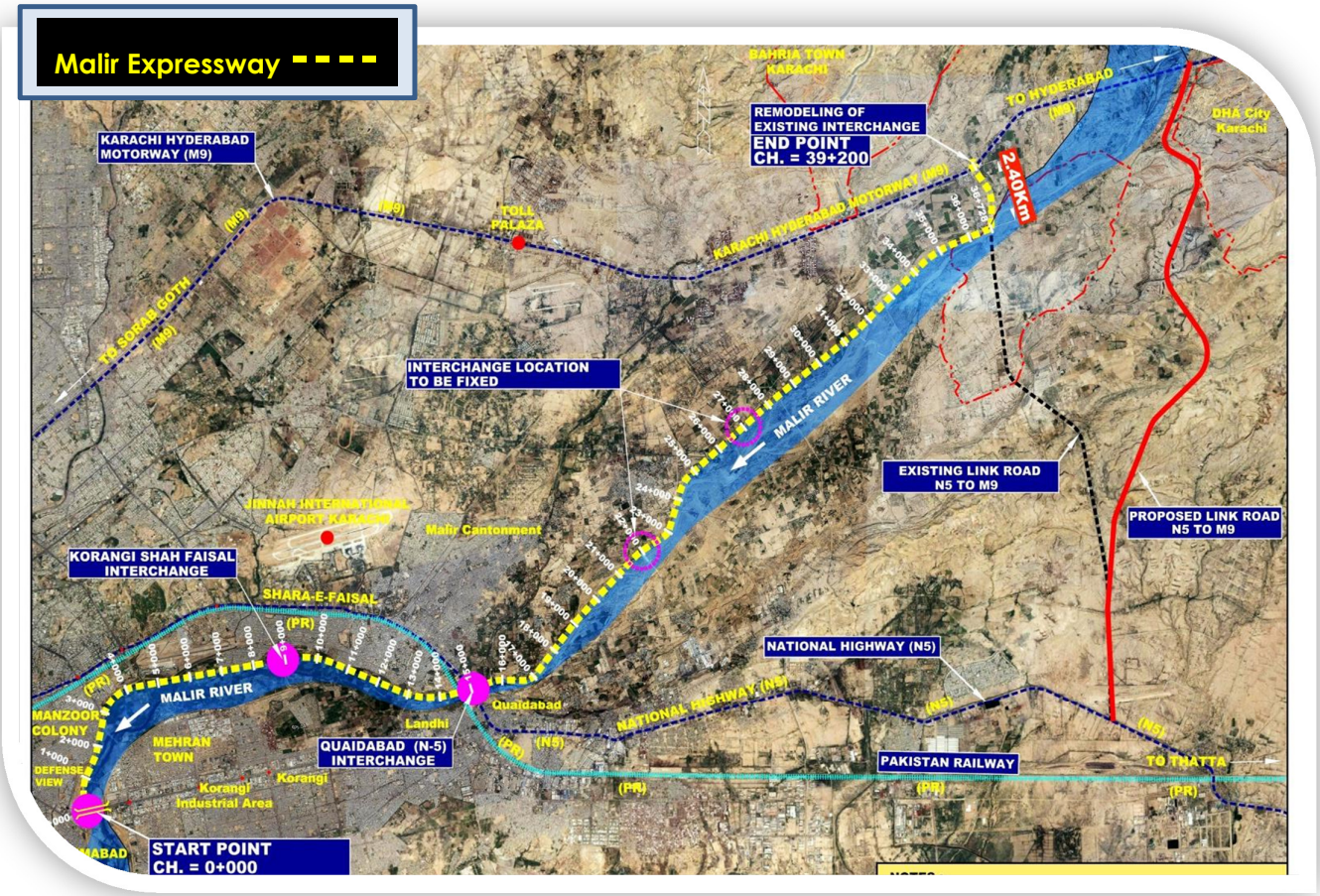
MALIR EXPRESSWAY PROJECT

TRAFFIC STUDY REPORT

September 2019



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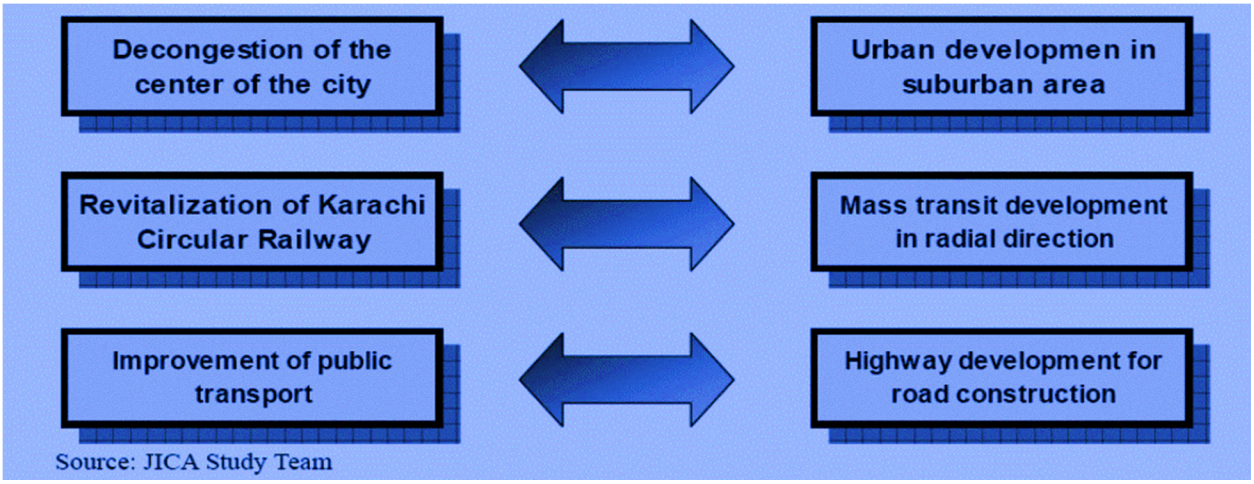
EXECUTIVE SUMMARY

Located along the shores of Arabian Sea, Karachi is Pakistan's gateway and the largest metropolitan city. It is also the capital of Sindh province and the country's main seaport, economic and financial center sprawling over an area of about 3500 square kilometer. Like other major port cities and commercial centers in the World, Karachi also attracts people from all over the country and beyond in search of better economic prospects. Therefore, due to this high rate of in-migration, the population of this fast-expanding megacity has been growing annually by 4.2% since 1998. According to JICA Study 2012, Karachi Transport Improvement Plan - Final Report, it is projected to grow from 18.9million in 2010 to around 31.6million in 2030 and would thereby make it the fastest growing city in the World.

This rapid increase in population has put a lot of pressure on the city's infrastructure especially the urban transport system (UTS) which is not yet organized in a modern manner, and therefore barely caters to the mobility needs of the mega city. With limited infrastructure and low level of public services coupled with other factors such as weak traffic management, lack of modern mass transit network, a rapid level of motorization of roads has been observed during the last two decades resulting in severe traffic congestion and unnecessary delays, noise and air pollution along the main corridors of travel in the city and impeding the economic efficiency and growth. The various challenges being faced by urban transport system in Karachi were also highlighted in the Final Report of Karachi Transport Improvement Project – JICA Study 2012, as shown in following figure:



Source: JICA Study Team

In view of the phenomenal population growth, increase in vehicular traffic and the consequent traffic congestion and delays across the city, the Local Government Department, Government of Sindh has envisaged to construct Malir River Expressway as a strategic expressway which will serve as the southern alternative route for carrying

traffic of the port and industrial areas to the main highways and will also provide speedy access to key real estate schemes along the route. Location plan showing the proposed alignment of Malir Expressