffic regulation scheme and physical scheme. For the urban areas of Lagos, it is required to introduce these schemes in the road planning, with an emphasis on backside roads.

② Details of Task

- Designate areas for a pilot project and execute the project after modifying or enacting relevant laws and regulations for Lagos state.
- Benchmark guidelines of surrounding African countries and developed countries and then, with necessary modifications so as to be in line with the situations of Lagos urban areas.

→ Items to be included in the guidelines

Safety facilities installation place: school zones, etc.

Installation location: specific guidelines required (e.g., within 00m of intersections)

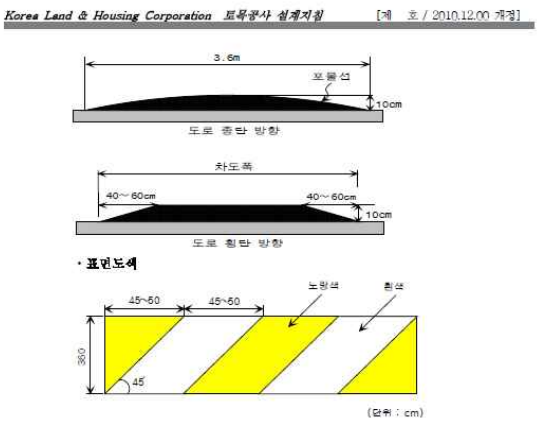
Installation prohibited place: places where traffic safety facilities may act as obstructions

Installation interval: specification of intervals so as not be obstructions resulted from excessive installation

Facility structure (specifications): specifications ensuring safety facilities to function properly

Installation drawing sample: drawings easy for designers and contractors to understand

Other requirements: explanation of other factors to be considered for installation



<Design guidelines of South Korea (Case study of LH)>

③ Directions

- Complete guidelines by complementing problems after putting established draft traffic safety related design guidelines into practice in a pilot project of pedestrian passage related safety.

15) Establishment of guidelines for urban traffic related planning

① Background

- Traffic safety is a factor which should be always taken into consideration in the entire process for a traffic system: planning, construction, operation, maintenance and management. In particular, in case of planning a new road or an alignment change, traffic safety must be considered from the planning stage.
- In the urban areas of Lagos, the roads have been constructed with different specifications according to the developers/contractors. As it provides road users with inconsistency, it is easy to cause accidents to those who are not accustomed to the various road specifications. In addition, a lack of traffic flow control systems/devices such as road lanes is likely to induce accidents and makes it difficult to judge causes of accidents in case of traffic accidents.

② Details of Task

- It is necessary to make it mandatory guidelines to construct pedestrian passage related facilities and traffic safety facilities when planning road maintenance, land development and urban development as well as traffic related facility development in Lagos State in the future.
- The items required to be included in the guidelines are described below for each traffic safety area.

  - For roads, safety facilities by road functions: pedestrian ways, crosswalks, drainage facilities, etc.

- For land development, safety facilities considering future traffic demand, smooth pedestrian passage, public transportation, etc.: bus bays, pedestrian ways, crosswalks, speed reduction facilities.

[Table 4.1-26] Improvement measures for each traffic safety area (comprehensive measures)

Classification	Improvements	
Traffic accident	- Establishment of a traffic safety management system for transportation companies - Implementation of traffic safety diagnoses for transportation companies - Enforcement of vehicle performance tests - Designation of Children Protection Zones - Improvement of the areas/spots where traffic accidents frequently occur - Installation of an automated traffic enforcement system (Collectable type) - Structural improvement of roads with high accident risks	- Designation of Pedestrian Priority Zones - Establishment of a traffic safety related data system
Traffic safety related organization	- Strengthening of traffic safety policy enforcement	
Traffic safety education	- Support for experience education for workers working in the transportation business - Implementation of customized education for children	- Creation of traffic safety education facilities - Introduction of traffic safety model schools - Training of professional manpower such as traffic safety education professionals - Creation of safe driving experience education facilities - Creation of children's transportation park
Laws and regulations	- Reorganization of traffic safety related laws and regulations - Establishment of guidelines for traffic safety design - Establishment of guidelines for urban traffic related planning	

4.1.8 Cost estimate by major business sector

- For the cost estimate of each of the major projects considered in this section concerning traffic safety of LMA, we have reviewed GDP of Nigeria and budget of Lagos to base our estimation.
- It has been found that 2012 GDP of Nigeria is 262,597 million USD and the 2013 budget of Lagos State is 294 million USD (499.605bn N).
- Some of the sub-tasks of which have fixed quantities, the project cost has been estimated for the entire quantity, whereas those sub-tasks of which the quantity has been not fixed, the cost has been estimated considering the budge of Lagos state.
- Situations of the investment in national traffic safety basic plan show that investment in the initial year (1st year) is approx. 1.0% of GDP. However, since the exact GDP of Lagos urban areas is unknown, the cost of the traffic safety projects has been estimated applying the GDP of Lagos urban areas calculated based on the ratio of Nigerian total population to Lagos urban area population, with an annual investment rate of approx. 0.09% of GDP of Lagos urban areas.
- Although the annual investment rate estimated by the above method has been somewhat low, it has been analyzed that the annual investment of 9.1% is required in the scale of 2013 budget of Lagos urban areas.

[Table 4.1-27] 2012 GDP of Nigeria/Lagos Urban Areas and 2013 Budget of Lagos Urban Areas

Classification	Amount (USD)	Remarks
·2012 GDP of Nigeria (USD)	262,597,405,488	
·2012 GDP of Lagos Urban Areas (USD)	31,155,624,380	Calculated based on the ratio of Nigerian total population to Lagos urban area population
·2013 Budget of Lagos Urban Areas (Nbn)	499.605	294 million USD

Note: Applied exchange rate: 170 NGN/USD

- Although there are 1,001 primary schools in Lagos, the cost of the Children Protection Zone Project has been estimated only for 150 zones (10 zones a year) in

light of the budget. For the high accident frequency areas, the cost has been estimated for 44 locations of 16 areas (out of total 20 areas) which are the subject LGAs of the project.

[Table 4.1-28] Cost estimate by traffic safety project (2015~2030)

Classification	Project name	Cost (million USD)				Remarks
		Pilot	Short term	Mid term	Long-term	
Traffic accidents	·Designation of Children Protection Zones	4.8	10.2	15	15	150 out of 776 locations except for outskirts
	·Improvement of the areas/spots where traffic accidents frequently occur	9	11	12	12	44 locations
	·Installation of an automated traffic enforcement system (Collectable type)	0.9	2.2	3.1	3.1	100 locations
	·Structural improvement of roads with high accident risks	10	10	40	40	1 million for 16 years
	·Designation of Pedestrian Priority Zones	0.7	0.7	9.8	9.8	Test and Mid-term projects : 2 Long-term projects : 28
	·Establishment of traffic safety related database	-	-	10	10	Persistent implementation from mid-term to yearly term
Traffic safety education	·Experience education of workers working in transportation industry	0.3	0.3	0.5	0.5	0.1 million USD per year (Implementation of commissioned education)
	·Preparation of traffic safety education facilities	3.3	15.7	19	19	Creation of safe driving experience education facilities(16 EA) Creation of children's transportation park (16 EA)
Cost for each period		29	50.1	109.4	109.4	Annual average cost : 18.62 million USD
Proportion (%)		9.7	16.8	36.7	36.7	-
Total		297.9				

Note: Pilot 2015~2017, Short-term 2018~2020, Mid-term 2021~2025 and Long-term 2026~2030

4.2 Non-Motorized Transport

4.2.1 Overview of non-motorized transport

a. Background and goal

- The goal towards an environmentally-friendly transportation system centered on people and public transportation is a common goal throughout transportation planning in the world, especially in light of recent events such as climate change and global warming. It has had a great impact on shifting the paradigm of transportation policy and is quickly becoming a widespread practice.
- However, since developing countries and cities are placing importance on mobility and efficiency, they are constructing and operating transportation infrastructure centered on private vehicles. As a result, non-motorized transport facilities are severely lacking in the developing world.

- Motorized transport > non-motorized transport, there is a lack of awareness regarding the safety of a transport system.
  - As the most basic mode of transport, non-motorized transport is an environmentally-friendly mode of transport which has the capacity to be connected with other modes of transport, provide access to public transportation services, and build an efficient transportation system. Non-motorized transport, therefore, is an essential mode of transport in African cities, especially in Lagos, in order to improve the quality of life and urban development and build a sustainable transportation network.
- Non-motorized transport is a necessary element in achieving the goals of transportation policy and planning, and is an essential component in connecting various modes of transport, connecting transportation nodes, vitalizing public transportation use, reducing traffic safety accidents and reducing the environmental impacts of motorized transport.
  - The goal of the Lagos Urban Transport Master Plan is to establish a pilot, short- and mid-term project plan which considers the current situation and

future direction of development and changes in conditions of Lagos, Nigeria, in order to improve and expand transportation social overhead capital (SOC), and draw a strategy to maximize operational efficiency.

- To grasp Lagos' non-motorized transport's current situation and problems, and establish a strategic basic plan through setting planning goals.
- To establish an optimal, step-by-step and efficient plan for the construction, operation and usage of non-motorized transport facilities, in addition to preparing an investment plan and investment procurement improvement plan.
    - The study aims to build a transportation network centered on human and sustainable modes of transport, and promotes Lagos' future urban development and draws detailed implementation strategies to improve citizens' quality of life through promoting a cooperative international partnership between Korea and Nigeria.

b. Scope of the plan

1) Study area

- Lagos, Nigeria (including 20 Local Government Areas)

[Figure 4.2-1] Target area: Lagos, Nigeria

2) Time frame

- Base year: 2014 (or most recent year which data was available)
- Short-term goal year: 2017~2020 (including pilot project)
- Mid-term goal year: 2025
- Long-term goal year: 2030~

3) Contents

- Study of non-motorized transport's attributes and necessity for implementation
- Analysis of the survey of the current situation of non-motorized transport and identification of problems
- Setting of planning goals and proposed strategies
- Detailed recommended strategies and a draft basic plan

- Target area and priority regions, pilot project, step-by-step implementation plan and operation plan
  - Step-by-step plan for investment procurement

4.2.2Analysis of non-motorized transport

a. General

1) Definition and advantages of non-motorized transport

- Non-motorized transport (NMT) is defined as a mode of transport which uses walking, cycling and others (rickshaw, carriage, inline skate, wheelchair, etc.) in order to move people and cargo, and does neither use fossil fuel (or other energy), resources, nor exhausts greenhouse gas (GHG) emissions.

- Most NMT is focused on walking and cycling as the major modes of transport; similarly, this study is centered on providing facilities for walking and cycling.

- Generally, NMT has the following advantages:

- The most basic mode of transport, as it is common to all transportation trips.
- It is a mode of transport which is used for everyday short-distance trips.
- It is often the main mode of transport for the low-income class.
- It is an environmentally-friendly, sustainable, and safe mode of transport.
- It connects other modes of transport as well as other transportation nodes.
- It is the most advantageous mode of transport socially, economically, and environmentally.

- However, though NMT is characterized by these advantages, in reality, its status in the transportation system is in an extremely inadequate state compared to that of other modes of transport.

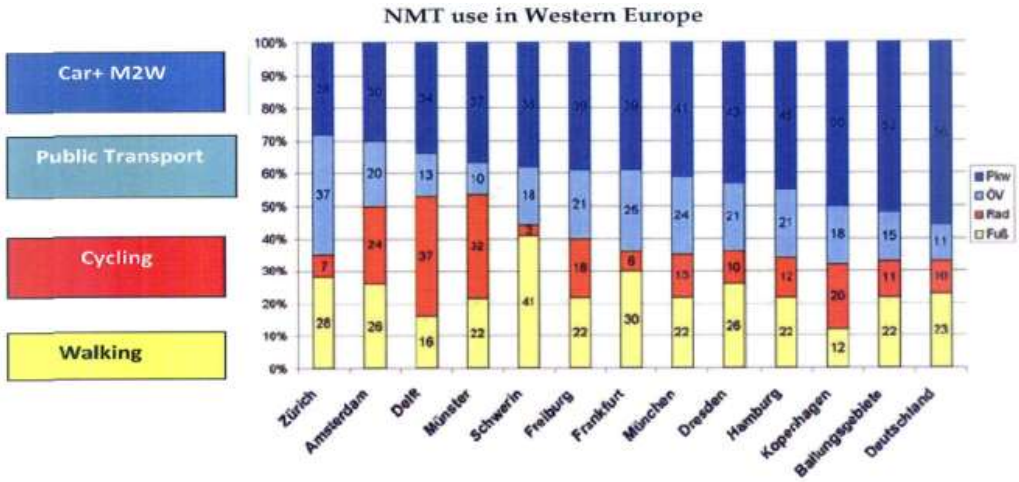
- In addition to the fact that the construction and operation of transportation infrastructure/facilities generally emphasize mobility and efficiency, policy makers tend to give less priority and importance to NMT compared to that of motorized transport modes.

- As such, this is ever present in Africa's developing countries and cities, where transportation policy and planning largely disregards non-motorized transport.

-

2) International trend of non-motorized transport

- As more and more urban dwellers are seeking to improve their quality of life and living environments, they desire modes of transport which provide safer and more environmentally-friendly ways of mobility.
- The international trend is further strengthened by the recent events regarding climate change, which has given way to the shifting paradigm of transportation policy towards a sustainable transportation system.
- Sustainable transportation systems worldwide are built to ensure accessibility, enhance safety and security in the use of transport modes, reduce air pollution, GHG emissions and energy consumption, and increase cost-efficiency in the transport sector for urban travel and travel behavior, with NMT as the foundation.
- In many European countries and cities, where public transportation, NMT and facilities are well-developed, NMT (including walking and cycling) contributes to 33~53% of the modal share.



[Figure 4.2-2] Modal share of Western Europe

Source: Lagos: Building a Walking and a Sustainable City. LSG, 2012. 3.

- This phenomenon is due to the early transition towards a sustainable transportation system, and the large percentage of modal share is due to the seamless connection with public transportation, and the provision of NMT and related facilities.

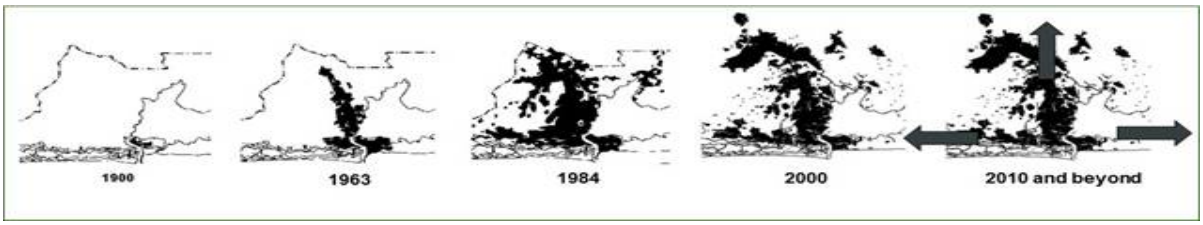
[Figure 4.2-3] Examples of NMT in other cities

- The common tasks that transportation policymakers worldwide face are to draw up measures towards the expansion and improvement of facilities and the increase of operational efficiency for NMT, as NMT's importance in a sustainable and environmentally-friendly transportation system is often less recognized.
- In particular, as many African countries have recently been experiencing rapid urban development and urbanization, the expansion and improvement of transportation SOC facilities have followed international trends in considering the Global Standard and Universal Design. As a result, there has been a growing recognition towards the expansion, improvement, and operation of NMT-related facilities.

- In recent years, the United Nations Environment Program's (UNEP) Share the Road has introduced a design standard for NMT facilities and strategies towards investment in NMT infrastructure for transportation policy measures in Africa.

b. Necessity for the introduction of non-motorized transport

- Lagos is the most populous city in Nigeria and is the center of West Africa, and has been experiencing rapid urban and economic growth following active urbanization and population concentration.



[Figure 4.2-4] Lagos' urban development over time

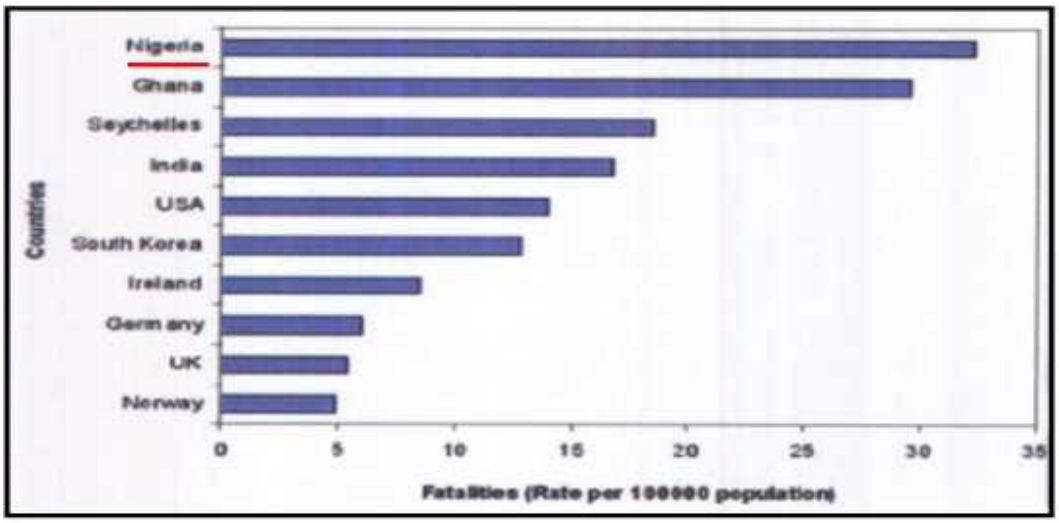
Source: Consultancy Services for the Extension of the Strategic Transport Master Plan and Travel Demand Model to Cover the Mega City Region, ALG, March 2014.

- While the gap between the rich and the poor is still extremely large, the growth of the wealth of the middle-class has given way to motorization. The lagging and lacking of the existing transport infrastructure and inadequate operation are the main factors contributing to the issues of the transportation system.

- The major transport-related urban issues include extreme traffic congestion, air and noise pollution, increase in fatal traffic accidents, and the degradation of living and health conditions.

[Figure 4.2-5] Current situation of transport in Lagos

- From examining the data relevant to the traffic fatalities by country, Nigeria shows extremely high rates of traffic fatalities compared to both developing and developed countries.

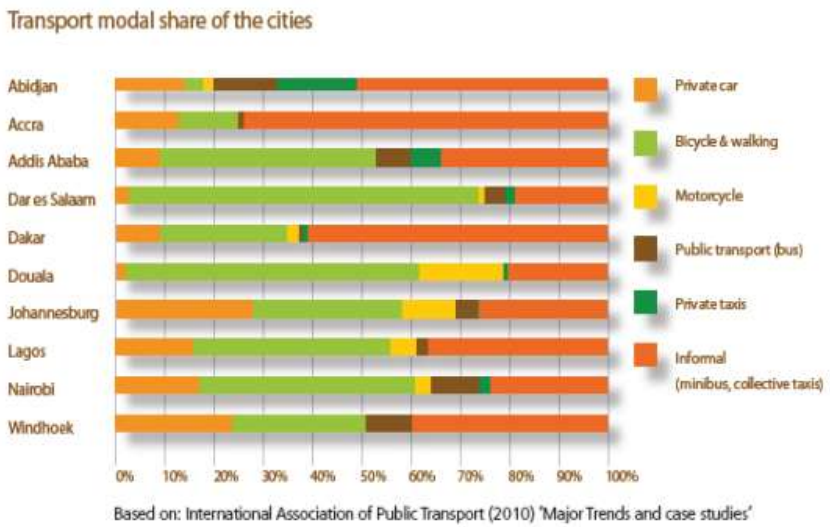


[Figure 4.2-6] Traffic fatalities by country

Source: Lagos: Building a Walking and a Sustainable City. LSG, 2012. 3.

- The world average traffic fatalities rate per 100,000 population is 18 persons, but that of Nigeria is at 34 persons, which is 1.9 times higher than the average.

  - NMT in Lagos is the most basic mode of transport, as it is the most common mode used to commute to work, school and for other everyday purposes by the lower-income class.



[Figure 4.2-7] Modal share of major African cities (2010)

Source: Share the Road: Design Guidelines for NMT in Africa, FIA Foundation.

- The modal share of NMT (walking and cycling) in Lagos is around 31%.
    - In response to rapid urban growth and urban transport issues, the Lagos State Government has taken measures to expand the rail network and bus rapid transit (BRT) system towards a multi- and inter-modal transportation system through establishing a long-term comprehensive transportation plan, which includes a plan for urban and transportation facilities.
- The Lagos Urban Transport Project (LUTP) and the 2009 Strategic Transport Master Plan (STMP) aim to establish an implementation strategy to re-establish the focus of urban transport improvement and mobility through the expansion of mass public transit and opportunities for strengthening connections with NMT.
    - When examining the most recent comprehensive transport plan for Lagos (as of March 2014), the plan proposes the expansion of rail and BRT lines and focuses on the mass public transit's inter-connectivity with NMT.
- Expansion of the Blue line (scheduled to enter revenue service by December 2014) and plan for an additional 7 urban rail lines
- - Currently operating BRT Mile 12 and plan for an additional 11 BRT lines

[Figure 4.2-8] Lagos' plan for the construction of rail and BRT lines

Source: Consultancy Services for the Extension of the Strategic Transport Master Plan and Travel Demand Model to Cover the Mega City Region, ALG, March 2014.

- The expansion of the mass public transit modes is expected to contribute to solving Lagos' urban transport issues, with major rail stations and bus stations

being inter-connected by NMT, thereby raising the importance of NMT in the urban transportation system.

- There exists a need for a strategy which connects NMT with major rail stations and transfer stations, especially those that serve as nodes, in order to vitalize public transportation use and resolve urban transport issues.

  - The improvement and expansion of NMT and related facilities is necessary to meet the needs of African countries and the needs of Lagos' citizens' desire for an optimal transportation service, given the international trend of the importance of NMT as the foundation for a sustainable transportation system.

c. Site investigation of the conditions of non-motorized transport

1) Conditions of non-motorized transport

  - The current conditions of Lagos' NMT facilities and their usage show that the related facilities are severely inadequate and lacking.

- The environment in which walking and cycling most frequently take place in is in a critical condition.

  - NMT is not only neglected as a mode of transport, but there is also a severe lack of awareness for its necessity.

  - The provision of cycling facilities does not exist and there is an absence of pedestrian facilities (sidewalks, crosswalks, overpasses, guard rails, traffic lights, etc.) that are separated from motor traffic.

  - Due to the disorderly conditions of land-use and automobile-oriented road facilities, the pedestrian environment faces great harm. As a result, the expansion and improvement of NMT facilities are at a disadvantage.

- Due to the expansion and usage of road facilities' being automobile-oriented, there is a lack of NMT facilities.

- There is an absence of a design principle and standard for road facilities, as well as that of NMT facilities.

- Overall issue with road facilities: the operation method of sidewalks and roads, and poor drainage facilities along the roads.
    - The pedestrian environment is further damaged by the illegal parking, illegal street vendors, illegal commercial activities, and other improper uses of the sidewalk. In addition, there is no surveillance method or laws which prevent these improper uses of the sidewalk.
- The illegal uses (illegal parking, commercial activities, waste, etc.) of the pedestrian sidewalk space make the pedestrian environment severely vulnerable.
- The absence of a legal and institutional system to regulate and enforce surveillance of the illegal uses of the sidewalk.
    - Due to the lack of a maintenance system of the pedestrian and road facilities, any damaged facilities are left neglected.
- The efficiency of pedestrian spaces are further impacted by the absence of a road and sidewalk maintenance system as the restoration of damaged facilities is delayed.
    - Pedestrians are at risk due to the neglected waste, garbage and inadequate installation of the drainage system and equipment.
    - The inadequate provision and lack of the operational conditions of NMT facilities are major factors which increase pedestrians' traffic accidents and put the low-income class at risk, and serve as an obstacle to mobility and the use of basic transportation.

[Figure 4.2-9] Conditions of NMT in Lagos

2) Site investigation of non-motorized transport

① Overview

- The Study Team carried out site investigations in order to understand Lagos' NMT conditions and identify the situation and issues in the field.
- Site investigations occurred during three business trips to the area of study.

- The 1st trip (Jan. 10-19, 2014, total of 9 days): visit to organizations, business meetings, consultations, understanding the field environment
- The 2nd trip (Mar. 16-24, 2014, total of 8 days): visit to organizations, request for cooperation from the relevant organizations, obtain related data and information, manage and oversee the local survey consultant
- The 3rd trip (Jul. 15-27, 2014, total of 13 days): meeting on the Interim Report with related organizations, obtain related data, field survey of study area and adjusting survey methodology with local consultant

- Details of the business trips are further explained in the business trip reports, which are attached in the Appendix.

② Main contents

a) Expressway system

- The status of the major expressway equipment are satisfactory, and the main traffic corridors and intersections are configured with traffic lights, crosswalks, overpasses, traffic route signs, and traffic information signs.

- During peak hours, the expressways in the downtown area are heavily congested, and some roads are a serious problem due to heavy traffic congestion at all times.
- Due to the overall issues with the power supply, the operation systems of the traffic signal lights are unstable.
- There is a lack of crosswalks, overpasses and traffic lights, information and regulatory signs, and related facilities for pedestrians.

[Figure 4.2-10] Lagos' expressway conditions

b) Sidewalk system along expressways

- There are various types of sidewalks along expressways with regards to the installation and maintenance conditions.
- There are three types of sidewalks: (1) those that are well-segregated from the road and well-ensure pedestrian space, (2) sidewalks which are segregated from the road but are not maintained, and (3) sidewalks which are segregated from the road but lack pedestrian space.

- Due to the lack of design, operational and installation principles and standards, the installation of pedestrian sidewalks and operational status vary depending on the surrounding land use and road environment.
- There is little space provided for pedestrians where sidewalks are segregated from the road.
- Though sidewalks are segregated from the road, most of the pedestrian facilities are neither paved nor provide adequate pedestrian facilities, such as sidewalk blocks, along the road.
- In the case where sidewalks are separated from the road, the width of the sidewalk is not wide enough to actually carry out its regular functions.

[Figure 4.2-11] Conditions of Lagos' sidewalk system along expressways

c) Sidewalk system along urban roads

- Most sidewalks along urban roads are inadequately separated from the road, even in cases where the sidewalk is separated, there is not enough pedestrian space for the sidewalk to function, inadequate maintenance of the sidewalk to utilize, sidewalks which are discontinuous, and areas which are dangerous to pedestrians due to poor drainage facilities. The pedestrian environment is a serious problem.

[Figure 4.2-12] Conditions of Lagos' sidewalk system along main roads

d) Absence of road infrastructure

- In the currently operating road facilities, there is an absence of space for which sidewalk and bicycle lanes and other NMT-related facilities can be expanded.

- Due to the automobile-oriented road system, it is not possible to introduce NMT facilities due to the lack of space.

  - Due to the absence of pedestrian facilities, such as crosswalks, traffic signal lights, overpasses, and other related facilities, jaywalking occurs frequently. In addition, the long distances between the existing overpasses make jaywalking as an alternative.

- As a result, there is an absence of and lack of maintenance for road facilities for pedestrians and cyclists (much like NMT users).

  - The greatest challenge to the expansion of NMT facilities, among all road facilities, is not only the inadequate installation of drainage facilities, but also

the dysfunctional wastewater drainage system which causes an obstacle to drivers, pedestrians and cyclists.

- Due to the inadequate installation of drainage facilities, wastewater does not properly get disposed of during heavy rains or rainy season; therefore it is extremely difficult to improve the pedestrian environment.

[Figure 4.2-13] Conditions of Lagos' operational road infrastructure

e) Illegal activities along the sidewalk

- In the case of the sidewalks which are relatively well-maintained, they are filled with illegally parked cars and are occupied often by street vendors or other commercial activities.
- Due to the absence and insufficiency of bus stops and waiting areas, it is a common issue that bus users, who are either getting on/off buses or waiting for buses, encroach and occupy the sidewalk.
- As pedestrians lack the awareness and level of consciousness regarding walking as a mode of transport, they are reluctant to improve their sidewalk's conditions.
- The pedestrian environment is caught in a vicious cycle where conditions continue to deteriorate due to the lack of regulation and surveillance to prevent illegal parking, commercial activities and other illegal activities.

- There are no regulatory and surveillance measures taken for the illegal activities (illegal parking, illegal commercial activities, etc.) on the sidewalks, even at the government-level.

- The illegal activities along the sidewalk are one of the greatest obstacles in the improvement of the pedestrian environment and the expansion of NMT facilities.

[Figure 4.2-14] Illegal activities on Lagos' sidewalks

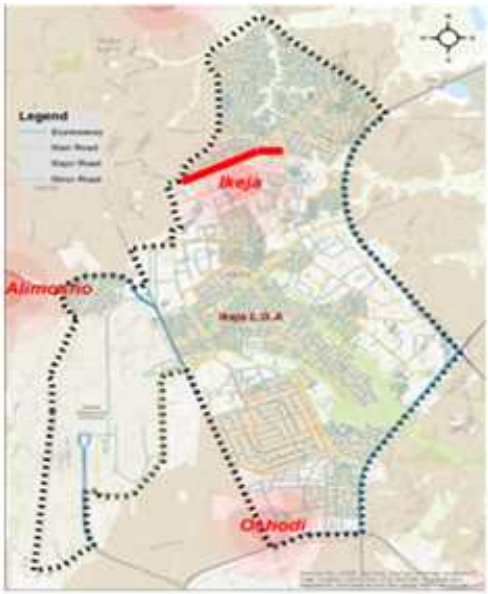
f) Conditions of bicycle facilities

- There are currently little to no bicycle lanes or related facilities, and not very many cyclists either.

- Cycling is not common due to Lagos' climate (heavy rain and extreme heat), absence of bicycle storage facilities, risk of theft, low social security, and lack of public security.
- Nigerians often use cycling when traveling within the local community, but lack awareness of cycling as a main mode of transport or as part of a multi-modal transport system connected with mass public transit.
  - Recently, some citizens and transport-related non-governmental organizations (NGOs) have pushed towards promoting cycling as part of the citizens' campaign 'Lagos Bike Boom Up.'
- Citizens who promoted cycling and a past senior government official played a key role in attempts to expand the availability of bicycle facilities.

[Figure 4.2-15] Campaigning for cycling in Lagos

- Citizens and transport-related NGOs have raised the issue regarding the importance of cycling as a mode of NMT, which initiated the construction of the first segregated bicycle lane in Lagos.



[Figure 4.2-16] Area of bicycle lane on Wempco R

- The pilot project consists of the construction of a one-way bicycle lane in Ikeja, a local government area (LGA) of Lagos State, on Wempco Rd. which is 1.8 km in length and 1.5 m in width.
- However, according to the site investigation, it was found that the construction of the bicycle lane was not for the purpose of providing and promoting cycling, but was only part of a road construction project, independent of connecting with other modes of transport and progressed with a disregard for the connectivity of cycling facilities.

[Figure 4.2-17] Construction site of Wempco Rd.

3) Surveys conducted regarding non-motorized transport

① Survey contents

- The survey results were analyzed in order to better understand citizens' awareness of issues, inconveniences and areas of improvement in terms of NMT in Lagos' transportation system.

- The survey results are from the Lagos State Government's 'LAGOS: Building a Walking and Sustainable City, 2012. 3.'

- Among the 20 LGAs of Lagos State, the survey targeted citizens of eight LGAs on issues and areas of improvement for road facilities through questions and answers, in order to prioritize and rank the results.

- Survey areas: Alimosho, Apapa, Eti-Osa, Ikeja, Kosofe, Shomolu, Mushin, and Surulere

- Surveyed items (issues): road width, walkway, pot holes, unpaved roads, lack of safety, poor TSM, no drainage, and no street lights

- Surveyed items (areas of improvement): expansion of walkway, expansion of bicycle lanes, maintenance of drainage facilities, expansion of street lights, and expansion of road

② Survey results

a) Problems with the existing sidewalks

- Each of the results of the eight issues surveyed was calculated into points by LGA and the rank was determined by the sum total of the points. The issues with a lower score of points are more critical, while issues with a relatively higher score of points are less critical.

- The ranked items with a sum total of points that were relatively low, include the lack of street lights with 20 points, road with 21 points, pot holes with 23 points, and lack of drainage with 29 points.

- Lagos citizens perceived that the primary obstacles to road usage and traffic congestion are the lack of street lights, road width, pot holes, lack of drainage facilities, and the overall lack of road facilities.

- On the other hand, those with a sum total of points that were relatively high, include unpaved roads with 58 points, lack of safety with 54 points, poor TSM with 42 points, and walkway with 41 points.

- As the aforementioned items, including unpaved roads, safety and lack of traffic facilities, walkway and other physical facilities along the road, have a sum total of points that were relatively high, they are perceived to be less critical by Lagos citizens.

[Table 4.2-1] Survey results of the major issues along roads

	Alimosho		Apapa		Eti-Osa		Ikeja		Kosofe		Shomolu		Mushin		Surulere		Total
	RII	RK	RII	RK	RII	RK	RII	RK	RII	RK	RII	RK	RII	RK	RII	RK	
Width (of road)	0.83	**8**	0.87	**1**	0.84	**2**	0.86	**1**	0.87	**2**	0.94	**3**	0.88	**2**	0.89	**2**	21
Walkway	0.83	**7**	0.72	**6**	0.77	**6**	0.81	**3**	0.80	**6**	0.93	**5**	0.84	**4**	0.86	**4**	41
Pot Holes	0.94	**1**	0.80	**2**	0.83	**4**	0.77	**4**	0.83	**3**	0.98	**1**	0.85	**3**	0.81	**5**	23
Not Paved	0.86	**5**	1.63	**8**	0.71	**8**	0.72	**8**	0.78	**7**	0.93	**6**	0.77	**8**	0.70	**8**	58
Lack Safety	0.84	**6**	0.76	**5**	0.71	**7**	0.72	**7**	0.72	**8**	0.91	**7**	0.80	**7**	0.73	**7**	54
Poor TSM	0.86	**4**	0.68	**7**	0.81	**5**	0.75	**6**	0.80	**5**	0.94	**4**	0.83	**5**	0.79	**6**	42
No Drainage	0.91	**2**	1.33	**4**	0.83	**3**	0.77	**5**	0.82	**4**	0.98	**2**	0.83	**6**	0.88	**3**	29
No Street Lights	0.89	**3**	1.33	**3**	0.84	**1**	0.82	**2**	0.88	**1**	0.91	**8**	0.89	**1**	0.90	**1**	20

RII: the correlation index RK: rank
Total shows the total sum of points (issues with a lower number of points are more critical)
Source: LAGOS: Building a Walking and Sustainable City

- From examining the rank of the issues among the surveyed LGAs, it shows that there exists great differences within Lagos State regarding the perception issues.

- In terms of road width (with a sum total of 21 points), in Apapa and Ikeja it is ranked as number one and in other regions ranked as the second and the third, showing that road width is a critical issue. On the other hand, in Alimosho, road width is ranked in the eighth, being perceived as a relatively uncritical issue.

- With the exception of Alimosho, all of the surveyed LGAs perceive road width as a critical issue ranking the issue between the first and the third.

- While issues with the walkway (with a sum total of 41 points) is ranked in the third in Ikeja, other regions ranked the issue between the fourth and the sixth, thereby showing that the issue is not perceived to be as critical compared to others. The respondents in Alimosho particularly ranked the issues with the walkway as the seventh.
- Pot holes (with a sum total of 23 points) are perceived to be a high-ranking and critical issue in most regions, ranking from the first to the seventh.
- The unpaved road issue (with a sum total of 58 points) is perceived to be a low-ranking and relatively less critical issue in all surveyed LGAs.
- Similarly, the safety issue (with a sum total of 54 points) is also perceived to be a low-ranking and relatively less critical issue across all surveyed LGAs.
- Poor TSM (with a sum total of 42 points) is considered as a low-ranking and relatively less critical issue, ranking from fourth to the seventh.
- The lack of drainage facilities (with a sum total of 29 points) is perceived by the all surveyed LGAs as an issue to a certain extent, ranking from the second to the sixth.
- The lack of street lights (with a sum total of 20 points) is perceived to be a critical issue, ranking the first to the third in all surveyed LGAs, with the exception of Shomolu, where the issue was ranked the eighth.

- Similar to the issue of road width, the lack of street lights is the most critical issue, ranking first to third in all surveyed LGAs with two exceptions. Alimosho was the only LGA which ranked road width as the eighth and Shomolu was the only LGA which ranked the lack of street lights as the eighth. It indicates that the extreme results are area-specific and dependent on the respective LGA's environment.
    - As a result, the differences in the issues of road infrastructure are due to the area-specific road facilities which are being constructed and operated, in addition to the local citizens' perceptions and inclinations.

Rank	Width of road (21 points)	Walkway (41 points)	Pot holes (23 points)	Not paved (58 points)	Lack safety (54 points)	Poor TSM (42 points)	No drainage (29 points)	No street lights (20 points)
1	Apapa Ikeja		Alimosho Shomolu					Eti-Osa Kosofe Mushin Surelere
2	Eti-Osa Kosofe Mushin Surelere		Apapa				Alimosho Shomolu	Ikeja
3	Shomolu	Ikeja	Kosofe Mushin				Eti-Osa Surelere	Alimosho Apapa
4		Mushin Surelere	Eti-Osa Ikeja			Alimosho Shomolu	Apapa Kosofe	
5		Shomolu	Surelere	Alimosho	Apapa	Eti-Osa Kosofe Mushin	Ikeja	
6		Apapa Eti-Osa Kosofe		Shomolu	Alimosho	Ikeja Surelere	Mushin	
7		Alimosho		Kosofe	Eti-Osa Ikeja Shomolu Mushin Surelere	Apapa		
8	Alimosho			Apapa Eti-Osa Ikeja Mushin Surelere	Kosofe			Shomolu

[Figure 4.2-18] Distribution of ranked road infrastructure issues by region and issue

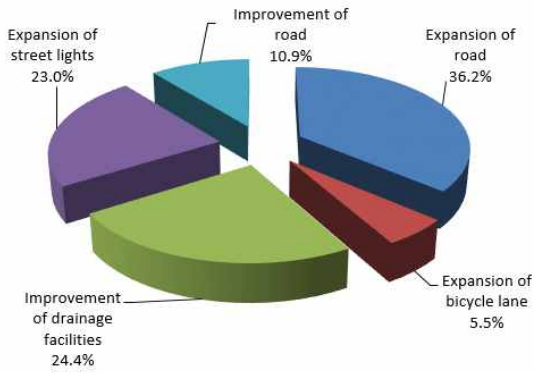
Source: Reconfigured based on 'LAGOS: Building a Walking and Sustainable City 2012. 3'

b) Preference for facilities along the road

- Using the results of the survey which assessed the issues of road infrastructure, a follow-up survey was performed to examine which areas of road infrastructure can be further improved.

- Expansion of sidewalk, expansion of bicycle lane, improvement of drainage facilities, expansion of street lights and improvement of road facilities

- The results of the preference for facilities along the road show the following: expansion of sidewalk with 36.2%, improvement of drainage facilities with 24.4%, expansion of street lights with 23.0%, and improvement of road facilities with 5.5%.



[Figure 4.2-19] Results for areas of improvement

- The survey was performed so as to maintain a similar number of survey respondents from each area.
- It was judged that as the calculated average value was higher for each criteria per area, preference for that criteria was greater.

[Table 4.2-2] Results of areas of improvement along the road

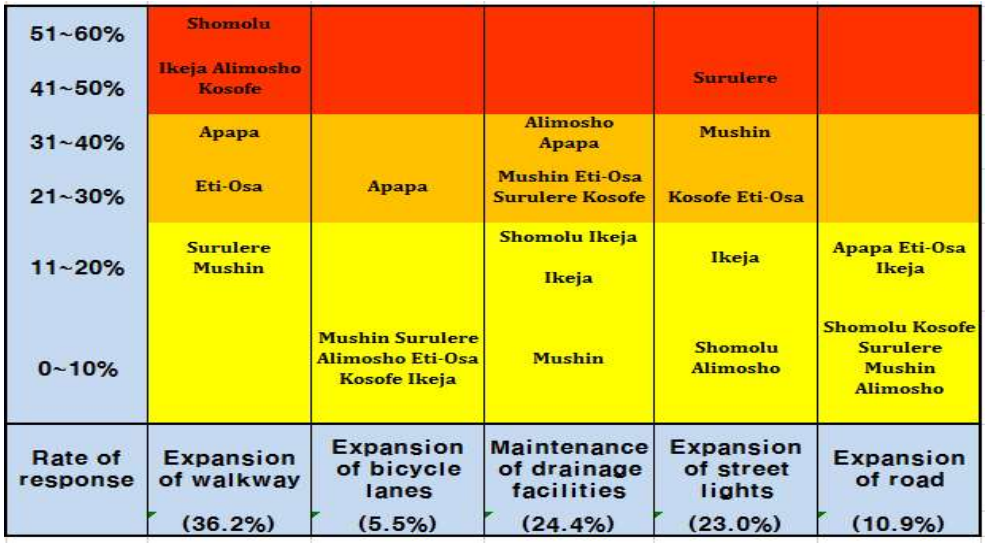
	Road with Sidewalk	Road with Cyclist	Road with Drainage	Road with Streetlight	Road Improvement	Total
Alimosho	43	5	31	8	6	93
(%)	**46.2**	**5.4**	**33.5**	**8.6**	**6.5**	100.0%
Apapa	20	10	20	0	10	60
(%)	**33.5**	**16.7**	**33.5**	**0.0**	**16.7**	100.0%
Eti-Osa	25	3	26	26	18	98
(%)	**25.5**	**3.1**	**26.5**	**26.5**	**18.4**	100.0%
Ikeja	43	1	15	17	11	87
(%)	**49.5**	**1.0**	**17.2**	**19.5**	**12.6**	100.0%
Kosofe	36	3	14	24	8	85
(%)	**42.4**	**3.5**	**16.5**	**28.2**	**9.4**	100.0%
Shomolu	60	0	20	10	10	100
(%)	**60.0**	**0.0**	**20.0**	**10.0**	**10.0**	100.0%
Mushin	15	8	29	39	7	98
(%)	**15.3**	**8.2**	**29.6**	**39.8**	**7.1**	100.0%
Surulere	17	6	18	50	7	98
(%)	**17.3**	**6.1**	**18.4**	**51.0**	**7.1**	100.0%
Calculated average	**36.2**	**5.5**	**24.4**	**23.0**	**10.9**	**100.0%**

Calculated average: refers to the average of each area for each criteria
Source: Reconfiguration of 'LAGOS: Building a Walking and Sustainable City, 2012. 3'

- The results of the areas of improvement show differences across the different areas.
- The area of improvement with the largest share in terms of the overall average is the expansion of the sidewalk with 36.2%. The area which showed the

greatest preference for this is Shomolu at 60.0%, and Alimosho, Ikeja and Kosofe and three other areas showed over 40% interest. Among the study areas, Mushin and Surulere showed only 15~17% interest in the expansion of the sidewalk.

- In terms of the expansion of bicycle lanes (with only an overall average of 5.5%), Apapa showed a 16.7% interest, while all other areas showed an interest of less than 10%. In particular, in Shomolu, which showed the greatest preference for the expansion of the sidewalk, the interest for the expansion of bicycle lanes was 0.0%.
- In terms of improvement in drainage facilities, the overall average was 24.4%, which is comparatively low to the results from the survey on issues in road infrastructure. All areas showed medium to low interest in the improvement of drainage facilities.
- Similarly, in terms of the expansion of street lights which shows an overall average of 23.0%, compared to the results of the issues in road infrastructure, the results show an even distribution of medium interest.
- Road improvement shows an overall small distribution of interest from all areas.



[Figure 4.2-20] Distribution of preference for areas of improvement

Source: Reconfigured based on 'LAGOS: Building a Walking and Sustainable City 2012. 3'

c) Cross reference analysis of the road facilities' problems and preferred facilities

- As the survey respondents responded regarding the priority areas for improvement in terms of inconveniences in usage as opposed to inconveniences in facilities, it is difficult to perform a cross reference analysis of the road facilities' problems and the results from the priority areas for improvement.
- However, according to the analysis of the survey results, the most critical high-ranking issue was the lack of street lights and in terms of the priority areas for improvement, the lack of street lights was ranked in the third.
- Among the issues with road infrastructure, though the sidewalk only ranked in the fifth, in terms of priority areas for improvement, the expansion of the sidewalk ranked in the first.
- While the issue of drainage facilities ranked in the fourth, preference for drainage facilities as an area of improvement ranked in the second.

- As shown in the comparison of the issues of road infrastructure and the preferred areas of improvement, the survey results show that Lagos' citizens have contradicting views on the surveyed items.

[Table 4.2-3] Cross-reference analysis of the survey results

Rank	Issues in road infrastructure	Preferred areas of improvement
1	No Street Lights	Expansion of Road with Side Walk
2	Width (of road)	Improvement of Road with Drainage
3	Pot Holes	Expansion of Road with Street Light
4	No Drainage	Improvement of Road
5	Walkway	Road with Cyclist
6	Poor TSM	
7	Lack of Safety	
8	Not Paved	

  - The following areas show contradicting results between the issues in road infrastructure and the preferred areas of improvement, while the rest of the areas show the results which reflect similar views.

- Alimosho: while issues with the sidewalk ranked low at the seventh, expansion of the sidewalk ranked the first, in addition, while issues with the absence of street lights ranked the third, expansion of the street lights ranked the fourth at 8.6%.

- Shomolu: while issues with the sidewalk were ranked with medium importance, expansion of the sidewalk ranked as the most preferred area of improvement.

- Apapa: while the issues with the drainage facilities ranked the fourth with medium importance, the results for the improvement of drainage facilities was 0.0%

d. Non-motorized transport in Africa

  - The Sub-Saharan Africa Transport Policy Program (SSATP) is a joint initiative between the World Bank and the United Nations Economic for Africa (UNECA). During 1995 to 1999, the SSATP carried out a program of Non-Motorized Transport Infrastructure and Services in Kenya and Tanzania, financed by the Dutch government. Through this program, various

interventions were implemented through NMT pilot projects in Nairobi and Eldoret, Kenya and Morogoro and Dara es Salaam, Tanzania.

- The NMT pilot projects' interventions built specialized infrastructure for pedestrians and cyclists, introduced traffic calming measures and took supply-side measures to increase bicycle ownership and use.
- The situation of these cities, at the time, is similar to that of Lagos, Nigeria in terms of modal share, the absence of adequate infrastructure and facilities, and the major challenges that face the transport sector.
- Among the four cities which the interventions were implemented in, the Temeke district in Dara es Salam, Tanzania was described to have experiences and conditions similar to that of Lagos, Nigeria.
- Pedestrians and cyclists in the Temeke district are threatened by the unsafe traffic conditions, which are attributed to the high speed of motorized traffic, poor driving behavior of minibus (Daladala) drivers and the serious lack of infrastructure. The little space which is allocated for NMT is often obstructed or occupied illegally by parked cars, and both legal and illegal street vendors. Cycling is, therefore, uncommon due to the extreme lack of safety. However, these conditions do not deter pedestrians from walking because of walking's large proportion of modal share. As a result, pedestrians are constantly at risk.
- The following outlines some of the interventions that were implemented as part of the NMT pilot project in Dara es Salaam, Tanzania. The full SSATP Working Paper provides further details on the background and objectives, conditions prior to the intervention, problems, the intervention itself, cost and impacts of the all interventions of the pilot projects in Tanzania as well as Kenya.

- "Bus bays with raised zebra crossings" => Travelling by minibus is the primary mode of public transport, but the minibuses stop for passengers (on or off) anywhere, especially on road shoulders,

and negatively impact the safety of cyclists and pedestrians, as well as the overall efficiency of traffic. Prior to the interventions, because the minibuses stopped almost anywhere along the road, there was no defined waiting area for passengers and the existing bus stops virtually lost their purpose. By implementing large bus bays, improved pedestrian waiting areas, raised zebra crossings at the bus bay locations and measures to separate the carriageway from the shoulders. There were several impacts, as a result of the interventions, including high utilization of the bus bays and the raised zebra crossing causing the minibuses to not only slow down but also use the provided bus bays.

- "MT-NMT road shoulder separation" => The road shoulders in the Temeke district were not separated from the carriageway. As a result, vehicles frequently drove onto the road shoulders, minibuses randomly stopped to pick up or drop off passengers and some spots were fully occupied by street vendors, creating an unsafe and unpleasant walking environment. As there was no defined function of the road shoulders, the intervention consisted of separating the carriageway from the road shoulders by lining it with T-blocks. The interventions restricted motor vehicle movement onto the shoulders and created more efficient pedestrian movement.
- "Pedestrian route improvement" => Prior to this intervention, the pedestrian environment was harmed due to the lack of adequate drainage facilities. The deterioration of the existing drainage facilities often occurred due to heavy erosion, lack of maintenance and illegally parked vehicles. This intervention was heavily focused on reconstructing the drainage facilities, as the overall improvement of and sustainability of the pedestrian environment is highly dependent on the drainage system, especially during the rainy season.

e. Improvement methods for the draft basic plan

- Using the analysis of the issues and current conditions from the site investigations and the results from the survey of Lagos citizens, the Study Team has prepared a draft of the basic plan for improvement methods for the improvement and expansion of NMT facilities in Lagos.

- As a result of the site investigations and survey results, the need for the improvement and expansion of NMT facilities was recognized, which instigated the improvement methods for the basic plan.

- As the NMT facilities of Lagos are severely lacking and the existing facilities are highly inadequate, the plan proposes innovative practices to improve and expand the physical facilities.
- In addition, in order to utilize the improved and expanded NMT facilities to their full capacity, there needs to be an institutional strategy which provides a strategy to simultaneously maximize usage and operational efficiency.
- The analyzed improvement methods for the draft basic plan follow the process as shown in [Figure 4.2-21], preparing for a strategy which builds NMT as part of a transportation network through the improvement and expansion of facilities as well as a feasible strategy for maximizing use and operational efficiency. The plan proposes a unified strategy which treats the construction and operation of the physical facilities into one system in order to maximize the use of the facilities.

- The improvement and expansion of NMT facilities will be done through understanding the usage condition of the major LGAs. Upon determining the optimal installation standards, a stepwise implementation plan will be established through prioritizing NMT-related facilities by area.
- In order for maximizing usage and ensuring the operational efficiency of NMT, thereby taking full advantage of NMT, the Study Team proposes the provision of convenience facilities and sustained educational training and promotion.
- As the provision of related facilities does not ensure the proper functioning of the mentioned facilities, it is proposed that there needs to be both regulatory and institutional improvements, and a responsible administrative structure.
- In addition, in order for NMT to function as a practical mode of transport, the need for the improvement and expansion of NMT facilities and maximizing use and ensuring operational efficiency should be part of the decision-making process of policy makers.

[Figure 4.2-21] Draft basic plan for the alternative improvement methods

4.2.3 Purpose of plan and proposed strategy

- In order to fulfill the improvement and expansion of NMT infrastructure, to vitalize use, and to ensure operational efficiency, the Study Team has set goals of the plan for each sector through the proposed strategies.

- The goal of the plan is to consider the Nigerian Federal Government and Lagos State Government's transportation policy directions and future needs for NMT to 'build a NMT network for urban development and sustainable transportation policy'
- In order to achieve the goals, the improvement plan approaches the two goals (improvement and expansion of infrastructure and vitalization of use and operational efficiency) through five main strategies.

[Figure 4.2-22] Planning goals and proposed strategy for NMT

4.2.4 Expansion and improvement of non-motorized transport facilities

a. Target facilities

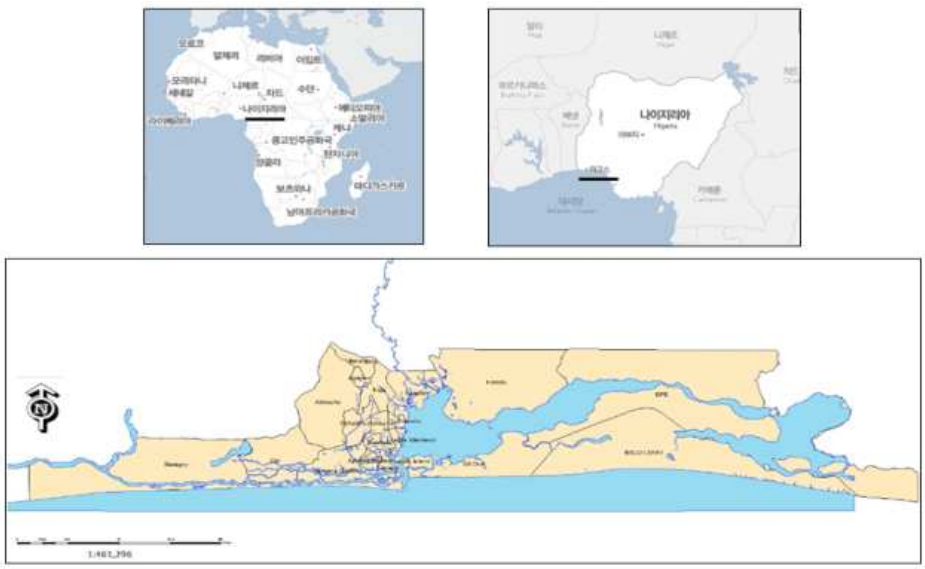
- Lagos, Nigeria is located in West Africa, and the Lagos State Government is part of the Nigerian Federal Government. With a population of about 20 million, Lagos is a metropolis comprised of 20 local government areas (LGAs).

- 20 LGAs: Agege, Ajeromi/Ifelodun, Alimosho, Amuwo/Odofin, Apapa, Badagry, Epe, Eti-Osa, Ibeju-Lekki, Ifako/Ijaiye, Ikeja, Ikorodu, Kosofe, Lagos/Island, Lagos/Mainland, Mushin, Ojo, Oshodi/Isolo, Shomolu, and Surulere

- The current capital city of Nigeria is Abuja, but up until 1991 the capital city was Lagos. With the exception of the administrative role, Lagos plays the greatest role in terms of social, economic, cultural, and trade and commerce.

- The area of Lagos is 3,475.1 km^2, and is approximately 5.7 times greater than that of Seoul (605.4 km^2).

- Located along the Atlantic Ocean, Lagos was formed as a linear city which runs from east to west. Ikeja is an administrative district, and is the center of the main local government, while other local governments of rural areas are located in the suburbs.



[Figure 4.2-23] Target area: Lagos

 **Agege**	 Ajeromi/Ifelodun	 Alimosho	 Amuwo/Odofin
 **Apapa**	 Badagry	 Epe	 **Eti-Osa**
 Ibeju-Lekki	 Ifako/Ijaiye	 **Ikeja**	 Ikorodu
 Kosofe	 **Lagos/Island**	 **Lagos/Mainland**	 **Mushin**

Ojo

Oshodi/Isolo

Shomolu

Surulere

[Figure 4.2-24] Lagos State's 20 LGAs

- In order for the improvement and expansion of Lagos' NMT facilities, it is necessary to examine the current conditions and usage of the existing NMT facilities, demand, urban development potential, distribution of demand-generating facilities, introduction of prospective mass public transit and other related matters.

- It is crucial to understand the NMT sector's current environment and conditions, in addition to the future changes to the environment and conditions, in establishing a plan for the improvement and expansion of NMT facilities in the target areas.

- However, due to the large size of the target area, Lagos, and the extensive nature of the items (site investigation and facility usage) that need to be surveyed for NMT, considering the duration and budget allotted for the Study, the reduction of the surveyed areas and items is inevitable.

- In addition, the local survey consultant (FAO) expressed that it is not possible for the site investigation and surveying for NMT of all areas. As a result, establishing plans for the target area is limited to the nine LGAs.

- Agege, Ikeja, Oshodi/Isolo, Mushin, Surulere, Lagos Mainland, Apapa, Lagos Island and Eti-Osa, as shown in bold in [Figure 4.2-24].

- Considering the local consultant's suggestion that due to the local conditions, it is not possible and is impractical to perform a comprehensive survey for all 20 LGAs, the Study Team negotiated and reduced the target areas.

- Though NMT and related facilities are needed in all areas, this Study places urgency on the introduction of NMT facilities in the core local government areas which constitute Lagos.
- The selected nine local government areas represent areas with the largest population density, and represent Lagos' core and downtown districts. These areas are not only part of the planned introduction of mass public transit facilities, but also comprise of demand-generating and major facilities.

b. Area-specific survey

1) Purpose of survey

- The purpose of the area-specific survey is to perform literature and site investigations for the nine LGAs, and to use the results as the foundation for establishing a draft plan for the improvement and expansion of NMT facilities given the optimal priority facilities based on the rankings for each area.

2) Survey items

- The surveyed items for each area includes the survey area's population, condition and usage of NMT facilities, future development potential and possibility of changes, major demand-generating facilities, hierarchy of road facilities, and usage.

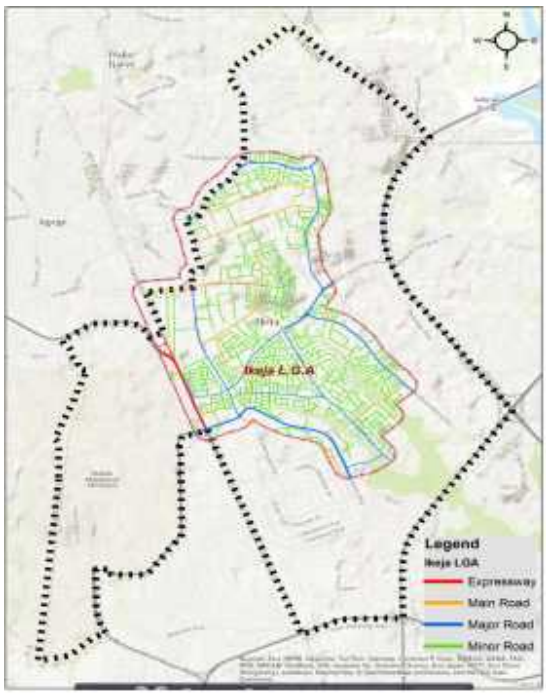
- Current conditions and usage: population, conditions and usage of NMT-related facilities, demand-generating facilities and their usage, hierarchy of roads by function and condition of facility installation.
- Future development potential: population and population growth rate, future plan for introduction of public transportation facilities, prospective usage and location of stations and bus stops and future plan for major transportation facilities.

- The Study Team performed a literature review and site investigation for the selected survey items and prepared a standardized list and table.

① Survey areas

○ The actual study area of each of the nine LGAs was reconfigured with new spatial boundaries.

- The spatial boundaries were based upon each of the nine LGAs core areas due to the extensive nature of the selected LGA's areas.
- [Figure 4.2-25] depicts Ikeja's adjusted spatial boundary for the study. The other eight LGA's spatial boundaries were similarly adjusted.
- The survey included each area's residential population and socio-economic indicators.
- In terms of Ikeja, the spatial boundaries were adjusted to be centered around the areas with high population density.



[Figure 4.2-25] Ikeja's readjusted spatial boundaries

Example of the socio-economic indicators included in the survey

LGA	POPULATION				Other Indicators	Probability a Growth of LGA[2]			Remark[3]
	2006	2010	2015	Rate (%)		High	Medium	Low	
AGEGE	1,033,064	1,171,780	1,371,654				○		
:	:	:	;	3.2		:	:	:	
SURULERE	1,274,362	1,445,478	1,692,038					○	
TOTAL	17,552,942	19,909,883	23,305,971			-	-	-	

② Current conditions and plan for public transportation facilities

○ The survey examined the type, plans for future operating corridors, location of major stations and bus stops, and future prospective usage of the mass public transit facilities (urban rail system, BRT, etc.).

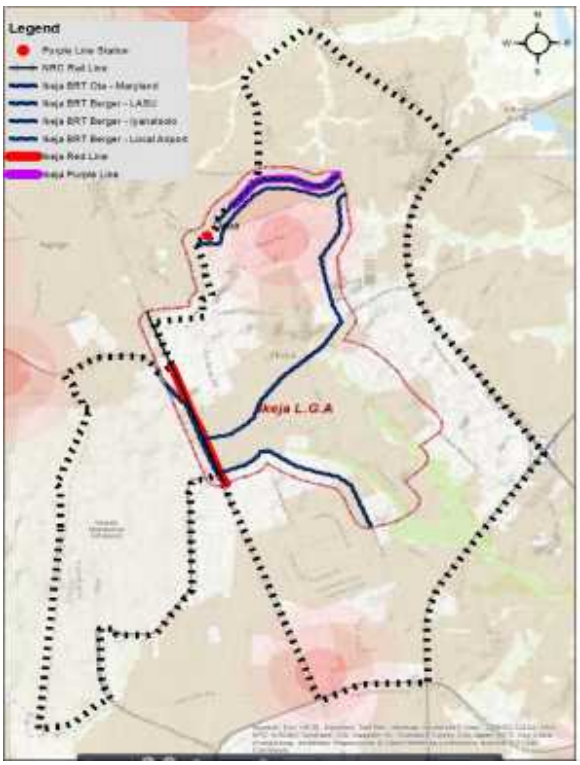
- Public transportation corridors' conditions, usage and future timeline for the operation of new lines, and the location of major stations and bus stops.
- Used the scale and purpose of public transportation facilities as the basis for prospective usage.
- Example of the survey of rail lines in Ikeja

: Red line, prospective operation by 2017, main station is Ikeja station

: Purple line, prospective operation by 2022, main station is Ogba station

- Example of the survey of BRT in Ikeja

: Four planned lines



[Figure 4.2-26] Ikeja's current conditions and plan for public transportation

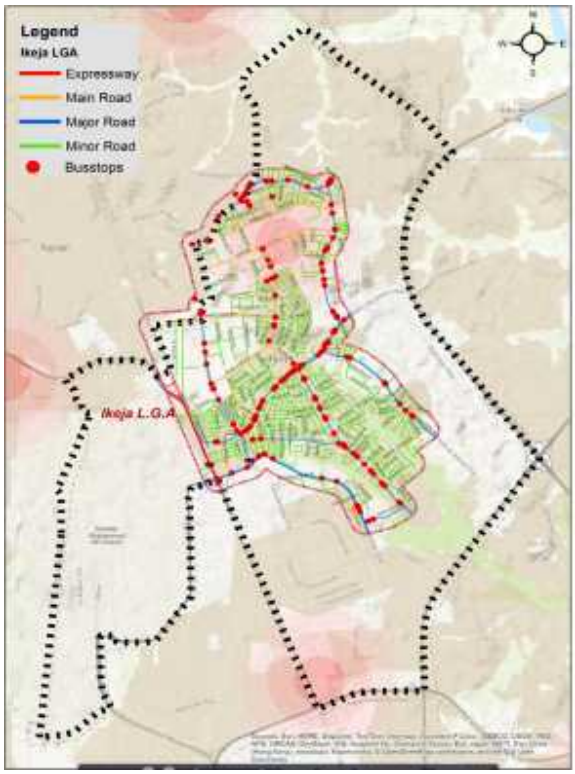
Example of Ikeja's conditions and plan for public transportation facilities' survey table

LGA	Type	Name of Lines	Operation start year	Stations	Using Status	Remark
Ikeja	Rail	Red line	2017	- Ikeja	High	
		Purple line	2022	- Ogba	High	
				- Omole	Medium	
	BRT	Ikeja BRT Ota-Maryland	2020 ~	Uncertain		
		Ikeja BRT Berger - LASU				
		Ikeja BRT Berger - Iyanalsolo				
		Ikeja BRT Berger - Local Airport				
	Waterway	-	-	-	-	-

③ Current conditions and plan for major transportation facilities

○ The survey examined the main operating transportation facilities that are currently operating or will be introduced in the near future, such as bus stops, and other major transportation facilities.

- Separate from the previously mentioned public transportation facilities, the survey examined the name, location, function, operational year, and usage of the facilities.
- In terms of Ikeja, there are currently no stations, bus terminals or waterway terminals, and no future plans for the aforementioned facilities. Therefore, the survey examined the main bus stops only.
- The survey examined a total of 197 bus stops and their demand/use.



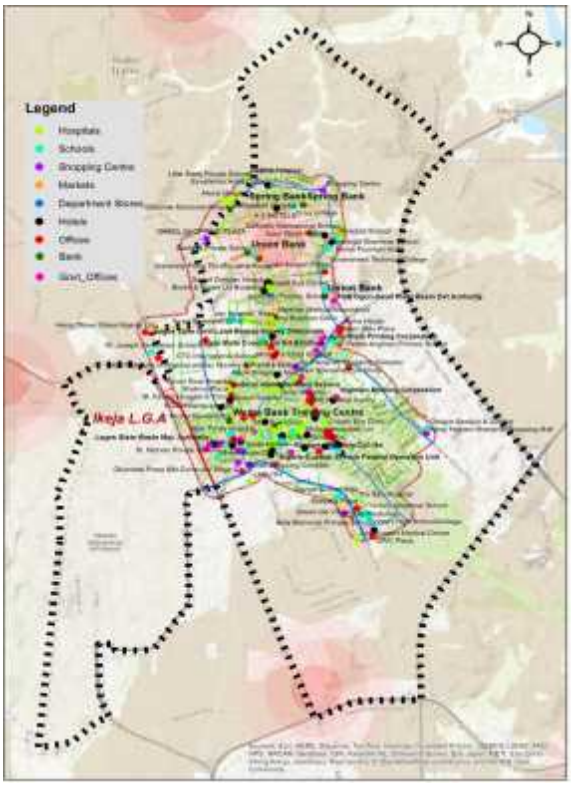
[Figure 4.2-27] Ikeja's current conditions and plan for transportation facilities

Example of Ikeja's conditions and plan for transportation facilities' survey table

LGA	Type		Name of Facility	Operation start year	Using Function	Using Status	Remark
Ikeja	Rail Station (Regional)		-	-	-	-	
			-	-	-	-	
	Terminal	Road	-	-	-	-	
		Waterway	-	-	-	-	
	Bus Stop		Airport	Now	Intercity/Intracity	High	
			;	;	;	;	
			Unity	Now	Intercity/Intracity	High	

④ Condition and usage of major demand-generating facilities

○ The survey examined five types of demand-generating facilities in the survey area, and recorded each facility's function, location and usage.



[Figure 4.2-28] Survey of Ikeja's demand-generating facilities

- The main types of demand-generating facilities were divided into the following: public administration facilities (Federal Government, LGA and others), education facilities (by education level), commercial facilities (markets and shopping malls), business facilities (office buildings, hotels, etc.) and medical facilities (by type).
- Understand the main facilities' name and usage status.
- In terms of Ikeja, the facilities were distributed among the aforementioned types of categories: administration, education, commercial, business and hospital.
- The usage statuses of the facilities were determined by considering the facility's type and scale.

Example of Ikeja's demand-generating facilities' survey table

LGA	Type		Name of Facility	Using Status	Remark
Ikeja	Administration	Federal	Nigeria-Custom Service Federal Operation Unit	High	
		State	Lagos State Council for Art &Culture	medium	
		Etc.	Ikeja LGA	Low	
	Education	Primary	Bola Memorial Primary School	Medium	
		High/College	Victory High School/College	High	
		Etc.	Government Technical College	Medium	
	Commercial	Market	Ipodo Market	High	
		Shopping Mall	Greenville Village	High	
	Business	Office Bd.	OPIC Plaza	High	
		Hotel	Sheraton Hotels & Towers	High	
		Etc.	Wema Bank Training Centre	Medium	
	Hospital	General	Life Support Medical Centre	High	
		Clinic	CRI Mediclinic	Low	
		Etc.	LASUTH	Medium	

⑤ Traffic corridors for the installation of NMT facilities

○ Upon selecting the main traffic corridors (road facilities) in the study area which NMT facilities can be installed along, the survey examined the current and future conditions.

[Figure 4.2-29] Survey of Ikeja's traffic corridors

- The three types of roads were divided based on the hierarchy of road facilities: express major, minor, and local.
- In order for the improvement and expansion of NMT facilities to be constituted in the transportation network, the study considered the NMT facilities' connection with future transportation facilities (main stations and stops) and demand-generating facilities.
- In order for the installation of NMT facilities, the survey examined the current conditions of the existing NMT facilities, assessed the development potential for future facilities, number of travelers by section and the usage of bicycles.
- In Ikeja, there are seven expressways, 20 main roads, 16 major roads and 132 minor roads which were included in the survey.
- The main survey items include the extension, number of lanes, width of sidewalk, NMT (pedestrian and bicycle) facilities and the number of travelers (pedestrians and cyclists).

Example of the survey of Ikeja's NMT facilities along traffic corridors

LGA	Type	Name of Road	Extension (km)	No. of Lanes (two-way)	Width of Sidewalk (m)	NMT facilities		No. of Travellers		Re.
						Pedestrian	Bicycle	Pedestrian	Bicycle	
Ikeja	Express	Lagos Abeokuta Expressway	31.34	6	3	N/A	N/A	Medium	N/A	
		:	:	:	:	:	:	:	:	
	Main	WEMPCO Rd.	1.97	4	2	Walkway	under construction	Heavy	N/A	
		:	:	:	:	:	:	:	:	
	Major	Allen Ave.	1.38	4	1.5	Walkway	N/A	Heavy	N/A	
		:	:	:	:	:	:	:	:	
	Minor	Adepeju St.	0.36	2	N/A	N/A	N/A	Medium	Nil-low	
		:	:	:	:	:	:	:	:	

3) Site investigation results by area

- The remaining eight LGAs which are included in the Study were surveyed similar to that of Ikeja with the standardized survey method and items through literature and site investigation.

- The detailed survey and site investigation results are included in the Appendix.

- Lagos State's total population (including the 20 LGAs) as of 2010 was 19,098,000 and is expected to grow to 23,306,000 by 2015, with an annual average growth rate of 3.2%.

- In the case of Nigeria, rapid urbanization is currently still occurring. Due to rural-urban migration, the population growth rate is high, and is expected to continue for a period of time.

- The LGAs which are expected to introduce and mass transportation facilities (rail and BRT) and urban development show high levels of probability of growth.

- While the majority of the surveyed LGAs show medium to high probabilities of growth, some (such as OshodiIsolo, Shomolu and Surulere) show low probabilities.

[Table 4.2-4] General indicators and probability of growth for Lagos State's 20 LGAs

LGA	POPULATION				Probability of Growth of LGA		
	2006	2010	2015	Rate (%)	High	Medium	Low
AGEGE	1,033,064	1,171,780	1,371,654			x	
AJEROMI/IFELODUN	1,435,295	1,628,021	1,905,717			x	
ALIMOSHO	2,047,026	2,321,893	2,717,945		x		
AMUWO ODOFIN	524,971	595,462	697,032			x	
APAPA	522,384	592,528	693,597		x		
BADAGRY	380,420	431,501	505,104		x		
EPE	323,634	367,090	429,706		x		
ETI-OSA	983,515	1,115,578	1,305,865		x		
IBEJU-LEKKI	99,540	112,906	132,165		x		
IFAKO IJAYE	744,323	844,268	988,277			x	
IKEJA	648,720	735,828	861,340	3.2		x	
IKORODU	689,045	781,567	914,882			x	
KOSOFE	934,614	1,060,110	1,240,936			x	
LAGOS ISLAND	859,849	975,306	1,141,667		x		
LAGOS MAINLAND	629,469	713,992	835,779			x	
MUSHIN	1,321,517	1,498,965	1,754,648			x	
OJO	941,523	1,067,947	1,250,110		x		
OSHODI ISOLO	1,134,548	1,286,891	1,506,399				x
SHOMOLU	1,025,123	1,162,773	1,361,110				x
SURULERE	1,274,362	1,445,478	1,692,038				x
TOTAL	17,552,942	19,909,884	23,305,971				

◦ Agege

Boundary of study area

Current condition and plan of public transportation

Major transportation facilities

Major demand-generating

Major traffic corridors (road

	facilities	facilities)
◦ OshodiIsolo	 Boundary of study area	 Current condition and plan of public transportation
Major transportation facilities	 Major demand-generating facilities	 Major traffic corridors (road facilities)
◦ Mushin	 Boundary of study area	 Current condition and plan of public transportation

Major transportation facilities

Major demand-generating facilities

Major traffic corridors (road facilities)

◦ Surulere

Boundary of study area

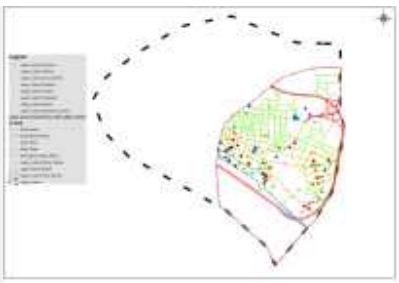
Current condition and plan of public transportation

Major transportation facilities

Major demand-generating facilities

Major traffic corridors (road facilities)

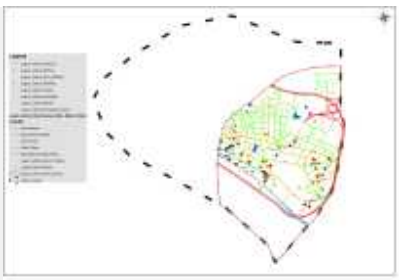
◦ Lagos Mainland



Boundary of study area

Current condition and plan of public transportation

Major transportation facilities



Major demand-generating facilities

Major traffic corridors (road facilities)

◦ Apapa

Boundary of study area

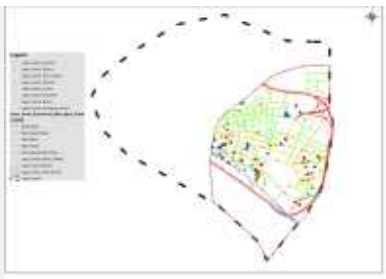
Current condition and plan of public transportation

Major transportation facilities

Major demand-generating facilities

Major traffic corridors (road facilities)

◦ Lagos Island



Boundary of study area

Current condition and plan of public transportation

Major transportation facilities

Major demand-generating facilities

Major traffic corridors (road facilities)

◦ EtiOsa

Boundary of study area

Current condition and plan of public transportation

Major transportation facilities

Major demand-generating facilities

Major traffic corridors (road facilities)

c. Priority regions

1) Selection method of priority areas

① General

o In order to determine the priority areas among the selected nine LGAs, the Study Team recognized the necessity of an optimal evaluation method to assess the study areas.

o Due to the immense amount of finances necessary for the improvement and expansion of NMT facilities, the Study Team recognized the necessity for

considering investment efficiency and the site investigation results as the basis for deducing optimal analysis results.

- In this case where public resources are used for financing public SOC projects, the most basic selection method of the priority areas is based on the assessment of the analysis of economic feasibility.
- However, because the economic analysis of NMT facilities is not established, it is not possible to quantify the effect of improving and expanding these facilities.

o The priority investment areas were selected based on a point system through assessing the criteria chosen for each LGA.

② Methodology

o Due to the absence of quantitative data to assess the improvement and expansion of NMT facilities, the Study Team applied a multi-criteria-based Analytic Hierarchy Process (AHP) as the assessment method, as opposed to a basic economic feasibility analysis.

o The AHP analysis provides a variety of advantages, as it provides a comprehensive feasibility assessment of the various items determined by relative importance.

- Concise application method of the model, and clear representation of the decision-making process
- The hierarchical structure used in the analysis is suitable for analyzing a public sector's policy structure with multiple levels of goals.
- The standardized model allows for the application for a variety of business fields and geographic areas.

o The AHP analysis is performed through four stages: conceptualizing → hierarchy structuring → weighting → measurement. In order to assess the relative importance of the hierarchy structuring stage, the Study Team surveyed experts for their opinions.

- The AHP evaluation surveyed the experts (on a set of assessed items ≒) to estimate the relative weight of each item.
- The results of the experts' opinions regarding the relative importance of the priority items (≒weighted) were reflected in selecting the assessment and priority items.

③ Selection of criteria and items

▷ Demand for NMT facilities

○ In order to analyze the need for the improvement and expansion of NMT facilities, demand was selected as tier-1 criteria, along with the population and future connection with mass transportation facilities (rail, BRT and related stations and stops) of each area as tier-2 criteria.

- The demand criteria and its related items were scored between 1~5 points depending on the scale of each area's residential population.
- The assessment of the future connection with mass transportation facilities, such as the scheduled opening time and number of lines, stations and stops were scored between 0~2 points or 3 points.

▷ Physical conditions of NMT facilities

○ In order to analyze the potential for the improvement and expansion of NMT facilities, physical conditions of NMT facilities were selected as tier-1 criteria along with the road facilities, demand-generating facilities and existing transportation facilities as tier-2 criteria.

- As part of the physical conditions of the road facilities, whether sidewalks were present along the road facilities was scored between 0~1 points, effective sidewalk width was scored between 0~3 points, and usage was scored depending on the volume of usage between 1~3 points.
- In terms of demand-generating facilities, due to the differing basic units for trip-generating types, usage was scored between 1~3 points depending on the type of trip generated and the volume of usage.
- In terms of the existing transportation facilities, each area's major terminals and stations were scored between 0~2 points based on the availability and number of the facility, and the availability of bus stops were scored between 1~3 points.

▷ Political will for NMT facilities

o In order to analyze the improvement and expansion of NMT facilities from a policy maker's perspective, political will was selected as tier-1 criteria, along with economic feasibility, the area's development potential and citizens' insurance of safety as tier-2 criteria.

- In the case of economic feasibility, due to the difficulty of performing a quantitative analysis and assessment, the economic feasibility of the improvement and expansion of NMT facilities was scored 1 point for all areas.
- Each area's development potential considered future urban development and plans for transportation facilities, and was scored between 1~3 points.
- In terms of citizens' safety, similar to that of economic feasibility, due to the difficulty of performing a quantitative analysis and assessment, the insurance of safety for the improvement and expansion of NMT facilities was scored 1 point for all areas.

[Table 4.2-5] Priority areas' surveyed items, criteria and standards

	Tier-1	Tier-2	Description	Assessment standards
Surveyed items	Demand	Population	Population living in the area	- Population and population growth rate
		Connection with prospective transportation facilities	Introduction of mass transportation facilities in the future (rail, BRT, etc.)	- Number of lines, number of stations and bus stops
	Physical conditions	Road facilities	Current status of the presence of, effectivity of (width) and demand for sidewalks	- Sidewalk availability, sidewalk width (m) and distribution of usage
		Demand-generating facilities	Demand-generating facilities located in the area	- Number and distribution of usage
		Transportation facilities	Status of currently available terminals, rail stations and bus stations	- Number and distribution of usage
	Political will	Economic feasibility	Cost-effectiveness considering investment quantity of traffic facilities	- B/C of at least 1.0
		Development potential	Development potential of area	- Expected development potential
		Safety	Safety level of transportation facilities	- Safety impact 1.0
Assessment scale	- Availability of the related content (0~1, or 2, 3), distribution of usage (low 1 ~ medium 3, high 5) - Economic feasibility and safety's quantitative indicators are based on the aforementioned justification, and are all 1.0			

[Figure 4.2-30]Selection for hierarchy structuring and weighting

[Figure 4.2-31] Calculation process for measurement

④ Survey of experts

o The survey was prepared, based on the assessment items and standards, for the experts in the transportation field.

o The survey consisted of a total of 20 respondents, including transportation experts, related government officials, and local transportation experts in Nigeria.

- 17 Korean transportation experts and related government officials
- 3 local Nigerian transportation experts

⑤ Computation of weights for the selected priority items

o On the basis of the survey, the priority areas' weighted values and the overall weighted value were selected.

o The calculated weighted values for the tier-1 criteria were 0.378 for political will, 0.334 for physical conditions and 0.289 for demand. Political will was determined as the most important, followed by physical conditions and demand.

- Political will with the highest weighted value, followed by physical conditions and demand.

o Among the tier-2 criteria for demand, connection with prospective transportation facilities was calculated as 0.660 and population as 0.340. As a result, linking NMT facilities with mass public transit facilities to generate current and future demand was analyzed to be more important than population.

- The actual users of NMT and its facilities in the entire city of Lagos shows an overall similar increase, which may be the reason as to why connections to prospective transportation facilities was heavily weighted.

o Among the tier-2 criteria for physical conditions, road facilities was calculated to be 0.421, demand-generating facilities as 0.327 and the existing terminals, stations and bus stops (and other transportation facilities) as 0.252.

- Road conditions and usage which NMT facilities could be installed onto were shown to be the most important factor, followed by demand-generating facilities and existing transportation facilities.
- NMT facilities installed depending on road conditions and the volume of usage along with the volume of demand-generating facilities also showed to be of importance.

○ Among the tier-2 criteria for political will, safety was calculated to be 0.483, development potential as 0.283 and economic feasibility as 0.243.

- Generally, in the construction of transportation infrastructure, the most importantly weighted factor is economic feasibility. However, the results show that economic feasibility was weighted the lowest which is due to the standardized value of 1 given to this factor.
- However, though safety had the equivalent terms, it showed the highest among the three items and reflects the extent of the danger of security and public order of Lagos' current conditions.

[Figure 4.2-32] Weighted analysis results of each determinant (μ represents the weighted average)

2) Results of the selection of the priority investment areas

○ The following is the ranking of the priority investment areas according to the selected criteria and the AHP analysis for the installation of NMT facilities

- Rank 1: Surulere
- Rank 2: Eti-Osa
- Rank 3: Agege
- Rank 4: Mushin
- Rank 5: Ikeja
- Rank 6: Lagos Island
- Rank 7: OshodiIsolo
- Rank 8: Apapa
- Rank 9: Lagos Mainland

[Table 4.2-6] Results of the selection of the priority investment areas

	Demand			Physical conditions				Political will				Total	Priority ranking
	Population	Connection with prospective transportation facilities	Grade	Road facilities	Demand-generating facilities	Transportation facilities	Grade	Economic feasibility	Development potential	Safety	Grade		
AGEGE	90.0	98.0	95.3	80.9	84.0	13.5	65.0	100.0	90.0	100.0	97.1	87.1	**3**
APAPA	60.0	77.0	71.2	70.6	65.8	15.3	55.1	100.0	100.0	100.0	100.0	76.2	**8**
ETI-OSA	80.0	86.0	84.0	100.0	100.0	16.4	79.0	100.0	100.0	100.0	100.0	87.9	**2**
IKEJA	70.0	100.0	89.8	72.0	88.3	20.0	64.2	100.0	90.0	100.0	97.1	84.9	**5**
LAGOS ISLAND	80.0	93.0	88.6	72.3	75.2	12.6	58.2	100.0	100.0	100.0	100.0	83.6	**6**
LAGOS MAINLAND	70.0	72.0	71.3	62.7	67.0	13.5	51.8	100.0	90.0	100.0	97.1	74.3	**9**
MUSHIN	100.0	96.0	97.4	72.1	68.1	17.9	57.2	100.0	90.0	100.0	97.1	85.7	**4**
OSHODI ISOLO	90.0	85.0	86.7	83.3	69.7	13.5	61.3	100.0	80.0	100.0	94.3	81.9	**7**

SURULERE	100.0	100.0	100.0	94.8	80.4	19.5	71.2	100.0	80.0	100.0	94.3	89.8	**1**

d. Installation standards for NMT facilities

- Upon investigation, it was found that the design standards and construction guidelines for the construction of Lagos' road facilities are severely inadequate, and are non-existent for NMT facilities such as sidewalks and bicycle lanes
- The road hierarchy used for the installation of NMT facilities will be based upon UNEP's Share the Road's Guidelines, which were previously analyzed.

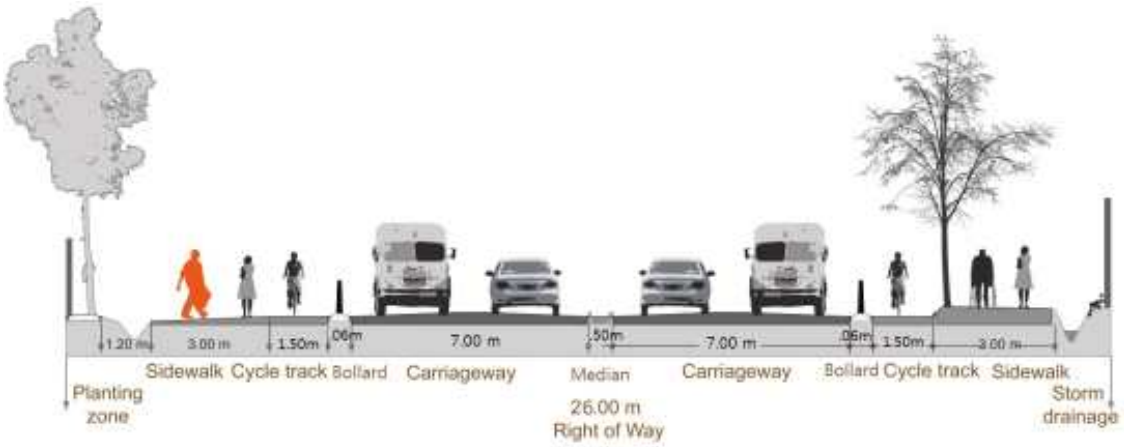
- The guidelines for the installation of NMT facilities are of high quality, as they propose standards for roads (including BRT), sidewalks, bicycle lanes, bollards and storm drainage facilities.
  - Based on these guidelines, the installation standards of the NMT facilities will differ depending on the hierarchy of the road.
  - In the case of expressways, the included roads were separated into those with plans to implement BRT and other mass public transit facilities and those that function as main roads, both of which are planned for the construction and operation of sidewalks, bicycle lanes and other related NMT facilities.

- Installation standards of NMT facilities along expressways: divided into roads which are planned to introduce BRT and those that function as main roads.

[Figure 4.2-33] Installation standards of NMT facilities for expressways with planned BRT

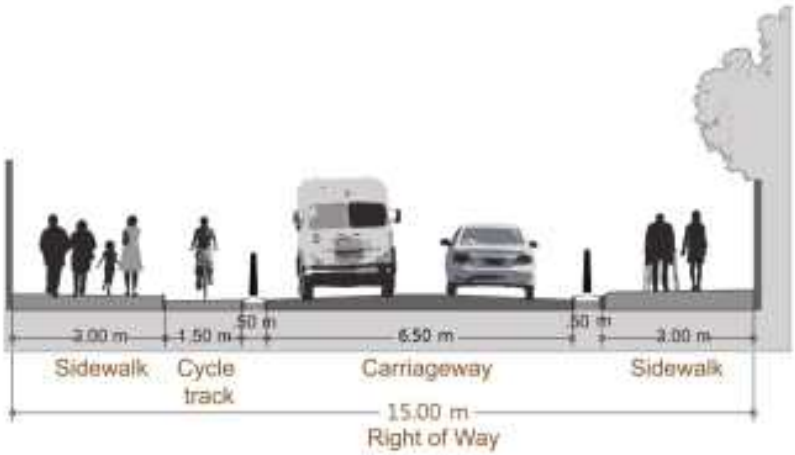
[Figure 4.2-34] Installation standards of NMT facilities for main roads

- Installation standards of NMT facilities for major roads: install two-way sidewalks along both carriageways, and install a one-way cycle track



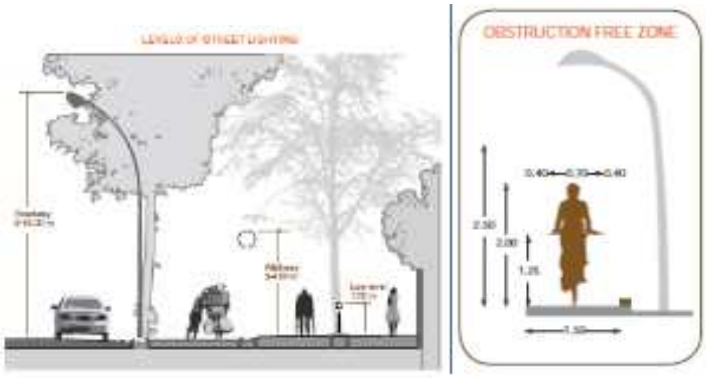
[Figure 4.2-35] Installation standards of NMT facilities for main roads

- Installation standards of NMT facilities for minor roads: introduce Share the Road's Road Diet which reduces the width of the carriageway, and introduce two-way sidewalks and a one-way cycle track



[Figure 4.2-36] Installation standards of NMT facilities for minor roads

- All areas where NMT facilities, such as sidewalks and cycle tracks, to be constructed, shall follow the following standards for the installation of street lights.



[Figure 4.2-37] Installation standards of street lights along NMT facilities

e. Proposed implementation plan in phases

1) Unit cost of construction by road hierarchy

- With the three types of roads for the introduction of NMT facilities, including expressways (those with BRT and those with regular functions of main roads), major roads and minor roads, a basic premise was set in order to calculate the unit cost of construction in accordance with the aforementioned installation standards

- As all roads (and sidewalks included) are state- or city-owned, the Study Team disregards right-of-way land purchasing and compensation expenses.
- Upon the construction of NMT facilities in accordance with the installation standards by road hierarchy, the unit cost of construction was calculated per km.
- Due to the lack of data Nigeria's unit cost of construction (per km), the calculation was based on Korean standards.
- Upon considering Korea and Nigeria's economic conditions (such as exchange rate, national income, average monthly income, average monthly cost of labor, etc.), the Study Team applied a revised unit cost of construction.

○ The following shows the calculation standards for the unit cost of construction by road hierarchy per km

- Expressway (with BRT): two-way BRT median lanes (separation of tolls, assign BRT stations every 2.0 km) with a total of two lanes, two-way carriageways with a total of four lanes, and installation of a two-way side gutter, divisional strips and bicycle lanes, planting zone and drainage facilities, all included in the 40 m.
- Main roads: installation of a total of four lanes of two-way carriageways, two-way side gutters, divisional strips and bicycle lanes, sidewalks and drainage facilities, all included in the 32 m.
- Major roads: installation of a total of four lanes of two-way carriageways, two-way side gutters, divisional strips, sidewalks and drainage facilities, and a one-way bicycle lane, all included in the 26 m.
- Minor roads: installation of a total of two lanes of two-way carriageways, two-way side gutters, drainage facilities and sidewalks, and a one-way bicycle lane, all included in the 15 m

○ Korean unit cost of construction standards for one-way roads per km are as follows:

- Expressway (with BRT): KRW 940 million/km
- Main roads: KRW 940 million/km
- Major roads: KRW 730 million/km
- Minor roads: KRW 385 million/km

※ Sidewalk (width 3.0 m) KRW 140 million/km, bicycle lane (width 3.0 m) KRW 210 million/km, drainage facilities KRW 120 million/km (Korean national highway's concrete storm drainage cost)

2) Revised unit cost of construction

○ Korean construction costs for transportation infrastructure are based on the preliminary feasibility standard, which is comprised of direct construction costs and indirect costs. The detailed components of each cost and its ratio of the total costs are further specified.

- Direct construction costs: material costs, direct labor costs, other expenses (excluding land purchasing and compensation expenses)
- Indirect costs: indirect labor costs, insurance (industrial accident, employment, health, pension), non-deductible retirement installments, occupational safety and health expenses, other expenses, environmental preservation cost, general management expenses, profit, construction damage insurance, regular safety inspection costs and VAT

[Table 4.2-7] Ratio of direct construction costs and indirect costs of total construction cost

		Material costs (KRW)	Direct labor costs (KRW)	Other expenses (KRW)	Total (KRW)	Ratio (%)	Notes
(1) Direct construction cost		**44.00**	**39.00**	**17.00**	**100.00**	**68.53**	-
(2) Indirect costs	Indirect labor costs	-	4.37	-	4.37	2.99	**31.47**%of total construction cost
	Industrial accident insurance	-	1.65	-	1.65	1.13	
	Employment insurance	-	0.51	-	0.51	0.35	
	Health insurance	-	0.55	-	0.55	0.38	
	Pension insurance	-	0.94	-	0.94	0.64	
	Non-deductible retirement installments	-	0.74	-	0.74	0.51	
	Occupational safety and health expenses	0.70	0.62	-	1.32	0.90	
	Other expenses	3.12	3.08	-	6.20	4.25	
	Environmental preservation cost	0.66	0.59	0.26	1.51	1.03	
	General management expenses	1.54	1.52	0.60	3.66	2.51	
	Profit (9%)	4.10	4.02	1.58	9.72	6.66	
	Construction damage insurance	0.56	0.50	0.22	1.28	0.88	
	Regular safety inspection costs	0.09	0.08	0.03	0.2	0.14	
	VAT (10%)	5.48	5.82	1.97	13.27	9.09	
	Sub total	16.25	25.01	4.66	45.92	31.47	
Total (1) + (2)		60.25	64.01	21.66	145.92	**100.00**	-
Ratio (%)		41.29	43.87	14.84	100.00	-	-

Applied Korean Transport Infrastructure Construction Cost Standards "(5th) Standard Guidelines for Feasibility Studies for Road and Rail Projects"

o In terms of the material costs of the direct construction cost, under the assumption that Korean facilities are introduced, 100.0% of the material costs will be used. For the direct labor costs and other expenses, due to the differing economic conditions between Korea and Nigeria, the applied ratio must be adjusted.

o In terms of the indirect costs, since the situation differs depending on the country it is discounted in the Study. The Study Team has chosen to discount the indirect costs until the project is proposed, and is in the stages of planning implementation and at the designing stage, whereby the indirect costs can be recalculated and are expected to incur additional costs.

o Though in order to adjust the unit cost of construction, there exists a need to take a comprehensive approach, taking into account various factors; however, the Study has used income level, namely GDP per capita, as the standard and applied a 10.8% ratio.

[Table 4.2-8] Forecast of 2014 GDP per capita ($) for Korea and Nigeria

GDP per capita ($)				(b/a)
Korea	28,738.734(a)	Nigeria	3,416.494(b)	**0.108**

Source: IMF's 2014 GDP Forecast by Country, 2014.10

o Based on the results of [Table 4.2-7] and [Table 4.2-8], the ratio of Nigerian unit cost of construction to that of Korean is 34.3% for the adjusted unit cost of construction.

- The ratio of the direct construction cost (①) to total construction cost of 68.53% divided into material costs, direct labor costs and other expenses (②), and is calculated back to 100.0% with the adjusted ratio (③)

- Under the assumptions (④), the material costs use 100.0%, while the direct labor costs and other expenses depend on the 10.8% ratio calculated based on GDP per capita resulting in the applied ratio (⑤)

[Table 4.2-9] Ratio of the necessary expenses to the total construction cost (direct construction costs)

	Direct construction costs			Total
①	68.53%			
-	Material costs	Direct labor costs	Other expenses	
②	44.0%	39%	17%	-
Adjusted ratio (③=①*②/100.0)	30.2%	26.7%	11.7%	
Assumptions ④	100%	10.8%	10.8%	
Applied ratio (⑤=③*④)	30.2%	2.9%	1.3%	**34.3%**

o Using this method, the adjusted unit cost of construction per km was calculated for the introduction of NMT facilities depending on road hierarchy in Lagos, Nigeria (the applied exchange rate for US dollars is as of September 2014)

- Expressways (with BRT): KRW 322 million/km ($305,611)
- Main roads: KRW 322 million/km ($305,611)
- Major roads: KRW 250 million/km ($237,336)
- Minor roads: KRW 132 million/km ($125,171)

3) Calculation of project costs by area

o The project costs for the improvement and expansion of NMT facilities by area were calculated using the unit cost of construction per km and the extension of traffic corridors by road hierarchy.

o As the Study's calculated project costs, based on the premise and assumptions of Korean unit cost of construction, may differ from the actual costs, indirect costs are discounted and need to be recalculated in the future.

o The area with the highest construction costs is Eti-Osa.

- Though Eti-Osa does not have plans to construct BRT and mass public transit facilities, it has the highest construction costs because it has the greatest length (compared to other areas) for the extension of major and minor roads.

[Table 4.2-10] Results of the calculated project costs for the introduction of NMT by area

	Expressways and main roads (km)				Major roads (km)		Minor roads (km)		Total ($)
	Road extension (with BRT)	Unit cost ($)	Road extension	Unit cost ($)	Road extension	Unit cost ($)	Road extension	Unit cost ($)	
AGEGE	6.64	305,611	18.33	305,611	25.81	237,336	58.27	125,171	21,050,463
APAPA	0		22.08		9.47		37.99		13,750,707
ETI-OSA	0		89.61		36.88		222.14		63,944,206
IKEJA	16.94		19.73		15.25		51.2		21,234,886
LAGOS ISLAND	6.5		20.41		8.39		26.74		13,562,318
LAGOS MAINLAND	0		10.73		1.2		53.88		9,952,527
MUSHIN	3.48		18.7		0		44.24		12,316,008
OSHODI ISOLO	4.34		20.57		18.62		103.83		25,028,450
SURULERE	7.09		21.68		35.25		74.47		25,276,710

Exchange rate as of September, 2014 ($1 = KRW 1,055)

4) Introduction of non-motorized transport facilities by area

o The calculation of the extension of roads by hierarchy (four types) and project costs for each of the nine LGAs are as follows.

- Road hierarchy is divided into expressways (with BRT), main roads, major roads and minor roads.

▷ Area: Agege

▷ Extension of roads: total of 109.05 km

- Expressways (with BRT) 6.64 km, main roads 18.33 km, major roads 25.81 km, minor roads 58.27 km

▷ Project cost: total of KRW 222.1 million ($21,050,463)

▷ Area: Apapa

▷ Extension of roads: total of 69.54 km

- Expressways (with BRT) 0.0 km, main roads 22.08 km, major roads 9.47 km, minor roads 37.99 km

▷ Project cost: total of KRW 145.1 million ($13,750,707)

▷ Area: Eti-Osa

▷ Extension of roads: total of 348.63 km

- Expressways (with BRT) 0.0 km, main roads 89.61 km, major roads 36.88 km, minor roads 222.14 km

▷ Project cost: total of KRW 674.6 million ($63,944,206)

▷ Area: Ikeja

▷ Extension of roads: total of 103.12 km

- Expressways (with BRT) 16.94 km, main roads 19.73 km, major roads 15.25 km, minor roads 51.2 km

▷ Project cost: total of KRW 224 million ($21,234,886)

▷ Area: Lagos Island

▷ Extension of roads: total of 62.04 km

- Expressways (with BRT) 6.50 km, main roads 20.41 km, major roads 8.39 km, minor roads 26.71 km

▷ Project cost: total of KRW 143.1 million ($13,562,318)

▷ Area: Lagos Mainland

▷ Extension of roads: total of 65.79 km

- Expressways (with BRT) 0.0 km, main roads 5.59 km, major roads 6.32 km, minor roads 53.88 km

▷ Project cost: total of KRW 105 million ($9,952,527)

▷ Area: Mushin

▷ Extension of roads: total of 66.42 km

- Expressways (with BRT) 3.48 km, main roads 18.7 km, major roads 0.0 km, minor roads 44.24 km

▷ Project cost: total of KRW 129.9 million ($12,316,008)

▷ Area: OshodiIsolo

▷ Extension of roads: total of 147.36 km

- Expressways (with BRT) 4.34km, main roads 20.57 km, major roads 18.62 km, minor roads 103.83 km

▷ Project cost: total of KRW 264.1 million ($25,028,450)

▷ Area: Surulere

▷ Extension of roads: total of 133.42 km

- Expressways (with BRT) 7.09 km, main roads 21.68 km, major roads 30.18 km, minor roads 74.47 km

▷ Project cost: total of KRW 266.7 million ($25,276,710)

5) Implementation plan in phases

- The duration of the Study is divided into pilot (2017), short-term (2020), mid-term (2025), long-term (2030) and the long-term plan (2030~) for the LGAs.
- The Study Team established the project implementation plan in phases (pilot, short-term, mid-term, etc.) through combining the result of the priority investment areas and the Lagos State Government's opinions.
- Though the first pilot project area is ranked in the fifth according to the priority ranking, Ikeja is the first area in Lagos which has initiated a bicycle pilot project, and has a high concentration of government offices, demand-generating facilities and residential areas
- The implementation plan was established for the nine LGAs according to the following timeline: Surulere and Eti-Osa were selected as the short-term project areas; Agege, Mushin and Lagos Island as the mid-term project areas; and, OshodiIsolo, Apapa, and Lagos Mainland as the long-term project areas.

[Table 4.2-11] Implementation plan in phases

	Priority ranking	Project areas by phase																
		Pilot (~2017)			Short-term (~2020)			Mid-term (~2025)					Long-term (~ 2030)					Long-term plan
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
AGEGE	3																	
APAPA	8																	
ETI-OSA	2																	
IKEJA	5																	
LAGOS ISLAND	6																	
LAGOS MAINLAND	9																	
MUSHIN	4																	
OSHODI ISOLO	7																	
SURULERE	1																	
- Project area - Project cost	-	IKEJA ($21,234,886)			SURULERE, ETI-OSA ($89,220,916)			AGEGE, MUSHIN, LAGOS ISLAND ($46,928,789)					APAPA, LAGOS MAINLAND, OSHODI ISOLO ($48,731,684)					-

f. Plan for vitalization of use and operational efficiency for non-motorized transport

1) Vitalization of use

o Most transportation facilities which are built out of necessity naturally become used, therefore it is normal for the usage of the facilities to occur naturally.

- In terms of the supply and demand of the transportation facilities, the supply of transportation infrastructure naturally results in the creation of demand for usage.
- This is a phenomenon which occurs independent of the transportation facilities' economic feasibility

o This Study analyzed the main modes and facilities of NMT, including sidewalks for pedestrians and bicycle lanes and related facilities for bicycle transport.

o The analyzed strategy for vitalizing use and achieving operational efficiency for NMT is under the assumption that the implementation of the improvement and expansion of NMT facilities followed this Study's proposed plan.

① Plan for vitalizing use of sidewalks

o In the case of pedestrian sidewalks, the proposed improvement and expansion of pedestrian space is expected to largely improve Lagos' pedestrian environment, and is expected to vitalize use.

o However, as outlined in the issues of the current conditions of NMT, the pedestrian environment should not be interfered by illegal activities (illegal parking, illegal commercial activities, illegal street vendors, etc.) and the lack of maintenance.

- The improvement method for the illegal activities are further discussed in institutional improvement.

o Therefore, in order to vitalize use of the pedestrian space's physical facilities, the Study Team proposes a strategy to ensure optimal management and operative measures.

[Figure 4.2-38] Effective-use of sidewalk space

② Plan for vitalizing use of bicycle lanes

o Centered around the initiatives of citizens, NGOs and previous government officials, the importance of cycling as a mode of NMT has started to become more recognized, as NMT has the potential to change the transportation network through its ability to connect with rail, BRT and other mass public transit, reduce traffic fatalities and reduce air pollution from motorized vehicles.

- As the previous Commissioner for Transport of the Lagos State Government, Mr. KayodeOpeifa was a key person for the active initiatives for cycling, the expansion of bicycle lanes along roads and other initiatives which aimed at vitalizing bicycle-use.

o Furthermore, government officials of Nigerian Federal Government and Lagos State Government have recognized the importance of cycling as a mode of NMT, and are analyzing ways to expand cycling facilities through attending international forums and seminars.

- October 17, 2011: Inauguration of National Stakeholders Forum on Bicycle Transportation
- December 9, 2011: International Engineering Conference (presentation of bicycle-related paper)
- February 15, 2012: 2nd Meeting of National Stakeholders Forum
- June 20, 2012: 3rd meeting of National Stakeholders Forum
- June 24~29, 2012: VELO-CITY Global Cycling Conference

  - However, as shown in the current situation and issues with NMT in Lagos, Nigeria, the citizens do not perceive cycling as a mode of transport.

- Cycling is perceived as a subsidiary mode of transport, which can use the existing sidewalks and roads.
  - In Lagos, there are almost neither infrastructure nor facilities for cycling as a mode of transport. As part of a pilot project, the bicycle lane along Wempco Road in Ikeja is being constructed (1.8 km in length, and 1.5 m in width).
  - Through such pilot projects, the Lagos Metropolitan Area Transport Authority (LAMATA) and the state transit system of Lagos State Government have come up with measures to vitalize bicycle-use through constructing a bicycle network.

- "Proposed Cycle Routes Linking Wempco Road, LAMATA (Transport Safety Unit), March 5, 2014"
- Preparation of three alternative bicycle networks to connect with the construction of the pilot project along Wempco Road
- Proposed line A: Oba Ogunji~Wempco Road and 7.7 km part of minor road
- Proposed line B: Origin from Oba Ogunji and connection to ObafemiAwolowo, and partially connected to Wempco Road (6.9 km)
- Proposed line C: Origin from Oba Ogunji and connection to Wempco Road, connected to ObafemiAwolo (7.4 km)

Proposed line A

Proposed line B

Proposed line C

[Figure 4.2-39] LAMATA's proposed bicycle networks

- Upon negotiating with the Lagos State Government and considering the lines proposed by LAMATA, the Study Team's proposed recommendation is adopted to pursue the proposed line A through foreign aid.

- The Study Team proposes the implementation of the proposed line A, which is built centered on expressways and minor roads, for the construction of a bicycle network through Korean official development assistance (ODA)

- In addition, the Study Team proposes the allocation of bicycle storages and other amenities in major areas in order to vitalize use.

③ Policy plan for vitalizing use of non-motorized transport

▷ Creation of a dedicated administrative organization

- The transportation department of the Lagos State Government should create a subsidiary department or division in charge of NMT and each LGA shall also create a division as part of each local government council (LGC) in charge of NMT, in order for the LGCs and the Lagos State Government to build an inter-connected institutional system.

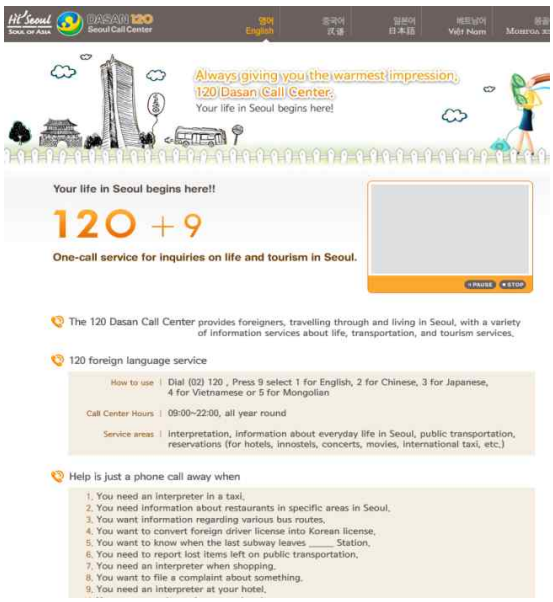
- Create Lagos State Government and LGCs' NMT departments to take administrative role in NMT
- Build a cooperative and inter-connected system between the Lagos State Government and LGCs and divide the administrative roles

- Establishment of major responsibilities and roles of the NMT departments

- Establishment and implementation (in phases) of a comprehensive basic plan for the improvement and expansion of pedestrian facilities
- Preparation of installation standards and design guidelines for pedestrian facilities
- Construction projects for the improvement and expansion of sidewalks and the maintenance and repair of pedestrian facilities
- Build a database for pedestrian facilities and an annual synchronizing function

▷ Operation of a call center

- The operation of a call center should allow for the citizens of Lagos to raise direct complaints about any inconveniences experienced regarding pedestrian facilities.
- The call center should collect all complaints made, either online or offline, and forward the complaints to the respective departments in charge.
- Upon receiving the complaints, the respective departments should take measures to better understand the situation of the complaints and take measures to minimize the inconveniences felt by the citizens.



[Figure 4.2-40] Seoul's operation of a call center

- In the case of Seoul, Korea, a call center ("120 Dasan Call Center") was established and is operating in order to receive complaints regarding inconveniences in daily life. A similar idea can be applied as a benchmark in Lagos.

▷ Procurement of steady funds for pedestrian facilities

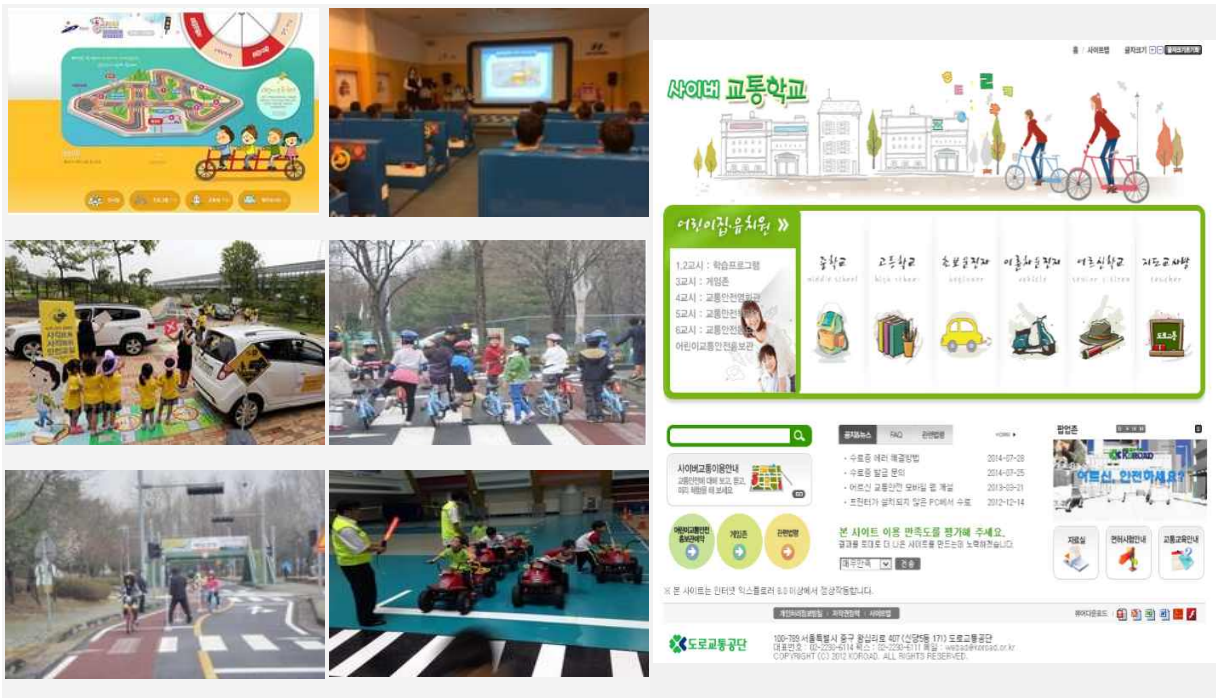
- In order for the creation of an administrative organization and the operation of a call center, and other measures for the maintenance and operation and vitalization of usage of pedestrian facilities, there exists a need for a steady procurement strategy which ensures the provision of annual funds.

2) Raising awareness (education and promotion)

- While the expansion of the supply of facilities is important for vitalizing NMT-use, it is necessary to strengthen the perception of cycling as a mode of transport.

- In the case of Korea, the foundation of which bicycle use was vitalized was due to both the expansion of bicycle lanes and amenities as well as educational and promotional programs for NMT (pedestrian and bicycle), and was influential in changing citizens perceptions.
- The central government and local governments actively developed and implemented educational and promotional programs, involving all citizens by implementing into the regular curriculum.

- Preparation of textbooks and implementation of educational programs in the curriculum from elementary school to high school which includes traffic safety, use of transportation modes and NMT.
- Development of online educational and promotional programs, operation of traffic park for children, issuance of bicycle licenses and implementation of pedestrian and cycling experiential learning programs



[Figure 4.2-41] Korea's traffic educational and promotional programs

- Korean traffic education and promotional programs are highly effective, and have been modeled after by many countries; therefore, the Study Team

proposes that Nigeria adopts the traffic education and promotional programs of Korea.

- As transportation-related educational and promotional programs normally need to be recommended at the government-level, the Study Team proposes that Korean and Nigerian transportation-related administrative organizations build a cooperative system in order to adopt and share the experiences of Korea.

- The Study Team proposes that Korea and Nigeria sign an MOU in order to share the educational and promotional programs of Korea, as well as through knowledge sharing programs (KSP).
- In addition, the Study Team proposes Nigerian government officials to be included in Korean central and government-affiliated organizations' various training programs for developing countries' government officials in the transportation field.

- This Study proposes for the future of Nigerian educational and promotional programs for traffic safety and NMT use through knowledge support and joint cooperation.

3) Institutional improvement

- The Study Team proposes the institutional improvement strategy, as the most important aspect of vitalizing use and operational efficiency of NMT is the legal and institutional mechanisms, and the use of these mechanisms to add and supplement to any deficiencies through the establishment of new laws and institutions.

- Upon realizing the importance and need for NMT (pedestrian and cycling) in Korea, related laws and institutions were built in order for the significant expansion of related facilities and promotion of vitalizing use.

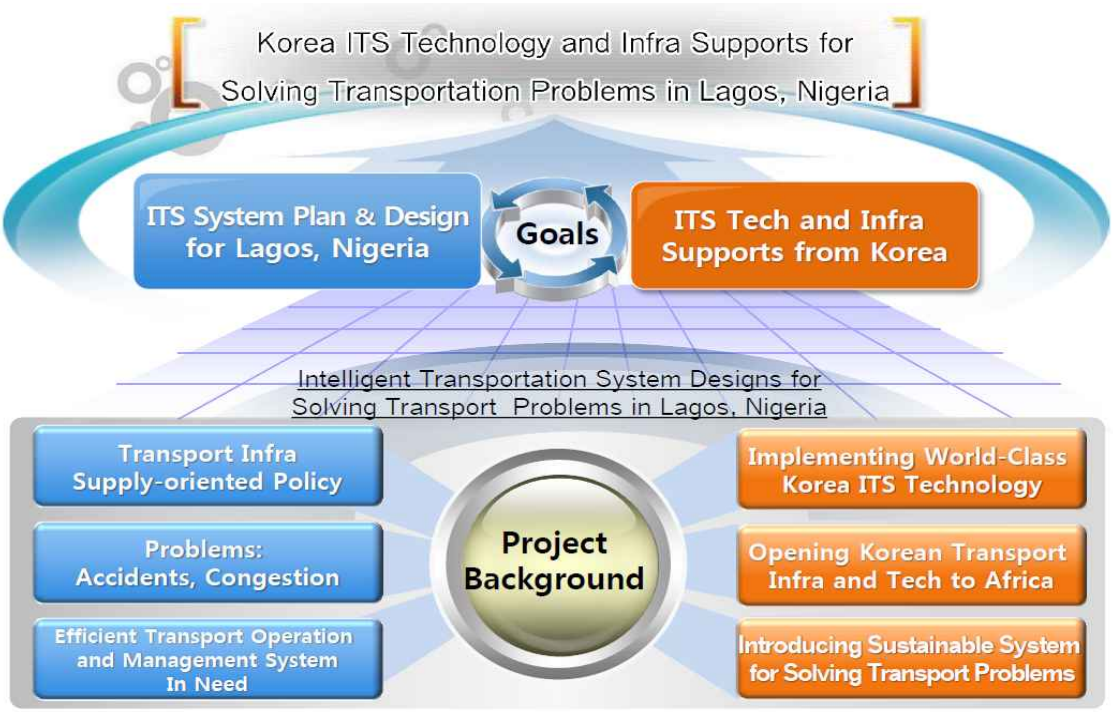
- Laws related to pedestrians include the enactment of the "Act on Guarantee of Promotion of Convenience of Persons with Disabilities, the Aged, Pregnant Women, etc. 1997" and, later, the enactment of the "Act on Promotion of the Transportation Convenience of Mobility Disadvantaged Persons 2005" in order to maximize the effectiveness of the legal capacity.

- The law related to cycling includes the enactment of the "Promotion of the Use of Bicycles Act 1995"
    - Following the enactment of the mentioned Acts, design guidelines, installation standards and measures to maximize operation efficiency for the construction and operation of related facilities were prepared.
    - Currently, the Lagos State Government's laws and institutional capacity related to NMT are severely inadequate, and there is a large absence of design guidelines and installation standards, and measures to maximize efficiency in management and operation for the related facilities.
    - Therefore, this Study proposes the development of educational promotion programs and the joint cooperation between Korea and Nigeria based on Korean related laws and regulations in order to carry out the matters proposed in this Study.

4.3 Intelligent Transport Systems (ITS)

4.3.1 Basic Direction of ITS Master Plan Establishment for Lagos

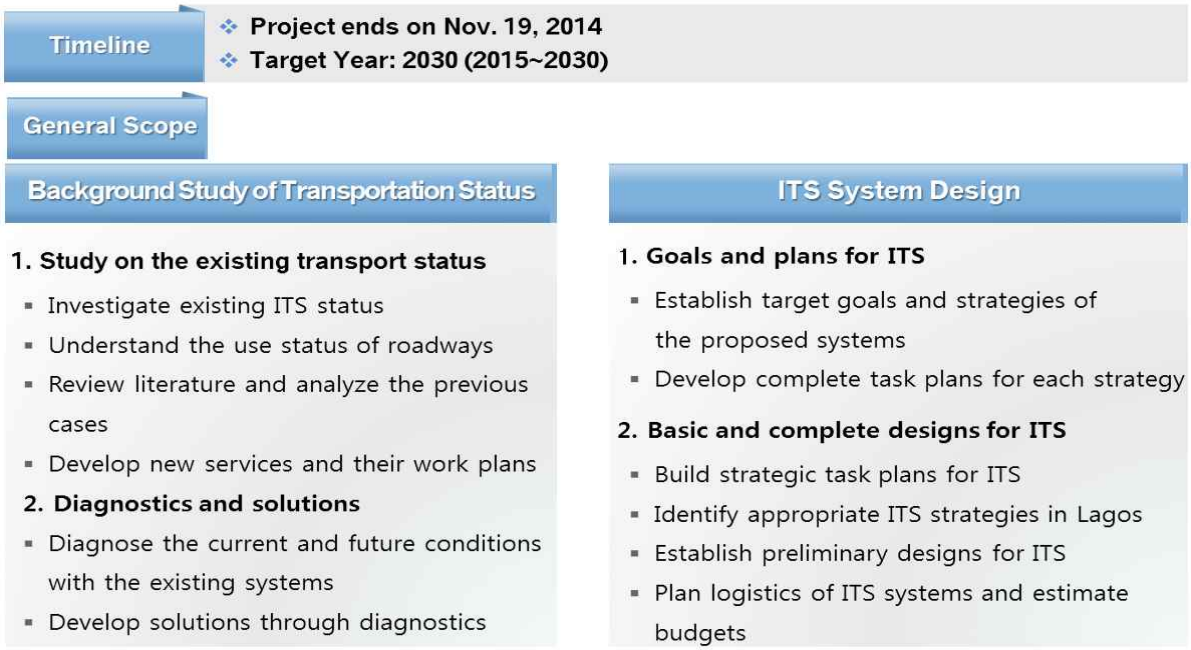
- Nigerian government continues to build highways and expand bus rapid transit (BRT) under the policy of expanding infrastructure to solve transport problems, such as heavy traffic congestion and accidents, caused by steady economy growth in urban regions.
- Despite of the efforts on supplying infrastructure, transport problems are still serious hindrance in social and economic activities in Lagos. In order to resolve traffic problems in the city of Lagos, this ITS master plan is proposed, which focuses on integration of the cutting-edge electronic and information technologies for the most-efficient and scientific transport operation/management systems in the metropolitan region.
- The Lagos ITS master plan was established by benchmarking successful national ITS architectures of Korea (Version 2.0) and other front-leading countries, understanding cultural traditions, transport characteristics, and urban uniqueness in Lagos, Nigeria.
- In addition, the complete system plans for the stepwise phases (pilot-, short-, mid-, and long-term) were developed, based on the Lagos citizens' needs and preferences through demand survey analyses from the public and transportation agencies.



[Figure 4.3-1] Background and Purpose for Building the Lagos ITS Master Plan

4.3.2 Project Scope and Contents

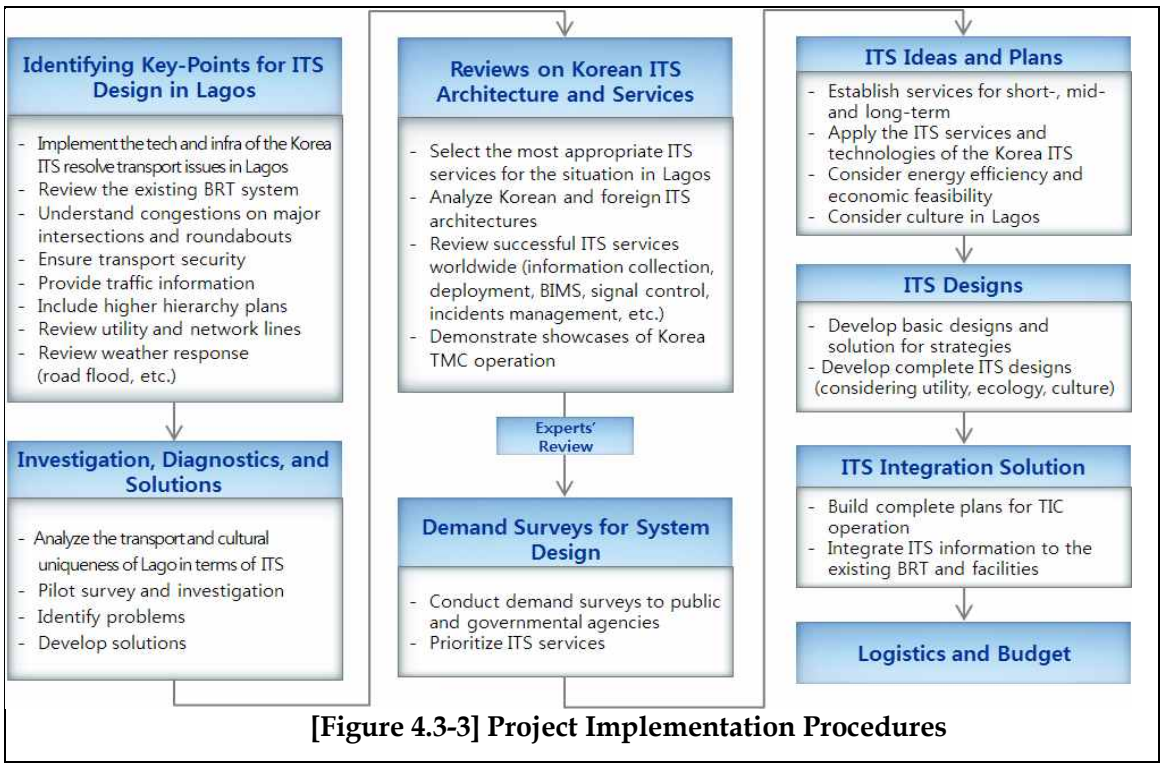
- The spatial scope of Lagos ITS master plan covers transportation system planning on highways, major arterial roads, BRT, and railroads in Lagos State, including 16 adjacent regions (except Bodagry, Ikorodu, Epe, and Ibeju Lekki).
- Lagos ITS master plan will be fully implemented by 2030, the target year.
- The complete system plans will be implemented in short-, mid-, long-term phases by applicability of each system (either prompt applicable systems or stepwise-implementing systems) with flexibility.



[Figure 4.3-2] Project Scope and Main Components

4.3.3 Project Implementation Procedures

- The stepwise procedure of the Lagos ITS implementation was established in order to identify the key-points and to apply them into ITS-related survey, analysis, and system conceptualization for efficient project delivery.
- The essential components are reviewed and applied to the system development in each phase.
- In addition, the best-fitting effective ITS services are chosen and implemented to resolve transportation problems in Lagos through investigating the worldwide ITS service trends and transferring the successful ITS technology and resources of Korea.



[Figure 4.3-3] Project Implementation Procedures

4.3.4 Diagnose the Traffic Status and Derive the Solutions through ITS

- In the analysis of the current urban traffic status, the problems were analyzed in relation to policy, traffic management, traffic facilities, traffic information services, traffic safety, etc. The solutions for these urban traffic problems in Lagos were derived from the application of ITS in terms of law, system and relevant organizations, road and traffic infrastructure, and traffic operation and management.
- Establishing/implementing an efficient ITS system maximizes the efficiency of infrastructure expansion along with economic growth in Lagos, by reflecting the ITS technological trends and requirements in the ITS systems of Korea and other front-leading nations.

[Figure 4.3-4] Diagnose the Current Status of Lagos and Derive the Solution Set.

a. Analysis of the Current Status of Urban Traffic for Lagos ITS

- The current status of urban traffic in Lagos were analyzed in terms of ten items, including policy, traffic management, traffic facilities, traffic information services, traffic safety, public transportation, parking, freight, traffic order/law abidance, and environment.
- The conclusion of the analysis includes identification of the transport problems and suggestions of the appropriate corrective measures supported by the ITS implementation.

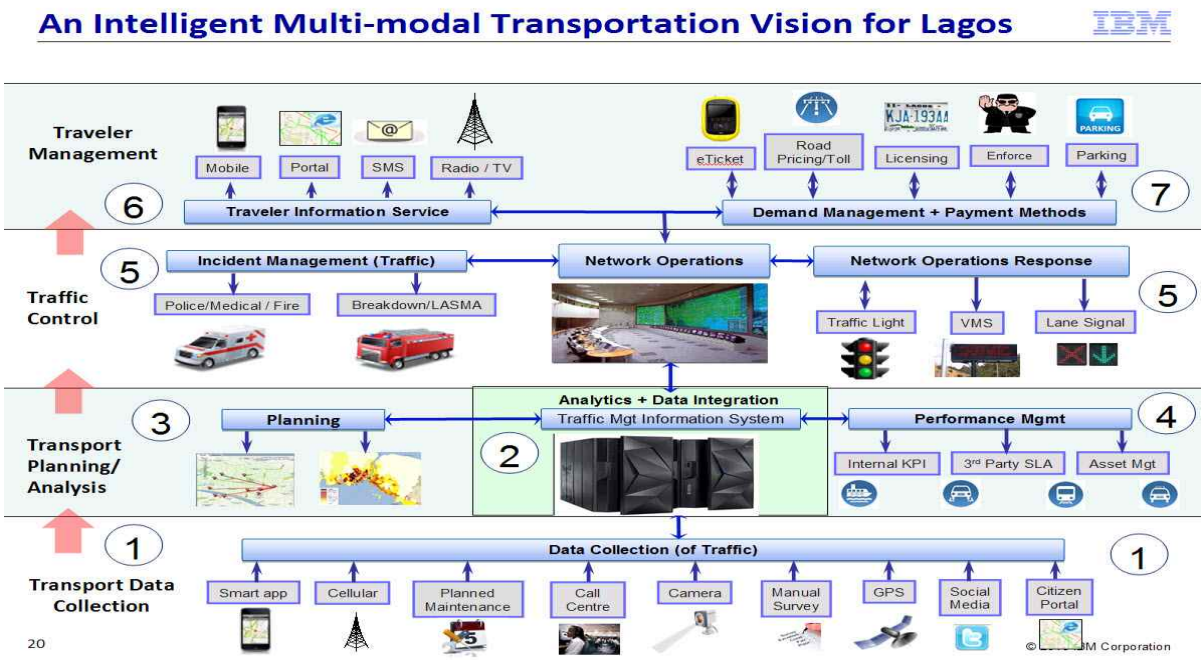
1) Analysis of Policy and Related Plan

- As the largest city in Nigeria, Lagos is densely populated and its population and the number of the vehicle registration are increasing. Therefore, to deal

with the traffic problems arising from the increased traffic demand, Lagos has established and is implementing mid- and long-term urban plans, traffic plans, etc. However, they are facing transport problems such as traffic congestion, accidents, and safety issues.

① IBM's "Smarter Cities Challenge"

- IBM proposed the "Smarter Cities Challenge" project to Lagos State. This project presents solutions to resolve the problems confronting the city in the nine fields; society, economy, education, environment, safety, transportation, etc.
- "Creation of an Intelligent Transportation System (ITS)", with the following four layers - data collection, transportation planning & analysis, traffic control, and information services- was proposed to address the traffic problems in Lagos.
- However, IBM's proposal lacked detailed task plans and data flow accounting for cultural tradition, urban and transportation characteristics of Lagos.
- Moreover, it is limited in customizing the system in Lagos because the logical/physical architecture of ITS for system expansion and compatibility is unavailable.



[Figure 4.3-5] Lagos ITS Conceptual Diagram Suggested by IBM

② BIS/BMS Implementation Plan

- One BRT route (BRT lite) with a length of 22 km, has been operational since 2008 in Lagos State.
- Bus Information System/Bus Management System (BIS/BMS) is under construction on the existing BRT route in Lagos.

[Figure 4.3-6] Scope of BIS/BMS Establishment for Lagos BRT

2) Analysis of the Existing Traffic Operation and Management

- Lagos is now suffering from heavy traffic congestion due to the absence of coordination on adjacent un-signalized intersections. The un-signalized intersections are also threatening the safety of pedestrians crossing streets.

- Roundabouts and un-signalized intersection operations at major roads with high traffic demands cause heavy traffic congestions and increase traffic accidents.
- At the signalized intersections, the transportation problems, which include the absence of diverse Time of Day (TOD) plans, lack of coordination among the intersections, and inadequate placement of traffic signals, aggravate the traffic congestion and increase traffic accidents.
- Faded pavement markings and lane striping on the multi-lane corridors cause confusion for drivers, increase traffic congestion, and worsen traffic safety.
- The inadequacy of the incident monitor and response system is a cause of inconvenience for the citizens in Lagos.
- Therefore, an organization and a system should be established to collect real-time traffic/incident data, to deploy dynamic information, to monitor traffic condition, and to detect incident/disaster for efficient traffic operation and management in Lagos.

- Traffic Signal Operation
  - Poor coordination at signalized and un-signalized intersections
  - Congestion at un-signalized large roundabouts
  - Lacking TOD for time-wise and location-wise
  - Inappropriate locations for signal lights
- Roundabout
  - Saturated flows on major corridors
- Incidents and Disasters
  - No monitoring system for traffic accidents, incidents
  - No security system for preventing crime
- Traffic Safety
  - Lack of pedestrian street crosswalks
  - Poor pavement marks
  - Needs for education, training, campaigns
- Traffic Operation/Management
  - Inadequate system/entity for traffic operation during peak hours

[Figure 4.3-7] Problems with Traffic Operation and Management

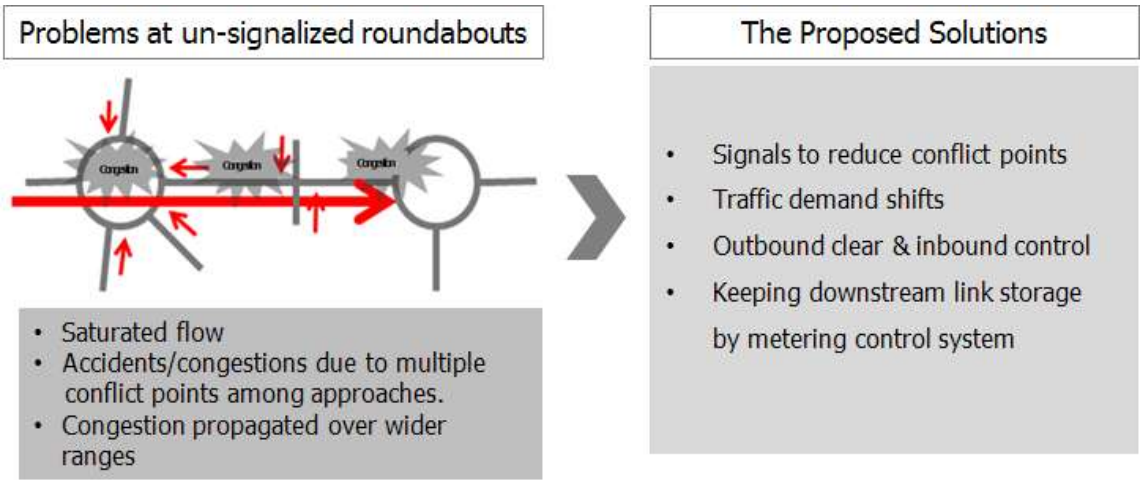
→ The Proposed Solution for Transportation Improvement

① Real-Time Signal Control System

o Signalized Roundabout

- Merging with saturated traffic flow increases congestion at roundabouts.

- Operating traffic signal systems would mitigate congestion by controlling right of way per approach at roundabouts.

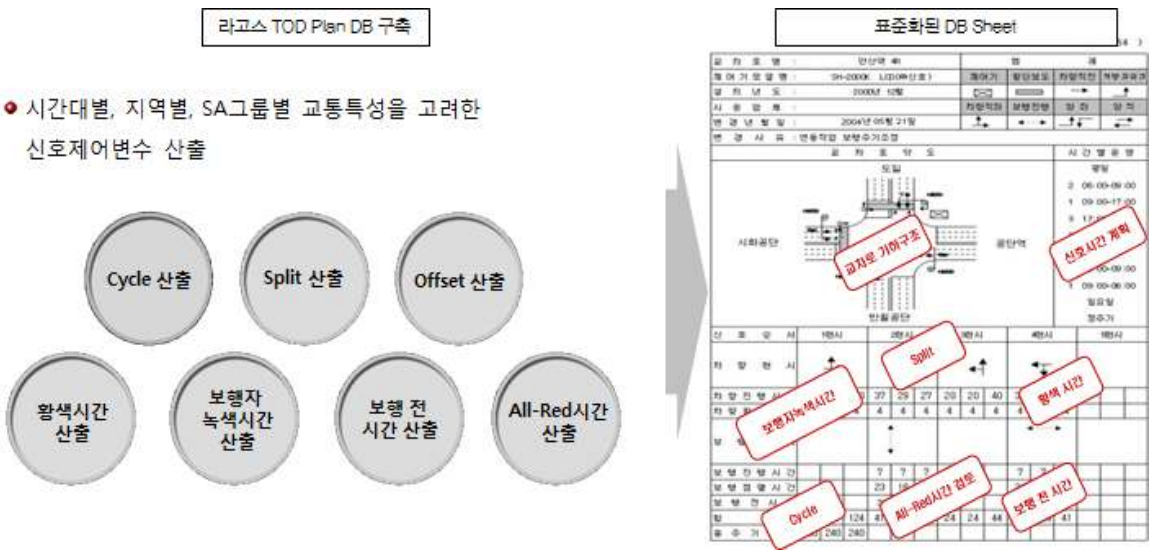


[Figure 4.3-8] The Proposed Solution for Roundabout Problems

○ Improvement of DB for Signal Operation

- Establish a signal operation DB to respond to the traffic demand by time of day and by day of week.

- Improve signal coordination to allow traffic progression at multiple signalized intersections on major corridors.



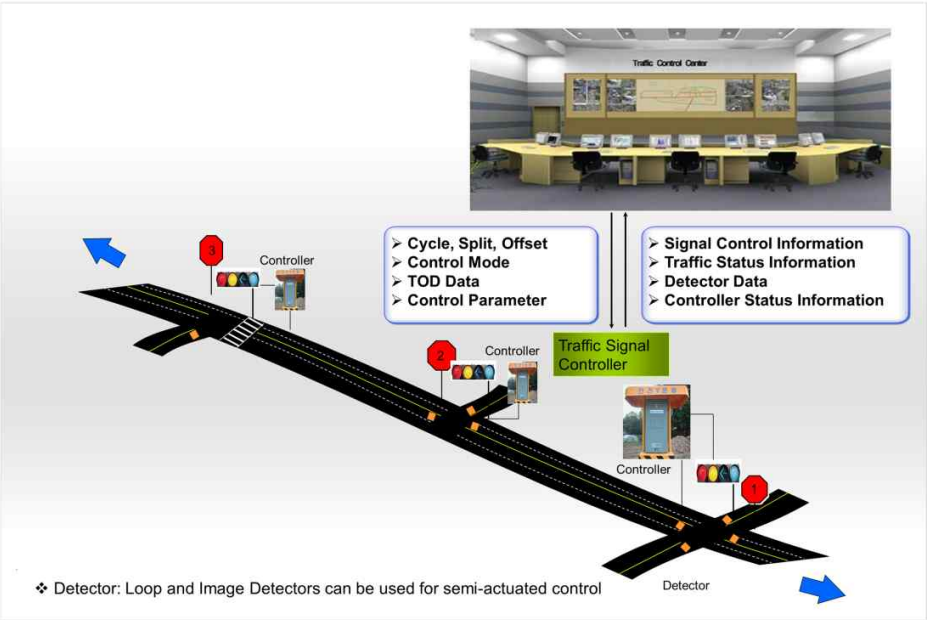
[Figure 4.3-9] Improved DB for Signal Operation (Example)

◦ Signal Control System, On-Line

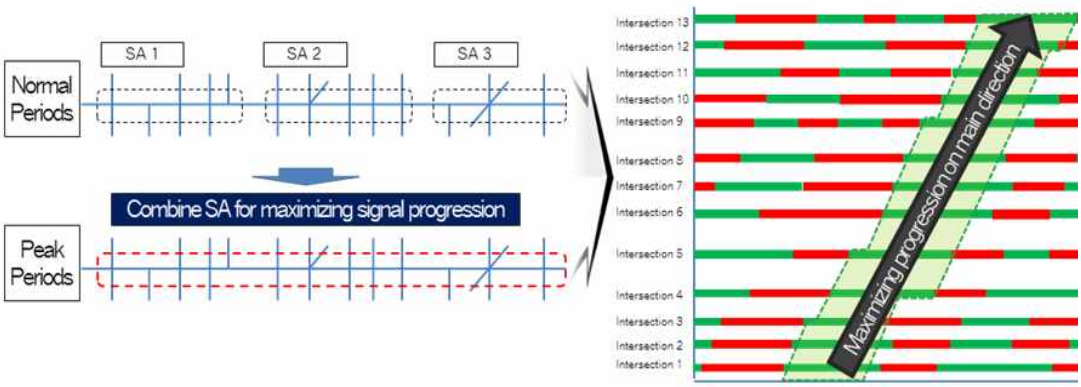
- Build an online remote control system to control the traffic signal controllers from the transportation management center (TMC) to allow immediate response to various traffic conditions

- Build traffic signal coordination system to provide continuous progression among signalized intersections

◦ Configuration of On-line Traffic Signal Control System



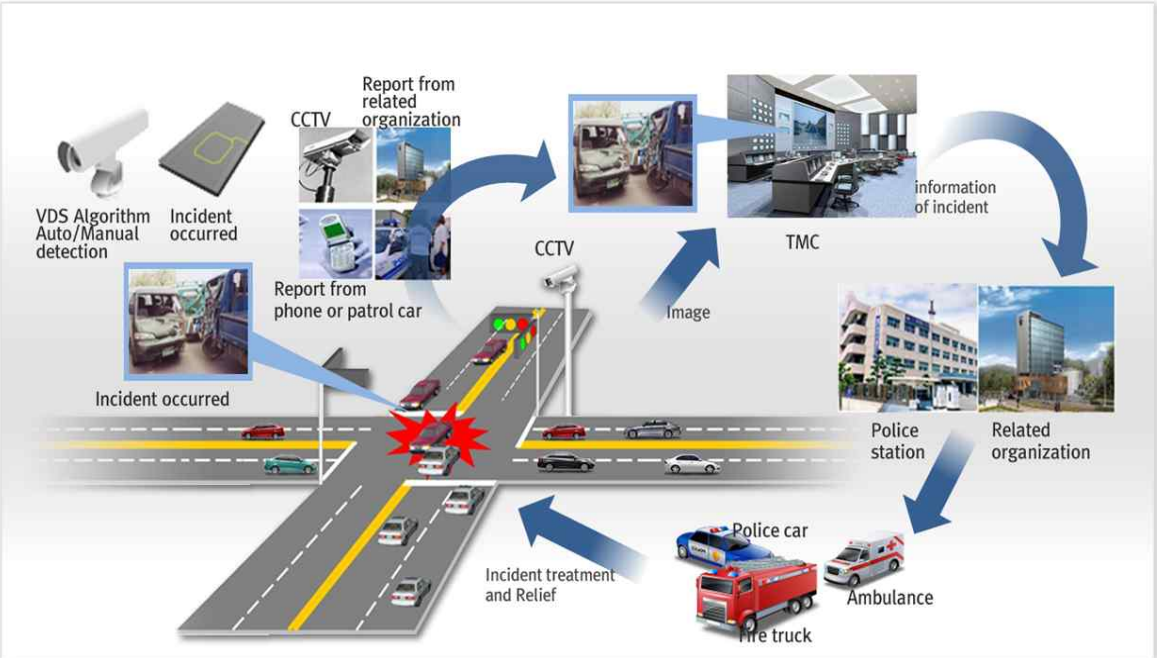
◦ Configuration of Signal Coordination System



[Figure 4.3-10] Traffic Signal Control System, On-Line and Coordination System

② Incident Management System

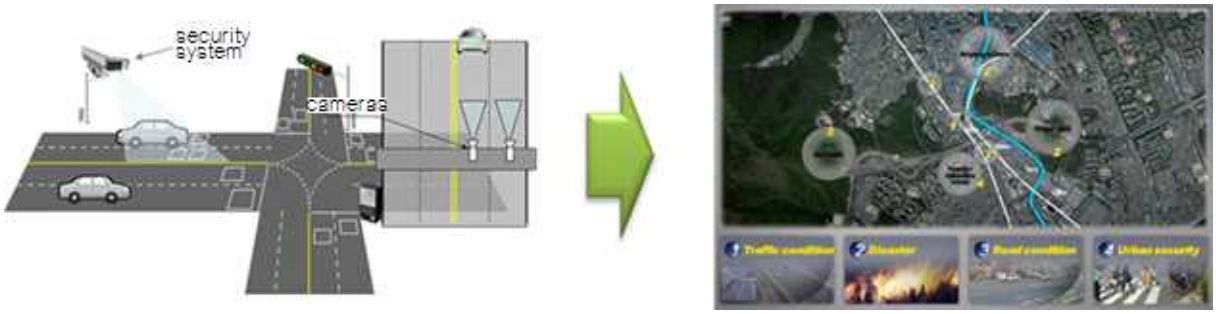
- Establish an incident management system to detect any incident on the road to promptly confirm and respond to each situation
- Increase the efficiency of urban central area management to execute comprehensive and effective response to various situations such as areas of frequent accidents, foggy areas, flood areas, congestion areas, etc.



[Figure 4.3-11] Conceptual Diagram for Incident Management System (Example)

③ Security System

- Build a total urban defense system by establishing security systems at the perimeter locations on the major corridors for managing in-and out vehicles
- Facilitate tracking the criminals or the terrorists, associated with the incident management system



[Figure 4.3-12] Conceptual Diagram of Security System (Example)

3) Traffic Facilities

- Numerous bottleneck segments cause heavy traffic congestion in Lagos. Furthermore, the absence of road/traffic safety devices, structural defects of the road infrastructure, and the deteriorated pavement condition negatively affect traffic safety. The lack of crosswalks and sidewalks for pedestrians also increases 'vehicle to pedestrian' accidents.

[Figure 4.3-13] Traffic Facilities Problems

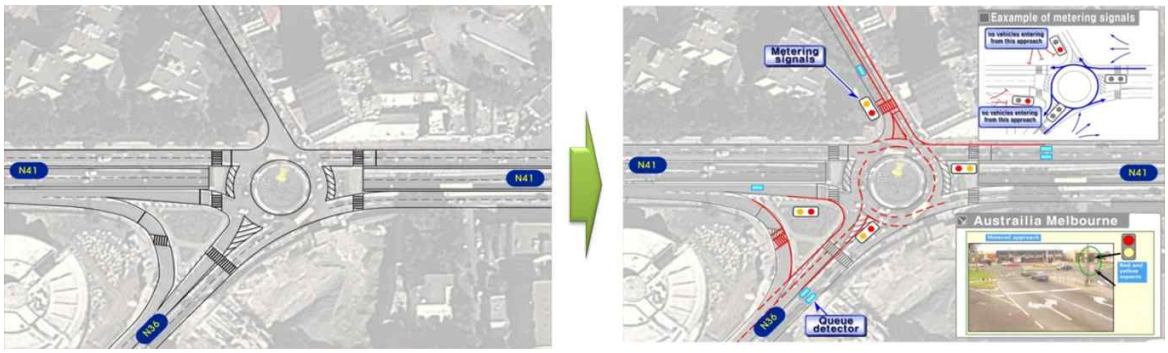
→ The Proposed Solutions

o Traffic System Management (TSM)

- Improve traffic safety signs and pavement markings/stripings to enhance visibility during nighttime, adverse weather, etc.

- Implement a traffic safety device management system (traffic safety signs, pavement marks, and traffic signals)

- Install additional crosswalks at commercial and school zones, where pedestrians are concentrated



[Figure 4.3-14] TSM (Example)

4) Traffic Information Services

o Currently, based on the cases reported by the police officers and ordinary drivers, Lagos provides traffic information only by means of traffic radio broadcasting (FM), which is insufficient to provide the road users accident/incident occurrences, work zone condition, road and weather information, etc.

[Figure 4.3-15] Providing Traffic Information Problems

→ The Proposed Solutions

o Traffic Information Service System

- Collect/deploy traffic information for congestion, accident, alternative routes, etc.

[Figure 4.3-16] Traffic Information Service System (Example)

5) Traffic Safety

o Sidewalks and crosswalks are insufficient for pedestrians in Lagos. Illegally parked vehicles also hinder the pedestrians' safety and right of way.

o Poor pavement condition and unstandardized freights including mixed loading trucks are major road hazards causing traffic accidents

[Figure 4.3-17] Traffic Safety Problems

→ The Proposed Solutions

① Traffic Signal and Speed Enforcement System

o Increase the enforcement level and efficiency for traffic signal violations and speeding with the use of an automated enforcement system to mitigate traffic accidents

[Figure 4.3-18] Traffic Signal Violation and Overspeed Enforcement System (Example)

② Traffic System Management (TSM)

o Increase traffic safety by improving pedestrian sidewalks, pavement marking/striping, etc. with the use of TSM

6) Public Transportation (Transit)

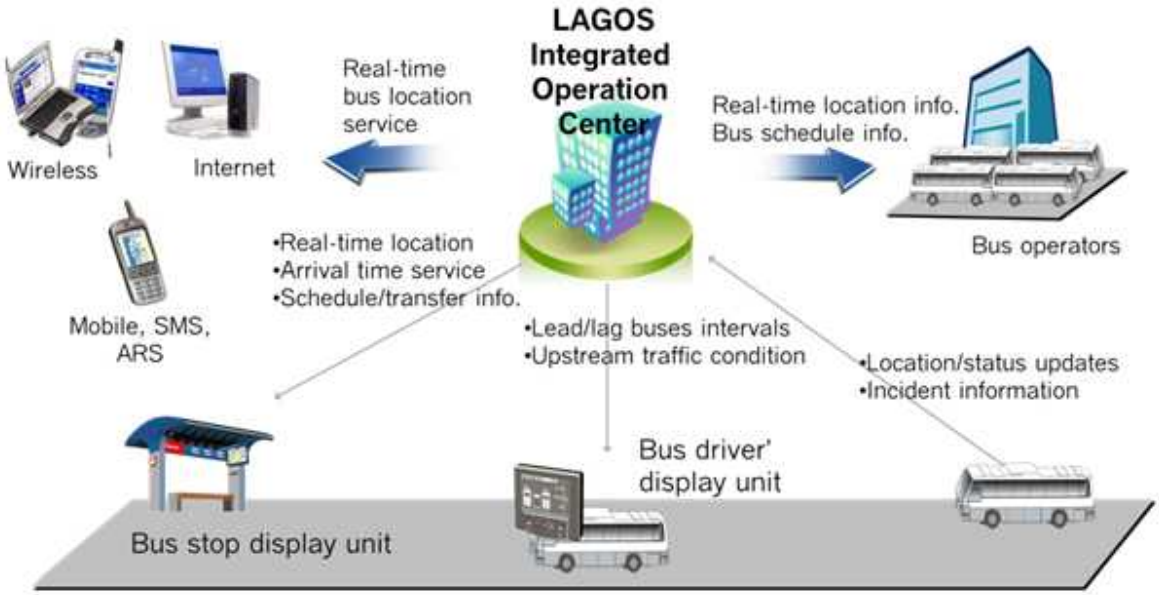
o Lagos is endeavoring to improve the public transportation service by establishing BRT, extending the railway line, etc. However, many citizens still use the unlicensed bus services and the city does not have enough passenger transfer facilities among on buses, trains, etc.

[Figure. 4.3-19] Public Transportation Problems

→ The Proposed Solutions

o Bus Information System and Bus Management System (BIS/BMS)

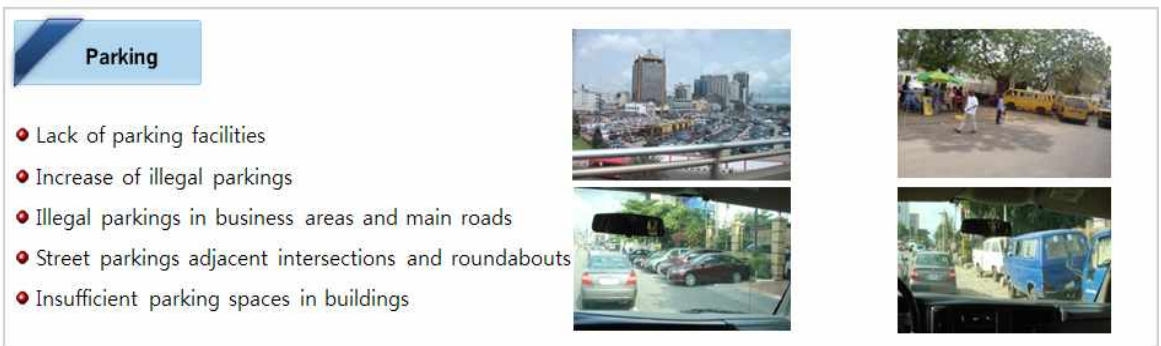
- Continued monitoring and management of the bus operation system
- Provide logical information, such as schedules, routes, and arrival time, on bus operation for passengers waiting at the bus stop, those in the bus, bus drivers, etc.
- Promote ridership of transits by improving the service quality



[Figure 4.3-20] Concept Diagram for Bus Information and Management System (Example)

7) Parking

- Insufficient parking facilities and spaces in downtown have become a considerable problem in Lagos, due to the steady growth in traffic demand. Illegal parking on commercial districts, street sides, intersections, and roundabouts increase traffic congestion and cause traffic accidents related to vehicles and pedestrians.



[Figure 4.3-21] Parking Problems

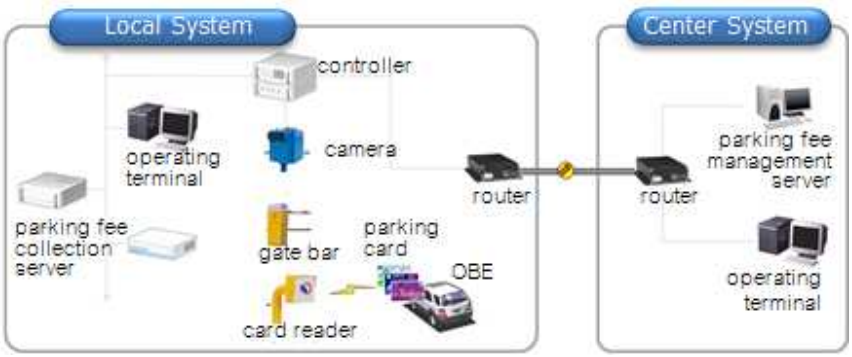
→ The Proposed Solutions

① Illegal Stopping and Parking Enforcement System

- Maintain the road capacity and prevent accidents by penalizing illegal parking
- Secure pedestrians' walking spaces on the sidewalks and the crosswalks for safety
- Prior to implementing the illegal parking enforcement system, provide more parking spaces and distinguish and advertise the illegal parking zones clearly in compliance with the standards of parking enforcement in Lagos.

② Automatic Parking Fee Collection System

- Reduce traffic congestion by increasing the efficiency of parking facility management through automatic parking fee collection systems using the vehicle license plate recognition technology

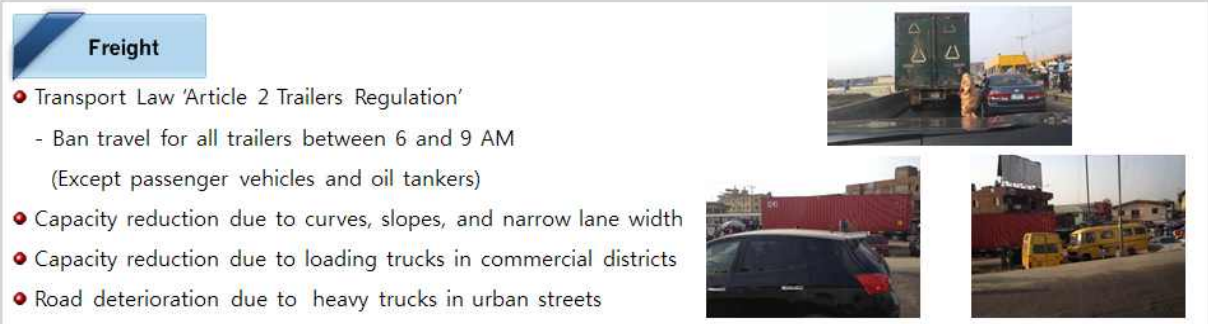


[Figure 4.3-22] Conceptual Diagram for Automatic Parking Fee Collection System (Example)

8) Freight

- Large heavy vehicles reduce road the capacity in curved, sloped, and narrow width segments.

- Based on 'Article 2 Trailer Management', Lagos prohibits all trailers (except oil tankers and passenger vehicles) from traveling in urban areas during morning peak hours (6:00~9:00 AM).
- Heavy vehicles traveling in urban areas aggravate the deterioration and deformation of pavements and often induce pedestrians' accidents.



[Figure 4.3-23] Cargo Transportation Problems

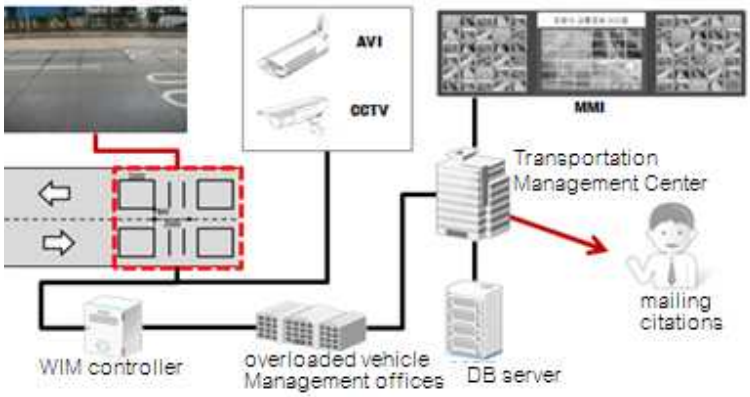
→ The Proposed Solutions

- Heavy Vehicle Management System

- Implement an automated enforcement system for vehicles exceeding the weight limit by the related law

- Mitigate infrastructure damage, capacity reduction, and large-scale traffic accident by restricting overloaded vehicles.

- Prior to implementing the heavy vehicle management system, construct freight terminals at major entrance and exit points of urban area and develop a system for distributing freight to the urban area via small/medium sized vehicles.



[Figure 4.3-24] Conceptual Diagram for Heavy Vehicle Management System

9) Traffic Order and Law Abidance

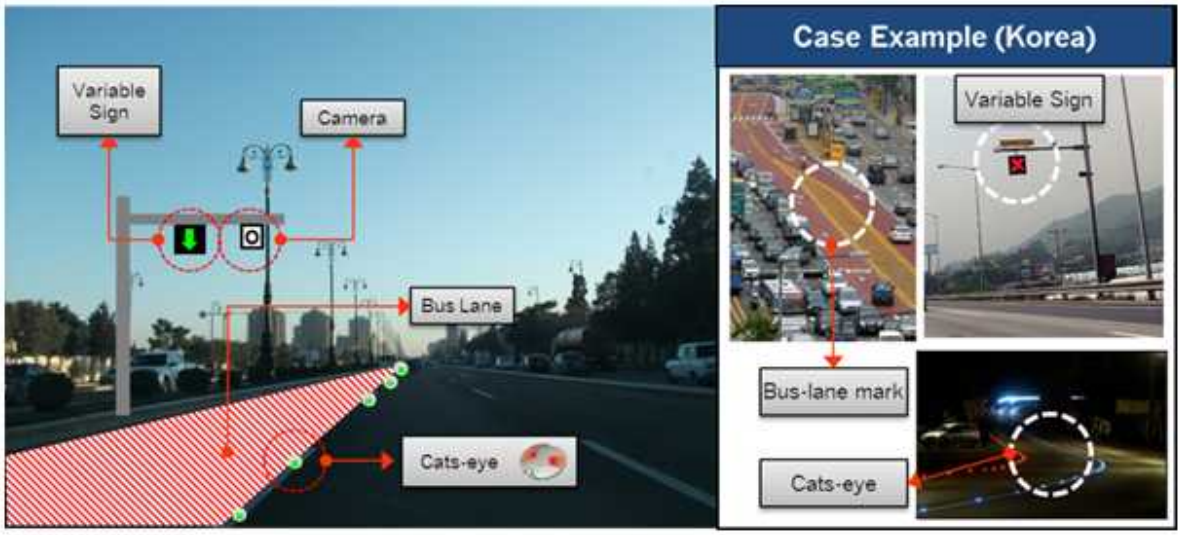
- Since the existing BRT routes are partially grade-separated, non-eligible vehicles often intrude on exclusive bus lane.
- Vehicles often drive in the counter-direction lane or on pedestrian sidewalks.
- Pedestrians often commit jaywalking, ignoring overpass passes and crosswalks.

[Figure 4.3-25] Problems in Terms of Traffic Order and Law Abidance

→ The Proposed Solutions

① Exclusive Bus Lane Violation Enforcement System

o Ensure smooth traffic for BRT buses and mitigate accidents by enforcing bus lane violations



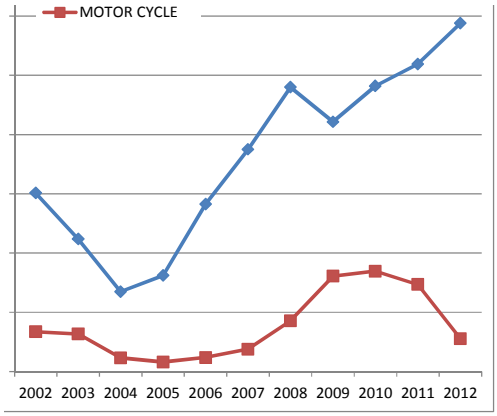
[Figure 4.3-26] Conceptual Diagram for Exclusive Lane Violation Detecting System

② Traffic System Management (TSM)

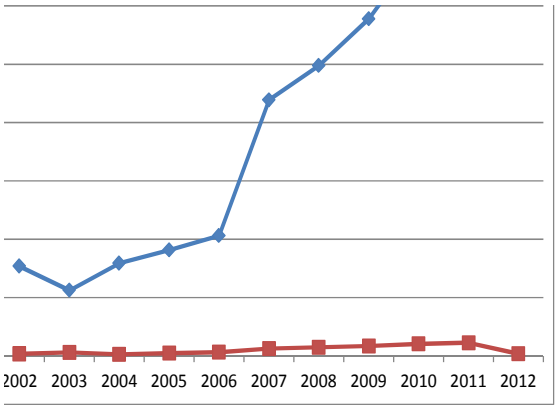
o Install barriers to reduce jaywalking at the areas where pedestrians frequently commit the violation.

10) Environment

o The air pollution levels in Lagos are not serious at the moment, but an increase in fuel consumption and gas emissions, caused by the annually rising number of vehicles and traffic congestion, are gradually starting to lead to environmental pollution.



< Current Status of Increased Number of Cars in Lagos - NEW REGISTRATION >



< Current Status of Increased Number of Cars in Lagos - RENEWAL >

< Traffic congestion due to increased number of cars>

< Flooding road due to rainfall >

→ The Proposed Solutions

o Implementation of ITS

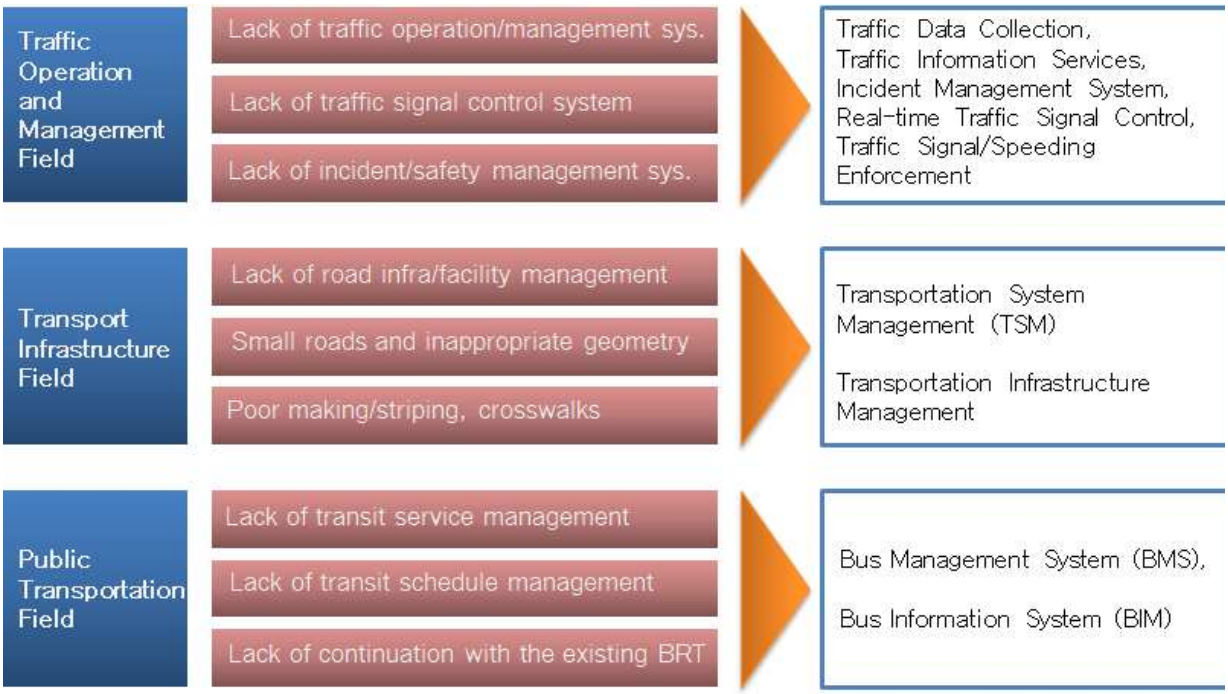
- Implement ITS to relieve traffic congestion due to steady vehicle ownership growth.

- Mitigate traffic congestion through real-time monitoring and rapid response (traffic information service to drivers, etc.) to traffic, road flood, road construction, security, etc.

- Utilize the traffic database as reference for developing policy for future road infrastructure plans

11) Comprehensive Analysis of the Problems

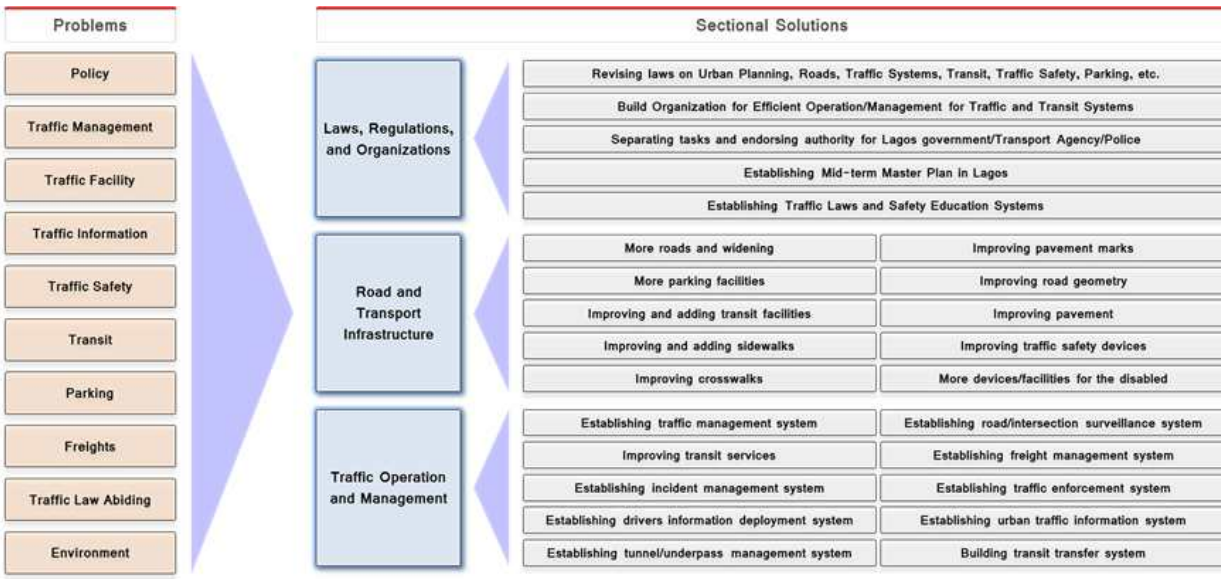
- Compared to the increasing number of vehicles in Lagos, road infrastructure facilities are still insufficient, due to the limited time and budget, although more infrastructures are being built. In that sense, transportation problems, including traffic congestion and accidents, are aggravating.
- Traffic congestion occurs at most of the main roads during the peak hours, and the large un-signalized roundabout suffers from congestion due to the concentrated traffic demand.
- Therefore, for efficient traffic operation and management, the traffic problems in Lagos require an urgent solutions through the ITS services, including real-time signal control system, various signals operational DB, and incident management system, which are capable of responding to traffic demand variation.



→ The Proposed Solutions

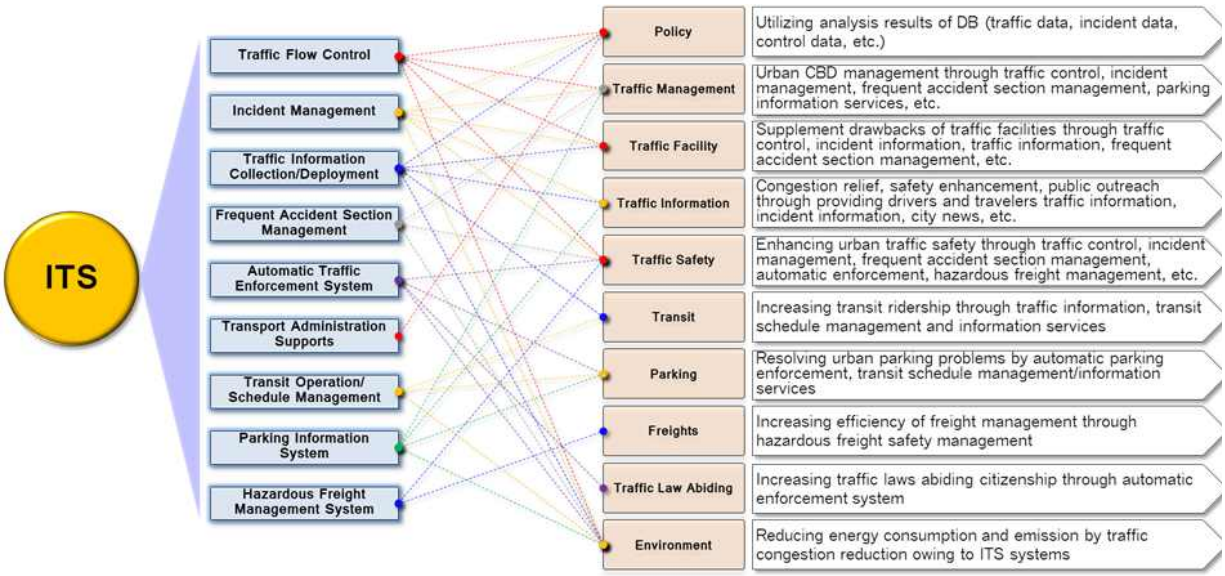
1) The Solutions by Field

- Derive the solutions for each field by analyzing problems with the current status of the road and traffic conditions in Lagos.



2) The Proposed Solutions through ITS Implementation

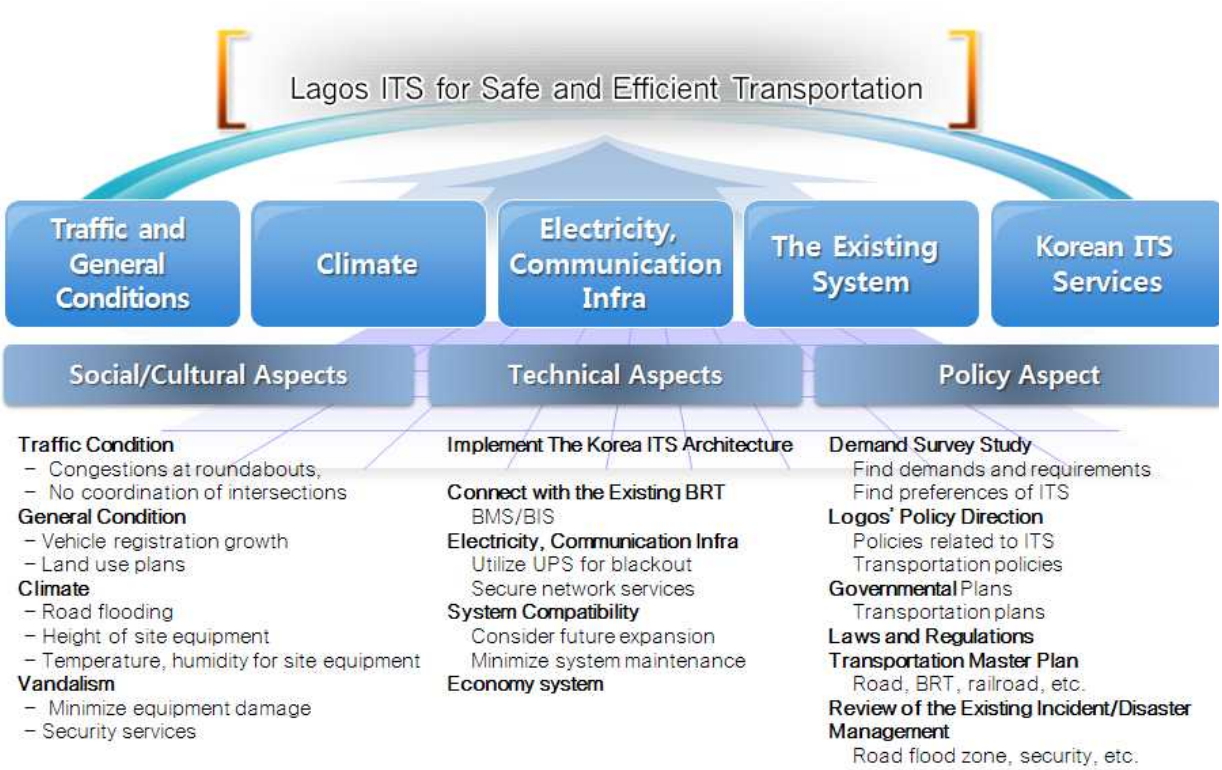
- To provide direct/indirect solutions to the current identified problems with the road and traffic conditions in Lagos, ITS implementation is proposed. The following are the proposed solutions for each field through ITS implementation:



4.3.5 Master Plan for ITS in Lagos

a. Lagos ITS Design Objective and Establishment Strategy

- In order to design ITS for realizing safe and convenient traffic environment in Lagos, the final target services were derived by analyzing the following: the current status of traffic condition, social economy, weather, power utility supply, IT infrastructure, the existing transportation facilities, and the Korean national ITS Architecture and currently operating services.
- Lagos' customized services were developed in terms of security, considering social and cultural characteristics, and disaster management fields. This way, design will be done in a way that allows integrated urban control.



b. Analysis of ITS Architecture in Korea and Other Leading Countries

1) Korea

① Analysis of Automobile and Road Traffic Field ITS Plan 2020

o The national ITS Architecture 2020 service consists of 7 fields of service, 22 services and 47 unit services, and based on this, the final ITS services for Lagos were derived through surveys and analyses of the existing traffic conditions in Lagos.

7 Service Fields, 22 Services, 47 Service Units		
7 Service Fields	22 Services	47 Service Units
1) Traffic management	1) Traffic control	1) Real-time traffic signal control 2) Signal priority control 3) Railroad crossings control 4) Freeway traffic management
	2) Incident management 3) Basic traffic information services	5) Incident management 6) Basic traffic information services
	4) Cautious driving segment management	7) Speed changed segment management 8) Poor visuality section management 9) Pavement condition management 10) Incidental obstacles control
	5) Automated traffic enforcement	11) Speeding control 12) Traffic signal enforcement 13) bus lane use enforcement 14) Parking enforcement 15) Overloaded vehicle restriction
2) Public transportation (Transit)	6) Traffic administration support	16) Facility management support 17) Emission management support 18) Demand management support
	7) Transit information services	19) Bus information service
	8) Transit schedule management	20) Bus schedule management
	9) Transit reservation 10) Para-transit service support	21) Transit reservation service 22) Para-transit service support
3) Electronic payment	11) Electronic toll system	23) Freeway toll fee e-payment 24) Congestion pricing fee toll e-payment
	12) Facility use fee e-payment	25) Parking fee e-payment
	13) Transit e-payment system	26) Transit fare e-payment
4) Traffic information sharing	14) Traffic information consolidation	27) Traffic information consolidation
	15) Integrated traffic information service	28) Integrated traffic information service
5) Travel information services	16) Pre-trip information service	29) Pre-trip information service
	17) Real-time travel information service	30) Traveler information service 31) Transit information for riders 32) Information for pedestrian/bicyclist
6) Intelligent vehicles/roads	18) Safe driving vehicle	33) Driver visual improvement 34) Safe driving assistant option 35) Vehicle self- diagnostics option 36) Accident warning system 37) Collision avoidance 38) Lane assistant system 39) Pedestrian safety
	19) Safe road environment	40) Safe intersection crossings 41) Safe rail crossing 42) Cautious section guide support
	20) Automated driving vehicle	43) Vehicle gap interval auto-control 44) Automatic driving vehicle 45) Automatic parking vehicle
7) Freight	21) Freight operational support 22) Hazardous material vehicle management	46) Hazardous material vehicle route control 47) Hazardous material vehicle management

② Analysis of Current Status of Korean Traffic Information Center and ITS Service

o In Korea, the National Transportation Information Center is operated by the Korea Ministry of Land, Infrastructure and Transport, and five Traffic Information Centers are run by the regional offices of the National Land Administration. Also, 54 Traffic Information Centers (including BIS centers) are operated by the local governments, including Seoul Metropolitan City, Busan Metropolitan City, Daegu Metropolitan City, etc.

o Since 2006, Korea has exported ITS products and technology to 22 countries abroad, which include bus Electronic Fare Collection System (EFCS), Automatic Traffic Enforcement System (ATES), subway Automatic Fare Collection System (AFCS), Automatic Traffic Management System (ATMS), Parking Information System (PIS), Weigh-In-Motion(WIM), etc.

2) United States

- A brief description of the status of ITS projects in the United States is as shown in Table 4.3-1.

[Table 4.3-1] Status of ITS Projects in the United States

Field	Project	Description
Optimization of Traffic Management	Traffic Signal Control System (TSCS)	● A total of 47 cities use a real-time detector to monitor the traffic condition on the major arteries (6 percent of the total arteries). ● 48 percent of the total intersections are equipped with computerized traffic signal control devices. Signalized intersections are being controlled by signal control prioritizing emergency vehicles (67 cities), comprehensive signalized intersections (60 cities), actuated signal control (28 cities), signal control prioritizing public transportation (28 cities), etc. ● Artery traffic information is being deployed by message signs (17 cities), Highway Advisory Radio (HAR), In-Vehicle Signing (IVS, 1 city), etc.
	Freeway Management Systems (FMS)	● For accident management, traffic control, information services, and public safety, information is provided to road users through Dynamic Message Signs (DMS), Highway Advisory Radio (HAR) and In-Vehicle Signing (IVS).
	Urban Highway Traffic Management System in Minneapolis, Minnesota	● Traffic data is collected every 30 seconds through loop detector installed at an interval of about 800 m. ● Traffic information is provided to the road users through variable message signs and roadside broadcasting ● Speed limit is prescribed as 55mile/h (about 88㎞/h) and the traffic condition is classified into four categories (50mile/h(80㎞/h), 20~35mile/h(32~56㎞/h) and below 20mile/h) by average driving speed.
	Urban l Highway Traffic Management System in Chicago, Illinois	● A website, which provides real-time traffic information of highways in Chicago, provides various traffic information including congestion level, work zones, directional traffic volume, CCTV information, etc. ● Work zone information includes clear indications showing the starting point and end point of road work zone. ● Traffic information includes congestion level as well as link travel times for road users' better understanding.
	Urban Highway Traffic Management System in Phoenix, Arizona	● Congestion level is categorized into six classes. Seed information is provided (avoid providing qualitative information). ● Traffic information is provided for highways ● Congestion level is categorized into six classes. Traffic information is provided with the information of data quality (availability, communication connectivity, etc.) ● Six congestion classes are; Speed>58, 50<Speed≤58, 45<Speed≤50, 37<Speed≤45, 22<Speed≤37 and Speed≤22 (in mile/hr).
	Highway Traffic Management System, Milwaukee, Wisconsin	● Road traffic condition is indicated in travel speed. ● Traffic condition is categorized into 4 classes (Below 15mile/h, 15~30mile/h, 31~50mile/h, over 50mile/h).
Electronic Payment	Electronic Toll Collection System (ETCS)	● Mixed fare collection method is being used by adding automatic exclusive lane fare collection system to the existing fare office ● Among the entire number of fare offices, 36 percent of the lanes are capable of automatic fare collection ● 19 cities operate automatic fare collection for bus exclusive lanes or mixed fare collection system
	Electronic Fare Payment Program (EFPP)	● About 57% of the bus stations and 30% of the buses are equipped with an automatic fare payment program. ● Currently, magnetic cards are mainly used but gradually switching to smart cards.

[Table 4.3-1] Continued

Field	Project	Description
Vitalization of Public Transportation	Automatic Vehicle Location (AVL)	● Beacon and GPS methods are popular. The effect of use of vehicle location information (percentage of compliance with the operation schedule) has turned out to have increased 4.4% for Milwaukee (90%⇒94%), 12.5% for Texas (80%⇒90%) and 12~21% for Denver.
	Operation S/W	● Schedule management, vehicle interval adjustment, maintenance efficiency, information process and deployment, service monitoring. ● Winston-Salem: Saved 8.5 percent operating cost using by Computer Aid Dispatch (CAD) ● Blacksbury: Increase passenger transportation efficiency by 0.8~2.0% using Computer Aid Dispatch (CAD)
Efficient Freight	Intelligent Transportation System-Commercial Vehicle Operations (ITS-CVO)	● In the United States, the transit systems are mostly operated by the public section, while freight vehicles and taxi services are operated by private section (freight vehicles and taxis are classified as commercial vehicles).
	Commercial Vehicle Electronic Clearance	● Domestic and international (Canada and Mexico) freight vehicles and buses, which qualified and equipped with transponders, proceed the country borders and weight inspection stations without stopping for inspection. ● Enhance freight efficiency
	Automatic Roadside Inspection	● By automating various inspections conducted on the roadsides, they are providing services to minimize roadside freight vehicle inspections which are counted as 160 million cases.
	Commercial Vehicle Administration Processes	● The service to obtain efficient freight operation is being provided by automating the audit report of driving distance and fuel regulated by the law of each state.
	On-Board Safety Monitoring	● By detecting the safety status of freight vehicle, cargo and driver using the sensor attached to the vehicle, a warning message is given to the driver and the administrator for preventing accidents involving freight vehicles
	Freight Mobility	● The service is being provided, which increases the reliability and efficiency of freight operation by providing real-time communications system between freight vehicle drivers, managers and freight providers
	Hazardous Material Monitoring	● The service provides prompt guidance and properly responds to the accidents when freight vehicles carrying hazardous materials are involved in accidents
Advanced Vehicle and Road	Vehicle Signing System	● Among the 78 cities in the Unites States which operate ITS, about 22 percent use In-Vehicle Signing as part of highway traffic management system (FTMS) to provide the drivers with prior danger information necessary for driving. ● Road information is obtained through short-distance communications from roadside beacons.

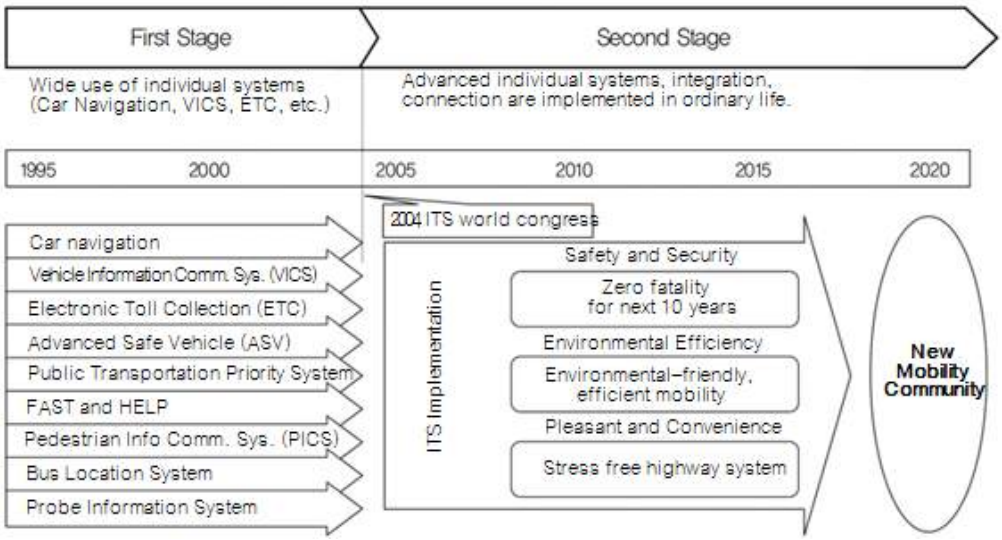
Electronic Payment	Electronic Toll Collection System (ETCS)	● Mixed fare collection methods are being using by adding automatic exclusive lane fare collection services to the existing fare office ● Among the entire number of fare offices, 36 percent of the lanes are capable of automatic fare collection ● 19 cities operate automatic fare collection or mixed fare collection system for exclusive lanes.

3) Japan

- Japan established an ITS master plan in July, 1996 based on the 'Governmental Basic Guidelines for the Advanced Information Technology for Roads and Vehicles', which were announced in August, 1995 by consultation of five ministries.
- The Japan ITS master plan consists of four stages. The first stage was the plan to provide traffic-related information through VICS by 2000. The second stage was the plan to provide various ITS services by 2005. The third stage included automated vehicle operation and advanced ITS system development. The fourth stage included completion of the ITS system by 2011.

[Table 4.3-2] Detailed Description of Each Objective of Japan ITS Strategy

Category	Detailed Strategy
Safety and Reliability	● Reduces traffic accidents through AHS. ASV system for improving safety of drivers. ● Contributes to safe driving environment by providing proper information in case of fire ● Improves traffic safety and reliability through advanced road management ● Probe data which provide efficient responsive measures ● Provide road maps to facilitate safe driving ● Install drive recorders to mitigate traffic accidents
Environment Efficiency	● Implement ETC to improve environment ● Smart IC increases utilization of highways and reduces CO2 emissions ● Implement bus location systems to promote use of bus system ● Create an ubiquitous environment through autonomous mobile support ● Support mobility of tourists through Machi Meguri Navi
Pleasant and convenient	● Evolution of car navigation. Public parking facility payment service. ● Information service in rest areas on the road. Provides work zone information on the road



4) Europe

- Europe has established an ITS execution plan and is implementing various ITS-related projects under the direction of the European Road Transport Telematics Implementation Coordination Organization (ERTICO).
- ITS implementation plan includes a wide range of industries, EU member countries, infrastructure, etc. and service provider and investors.
- In July 2010, Europe established a goal of reducing the traffic accident fatalities by half over the next 10 years, which is included in 'EU Road safety policy (2010～2020)'. The goal was set to implement research projects such as CVIS, SAFESPOT, Coopers, etc. and to working on proof projects such as DRIVE C2X, EURO-FOT (Field Operation Test) SPITS, etc.
- There are six implementation areas and 24 detailed implementation plans. They include optimized use of road and traffic information; (1) traffic information management, (2) continuous ITS service for traffic and freight management service, (3) road safety and security, (4) traffic infrastructure for vehicle communications, (5) Information security and protection, and (6) Europe ITS cooperation.

[Table 4.3-3] Europe ITS Implementation Plans

Action areas	Specific actions
Traffic information management	● Provide real-time traffic information. ● Optimize real-time traffic information collection/processing ● Provide traffic safety information and transfer information
Continuous ITS service for traffic. Cargo management service.	● Provide continuous ITS service for the main traffic corridors in Europe ● Develop e-Freight and ITS Architecture for the entire Europe ● Establish electronic fare collection system
Road safety and security	● Develop driver-assisting system and safety-related ITS ● eCall, Service for safe parking location for freight vehicles ● Develop services for the handicapped and interface providing in-vehicle information
Traffic infrastructure for vehicle communications	● Develop, introduce and implement vehicle open platforms, in compliance with the standards ● Develop cooperative systems for individual vehicles and facilities, I2I, V2I, V2V communications
Information security and protection	● Responsible for Information security and protection
Europe ITS cooperation	● Legal basis: Directive 2010/40/EU ● Knowledge tools for decision makers ● Attract ITS investment and organize ITS expert groups

5) Analysis Result

- According to the analysis results of ITS services of Korean and other leading countries, the traffic system shifted toward environmental friendliness, the handicapped and pedestrians.
- In the reviewed ITS plans, they reflect safety, mobility, green transportation environment, improved safety of the handicapped, expansion of innovative infrastructure, etc.
- Therefore, the Lagos ITS services reflects safety, mobility, environment friendliness, convenience, etc. and also it has been established to be user-friendly and suitable for Lagos traffic characteristics by applying the contemporary trends of ITS policy and technology.

[Table 4.3-4] Transportation Policy and ITS Service in Korea and the other Front-leading Countries

Class.	Transportation Policy	ITS Service
Korea	• Improve infrastructure and establish efficiently linked transportation system for convenient use of public transportation and bicycles • Establish low-carbon green logistics system and develop environment-friendly traffic	•Add plans for various means of transportation, which include linkage between railway, airport, road, etc. • Provide a goal of establishing safe transportation system, providing convenient transportation service and creating smart

	logistics technology • Establish safe transportation infrastructure, operate smart means of transportation, strengthen safety management system, etc.	transportation foundation
Japan	• Establish transportation policy for the elderly and establish safety measures for them • Establish road traffic safety measures for the elderly, children, pedestrians, bicycles, etc. • Establish traffic policy considering environment, depending on climate change such as global warming	• Collaborate with the related organization and prepare systematic system and plan • Establish a Vehicle Information & Communication System (VISC) center and manage real-time traffic information throughout Japan • Among the nine fields of service, safe driving support, pedestrian support, intelligent navigation system, etc. are included
United States	• Enacted a law for supporting project for increasing highway safety and improving public transportation • Establish policies that relieve congestion using ITS, develop technology reducing greenhouse gas emissions, etc. • Announced a plan improving and expanding infrastructure related to public transportation	• The service is being converted to development and policy for traffic safety using high-tech communications technology according to TEA-21(2003) • The service has a strategic goal to achieve safety, mobility and environment friendliness by linking various means of transportation, infrastructure, etc. • Assessment indicators and action plans for each objective are presented on the system map
Europe	• The policy is executed with a goal of saving energy by reducing greenhouse gas emissions. • Traffic well-being for every traffic user, including the handicapped • A new generation of road plans provide a vision for the future and fusing related technology • Support research program for preventing traffic accidents through information linkage between vehicles and roads	• To improve safety using ITS technology, there are four objectives which include safety, environmental awareness, traveler information, etc. under the mission of "Bringing Intelligence into mobility by." • 6 actions are provided, which include linkage focusing on users' mobility, strengthening of safety using high-tech IT technology, linked information management using high-tech communications, information security, etc.

c. Demand Survey for Lagos ITS Service

1) Survey

- A survey was performed on to the government officials and the general public (citizens) to identify the current traffic problems, the causes, and the beneficiaries' needs, prior to develop the Lagos ITS services.

[Table 4.3-5] Details of Demand Survey on Lagos ITS Services

<table>
<tr><td>Subjects of Demand Survey and Description of Survey</td><td colspan="3"><table>
<tr><th>Classification</th><th>Number of Samples Surveyed</th><th>Surveyed Content</th></tr>
<tr><td>Government Officials</td><td>50 copies</td><td rowspan="2">● Personal characteristics
● Trip modes and purposes
● Usage of private vehicles/transit and their problems
● Awareness and preference of ITS
● Major congestion areas and locations</td></tr>
<tr><td>General Public</td><td>450 copies</td></tr>
</table></td></tr>
<tr><td>Survey Period</td><td colspan="3">• Government officials: Aug. 10 ~ Oct. 17, 2014
• General public: Sept. 10 ~ Nov. 10, 2014</td></tr>
</table>

Demand Survey Form

1 Questionnaire of Traffic Condition

1. Where is the most frequently used road and section for you?

   Answer : Road Name _____ from _____ to _____

2. What is a transport mode you are using frequently?

   ① Car ② BRT ③ Bus ④ Rail
   ⑤ Taxi ⑥ Motorcycle ⑦ Bicycle ⑧ etc.( )

3. What is the main purpose of your travel?

   ① Work ② School ③ Shopping ④ Social gathering
   ⑤ Leisure ⑥ etc.( )

4. How do you evaluate the traffic condition in Lagos?

   ① Extremely Serious ② Serious ③ Normal ④ Good ⑤ Very Good

5. What kinds of traffic problems are there in Lagos? (Choose 3 items by the priority)

   ① Traffic congestion ② Traffic safety ③ Lack of traffic information
   ④ Poor road condition ⑤ Overloaded bus ⑥ Overloaded cargo truck
   ⑦ Air pollution ⑧ Others ( )

1st	2nd	3rd

6. What do you think about the major reasons of poor traffic condition in Lagos? (Please give the priority of the items below)

reasons of poor traffic condition	priority
① Unreasonable Traffic Signal Control	
② Illegal Parking	
③ Lack of turning lanes in intersections and road section	
④ Too few public transport(buses)	
⑤ Deficiency of Road capacity	
⑥ etc.( )	

7. Please give the priority of the items below to set up the goals for Lagos ITS.

goals for Lagos ITS	priority
① Mobility	
② Safety	
③ Operation Efficiency	
④ Management and Maintenance	
⑤ etc.( )	

2 Questionnaire of public transportation

8. How many times a week do you use public transportation?

① Do not use
② More than once ~ Less than 5 times
③ 5 or more times ~ Less than 10 times
④ 10 or more times ~ Less than 15 times
⑤ 15 or more times

At the above question, if you choose ①, please go to the next page.

9. What is your main purpose of use of public transportation?

① Work ② School ③ Shopping ④ Social Gathering ⑤ Leisure
⑥ Etc.( )

10. What do you mainly use as public transportation mode?

① BRT ② Unregulated Bus ③ Railway ④ Water Transport ⑤ Etc.( )

11. How do you evaluate the public transport service in LAGOS?

① Extremely Serious ② Serious ③ Normal ④ Good ⑤ Very Good

12. What kinds of the public transport problems are there in LAGOS?
(Please give the priority of the items below)

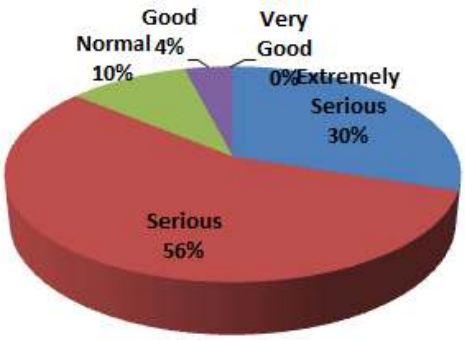
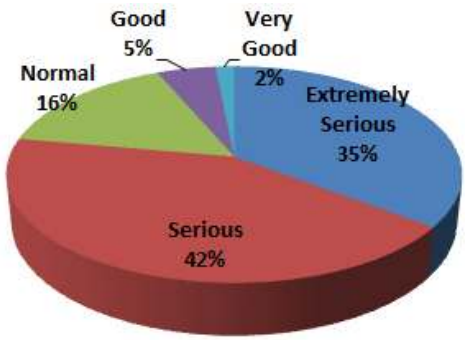
traffic problem	priority number
① Poor facilities	
② Poor service(Lack of information, Cleaning condition, etc.)	
③ No information regarding arrival time of buses	
④ Too long bus routes and too frequent stops	
⑤ No stop at the bus stop	
⑥ Aggressive Driving	
⑦ Unkind drivers	
⑧ There is no information on bus arrival time and transit Information	
⑧ Not good accessibility (Bus stop, Station)	
⑨ Irregular schedule	
⑩ Others ( )	

2) Survey Results

① Severity of Traffic Problems

o 85 percent of the government officials and citizens answered that the current traffic problems are serious in Lagos.

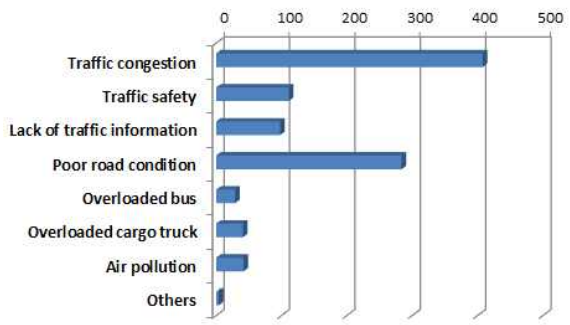
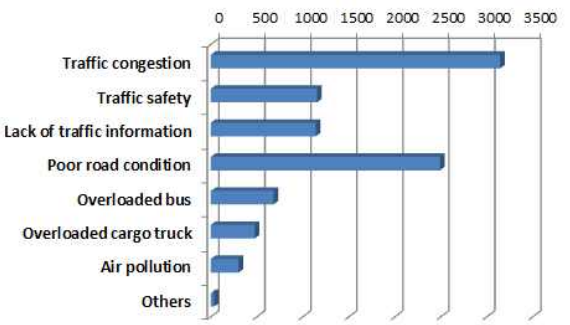
[Table 4.3-6] Survey Result – Severity of Traffic Problems in Lagos

Government Officials	Citizens
	

② Main Traffic Problems

o The most serious transportation problem is traffic congestion and the second most serious problem is poor road conditions.

[Table 4.3-7] Survey Result – Main Traffic Problems in Lagos

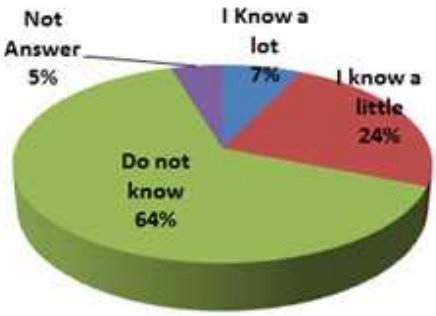
Government Officials	Citizens
	

Note: Weighted Value: First in rank (10pts.) ~ Third in rank (4pts.)

③ Awareness of ITS

- 289 general public respondents (64 percent) answered 'Do not know' and 23 government official respondents (46 percent) answered 'I know a little'.
- Overall, 87 percent of total respondents answered 'I know a little' and 'Do not know'.
- This indicates low awareness of ITS in Lagos.

[Table 4.3-8] Survey Result – ITS Awareness

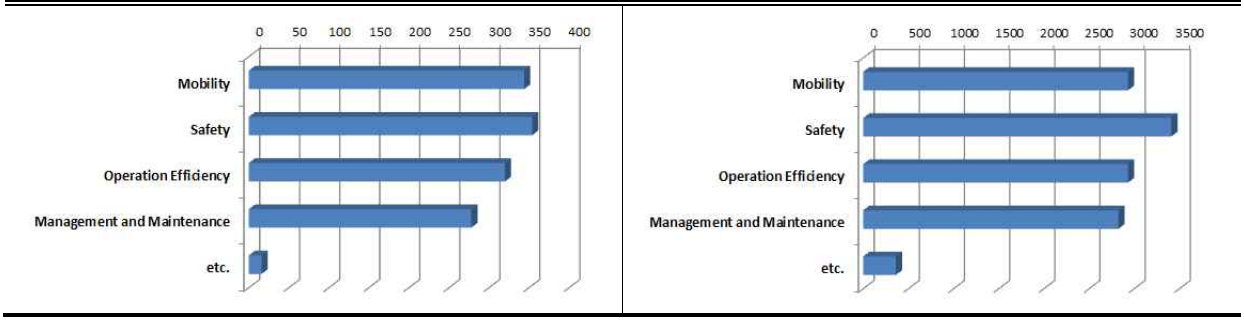
Government Officials	Citizens
	

④ Considerations for Implementing the Lagos ITS

- 'Safety', 'Mobility', and 'Operation Efficiency' are shown in the rank order for the consideration for implementing ITS in Lagos.

[Table 4.3-9] Survey Result – Considerations for Implementing the ITS in Lagos

Government Officials	Citizens

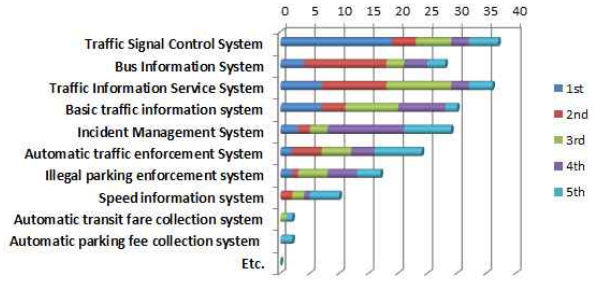
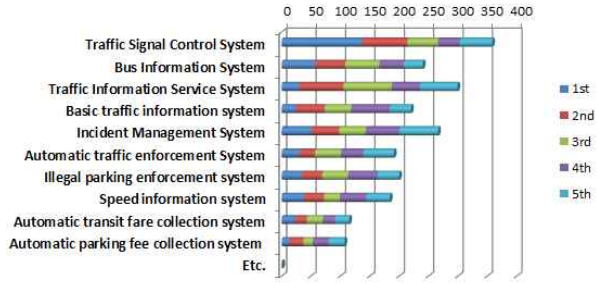


Note: Weighted Value: First in rank(10pts.) ~ Fifth in rank(2pts.)

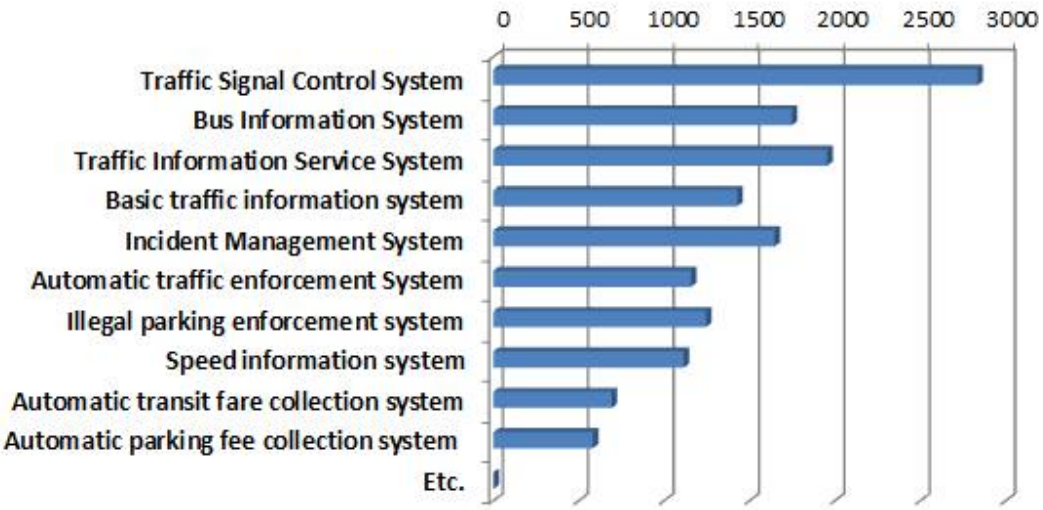
⑤ Priority of ITS Service Implementation

- To solve the traffic problems in Lagos, the government officials and citizens selected traffic signal control system as the first ITS service to be introduced and the second in the rank was bus information system for the government officials and for citizens.
- Putting together the responses from the government officials and citizens and by applying to them the weighted values, the order of priority of ITS services to be introduced were traffic signal control system, transportation information providing system, bus information providing system and incident management system.

[Table 4.3-10] Survey Result – Priority of ITS services

Government Officials	Citizens
	

< Comprehensive Analysis of Priority >



d. Selection of ITS Services Applicable to Lagos

1) Selection Criteria

- The applicable ITS services were prioritized to establish Lagos transportation system considering safety, convenience, mobility, and environment friendliness.
- The ITS services were selected by investigating the ITS services of Korea, the United States, Japan, and Europe, under consideration of the transportation infrastructure conditions, etc. in Lagos.
- The selected services will be implemented based on ITS Architecture, which will facilitate future urban development, technological development, etc.

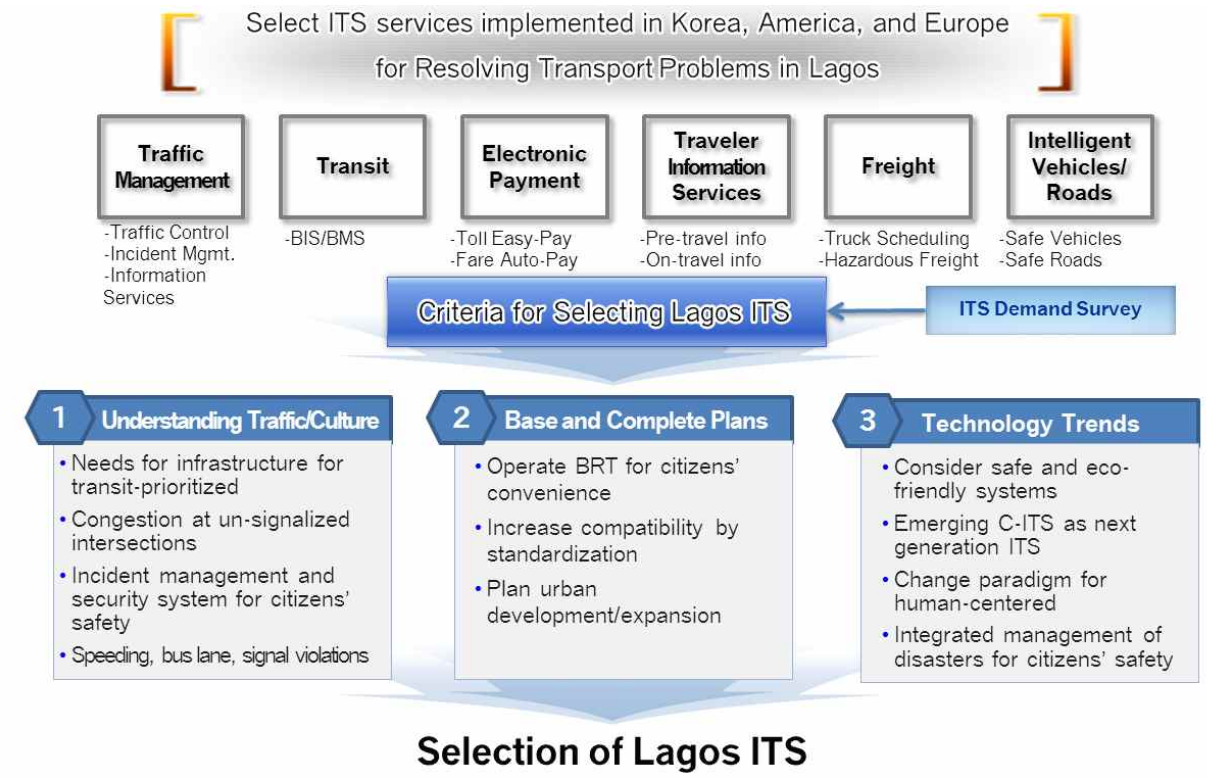
[Table 4.3-11] Criteria for Selecting Main ITS Services

Selection Criteria	Main Items

Current Status and Conditions of Traffic in Lagos	• Mixed operation of signalized and non-signalized intersections • Congestion due to the non-signalized intersections • Traffic demand concentration at the large roundabouts • Insufficient crosswalks for pedestrians' safe crossing • Absence of incident management system to respond to traffic accidents, disasters, etc. • BRT operation to respond to the consistently rising citizen demand for public transportation and to relieve traffic congestion • Absence of information service system for alternative routes and responding to traffic congestion, accidents, etc. • Security system required to promote citizen safety and to increase public security against crimes, terrorist attacks, etc. • Traffic accidents occur due to the violation of signals, speeding, and BRT exclusive lane, etc. • ITS field equipment improvement measures required due to frequent electricity failure (3 times a day on the average) • Vehicle control required due to road flood during rainfall
Upper Plans and Related Plans	• Analyze the cases of the ITS services in Korea, the United States, Europe, and Japan, etc. and review their applicability to Lagos • Apply plans such as of road network, public transportation system, etc. • Linkage between BRT operating sections and systems • Systems suggested by private organizations to Lagos
ITS Policy and Technology Trend	• Enhance public safety of the citizens • Overhanging typed of traffic sensors, integrated urban control centers • Integration of a new generation of ITS, C-ITS technology • A paradigm shift focusing on mobility of people • Secure expandability and compatibility through application of standardized Architecture and technology suitable for Lagos

2) Result of Selection of Lagos ITS Services

- The Lagos ITS services were driven by taking into account the traffic and cultural characteristics of Lagos, which include congestion at the un-signalized intersections, congestion around the entrance and exit area of the roundabouts, traffic accidents due to violations of speed limit and exclusive lane, etc.
- Considering the current status and characteristics of traffic, social, and culture to solve traffic problems in Lagos, eight ITS unit services were selected among the ITS services of Korea, the United States, Japan, and Europe.
- The Korea ITS architecture was chosen for the Lagos ITS implementation. The Korea ITS architecture is a logical and physical architecture, consisting of eight unit services. The Korea ITS architecture has been implemented in 22 countries because it is efficient in expansion and integration of system.



① Derivation of the Lagos ITS Service

o The configuration and unit services for deriving Lagos the ITS services have been selected based on the Korea national ITS service, which is standardized and which allows easy expansion, compared to the architecture of the United States, Europe, etc.

o Since the Korea ITS is a verified system being operated around the world, including Baku City, Azerbaijan and Ulaanbaatar City, Mongol, it was applied in deriving ITS services for Lagos.

[Table 4.3-12] Derivation of ITS Services Applicable to Lagos (Proposal)

Service Field	Configuration Service	Unit Service	Urban and Cultural Characteristics	Traffic Characteristics	Related System (BRT)	Infrastructure (Electricity/Communications/Civil	Technology Trend and Applicability	Other	Result of ITS Service Selection

						Engineering)			
Traffic Management	Traffic flow control	Real-time signal control		○			○	Many non-signalized intersections	●
		Prioritized signal control							-
		Linked control of railway crossing							-
		Highway traffic flow control							-
	Incident management	Incident management		○			○		●
	Basic traffic information service	Providing of basic transportation information		○			○		●
	Management of the cautious driving sections	Slow-down section management							-
		Low-visibility section management							-
		Poor-condition road section management							-
		Unforeseen obstruction management							-
	Automatic traffic violation detecting	Detecting speed limit violations	○				○		●
		Detecting traffic signal violations	○				○		●
		Detecting bus-only lane violations	○		○		○	BRT exclusive lane	●
		Detecting parking violations							
		Detecting weight limit violations							-

	Traffic administration support	Road facilities management support							-
		Traffic pollution management support							-
		Traffic demand management support							
Public Transporta-tion	Public transportation information service	Bus information service			○		○		●
	Public transportation operation management	Bus operation management			○		○		●
	Public transportation reservation	Public transportation reservation							-
	Support for use of semi-public transportation support	Support for use of semi-public transportation							-
Electronic Payment	Electronic toll payment	Highway toll, congestion toll							
	Electronic payment of transportation facilities fare	Electronic payment of parking fee		○			○		●
	Electronic payment of public transportation fare	Electronic payment of public transportation fare							
Traffic Information Share	Linkage and management of traffic information	Linkage and management of traffic information							-
	Providing of integrated traffic information	Providing integrated traffic information							-
Traveler Information Service	Per-trip information service	Providing traveler information prior to beginning		○			○		●

		trips							
	Real-time traveler information service	Providing traveler information for drivers		○			○		●
		Providing traveler information for public transportation users					○		●
		Providing traveler information for pedestrians and bicyclists							-
Intelligent Vehicle and Road	Safe driving vehicle	Improving drivers' visibility							-
		Preventing dangerous driving							-
		Automatic diagnosis of vehicle safety							-
		Automatic traffic accident warning							-
		Collision avoidance							-
		Lane assistance service							-
		Pedestrian protection							-
	Safe road	Safe driving support at intersection							-
		Safe driving support at railway crossing							-
		Safe driving support at road sections requiring attention							-

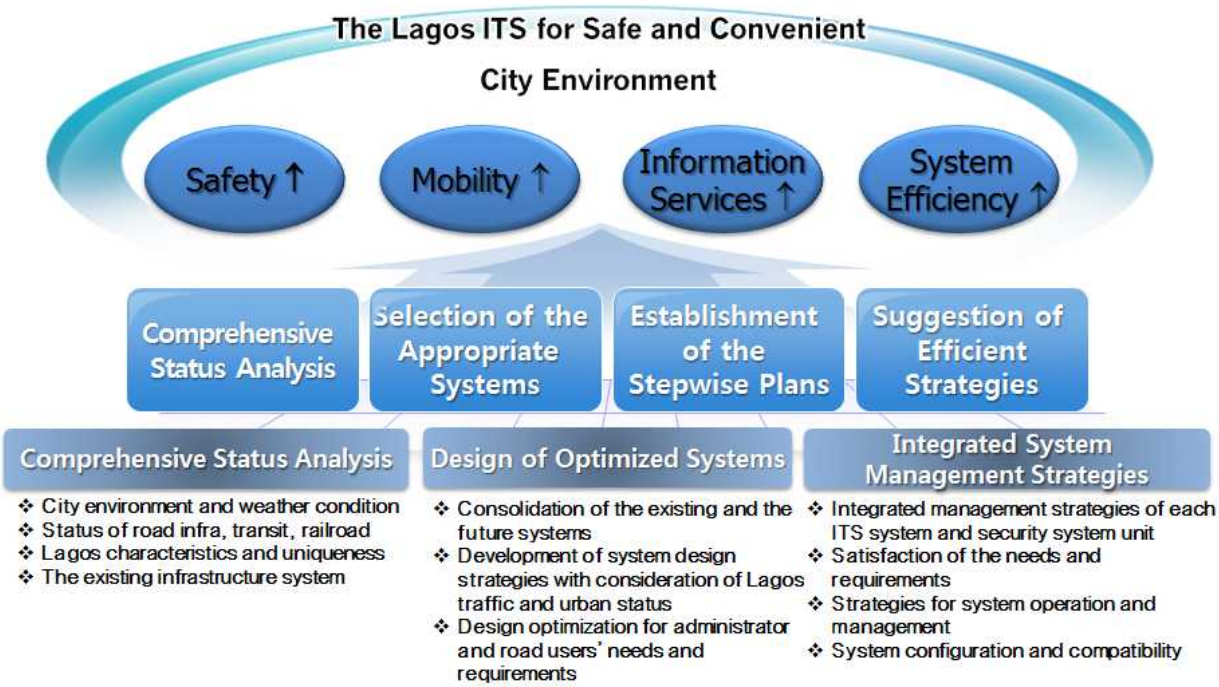
	Automated navigation	Automatic control of vehicle gap distance							-
		Automatic driving							-
		Automatic parking							-
Freight	Freight operation support	Freight route guide							-
	Safety management for vehicles carrying hazardous materials	Safety management for vehicles carrying hazardous materials							-
City and Culture of Lagos	Security	Disaster control	○				○		●
		Integrated urban control	○				○		●

4.3.6 The Lagos ITS Establishment Plan

a. Description

- Design of a realistic and applicable ITS unit system will be conducted, which meets the objectives of system establishment to solve the problems related to the current status of traffic and urban conditions in Lagos
- Design will be conducted in a way that establishes a linkage between ITS and security system so that efficient integrated management and operation of traffic and security throughout Lagos is possible.
- Design a system reflecting the current technology and future technology to be introduced by defining Lagos ITS Architecture considering the traffic and urban conditions in Lagos
- Prevent double investment in site equipment through precise analysis of the linkage between the unit systems
- Basic design of Lagos ITS will be conducted based on the following items.

- Outline of system: objectives and basic direction of system
- Definition of system: definition of unit system's physical Architecture
- System configuration and required functions: design functions complying with the system configuration and requirements
- System establishment plan: Selection of installation location of site system and establishment plan



b. ITS Service Establishment Plans by Stage (Proposal)

o Prepared establishment plans by stage so that the derived 5 service fields, 12 services, and 15 unit services can be effectively introduced to Lagos

[Table 4.3-13] Lagos ITS Service Establishment Plan by Stage (Proposal)

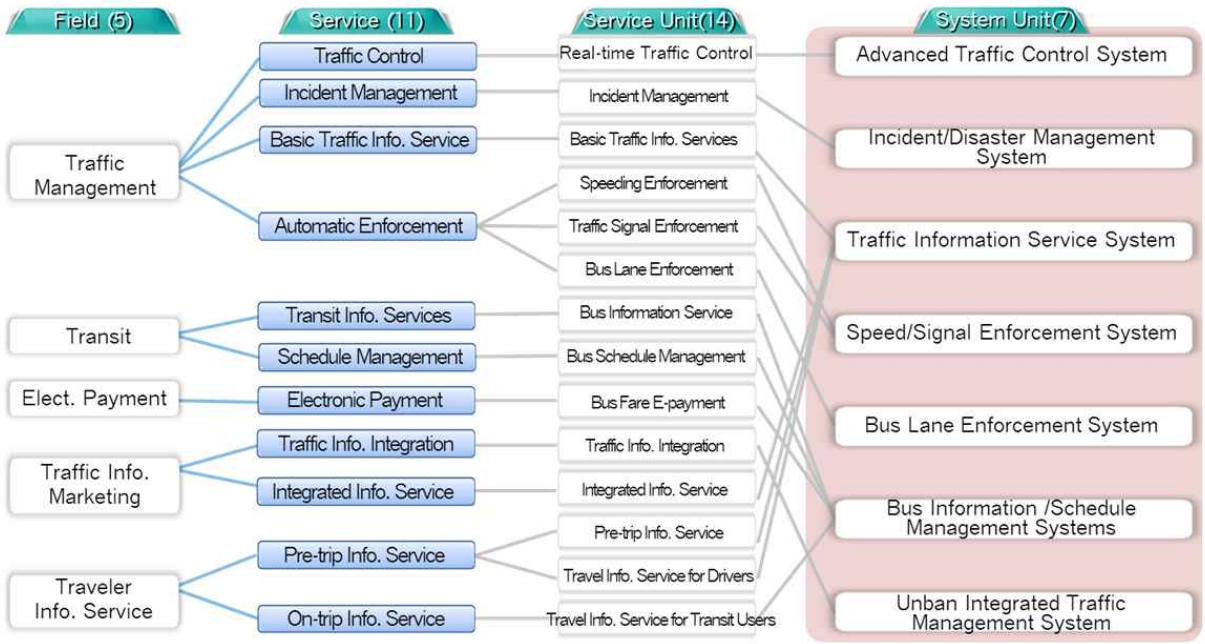
Service Field	Service	Unit Service	Establishment Plan		
			Short-term	Mid-term	Long-term
Traffic management	Traffic flow control	Real-time signal control	○	○	
		Prioritized signal control			
		Linked control of railway crossing			
		Highway traffic flow control			
	Unforeseen situation management	Unforeseen situation control	○	○	○
	Providing basic traffic information	Providing basic traffic information		○	○
	Management of road sections requiring attention	Slow-down section management			
		Low-visibility section management			
		Poor-condition road section			

		management			
		Unforeseen obstruction management			
	Automatic traffic violations detecting	Speed limit violations detecting	○	○	
		Traffic signal violations detecting	○	○	
		Bus-only lane violations detecting		○	○
		Illegal stopping and parking detecting			
		Weight limit violations detecting			
	Traffic administration support	Road facilities management support			
		Traffic pollution management support			
		Traffic demand management support			
Public transportation	Providing public transportation information	Providing bus information	To be established partially	○	○
	Public transportation operation management	Bus operation management	To be established partially	○	○
	Public transportation reservation	Public transportation reservation			
	Support for use of semi-public transportation	Support for use of semi-public transportation			
Electronic payment	Electronic toll payment	Electronic payment of toll road passage money	Already established		
		Electronic payment of congestion fee			
	Electronic payment of transportation facilities fare	Electronic payment of parking fee	○	○	
	Electronic payment of public transportation fare	Electronic payment of public transportation fare	Partially already established	○	○
Traffic information flow	Linkage and management of traffic information	Linkage and management of traffic information		○	○
	Providing integrated traffic information	Providing integrated traffic information		○	○
Providing traveler information	Providing traveler information before passage	Providing traveler information before passage		○	
	Providing traveler information during passage	Providing traveler information for drivers		○	
		Providing traveler information for public transportation users		○	
		Providing traveler information for pedestrians and bike users			

Intelligent vehicle and road	Safe driving vehicle	Improvement of driver visibility			
		Prevention of dangerous driving			
		Automatic diagnosis of vehicle safety			
		Automatic traffic accident alarm			
		Collision prevention			
		Road lane deviation prevention			
		Pedestrian protection			
	Safe driving road	Support for safe driving at intersection			
		Support safe driving at railway crossing			
		Support safe driving at road sections requiring attention			
	Autonomous navigation	Automatic control of vehicle interval			
		Automatic driving			
		Automatic parking			
Freight transportation	Freight vehicle operation support	Freight vehicle route guide			
	Safety management for vehicles carrying hazardous materials	Safety management for vehicles carrying hazardous materials			
Lagos city and culture	Security	Disaster management		○	
		Integrated urban control		○	

c. Sub-System Establishment Plan by Stage

- The applicable eight unit systems were selected to effectively provide the five service fields, twelve services, and fifteen unit services selected for Lagos ITS. The sub-system establishment plans by stage have been prepared based on the service establishment plans for each stage.



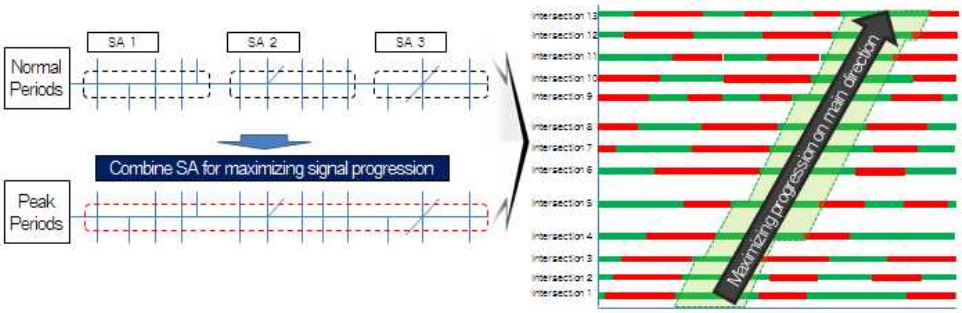
Sub System	Pilot Project (2015-2017)	Short-term (2018-2020)	Med-term (2021-2025)	Long-term (2026-2030)
Advanced Traffic Signal Control				
Incident/Disaster Management				
Traffic Information Collection/Deployment				
Speed/Signal Violation Automatic Enforcement				
Bus-lane Violation Automatic Enforcement				
Bus Information/Schedule Management				
Integrated Urban Traffic Management Center				
Quality Services and New ITS Technology				

d. Basic Direction for Establishing the Lagos ITS Unit System

- Basic establishment plans for the eight main unit systems have been provided.

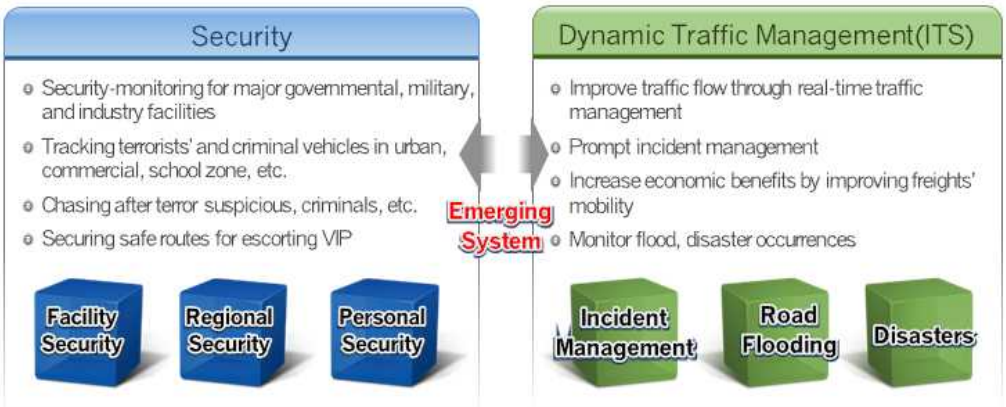
System Unit 1 — Advanced Traffic Signal Control

- Pilot Project : Build on-line center, and signal operation DB
- Short-term: Expand on-line centers, Install signal controlling sensors
- Signalize the un-signalized roundabouts and intersections
- Major corridor managements (metering, SA grouping, etc.)
- Change timing/phasing by time of day, day of week



System Unit 2 — Incident/Disaster Management

- Pilot: Incident Management (Traffic Management)
- Short-term: Incident Management (Traffic + Security)
- Mid-term: Urban Integrated Management
- Emerging ITS and Security for providing needs of Lagos



System Unit 3 Traffic Information Collection/Deployment System

- Short-term: Major arterials along with signal control systems
- Mid-term: Minor arterials and alternative streets

System Unit 4 Speeding/Signal Enforcement System

- Pilot : Frequent speeding zones among existing signal control system on-line segments
- Short-term: Frequent speeding zones among future signal control system on-line segments
- Increase efficiency through automatic enforcement system
- Preventing accident by settling steady enforcement system

System Unit 5 Bus Lane Enforcement

- Short-term : Existing and working BRT routes
- Mid-term : New BRT routes
- Increase efficient enforcement by automation
- Make bus's right of way and prevent accidents

System Unit 6 BIS/BMS

- Short-term : Connect the existing BIS to BRT routes
- Mid-term: Plane new BRT routes
- Bus arrival info services at bus stops
- Bus schedule, routes information management

System Unit 7 Automated Parking Fee Collection

- Short-term: Major parking facilities
- Mid-term: Public parking facilities
- License plate recognition technology
- Saving time for entering/exiting parking facilities

System Unit 8 Integrated Urban Management Center

- Short-term: Integrate traffic management + the existing BIS/DMS
- Mid-term: Integrate traffic + security + incident/disaster management systems
- Total operation/management center of metropolitan region

Misc. Other Key points

- Equip a generator and UPS at the Lagos TMC for 24/7 operation against frequent interruption of electricity
- Equip UPS and prevent vandalizing systems at the sites

e. Emphasized items of the project

- Short-term plans are mainly divided into three, which are advanced traffic signal control system and incident/disaster management system, speed limit/signal violations detecting system, and automatic parking fee collecting system. The project will be implemented with emphasis on these categories.
- The scope of establishment for each stage of each unit system was designed to be consistent so that the effect of system establishment can be maximized.

[Table 4.3-14] Derivation of Emphasized Items of Lagos Project

Service Field	Service	Unit Service	Unit System	Emphasized items of project			
				Short-term	Mid-term	Long-term	Emphasized items (short-term)
Traffic management	Traffic flow control	Real-time signal control	Advanced traffic signal control system	○	○		★ (Signal control system establishment location)
	Incident management	Incident management	Incident/disaster control system	○	○	○	★ (Installation location for BRT section, signal control system, etc.)
	Providing of basic traffic information	Providing of basic traffic information	Traffic information collecting/providing system		○	○	-

	Automatic traffic violation detecting	Speed limit violations detecting	Speed limit/signal violations detecting system	○			★ (Speeding and dangerous portion of the traffic signal location)
		Traffic signal violations detecting		○			
		Bus-only lane violations detecting	Exclusive lane violations detecting system		○	○	-
Public transportation	Providing of public transportation information	Providing of bus information	Bus information providing/operation management system		○	○	
	Public transportation operation management	Bus operation management			○	○	
Electronic payment	Electronic payment of public transportation fare	Electronic payment of public transportation fare			○		
	Electronic payment of transportation facilities fare	Electronic payment of parking fee	Automatic parking fee collecting system	○			★ (Public parking lot and parking lot for main

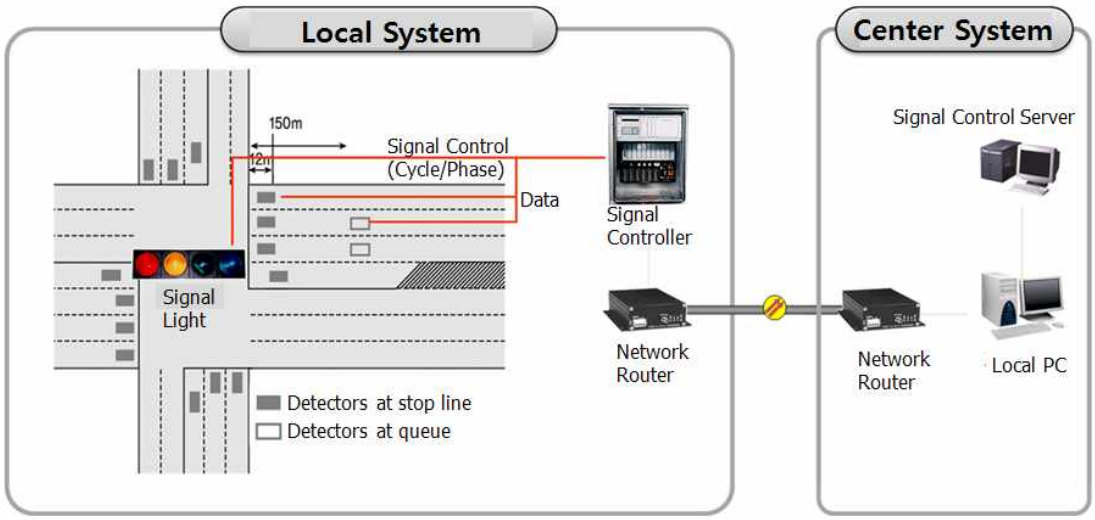
							facilities)
Traffic information flow	Linkage and management of traffic information	Linkage and management of traffic information	Integrated urban control center system		○	○	-

4.3.7 Field system design

a. Advanced traffic signal control system

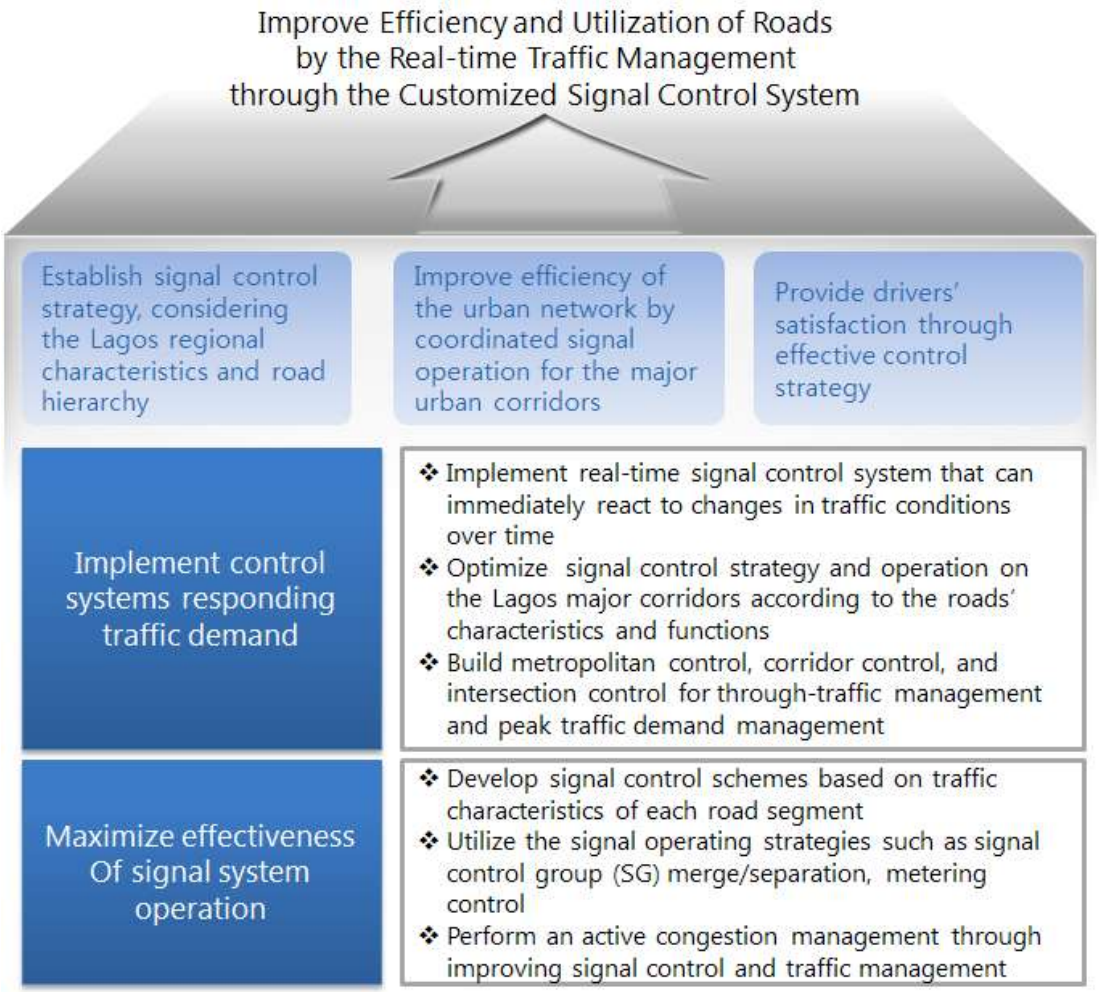
1) System overview

- Advanced traffic signal control system controls the traffic signal system such as signal cycle and split in real-time in accordance with the traffic demand to facilitate traffic movements at the signalized intersection.
- It implements a real-time signal control algorithm by providing a variety of control signals. It is a core ITS system in traffic network of the urban areas serving interrupted traffic flow.
- The basic function of the advanced traffic signal control system is to control signal parameters such as cycle, split, offset, etc. from the Lagos traffic management center through on-line connection to the signalized intersections.
- The main feature of the advanced traffic signal control system is corresponding traffic control to respond to various traffic conditions.
- The detectors at the major signalized intersections collect real-time traffic demand data and transmit them to the center every minute. The server at the center process/analyze the traffic data and determine the signal cycle and the phase for optimizing the signal time on traffic demand on each approach of the signalized intersection. The server also utilizes the traffic data from the adjacent intersection and determines the off-set for signal coordination for progressive signal operation for peak direction.
- Real-time traffic demand data are collected by the detector installed at the stop line and the middle of an approach link. The traffic signals are controlled by an optimum control parameters calculated from the Lagos integrated traffic management center.



2) Building objective and basic direction

- Lagos serves high traffic demand in the central area, and it's traffic pattern shows inbound traffic high concentration during peak periods and shows low traffic flows during off－peak period. However, the current simple signal operation is insufficient to manage intersections responding to the changes of traffic demand.
- The advanced signal control system capable of real-time control in response to traffic situations is proposed to relieve traffic congestion, including reducing the delay at the intersections and road sections, increasing the efficiency of road use, and coordinating signal times of a serious of intersections according to traffic demand changes.
- Adding more crosswalks and traffic signals on the major corridors is proposed to enhance safety of the pedestrians crossing streets.
- Establishing signal coordination DB of the adjacent intersections is proposed to enhance traffic flow at the multiple signalized intersections on the major corridors.



3) System scope

- Lagos has a total of 82 signalized intersections and they are operated by on-site data without communication connection.
- This project will build network communications and advanced traffic signal control systems for the existing signalized intersections and the signalized intersections added in this project periods.
- Pedestrian crosswalk signals will be built and included in the project.
- The construction plan of the advanced traffic signal control system in Lagos is as follows.

[Table 4.3-15] Construction of signal control system in Lagos

Classification	Contents		
Site system Construction	Signal crossroads photo		
	Signal crossroads spot map		
Result of analysis	☐A total of 82 signalized intersections and operated by the field data ☐Lagos traffic signal control system is limited to active operating according to the traffic condition changes for each day/ direction / time. ☐When building a system for the advanced signal control system, building site systems including traffic signal controller replacement and center system		

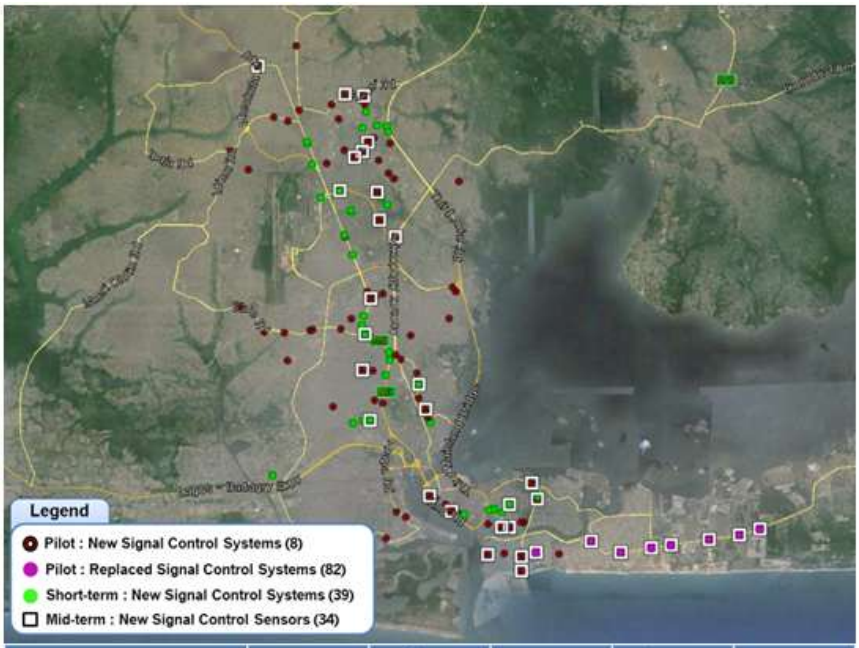
	such as signal control server, operating terminal and the bulletin are required.

4) Building of advanced signal control system

- Building of advanced traffic signal control system for traffic flow management is divided into short-term and mid-term. For short-term, the traffic flow management system includes online signal control, signalized roundabouts, and traffic signal DB. For mid-term phase, the advanced signal control systems include expanding online network and installing intersection detectors.

- Short-term: Build On-Line and signal operating DB (Existing building + signalized roundabouts)

- Mid-term: Expand On-Line and build signal operating DB + install intersection detectors

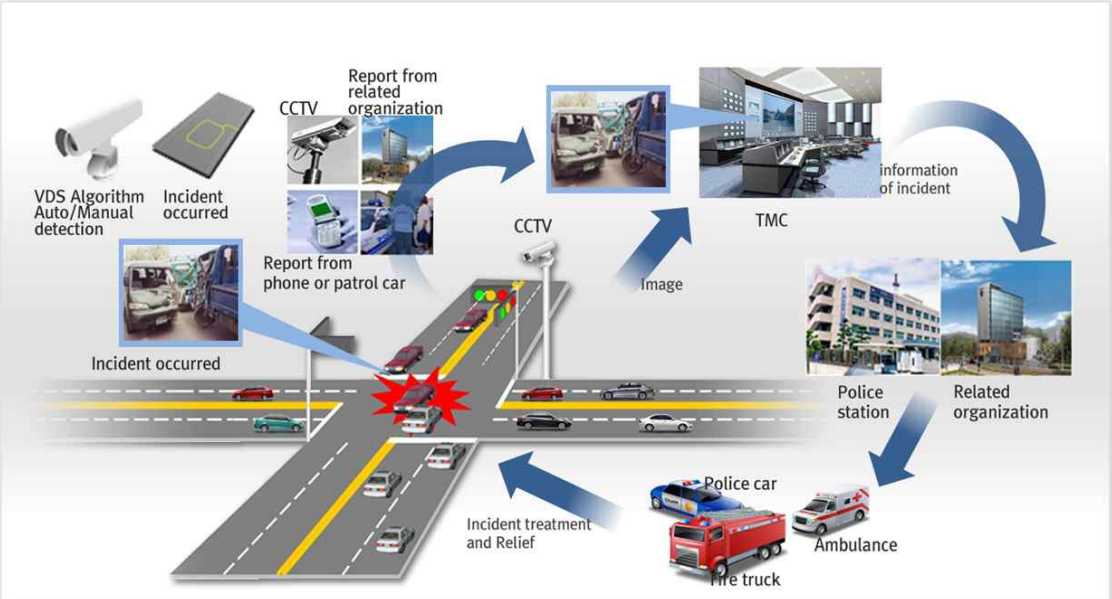


Category		Pilot	Short-term	Mid-term	Long-term	Total
On-Line	New	8	39	-	-	47
	Replacement	82	-	-	-	82
Signal Operation DB		90	39	-	-	129
Signal Control Sensors		-	34	-	-	34

b. Incident and disaster control system

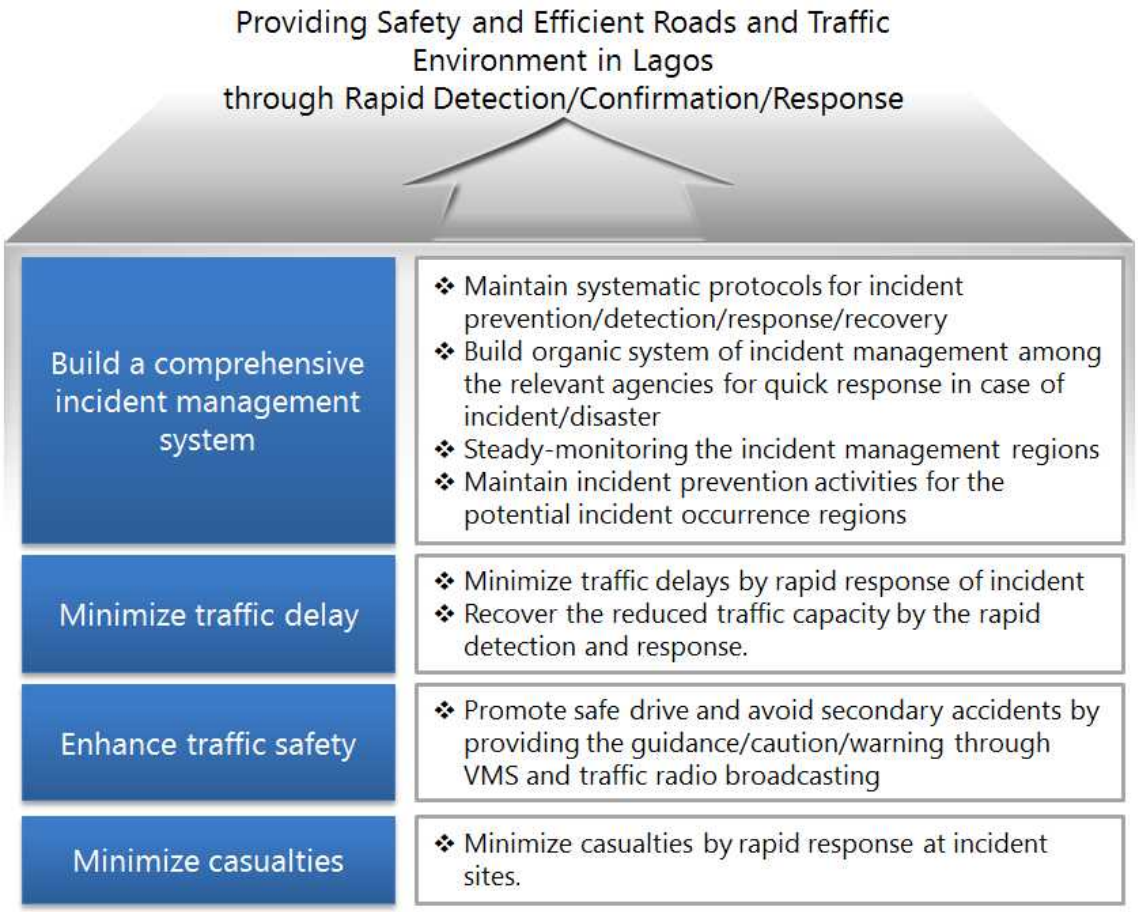
1) System overview

- Incident and disaster control system promptly detects, identifies, and confirms an incident, and responds to the incident for rapid recovery.



2) Building objective and basic direction

- Lagos has risks of incident due to traffic demand concentration at peak period and irrational balance of the road width and geometry of intersections.
- Immediate response process base through regular operation of the real-time incident and disaster control system is required.
- Accordingly, we will establish a permanent monitoring system that sets focus targets on major incident black spots, irrational geometry sections and traffic control sections to rapid recovery of traffic incidents and traffic accidents and other incidents that may occurred on roads in Lagos and to minimize their damage, and will also establish safer traffic environment in Lagos by preventing secondary incidents through rapid detection / identification / response when incidents may be occurred.



3) System scope

- Basically, it is desirable to include the entire area of Lagos, however in reality, installing the system on the entire road network is inefficient, considering its cost investment.
- Accordingly, construction range of the incident/disaster management system shall be installed on the major roads in Lagos. Other regions will be converted by police patrols and report calls.
- This is classified into the uninterrupted flow and interrupted flow depending on characteristics of traffic flow, and incidents shall be in advance monitored to centralized management sections by setting potential accident sections such

as congestion areas, frequent accident spots, main inflow and outflow points and linear defects, etc.

- In addition, accident surveillance camera will be installed to record video at the intersections where CCTVs do not cover. The CCTV data are used for analysis and verification if necessary.

[Table 4.3-16] Spatial extent due to the traffic flow characteristics

Classification	Contents
Interrupted flow	- Traffic flow failure occurs due to traffic signals and traffic safety facilities, etc. and repetitive congestion occurs due to the concentration of traffic during peak time. - Managed by setting main point of the city and establishing incident detection and verification system.
Uninterrupted flow	- Section that has high risk of serious traffic accidents because uninterrupted flow is possible without a break in traffic flow and running speed is considerably higher. - Connected with main road networks in Lagos and in charge of ring road in Lagos. - Monitor downtown traffic flow through CCTV in main crossroads connected with side- streets in downtown.

[Table 4.3-17] Spatial extent due to system characteristics

Classification	Contents
Direct range	- Range that is possible to direct operation by the operator where incident subsystem is installed - Areas required to manage incidents among this project scope of Lagos
Indirect range	- Section that incident management is indirectly possible through the Incident management system - Sub-roads in Lagos or roads required to connect in conjunction with this project

- Benefits

- Minimize the impact of an accident, caused by incidents, by minimizing the treatment and duration times when an incident is occurred and by recovering traffic conditions of roads to normal state in a short period of time and by shortening emergency treatment of the parties to an accident related to incidents

- Mitigate traffic congestion due to incidents by providing detour information during the incident occurrence.

- Promote traffic safety and minimize traffic delays according to the pre-management function

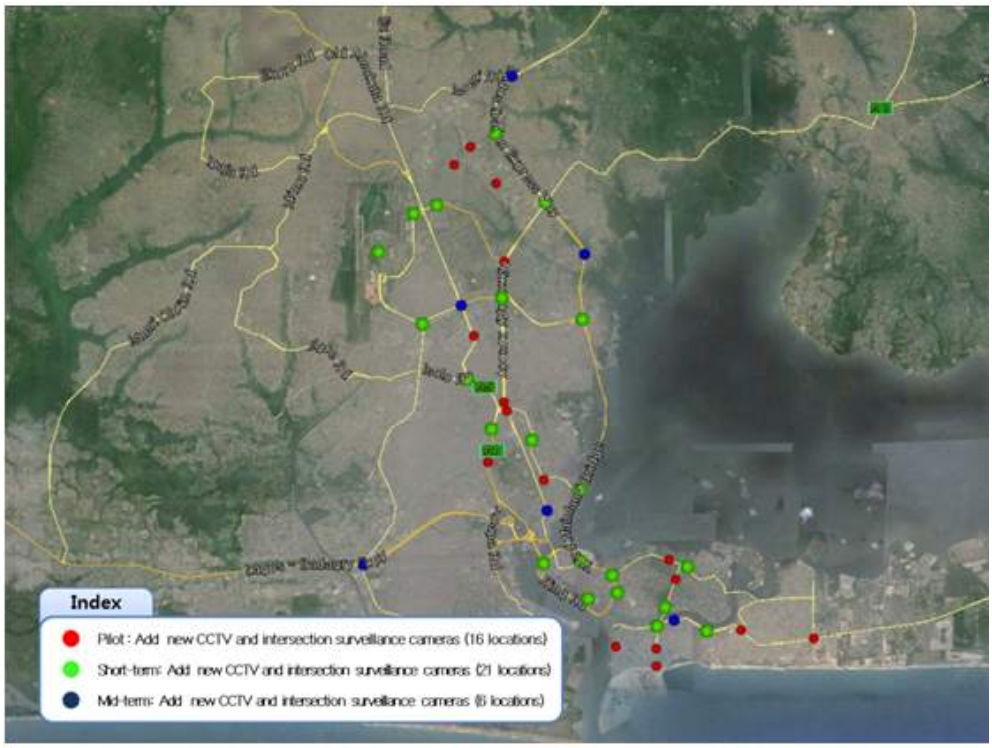
4) Building direction of Incident/disaster control system

- Incident/disaster control system will be installed on the points where require to monitor such as traffic situations of intersections and roads, and traffic accidents and surveillance cameras are also installed at intersections to supplement the shadow area of CCTV.

- Short-term: The areas of the online traffic signal control systems

- Mid-term: The expended areas of the online traffic signal control systems, major arterials, and BRT routes

- Long-term: Urban entrance/exit areas and alternative routes.



Category		Pilot Project	Short-Term	Mid-Term	Long-Term	Total
Incident/ Disaster Management	CCTV	16 locations	21 locations	6 locations	-	43 locations
	Surveillance Cameras	16 locations	21 locations	6 locations	-	43 locations

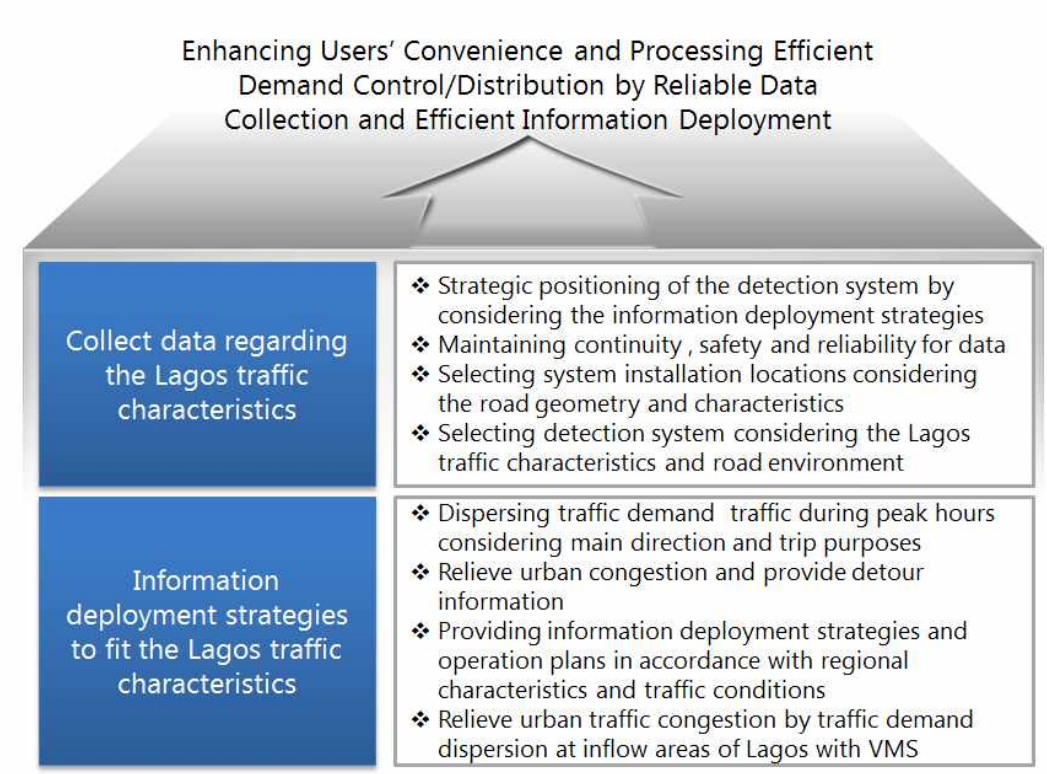
c. Traffic information collecting/providing system

1) System overview

- This is a system that provides traffic information to a driver to control traffic flows such as road and traffic conditions of main and side roads, detours, incidents, omnidirectional road and closure of roads in the city.
- Data collection techniques can be classified based on the vehicle detection data and vehicle operation information, which may be used by selecting one of the two or both of them.
- For the vehicle operation information, it may be used to produce traffic information by processing probe information transmitted to the center after road side equipment recognizes a vehicle identification information management device attached in a vehicle, or to produce communication information by processing individual vehicle travel data after sending it to the center which is transmitted to road side equipment from a vehicle terminal.
- The media to provide traffic information are Variable Message Sign (VMS) installed in the roadside, smart phone (Internet), telephone (ARS), cellular phone, kiosk (KIOSK) separated by traveler devices and vehicle terminal.

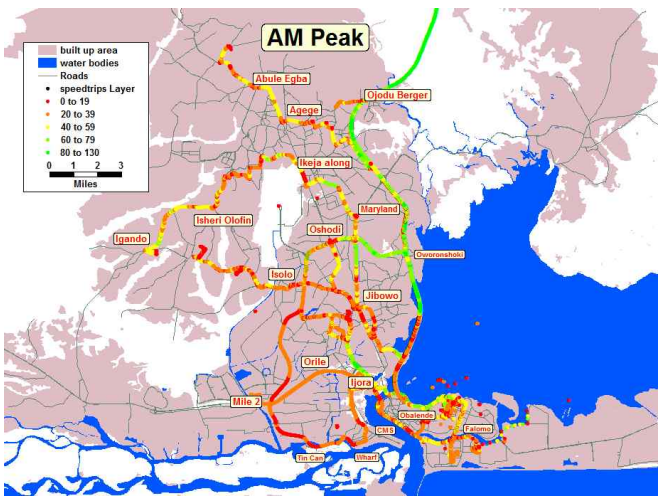
2) Building objective and basic direction

- Lagos basic traffic information system provides convenience for travel by analyzing and processing traffic information collected from each sub-system of the ITS, and providing the traffic information to drivers and travelers who travel on the road.
- Lagos traffic information system shall support safe travel for drivers and be required to build supporting system that selects a route in advance by providing real-time information in advance of travel.
- It also shall provide continuous information to fit the class of each roads and main traffic flows by focusing on the main roads in the central area.
- It aims to increase convenience of drivers by providing information on traffic condition in central area to the basic principle and providing additional tourist information, city public relations and safety driving support information.



3) System scope

- Information systems are largely classified by the information system for road users and the information system for operators.
- The information system for road operator is classified as center information system to collect traffic conditions and system operating conditions in real time by monitoring screens and operator terminals. Transportation policy information system supports transportation system improvement and transportation system plan in future.
- The information system for road users is built by classifying pre-departure information system and driver information system. The pre-departure information system enables drivers to determine transportation modes and routes in advance via personal information media such as internet. The driver information system provides traffic and incidents information using VMS and mobile devices.
- Lagos traffic information system would enhance efficiency of traffic management and increase satisfaction of the road users.
- System range includes main entrance/exit section of the major roads and main arterials in central area.



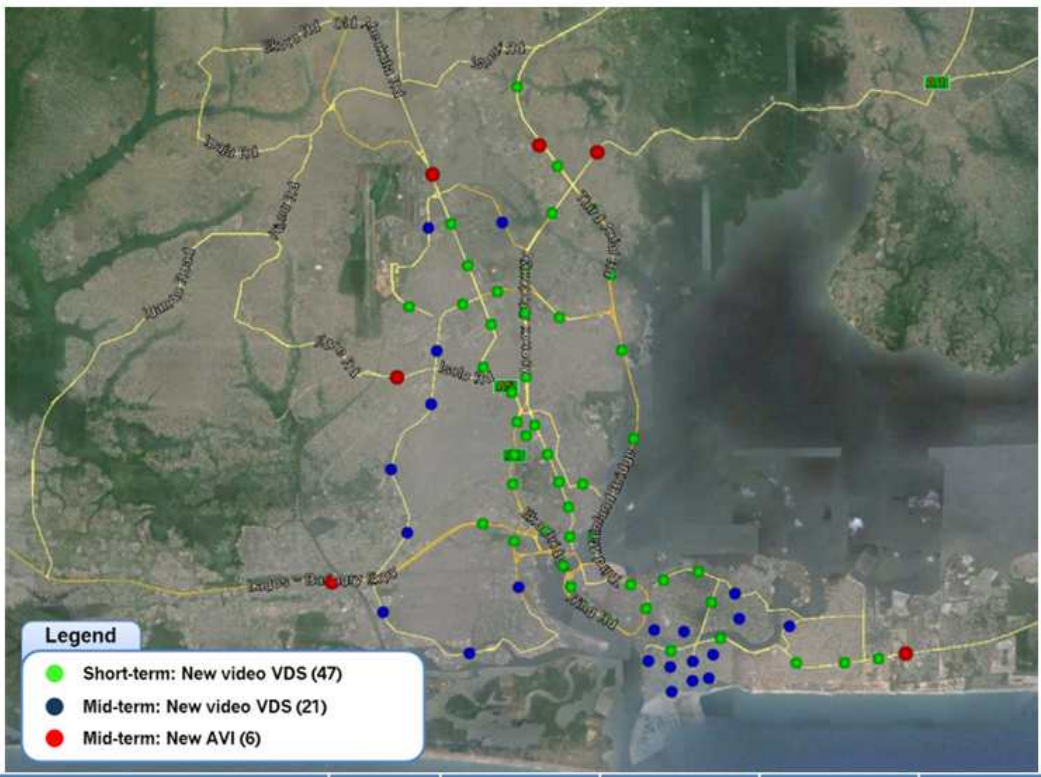
4) Direction of Traffic information collecting/providing system

① Traffic information collection system

o Traffic information collection System will be built on the major roads in Lagos and expanded to sub roads and alternative roads in the long-term, and be allowed to monitor vehicles in and out flowing in the city center by installing the vehicle license plate recognition camera (AVI) in main in and out flow sections.

- Mid-term: Collect traffic information on main roads (Video VDS)

- Long-term: Collect traffic information on local distribution roads and alternative routes (Video VDS), Collect traffic information on in and out flow sections in Lagos (AVI)



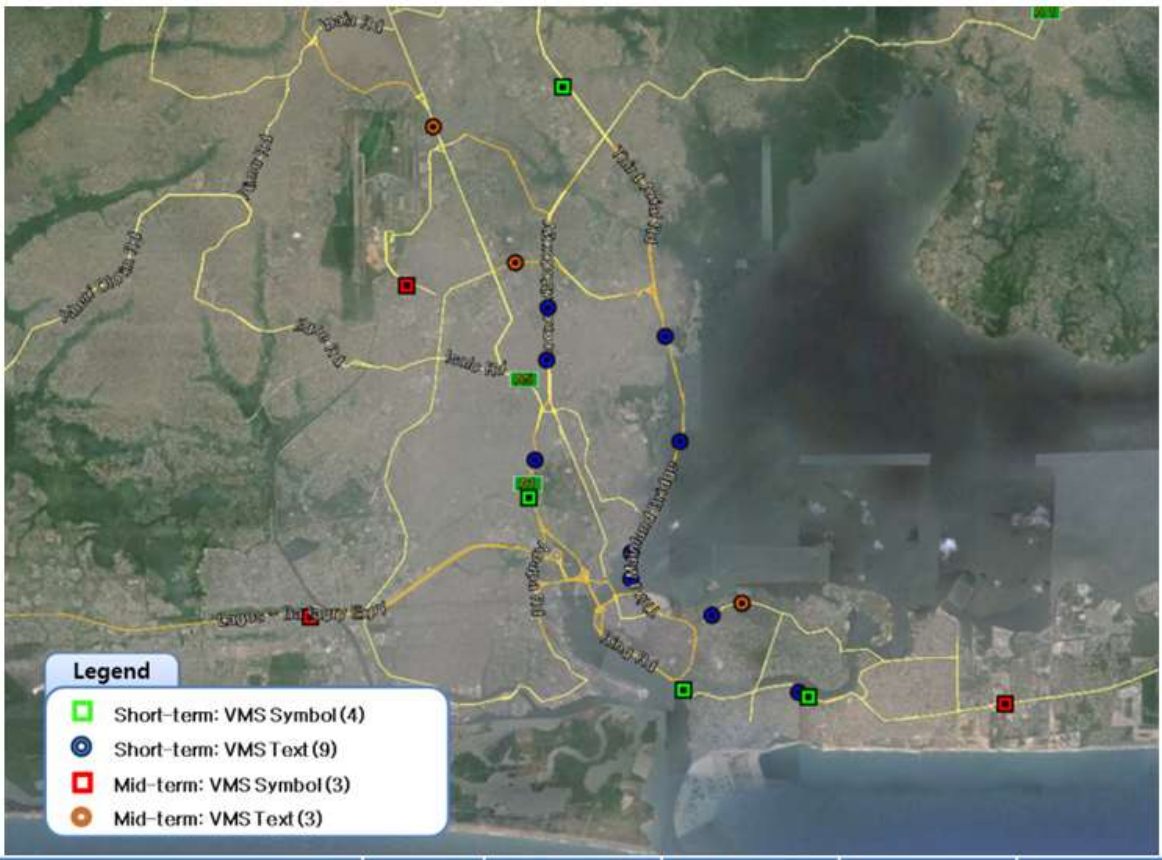
Category		Pilot	Short-term	Mid-term	Long-term	Total
Data Collection System	Video VDS	-	47	21	-	68
	AVI	-	-	6	-	6

② Traffic information system (variable message sign: VMS)

- Traffic information system was selected by classifying figure (symbol sign) type and text type to choose the best route by providing traffic and detour information considering visibility and legibility of drivers, and a total of 19 points are selected to install.

- Mid-term: Provide traffic information on main roads

- Long-term: Provide traffic information on local distribution roads and alternative roads



Category		Pilot	Short-term	Mid-term	Long-term	Total
Information Deployment System	Symbols	-	4	3	-	7
	Texts	-	9	3	-	12

d. Automatic traffic enforcement system

1) System overview

- Automatic traffic enforcement system is a system that automatically enforces vehicles in violation of speeding / traffic signal / bus lane on the road.

2) Objective and basic direction

- Speed/signal violation enforcement system detects a violation and transmits a video data of the vehicle to the center. The server processes the video data and issues a citation or a penalty bill through vehicle registration records.
- Exclusive lane violation enforcement system detects an ineligible vehicle on the BRT lane and transmits a video data of the vehicle to the center. The server processes the video data and issues a citation or a penalty bill through vehicle registration records.
- Speed/signal violation enforcement system is designed to separate the functional elements depending on the system object and installation position of on-site system.
- The objects and Lagos basic directions of automatic traffic enforcement system in Lagos are as follows.

[Table 4.3-18] Objective and basic direction

Classification	Contents
Objective	- Efficiency of the enforcement system for a vehicle that violates Speeding/Signal/exclusive lane - Minimize the burden of enforcement agents through optimization of system operation - Establish base of fully automated system
Basic direction	- Ensure fairness and reliability of enforcement by complying with reasonable enforcement standards - Recommend enforcement matters to drivers in advance by installing enforcement guidance signs at the front - The system shall be established to ensure enforcement operations that are always reliable regardless of day or night. - Prevent traffic accidents by inspiring compliance spirit and improving the driving behavior - Induce compliance driving by maximizing the effect of enforcements

3) System scope

o Spatial extent of building automated traffic enforcement system in Lagos is targeting all jurisdiction administrative area in Lagos and it shall be installed on signalized intersections on main roads and highways, frequent accident spot, high accident risk point and BRT sections.

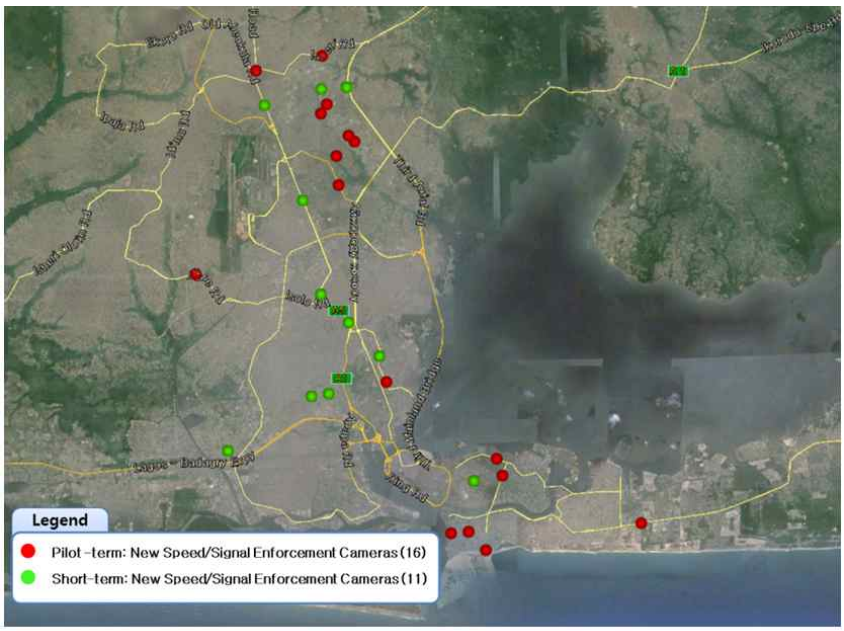
4) Building direction of system

① Speed/signal violation enforcement system

o Speed/signal violation enforcement system will be installed points that have a wide intersection and access road with more than one way 2 lanes centered in signalized intersections.

- Short-term: Points of existing and new signalized intersection of the short-term business

- Mid-term: Expend building points of signalized intersection



Category	Pilot	Short-term	Mid-term	Long-term	Total
Speed/Signal Enforcement Camera	16	11	-	-	27

② Exclusive lane violation enforcement system

o Exclusive lane violation enforcement system will be installed to the existing BRT exclusive lane and prevent congestion and accidents caused by vehicles entering into exclusive lanes and shall be expanded the scope to routes that are planning in the long term.

- Mid-term: Targeted to existing sections or sections under construction

- Long-term: Targeted to projected BRT sections

<Existing BRT sections>
- Mile 12 to TBS (BRT LITE) -

<BRT sections under construction>
- Mile 12 to Ikorodun (EXTENSION) -

No.	Route Name	Length (km)	State of construction	Remarks
1	Mile 12 con (BRT LITE)	25.6km	Construction completed	-
2	Mile 12-Ikorodu (EXTENSION)	13.61kn	Expected in 2017	Under construction
3	Oworonshoki -Apapa	27.53km	Expected in 2022	Plan
4	Ota - Maryland	24.84km	Expected in 2022	Plan
5	Berger - Iyana Isolo	27.52km	Expected in 2022	Plan
6	TBS - Berger	25.37km	Expected in 2022	Plan

Classification	Short-term (2017~2020)	Mid-term (2021~2025)	Long-term (2026~2030)	Total
Exclusive lane violation Enforcement cameras	-	2 routes (7 places)	4 routes (21 places)	6 routes (28 places)

e. Bus Information & Management System

1) System overview

- Bus Information & Management System increases service quality and ridership of public transportation by means of continuous monitoring and management of the city bus system, providing a variety of information related to the bus service to passengers at bus stops and in cars as well as bus drivers and administrators, etc.
- It also promotes convenience by providing bus schedule, real-time operating conditions, arrival time information and bus-related incident information through the collected bus operation data. That information is provided to the passengers through mobile devices, ARS, on-board screen, electronic displays, etc.
- Bus management system improves the punctuality and reliability of public transportation by inducing law-abiding service and modernizing the bus management by means of bus service status identification, supervision and coordination of bus service and real-time record management of drivers and vehicles, etc.
- Features of the Bus Information system are:

- Collection and guide of bus service plan

- Identify bus location

- Prediction and guidance of the arrival time

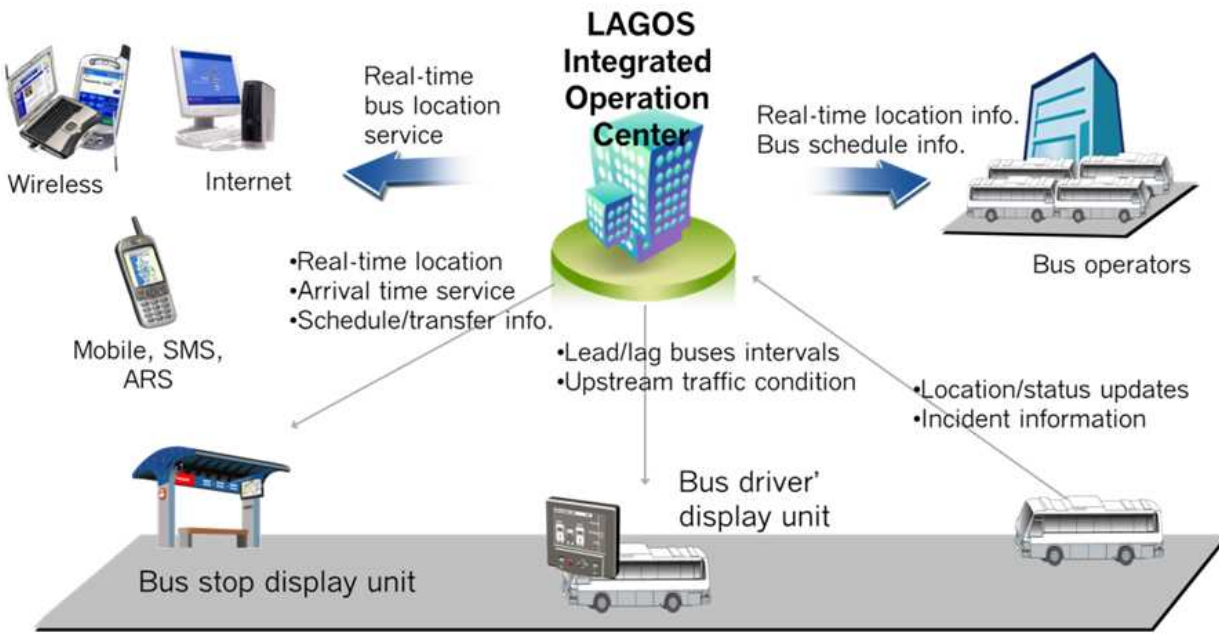
- Features of the Bus management system are:

- Identify bus location

- Bus service supervision and coordination

- Real time recording management of the driver and the vehicle

- Investigate and respond on incidents and passenger's safety



2) Objectives and basic directions

- Promote the activation of the use of public transportation by improving the quality of public transportation services through bus information and bus management in Lagos.
- Provide customized transit information available anytime (When), anywhere (Where)

- Provide real-time bus service information and user customized bus information through various information media: Expend bus terminal guiding terminal, passenger terminal in bus, Web’ Mobile’ SMS’ ARS

- Diversification of the bus informational content considering characteristics of each media

- Improve reliability of public transit by ensuring punctuality of buses

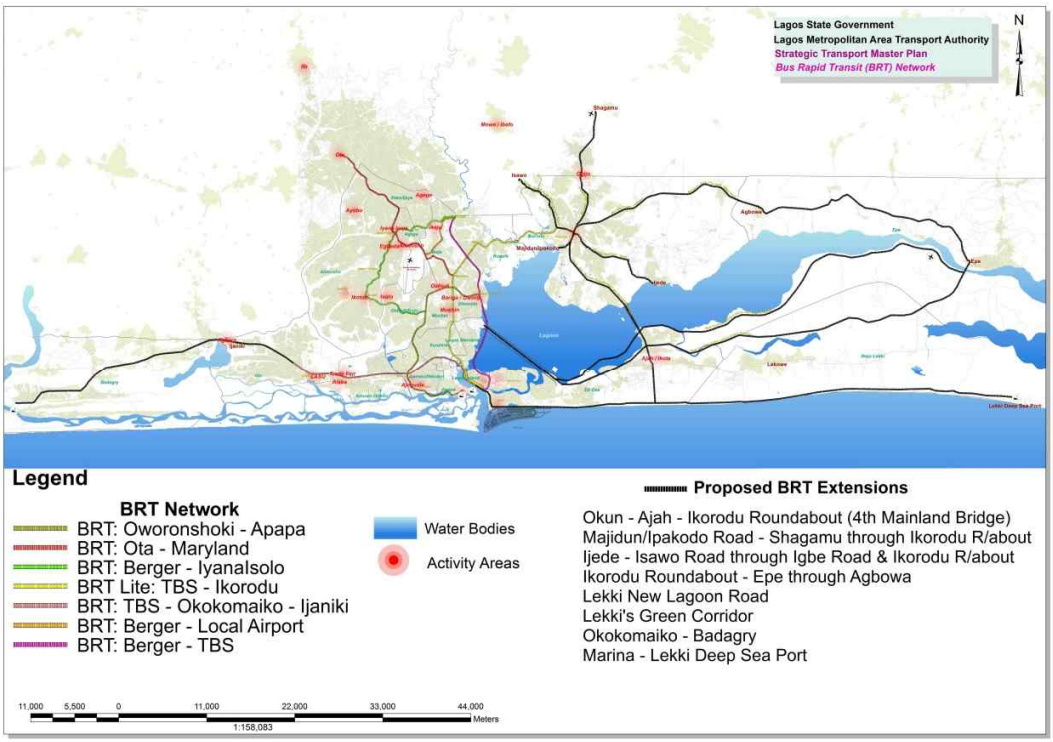
- Identify real-time operating conditions of buses in Lagos

- Organic management by complying intervals between buses (keep distance/time between an earlier departing car and a later car), monitoring service violation (route deviation, speeding, non-

stop passing, driving with opening door, tampering, etc.) and forming additional vehicle immediately when an incident is occurred.

3) System scope

- Lagos has building BIS/BMS in BRT-Lite sections (about 25.6 km), and has a plan to build 6 BRT routes additionally by 2032.
- Therefore, the scope is set to connect BIS/BMS system that is building now and BRT sections that will be built.



4) Building direction of Bus Information & Management System

- Lagos has building BIS/BMS at the 'Mile 12-TBS' sections (about 25.6 km) which is BRT route currently in operation.
- 220 buses per day are running for an average of 5 times per bus in 16 hours (6:00 am~10:00 pm) in the above route.

[Table 4.3-19] Lagos BRT status and plans

No.	Route Name	Length(km)	Existing last stops	Stop / Number of terminal	State of construction
1	Mile 12 con (BRT LITE)	25.6 km	Mile 12 -TBS	16	Construction completed (2008)
2	Mile 12-Ikorodu (EXTENSION)	13.61 km	Mile 12 - Ikorodu	9	Under construction (Expected in 2017)
3	Oworonshoki -Apapa	27.53 km	Oworonshoki - Apapa	-	Plan (Expected in 2022)
4	Ota - Maryland	24.84 km	Ota - Maryland	-	Plan (Expected in 2022)
5	Berger - Iyana Isolo	27.52 km	Berger - Iyana Isolo	-	Plan (Expected in 2022)
6	TBS - Berger	25.37 km	TBS - Berger	-	Plan (Expected in 2032)
7	TBS-Okokomaiko -Ijanikin	26.04 km	TBS - Ijanikin	-	Plan (Expected in 2017)
8	Berger - Local Airport	-	Berger - Local Airport	-	Plan (Expected in 2032)

- In the mid-term, it is set to connect BIS/BMS in 'Mile 12–TBS(BRT LITE)' sections and 'Mile 12-Ikorodu' which is construction in process, while in the long-term, it is set to the remaining planned routes.

[Table 4.3-20] Building direction of Bus Information & Management System

Classification		Short-term (2017~2020)	Mid-term (2021~2025)	Long-term (2026~2030)	Total
Bus Information & Management System	Connect to the existing system	-	1 Set	-	1 Set
	Building routes	-	1 route	6 routes	7 routes

f. Automatic parking fee collection system

1) System overview

- Parking fee is calculated automatically using a terminal or electronic payment card of a vehicle parked in a parking lot and the parking fee is collected automatically without a collector upon exiting the parking lot or a fee is paid

to a collector upon exiting the parking lot by calculating the fee automatically through issuing the parking ticket.

2) Objective and basic direction

- Automatic parking fee collection system is to improve parking turnover ratio by automatically collecting parking fees in public parking lots with high parking demands, to reduce labor costs, and to enhance traffic flow on parking facilities.
- For automated fare collection procedure using vehicle terminals, the system withdraws a parking fee automatically by reflecting time difference between entry time and exit time on the policy of a parking lot by automatically measuring exit time when a vehicle is exit the parking lot after automatically measure and save a vehicle number and its entry time when the vehicle enters the parking lot.
- Increase parking turnover ratio and maximize operational efficiency by computerization and automation of parking fee collection for public parking with high demand.
- Improve parking efficiency and provide convenience of parking vehicles through rapid parking fee charging.
- Ensure transparency of collecting parking fee by DB recording of entry and exit and parking fee.
- Eliminate distrust of parking fees, improve convenience of Lagos citizens and promote savings of parking lot management.

[Table 4.3-21] Objective and basic direction

Classification	Contents
Objective and basic direction	- Improve parking turnover ratio by automatically collecting parking fees in public parking lots with many vehicles parked - Provide convenience of parking vehicles - Decrease vehicle waiting due to parking fee charging - Review necessity of building integrated system of parking fees and transit fares and their connection

3) System scope

- Automatic parking fee collection system is intended for parking lots of major facilities in Lagos and its scope is as follows (now collecting data)

4) Building direction of Automatic parking fee collection system

- Build automatic system for paid / free parking lots and security system for entering and exiting vesicles in Lagos.
- For the convenience of users, automatic parking fee collection system shall unify or be compatible to automatic fee collection of parking fees and transport fares on transportation facilities and roads.
- Cash payment system through the issuance of parking tickets is also built not to cause discomfort for user's cash payment.
- Lagos Automatic parking fee collection system has introduced automatic collection system with a card method and will introduce a vehicle terminal method upon expending in future.
- The vehicle terminal method will be promoted in long-term planning considering mounting terminal on a vehicle for economics of cost, technical reliability and automatic fare collection and will provide service when demand of the vehicle terminals are increased in future.

- Lagos Automatic parking fee collection system will be selected for parking lots attached to off-street/buildings or public parking lot with high parking demand and operated with charging.

[Table 4.3-22] Selection criteria of installation points of Automatic parking fee collection system

Classification	Selection criteria of installation points
Automatic parking fee collection system	- Paid public parking lots attached to off-street/buildings which are managed directly or consigned in Lagos - Points that have high parking demands due to commercial and traffic induction facilities, and traffic congestion is occurred due to parked cars

4.3.8 Center System Design

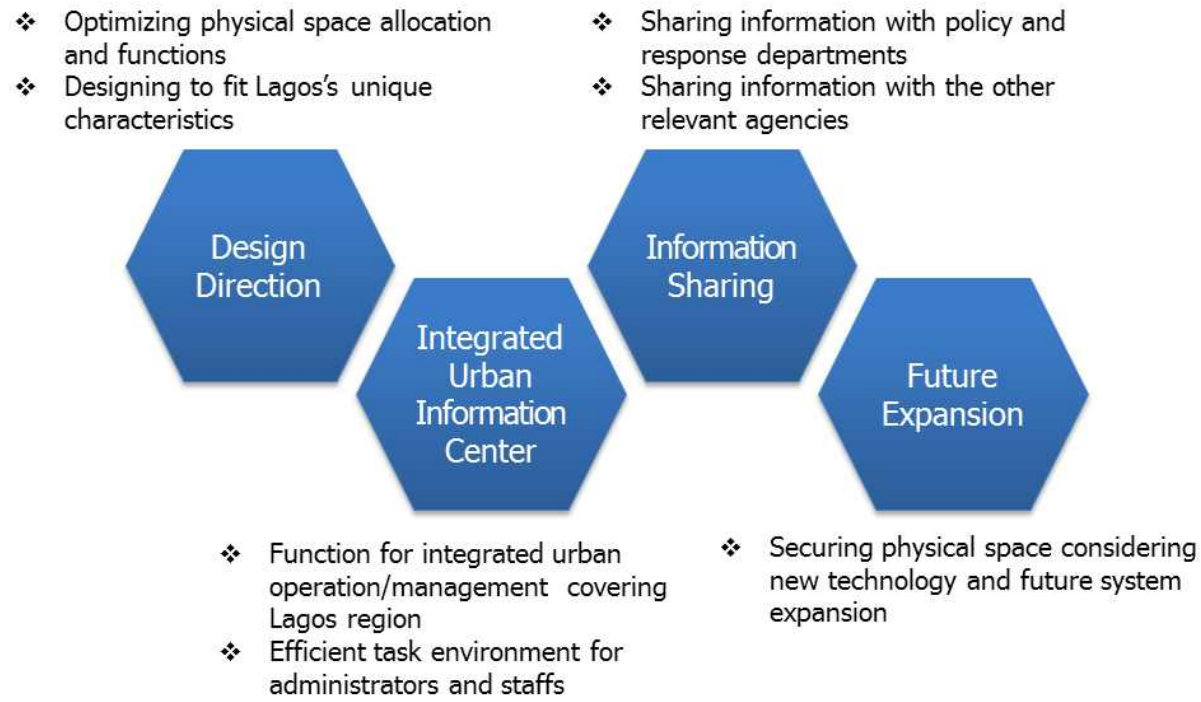
a. Overview of the integrated urban traffic management center

- Lagos integrated traffic management center shall plays roles in controlling each subsystem, processing the information collected by each system and relaying information required between the system, and monitoring and managing system operations, and shall perform the functions to process the information collected from external related organizations at the same time.
- Integrated traffic management center performs roles in collecting, processing and delivery of comprehensive traffic information with linked and integrated to systems that are built on short-term as well as systems that will be built on mid-term and long-term.
- In addition, Lagos integrated traffic management center performs roles in urban integrated control functions that integrate and manage the entire city of Lagos for crime and disaster prevention, etc. other than collection/ processing /treatment of traffic information.

- It also enables efficient information processing, providing and control by making comprehensive DB (Data Base) for traffic flow and the related information collected through on-site equipment, reports, etc.

b. Building direction of the City integrated traffic management center

- Lagos integrated traffic management center will perform the functions of the integrated information system for implementing new technologies and the integrated control of Lagos city in future.



1) Objective

- Build city integrated traffic management center that collects, processes and manages all the information related to the ITS being built in Lagos to link and provide the information to general users, relevant agencies and private information service provider (ISP) who need it.

- Link with BIS/BMS under construction

- Integrated operation and management of the ITS on-site system that will be installed on main roads in Lagos

- Make database, processing and treating for information that is collected from the field

- Provide required information using a variety of media to the user that requires the information

  - Build Lagos integrated traffic management center that may operates the whole city of Lagos including main functions of processing, treating and providing information collected form Lagos ITS on-site system.

- Lagos integrated traffic management center performs a role as a central city of Nigeria that plays roles in connecting information with relevant agencies through integrated management of security and transportation operation for the entire city of Lagos.

- In addition, it performs a role as the integrated management center to manage integrated for all of the elements consisting city infrastructure such as security, transportation, environment, government, disaster and facilities.

2) Definition of function

  - Lagos integrated traffic management center is responsible for processing and treatment of traffic information collected, traffic operation and management of the information and connecting information with relevant agencies.

  - Lagos integrated traffic management center provides overall control and management for a system based on the ITS and Security, and the scalability of the features shall be considered to enable effective operation and management when the system will be expended in future.

  - Lagos integrated traffic management center is responsible for operation and management of ITS system as well as functions as integrated traffic control center that provides integrated control such as security, transportation, and facilities, disaster prevention, etc. in the entire city of Lagos.

    ① Collection and integration of transportation information

- Collect real-time traffic, speed and occupancy data from the field system to operate a traffic management (Vehicle detectors, AVI, CCTV, on-site reports, etc.)
- The data collected in the field is transferred to the center and the data is to be database.

② Processing and management of traffic information

- As the process of processing and treating the data collected from the filed in the integrated traffic management center, the center performs primary process the collected raw data by traffic engineering algorithm to provide information as traffic information.

- Processed information: travel time for each sections, traffic speed, traffic accidents, passing traffic, congestion rate of main intersections, etc.

- If it is impossible to collect information from the site, it is responsible for the function that may manage database systematically to analyze traffic situations using past history data.

- Used as the basis for the Lagos transport policy and planning with supporting traffic analysis based on past historical data

- Provide collected information by Text, Voice and Video via a variety of media or transport the information combined from them.

③ Provision and distribution of traffic information

- This refers to the calculated result from the processing and treating steps and the primary processed information will be provided to relevant organizations through a wired or wireless network of the filed system on roads.

- Filed system: Variable message sign (VMS), BIT, etc.

- Wired/wireless network: Mobile, DMB, traffic broadcast, Internet, etc.

- Primary processed basic traffic information is public information and provided for free while the information is provided at a cost to Service Information Provider (ISP) that is in charge of traffic information distribution service such as large portal service and TPEG provider, etc.

④ Traffic management and control

- This function controls moving flows of vehicles traveling on the road and keeps traffic flow smooth by providing controllable information including traffic control signal.
- It also provides radio detection for incidents and information immediately to emergency agencies, polices and related agencies when an incident is occurred so that it is possible to rapid response for the incidents.
- This function automatically handles a vehicle that violates the traffic laws such as speeding and signal violation with real-time enforcement.

⑤ System maintenance

- This function is responsible for maintenance of the site and center system and emergency treatment upon system failure.

c. Building direction of Lagos integrated traffic management center

1) Calculation of estimated space of the integrated urban traffic management center

- An integrated traffic management center is required in Lagos to build a city integrated traffic management system that may operates the entire city of Lagos including main functions of processing, treatment and providing information collected form Lagos ITS on-site system.

- Collection and integration of traffic information, processing and management of traffic information, provision and distribution of traffic information and traffic management and control

- Information integration and system maintenance

- Provide a comprehensive service for the Lagos integrated traffic management center

  - It shall be planned to secure the space for performing functions for traffic Information center to operate and manage traffic information as well as for City integrated traffic control center.

- The area required for each function in the center has been planned by considering allocation of the number of people residing in it and enough space expansion for installing computational equipment and facilities.

- Consider the scalability for the function of the Lagos integrated traffic management center in future

- Calculate size of situation room consider additional construction for the center system and secure space for additional transportation facilities

[Table 4.3-23] Estimated space of city integrated traffic control center

Classification	Configuration of room on floors	Estimated space(㎡)
Traffic Situation Room	- Collection and delivery of traffic information and display and control on traffic boards - Bus information and management - conferencing and monitoring to respond to special event occurred	495㎡
Enforcement Situation Room	- Control boards of signal/speeding enforcement for operators	99㎡
CCTV control room	- Traffic control, Collection of video information including security and control boards for operators	330㎡
Information storage room	- Keeping date such as documents relating to integrated traffic information center, CD, penalty documents	33㎡
Data processing room	- Transmit and process CCTV videos and advanced traffic signal control information	148㎡
Communication room	- Send the data collected in the field to be filed after processing it in the center	
Office	- Work space for operators who are required for communication and computational tasks in the center	330㎡
UPS room	- Installation space for battery equipment	49㎡
Broadcasting room	- Broadcasting space for announcers and reporters dispatched from external broadcasting stations	66㎡
Show room / meeting room	- Place for tour of visitors and they may watch situation room from inside of this room	396㎡
Electrical room	- Consists of the equipment that distributes electricity	297㎡
Machine room	- Consists of the equipment for maintaining the proper temperature and ventilation in the center	

Night Duty Room	- Space where operators may rest during the night shift	
Utility room	- Utilized for warehouse, etc.	
Total		2,243㎡

2) Selection of location

- Location for the Lagos integrated traffic information center shall be considered for operational efficiency and accessibility with the other relevant organizations in order to function as the general information center to collect/provide traffic information across Lagos.
- Location of the Lagos integrated traffic information center shall be selected by analyzing advantages and disadvantages in various criteria for points capable of performing traffic management strategies, spatial scopes of the target area, linkages of related work, function and efficiencies of communication facilities, security of site and its scalability.
- Criteria for selecting location of the Lagos integrated traffic information center and target points associated with the criteria are described in Table 4-24.

[Table 4.3-24] Location selection criteria of the Lagos TIC

Selection criteria	Selected contents
Performing traffic management strategy	- Cooperative systems with the various agencies are required for performing traffic management, incident management, disaster management, emergency management, etc.
Spatial range of the target area	- Its space shall be at the center of the target range as much as possible and suitable in terms of operation and maintenance.
Connectivity with related works	- For the connectivity of responsibilities, business associations shall be considered with other relevant agencies such as Lagos City hall, Lagos police stations and other relevant agencies.
Function and efficiency of the communication facilities	- When constructing pipeline only for communication, the cost of construction may be different depending on the location of the center. Thus, the location shall be selected by considering the communication facilities.
Security of site and scalability	- The site shall be selected at a location that fully secures the site considering construction of the center building or expansion of large scale in the long-term.
Other environmental conditions	- It shall be considered for operating conditions of the center system, operating and installation conditions of the subsystem of center, accessibility of the operation, environmental requirements, structural condition of the center building, security and reliability of power supply/equipment, etc. - Space that may provide accessibility and comfort for other promotion, visitor tour, training, etc.

4.3.9 Calculation of Stepwise Project Budgets

- The total project budget for Lagos is estimated to be a total of 2,820 million dollars to the long-term while it will cost 1,000 million dollars in the short-term, 970 million dollars in the mid-term and 850 million dollars in the long-term.
- 35.4 percent of the total project budget is allocated to the short-term phase and 34.5 percent is allocated to the mid-term phase. The rest (30.1 percent) of the total budget is allocated to the long-term phase.
- Short-term projects shall be promoted mainly for building infrastructure for ITS implementation and will be expanded to mainly for services in the mid-term and the long-term phases.

[Table 4.3-25] Budget breakdown of Lagos ITS overall project

(Unit: million USD)

Classification	Short-term (2012-2014)	Mid-term (2015-2017)	Long-term (2018-2020)	Total	Ratio (%)
1. Advanced traffic signal control system	5.5	2.9	-	8.3	29.6%
2. Incident and disaster management system	1.0	1.3	0.4	2.7	9.4%
3. Traffic information collection/deployment system	-	3.5	2.0	5.5	19.5%
4. Speed/signal violation enforcement system	1.1	0.7	-	1.8	6.4%
5. Bus exclusive lane violation enforcement system	-	0.2	1.2	1.4	4.9%
6. Bus Information & Management Systems	-	0.7	4.6	5.3	18.8%
7. Automatic parking fee payment system	0.1	-	-	0.1	0.2%
8. City integrated traffic control center (H/W, S/W, etc.)	2.4	0.5	0.3	3.1	11.1%
Total	10.0	9.7	8.5	28.2	100%
Ratio (%)	35.4%	34.5%	30.1%	100%	-

5. Investment Plan and Strategy for Securing Financial Resources

5.1 Annual Investment Plan and Priority Investment Areas

5.2 Status of Funding and Financing Instruments

5.3 Strategy for Securing Financial Resources

Chapter 5. Investment Plan and Strategy for Securing Financial Resources

5.1 Establishment of Investment Plan

5.1.1 Investment plan by project

- [Table 5-1] shows the investment scale and plan, in phases, for the transport projects that are part of the Lagos Urban Transport Master Plan.

[Table 5-1] Investment plan by project

Project	Detailed contents		Project cost (Million USD)	Investment plan in phases (Million USD)			
				Pilot project	Short-term	Medium-term	Long-term
Road traffic safety	Traffic accident reduction measures	School zone	45.0	4.8	10.2	15.0	15.0
		Blackspot improvement	44.0	9.0	11.0	12.0	12.0
		Camera speed enforcement system	9.3	0.9	2.2	3.1	3.1
		Structural improvement of hazardous roads	100.0	10.0	10.0	40.0	40.0
		Designated pedestrian priority area	21.0	0.7	0.7	9.8	9.8
		Road safety data collection system	20.0	-	-	10.0	10.0
	Transport safety education	Experience education for commercial drivers	1.6	0.3	0.3	0.5	0.5
		Building safety education center	57.0	3.3	15.7	19.0	19.0
	Subtotal		297.9	29.0	50.1	109.4	109.4
Non-motorized transport (NMT)	Sidewalk and bicycle lane expansion project for nine LGAs	Agege	21.05	-	-	21.05	-
		Apapa	13.75	-	-	-	13.75
		Eti-Osa	63.94	-	63.94	-	-
		Ikeja (pilot project)	21.23	21.23	-	-	-
		Lagos Island	13.56	-	-	13.56	-
		Lagos Mainland	9.95	-	-	-	9.95
		Mushin	12.32	-	-	12.32	-
		Oshodi Isolo	25.03	-	-	-	25.03
		Surulere	25.28		25.28		

	Subtotal		206.11	21.23	89.22	46.93	48.73
Intelligent transportation system (ITS)	Advanced signal control system		8.4	5.5	2.9	-	-
	Emergency and disaster management system		2.7	1.0	1.3	0.4	-
	Traffic information collecting/providing system		5.8	-	3.5	2.3	-
	Automatic traffic enforcement system	Speeding/violation of traffic lights	1.8	1.1	0.7	-	-
		Violation of reserved lanes	1.2	-	0.6	0.2	0.4
	Bus information and management system		6.3	-	0.8	4.0	1.5
	Urban integrated traffic control center		5.3	2.4	2.4	0.5	-
	Subtotal		31.5	10.0	12.2	7.4	1.9
Total			535.5	60.2	151.5	163.7	160.0

Note: the investment plan is divided into the following phases: pilot project (~2017), short-term (2018~2020), mid-term (2021~2025) and long-term (2026~2030)

5.1.2 Selection of priority investments by project

- Though the most basic selection criteria for selecting the priority investment projects in phases is through performing an economic feasibility analysis to judge investment efficiency, similar to the issues that the individual project areas faced, the basis for performing an economic feasibility analysis is not available. It is, as a result, difficult to quantify the effects of the improvement and expansion projects.
- While each project, road traffic safety, NMT and ITS, is proposed as an interdependent project with the other projects to maximize project effectiveness, due to the different approaches of each project, it is difficult to set a standardized criteria to select the priority investments. As a result, the selection criteria for priority investments differed depending on each project.

- Road traffic safety: the priority of investments are divided into the short-, medium-, and long-terms, while considering the Lagos State Government's budget for the transport sector and plans for the equal division of investments for the execution of each phase.

- NMT: the priority of investments were selected based on the assessment of the selected criteria (on the basis of the detailed investigation of each study area), whereby the Study Team utilized the AHP method using the selected criteria and weighted average of each item, based on the expert surveys conducted.

- ITS: as this project area requires continued investment for the project contents, the Study Team established an investment plan in phases which balances the host- and sub-systems.

    - The opinions of the Lagos State Government were compiled and adjusted into the priority of investments, as the most important aspect of the priority of investments for each project area is the Lagos State Government's will to propel the project as well as the state government's areas of interest.

5.2 Status of Funding and Financing Instruments

5.2.1 Financial situation and funding sources of Lagos' transport sector

- The Lagos State Government has embarked on a wide range of capital-intensive infrastructure renewal projects since 2007. The total funds necessary for the development of infrastructure in Lagos totals to around $50 billion, which the Study Team proposes to be pursued by businesses in the private sector through a public-private partnership (PPP) model.
- While a set amount of Lagos State's annual budget is not set aside for transportation infrastructure, funds for transportation infrastructure are being allotted from the Economic Affairs sector of the Lagos State's annual budget. The 2014 budget for the Economic Affairs sector is a total of $1 billion dollars, including the funds for a variety of independent electricity projects, such as, the Lagos-Badagry Expressway expansion project, Blue rail line improvement project, and the continuous construction of roads, sidewalks, overpasses, etc.

[Table 5-2] Lagos State's budget by sector

(Unit: US $)

Sector	2010	2011	2012	2013	2014
General Public Service	704,046,666	726,503,226	597,116,667	607,705,556	626,250,000
Public Order & Safety	-	-	76,805,556	106,316,667	100,152,045
Economic Affairs	967,733,333	916,387,097	862,327,778	905,105,556	1,000,290,226
Environmental Protection	191,400,000	234,774,194	245,705,556	245,172,222	248,298,195
Housing & Community Amenities	246,113,333	172,651,613	243,400,000	256,383,333	315,857,512
Health	201,460,000	257,341,935	225,177,778	238,505,556	236,328,457
Recreation, Culture & Religion	-	-	62,788,889	31,938,889	19,344,899
Education	400,273,333	398,148,387	400,961,111	366,355,556	483,898,924
Social Protection	-	-	18,722,222	18,105,556	13,701,722
Total	-	-	2,733,005,556	2,775,588,889	3,044,121,979

Note: 1 US$ = 180 NGN

Source: Lagos State Government's Ministry of Economic Planning and Budget. "Y2013 Budget Analysis (2013.1)" and "Y2014 Budget Half AR/2ND Quarter Performance (2014.7)

5.2.2 Lagos' Official Development Assistance projects

- Though it is difficult to identify the details of Lagos State's projects funded through official development assistance (ODA), according to the Lagos State Government, the total amount of ODA funds is about $29.4 billion for the past ten years since 2003.

[Table 5-3] ODA funds for Nigeria for the past 10 years

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Amount ($ million)	308	577	6,409	11,428	1,956	1,290	1,657	2,062	1,769	1,916

Note: In 2006, the Paris Club Debt gave Nigeria $18 billion in aid.
Source: Transportation Sector Budget for Lagos State of Nigeria, 2014.9, Lagos State Government.

- ODA funds for Nigeria were low in 2003 at a total of $300 million, but have increased with the democratization of Nigeria to a total of $2 billion in 2012.
- The Lagos State Government's budget deficits are being supplied through debt issuance programs, medium-term internal loans, multilateral development fund (MDB) aid and PPP. Notably, the funds from multilateral aid are being used for social, educational, urban improvement and healthcare projects.
- The Lagos State Government was approved to receive $600 million from the World Bank for the three-year (2011-2013) Medium-Term Expenditure Framework, and received the approved loan for the first project in 2011; however, in 2012 and 2013, at the government's request, the loan was rejected. The government mitigated the progress of construction for two years and approved the phase 2 project expenditure equivalent to $200 million.

5.2.3 Lagos State's Official Development Assistance projects in the transport sector

- World Bank funded $200 million for the development of the Lagos Metropolitan area and the Lagos State Government's projects, which are being used to sustainably increase urban services.

- Lagos State's urban transport projects: inflow from the French Development Agency (FDA) for the efficient development of the transportation system.

- Of the total cost of the LUTP Project, which is $130 million, $100 million was shared between the IDA and the Nigerian government.

- An additional $50 million was approved by the Board of Executive Directors of the World Bank in 2007.

- [Table 5-4] shows examples of Lagos State's projects financed through multilateral aid.

[Table 5-4] ODA projects in Lagos State's transport sector

Sector	Project details	Notes
Road transport	• Project name: LAMATA / World Bank Lagos Urban Transport Project (LUTP) • Project cost : $130,000,000 • Source: World Bank • Loan: $100,000,000 (IDA and Nigerian government) • Project contents: extension of 3 roads (total length of 4.5 km, pavement and sidewalk reconstruction) • Progress: - 1st phase: approved in 2010 - 2nd phase: proposed as BRT project	Expected to be proposed as a PPP project
	• Project name: 10-lane, Lagos-Badagry Expressway Project • Project cost: $1,500,000,000 • Source: World Bank • Loan: undetermined • Project period: 5 years • Project contents: Expansion of Lagos-Badagry expressway (from 4 to 10 lanes) - Construction of expressway expansion, bridges and interchanges - Including LRT and BRT lanes • Progress: proposed as a PPP project - 1st phase of road construction: implemented by Julius Berger - 2nd phase of road and LRT construction: contracted to China Civil Engineering Construction Company (CCECC) - Reflected in Lagos State government's 2014 budget	Proposed as a PPP project

Source: LAMATA's internal data, 2014.9

5.2.4 Nigeria's Public-Private Partnership projects

a. Establishment of federal government policies for the promotion of PPP

- According to the Center for International Private Enterprises (CIPE), the private sector drives 80% of Nigeria's economy, which has resulted in a number of policy changes in the Nigerian government to promote private sector involvement.

- The current Nigerian government has set the goal to become one of the top 20 world's largest economies by 2020, and has persistently proposed policies for economic growth and development. However, this ambitious goal is being hindered due to the poor infrastructure; therefore the need for the improvement and expansion of infrastructure is not only a necessity for improving the quality of life of Nigerians, but also for achieving the Nigeria Vision 20:2020.
- Following this, the Nigerian Federal Government had supplemented "The Infrastructure Concession Regulatory Commission Act of 2005" and established the "National Policy on Public-Private Partnership" to have legal and regulatory provisions for private sector involvement.
- At the 4th Africa Public-Private Partnership Conference in 2012, Nigeria's Vice President, Mohammed Sambo, remarked that PPP is not only a business model that Nigeria is capable of, but it is also a model which is necessary for achieving the visions of the government.

b. Vitalization of public sector through maximizing private sector investment

- The Nigerian Federal Government has taken measures to lay the legal basis in order to pursue PPP projects through the enactment of the following: the enactment of the Infrastructure Concession and Regulatory Commission (ICRC) Act of 2005, and the 2008 National Infrastructure Supervisory Commission.
- Following these enactments, in the case of public sector investments, competitive bidding was applied. All PPP contract are subject to review by the Federal Government's Federal Executive Commission (FEC) in order to provide support for the effective partnership among the Federal Government, affiliated government organizations and the private sector investments in constructing national infrastructure projects.

- Nigeria's Federal Government's sectors of interest for PPP projects.

- Transport infrastructure: roads and bridges, construction of ports, railways, inland container depot, distribution hub, and urban transportation system

- Power, energy: generation, transmission and distribution, gas and oil infrastructure (storage tanks, distribution pipelines, etc.)

- Social infrastructure: provision of water supply and water treatment, (solid) waste disposal and provision of housing

- [Table 5-5] shows Lagos State Government's PPP projects in the transport sector.

[Table 5-5] PPP projects of the Lagos State Government by sector

Sector	Project details
Road	• Project name: Lekki-Epe Expressway Upgrade • Project cost: $382,000,000 • Client: Lagos State Government • Undertaker: Lekki Concession Co., Ltd. (ARM Group) • EPCM: Hitech Construction Co. Limited • Project contents: - 1st phase: expansion and improvement of Lekki-Epe Expressway (50 km) and installation of tollgates - 2nd phase: construction of Lekki peninsula's Coastal Road (20 km) • Project period: 3 years • Concession period: 30-year BOT method, operation, profit from maintenance and fund collection (from tolls)
Rail	• Project name: Lagos Mass Rail Transit System • Project cost: $1,005,000,000 • Client: Lagos State Government • Undertaker: Lagos Metropolitan Area Transport Authority (LAMATA) • EPCM: China Civil Engineering Construction Company (CCECC) • Project contents: construction of Blue Line - The Lagos State Government is funding the design, contracting, operation and vehicles, warehouse facilities, communications systems and control systems (including maintenance)
Airport	• Project name: Lekki-Epe International Airport Project • Project cost: $450,000,000 • Client: Lagos State Government • EPCM : undecided • Project contents: construction of airport terminal - Airport terminal building, air traffic control facilities, airfield ground lighting, navigational aids and aircraft ground services, digital surveillance for transportation, baggage and cargo handling systems and equipment and airport terminal and runway cleaning • Concession period: 25-year maintenance concession
Cable car	• Project name: Lagos Cable Car Transport Project • Project cost: $280,000,000 • Client: Ropeways Transport Limited • Consultants: Dopplemayr Cable Car GmBH • Cooperating organization: Lagos State Government and Lagos Mass Transit Authority (LAMATA) • Project contents: purely through private investment - AfDB funding of $1,300,000 • Concession period: operated through a 30-year franchise agreement
Port	• Project name: Lekki Deep Seaport Project • Project cost: $1,500,000,00 • Client: Nigerian Ports Authority (NPA) / Lagos State Government • Undertaker: Tolaram Group

	• EPCM: China Harbor Engineering Company • Project contents: construction of container terminal - Begin construction in 2015, start operation of container terminal in 2018

Source: LAMATA's internal data, 2014.9

- While the Nigerian government shows interest and efforts in various sectors such as road, power, telecommunications, and urban transportation, there still exists a great lack of national infrastructure and insufficient funds. Trends show that foreign companies as well as Korean companies are interested in PPP projects, as opposed to merely providing funding for the Nigerian government, in the construction of roads and bridges and building an urban transportation system. Nonetheless, these projects are not actively progressing forward.

5.2.5 Strategy for African Development Bank funding

- As Nigeria is an oil-producing, lower middle-income country (with a GNI per capita between $1,006 and $3,975), the African Development Bank (AfDB) funds large-scale plant projects, mostly in the form of providing finances to the construction companies which the Nigerian company hires.
- From examining the AfDB's funds, including loans and grants, to African countries from the past five years, it can be calculated that the total funds given to Nigeria account for 6.1% of that of all African countries.

[Table 5-6] AfDB's loans and grants to Nigeria

(Units: $ million, %)

		2009	2010	2011	2012	2013	'09～'13	'67～'13
Nigeria	Amount	365.0	67.8	453.6	63.9	410.6	1,360.9	3,918.0
	Ratio	4.9	1.8	11.0	1.8	11.5	6.1	5.8
Total approved amount		7,505.7	3,674.5	4,127.9	3,602.8	3,561.1	22,472	67,223.8

Source: AfDB Group, 2013 Annual Report.

5.2.6 Economic Development Cooperation Fund

a. Overview of the Economic Development Cooperation Fund

- The Economic Development Cooperation Fund (EDCF) was established in 1987 as an international funding mechanism to provide aid for developing

countries' business and economic development, as well as the economic cooperation between Korea and the recipient countries.

- EDCF's funding is provided in the form of government contributions, financial loading of special account loans and fund management funding. In early 1987, the Korean government contributed KRW 30 billion, which has accumulated to a total of around KRW 3.4 trillion ($3.242 billion) by the end of 2013.

- Upon examining the approved funds by continent and area, by the end of 2013, of the total loan amount of KRW 10.15 trillion for developing countries, KRW 6.4 trillion (64.4%) was for Asia and KRW 2.2 trillion (21.3%) for Africa. The total disbursed amount for the end of 2013 was KRW 4.4 trillion.

[Table 5-7] EDCF's funds up until the end of 2013 (cumulative from 1987~2013)

(Units: KRW hundred million, %)

Sector	Number of countries	Number of projects	Approved		Disbursed	
			Amount	Ratio	Amount	Ratio
Transport	22	81	32,765	32.3	15,646	35.3
Water resources/sanitation	18	51	7,794	7.7	5,606	12.6
Energy	16	32	10,575	10.4	4,585	10.3
Health	16	37	11,080	10.9	4,814	10.9
Communications	20	32	7,515	7.4	4,740	10.7
Other	-*	78	31,792	31.3	8,972	20.2
Total	52	311	101,521	100.0	44,363	100.0

Source: Korea EXIM Bank, 2013 EDCF Annual Report.

b. Economic Development Cooperation Fund's aid to Nigeria

- In the case of Nigeria, two projects amounting to a total of almost KRW 19 billion and accounts for 0.2% of the total approved amount (0.4% of the disbursed amount). Out of the total funding for Africa, the approved amount for Nigeria accounts for 8.8%, which shows that Nigeria was not the main funding recipient of the EDCF.

- The two projects for Nigeria include the Passenger Coach Purchase Project of 1987 and the Locomotive Modernization Project of 1991, whereby the scale of the loan for each project was KRW 8.05 billion and KRW 10.93 billion, respectively.
- The Railroad Car Modernization Project introduced around 50 railroad cars and improved the carrying capacity of passenger transportation with the goal of providing the general public convenience when transporting the rising number of railroad passengers. The details of the project include 24 secondary cars, 6 generator cars, 3 sleeping cars, 3 dining cars, and the purchase of spare parts.
- The Locomotive Modernization Project replaced the existing deteriorated locomotives with the goal to improve the carrying capacity of passenger transportation and rail road cargo deliveries, reduce transport costs and save transport times. The project included the purchase of 5 locomotives with engines from General Motors.
- After 1991, funding for Nigeria has been nonexistent and all loans have been paid off.

[Table 5-8] EDCF funding for Nigeria

(Units: KRW hundred million, %)

Project name	Approved amount	Disbursed amount	Approved	Lending rate	Maturity period	Term of loan
Passenger Coach Purchase Project	80.5	80.5	1987.12	5.00	20	5
Locomotive Modernization Project	109.3	109.3	1991.11	3.50	20	5
Total	189.8	189.8				

- Currently, there are, to some extent, issues for EDCF funding for Nigeria. The central government is rejecting EDCF loans, and only acts as the role of a borrower for projects proposed by the local governments, and does not act as the role of a guarantor for the local governments. Therefore, unless there is a

change of policy for the central government, EDCF funding for projects proposed by local governments in Nigeria will be difficult.

- In addition, Nigeria is classified as a Group 4 country according to its income standards. Countries in this group have a tendency in which they are not supported through tied aid, and therefore run against EDCF policies.
- As a result, even if the aforementioned issues for EDCF funding for Nigeria are resolved, it takes too much time in order to be granted approval by the central government and takes at least two years from acquiring approval to order. Therefore, EDCF funding is impractical for not only the pilot project, but also for the short- and medium-term projects.

c. Economic Development Cooperation Fund's aid in the ITS sector

- The EDCF has funded various projects in the ITS sector, such as the Ulaanbaatar Intelligent Transportation System (ITS) Project, Mongolia (KRW 17.3 billion), Intelligent Transportation System Project for Ho Chi Minh-Trung Luong Expressway (KRW 32.6 billion), Intelligent Transportation System Project in Santo Domingo, Dominican Republic (KRW 38.5 billion), which amount to a total of KRW 88.4 billion.
- In 2014, the Indonesia National Road Integration Data Center master Plan and Pilot System Project (KRW 1.59 billion) and two other projects are expected to amount to a total scale of KRW 5.378 billion.

[Table 5-9] EDCF funding for ITS project

Year	Country	Project name	Approved amount (KRW million)	Lending rate	Maturity period	Term of loan	Note
2006	Mongolia	Ulaanbaatar Intelligent Transportation System (ITS) Project	17,327	0.50	30	10	Development project loan
2009	Vietnam	Intelligent Transportation System Project for Ho Chi Minh-Trung Luong Expressway	32,656	0.05	40	10	Development project loan
2011	Dominican Republic	Intelligent Transportation System Project in Santo Domingo	38,437	0.20	40	10	Development project loan
2014	Indonesia	Master Plan for Indonesia's National Road Integrated Data Center and Pilot System	1,590	-	-	-	Scheduled for order '14.8

2014	Indonesia	Master Plan for Indonesia's National Road Integrated Data Center and Pilot System	1,568	-	-	-	Scheduled for order '14.10
2014	Bangladesh	Bangladesh Road Traffic Authority Traffic Administration Information Computerization Project (System development, including tools & equipment)	2,220	-	-	-	Scheduled for order '14.7

5.2.7 KOICA

a. KOICA's Official Development Assistance for Nigeria

- After 1991, KOICA provided a total of $14.33 million to Nigeria in ODA funds, and trends show that aid is increasing gradually.

[Table 5-10] Annual funding for Nigeria

Year	Amount ($ ten thousand)	Year	Amount ($ ten thousand)	Year	Amount ($ ten thousand)	Year	Amount ($ ten thousand)
1991	4.9	1997	5.6	2003	8.2	2009	173
1992	4.8	1998	2.5	2004	10.9	2010	308
1993	4.5	1999	4.4	2005	15.9	2011	252
1994	2.2	2000	2.8	2006	104.3	2012	160
1995	7.4	2001	10.0	2007	88	2013	253
1996	4.2	2002	22.0	2008	239.4	Total	1,433

Source: KOICA-Supported Projects by Country- Nigeria. 2013, 1. KOICA.

- KOICA's ODA for Nigeria is in the education, health and agricultural sectors, with no projects in transportation infrastructure up to date.

[Table 5-11] Support by project type

Project type		Project details (project period/scale of support)
Technical cooperation projects (Korean training programs)	~ 2012	446 people, $3.33 million
	2013 (tentative)	117 people, (22 courses)
Projects	Education	Construction of elementary school (Gombe and Adamawa) ('10-'11 / $2.8 million)
		Expansion of elementary school classrooms (Kogi and Katsina) ('08-'09 / $1 million)
		Construction of vocational training institute (Kogi) ('10-'13 / $3.5 million)
	Health	Strengthening of HIV/AIDS diagnosis ('08-'09 / $1.5 million)
	Agriculture	Agriculture manufacturing center (Kogi, Ogun, Enugu) ('07-'10 / $1.6 million)
	Subtotal	6 cases, $9.61 million
Expert dispatch		2 people, $20,000
Tae kwon do master dispatch		1 person, $80,000
Material support		12 cases, $1.29 million

Source: KOICA-Supported Projects by Country- Nigeria. 2013, 1. KOICA.

- KOICA's Medium Term (2014~2017) ODA scale amounts to KRW 2.577 billion, and the amount which is planned for Nigeria is $15.9 billion, which is around 3.8% of the planned amount for Africa. The sectors which these projects are planned for are in the education and vocational training sectors.
- However, due to future changes of Nigeria's circumstances, the $5 million of the other practical support for projects can be expected.

[Table 5-12] KOICA's Medium-Term budget

		Annual scale of budget ($ million)				
		Total	2014 (Budget)	2015 (Required standard)	2016 (Required standard)	2017 (Required standard)
KOICA		2,577.2	523.8	610.6	683.3	759.4
Region	Subtotal	1,313.5	264.5	313.7	349.1	386.2
	Africa	416.0	88.1	100.0	109.2	118.8
	Nigeria	15.9	1.6	4.2	4.8	5.3
	Asia Pacific	631.5	120.7	151.0	170.0	189.8
	Central and South America	130.9	25.9	31.1	35.0	39.0
	Middle East and CIS	135.0	29.8	31.6	35.0	38.5
Global programs		922.5	197.6	214.4	241.2	269.4
Support for cooperation projects		225.7	43.6	53.8	60.6	67.6
Climate change and environment		115.5	18.1	28.8	32.4	36.2

Source: 2014~2017 KOICA Medium-Term Budget Standards (Government Contributions), 2014, KOICA.

b. KOICA's funding in the transport sector

- From its establishment in 1991 until 2013, KOICA has funded a total number of 48 projects, amounting to $87.4 million with each project averaging $1.82 million.
- When examining by region, KOICA has funded one project each in Eastern Europe and the Commonwealth of Independent States (CIS), as well as one project in Oceania, two projects in Africa, three projects each in the Middle East and Central and South America. 87% (or 40 projects) of KOICA's projects in the transport sector are in Asian countries.
- The majority of these projects, making up a total of 33 projects, is in the form of feasibility studies, preliminary studies and design, as well as six master plans and six construction and system building projects. By transport sector,

27 road projects, eight rail projects, five airport development projects, three ITS projects, two BRT/public transportation projects, one road traffic safety project, but zero projects in NMT.

- While most of the projects in the 1990s were in the form of feasibility studies, preliminary studies and implementation design, recently projects have transformed towards an increase in BRT/public transportation and ITS projects.

[Table 5-13] KOICA's transport-related projects (1993~2014)

(Unit: $ thousand)

Sector	Country	Feasibility study/design (Number of projects)	Master plan (Number of projects)	Construction project (Number of projects)	Average project cost	Total project cost
Road	Indonesia	5	1	-	1,633	9,800
	Vietnam	1	-	-	558	558
	Philippines	3	-	-	807	2,420
	Nepal	2	-	-	1,279	2,558
	Palestine	-	-	1	1,500	1,500
	Sri Lanka	3	-	1	973	2,919
	Cambodia	3	-	1	4,245	16,979
	Laos	1	-	1	1,150	2,300
	Iraq	1	-	-	2,000	2,000
	Paraguay	1	-	-	2,000	2,000
	Myanmar	-	1	-	4,000	4,000
	Ethiopia	-	-	1	101	101
	Subtotal	20	2	5	1,687	47,135
Rail	China	1	-	-	330	330
	Vietnam	2	-	-	1,050	2,100
	Myanmar	1	-	-	1,200	1,200
	Bangladesh	1	-	-	3,000	3,000
	Cambodia	-	1	-	2,800	2,800
	Paraguay	1	-	-	2,000	2,000
	Indonesia	-	1	-	2,000	2,000
	Subtotal	6	2	0	1,769	13,430
Airport development	Papua New Guinea	1	-	-	608	608
	Philippines	1	2	-	1,900	2,800
	Montenegro	1	-	-	1,000	1,000
	Subtotal	3	2	-	1,352	7,208
Public	Vietnam	1	-	-	2,000	2,000

transportation	Cameroon	1	-	-	1,500	1,500
ITS	Iraq	-	-	1	5,000	5,000
	Paraguay	-	-	1	5,300	5,300
	Sri Lanka	1	-	-	2,500	2,500
	Subtotal	1	-	2	4,267	12,800
Road safety	Cambodia	1	-	-	3,200	3,200
Total		33	6	7	2,364	87,273

Source: KOICA's Transport-Related Projects (19C91-2013). 2014.8. KOICA.

5.3 Strategy for Securing Financial Resources

5.3.1 General direction

- The Study Team considered the nature of the projects in developing the strategy for securing financial resources. Each project's strategy was derived considering the following aspects:

- The recipient country's burden of the necessary funds (scale of finances)
- Depending on the type of the project, funding was divided into projects funded by the recipient country's government and the Korean government (possibilities of entering recipient country's market)
- Compatibility of financial resources and project requirements (the road traffic safety and NMT projects are not for-profit and therefore are incompatible)
- Timeliness (compatibility of the timing of the project and the proposed duration of the project/ promptness): consistency between the funding plan and the project execution period
- Recipient country's policy direction for constructing transport infrastructure
- Expansion (and maximization) of opportunities for securing financial resources and impact of project through connecting and integrating into Lagos' existing Strategic Transport Master Plan

5.3.2 Optimal strategy for securing financial resources by project

a. Road traffic safety

- For the three projects under "management and diagnosis of transport industry" of the road traffic safety portion of the Master Plan, including the safety management system for transport companies, diagnosis of road safety of the transport industry and the enhancement of vehicle performance tests, the Study Team proposes that these projects are supported and funded by KOICA and the Korean government through Korean companies.

- As the projects in this portion of the Master Plan are not on a for-profit basis, it is proposed that these projects are funded as public projects as opposed to that of private.

- Korea has extensive experience in the projects in this portion of the Master Plan, while the Nigerian government or companies have comparatively less experience. Korea's Ministry of Land, Infrastructure and Transport is currently supporting projects in the diagnosis of road safety of the transport industry and the enhancement of vehicle performance tests in several countries, such as the Philippines, Mongolia and Pakistan.

- Considering KOICA's scale of funds, these projects will not place a large burden on KOICA's budget.

  - For the automatic speed enforcement system project under the "traffic reduction measures through improvement and expansion of facilities" in the road traffic safety portion of the Master Plan, because this is considered strongly as a public good, generating additional profits would be difficult, thereby, upon examining KOICA's scale of ODA and case studies of ITS projects in other countries, the Study Team proposes that this project be funded through ODA.

  - For the following projects: school zone, black spot improvement, structural improvement of hazardous roads, designated pedestrian priority area and the road safety data collection system, the Study Team proposes that it would be the most appropriate if the projects be undertaken by the Lagos government, if possible, due to the site-specific nature of these projects. Considering the Lagos State government's financial expenditure scale and the budget for the transport sector, the Study Team assessed that these projects will not be difficult to implement. However, in the case that funds are unavailable, the Study Team proposes that the projects are implemented either wholly or partially through MDB funds, as the projects in the road traffic safety portion are not difficult to be attained from the MDB.

- For the projects under the "transport safety education" and "legal and institutional improvement" of the road traffic safety portion, the Study Team proposes that the projects are most appropriate to be undertaken by the Lagos State government, as the Study Team assessed that the government will not have difficulty in implementing these projects. However, in the case that funds are unavailable, the Study Team proposes that the projects are implemented either wholly or partially through MDB funds, as the projects in the road traffic safety portion are not difficult to be attained from the MDB.

[Table 5-14] Strategy for securing financial resources by project

Project	Proposed strategy	Detailed contents	Strategy for securing financial resources
Road traffic safety	Management and diagnosis of transport industry	Safety management system for transport companies	• KOICA and Korean government (pilot project)
		Diagnosis of road safety of transport industry	
		Enhancing vehicle performance test	
	Traffic reduction measures through improvement and expansion of facilities	School zone	• 1st: Lagos State's funds (including pilot project) • 2nd: MDB or MDB and Lagos State's funds
		Black spot improvement	
		Camera speed enforcement system	• KOICA(ODA) funding or MDB
		Structural improvement of hazardous roads	• 1st: Lagos State's funds (including pilot project) • 2nd: MDB or MDB and Lagos State's funds
		Designated pedestrian priority area	
		Road safety data collection system	
	Transport safety education	Experience education for commercial drivers	
		Taylor-made education programs for children	
		Education facilities for traffic safety	
	Legal and institutional improvement	Development of road safety design guideline	• KSP and KOICA-CSR
NMT	Improvement and expansion of facilities	Installation of sidewalk (drainage, dividers, etc.)	• 1st: Lagos State's funds (including pilot project) • 2nd: MDB or MDB and Lagos State's funds
		Expansion of bicycle lane	
	Policy support	Vitalization of use and operational efficiency	
ITS	Advanced cutting-edge transportation system	Real-time signal control system	• KOICA(ODA) funding or MDB
		Unforeseen situation management system	
		Traffic information provision system	
		Traffic signal and speed (violation) enforcement system	
		Bus information and management system	
		Automatic parking fee collection system	• Funding through PPP
		Integrated urban control center	• KOICA(ODA) funding or MDB

b. Non-motorized transport

- In the case of the installation of sidewalks and expansion of bicycle lane projects that are under the "improvement and expansion of facilities" in the NMT portion of the Master Plan, while the budget necessary is $206.1 million, there is not a large need for advanced technology, therefore the Study Team proposes that these projects are undertaken through Lagos State's funds.
- Considering the Lagos State government's scale of finances and the budget for the transport sector, the Study Team assessed that these projects will not be difficult to implement. However, in the case that funds are unavailable, the Study Team proposes that the projects are implemented either wholly or partially through MDB funds. If necessary, considering the financial situation, the phased investment plan can be adjusted.
- For the vitalization of use and operational efficiency of NMT, the Study Team proposes that it be the most appropriate for the Lagos State government to undertake these projects.

c. Intelligent transportation system

- The automatic parking fee collection system is the only project which has the possibility of generating additional projects. As a result, the Study Team recommends that a PPP approach is the most suitable for this project, as it would reduce the financial burden as well. As mentioned previously, the Nigerian government has formed a solid institutional foundation for PPP projects and several PPP projects are underway, therefore, the Study Team assesses that this approach would be the optimal method.
- The Study Team proposes that the remaining six projects in the ITS portion of the Master Plan be funded through the ODA/EDCF (long term). While

considering the comparatively smaller scale of ODA/EDCF's funds ($28.1 million), and the lower funding for Nigeria compared to other countries, the ODA(short term)/EDCF (long term) has funded a variety of similar ITS projects in other countries. As a result, the Study Team proposes that the ITS projects are funded through the ODA/EDCF, allowing for Korean companies to bid on the projects. Korean companies have extensive technical experience in the six project areas of the ITS portion, as well as experience in the international market, therefore, the Study Team proposes this optimal approach.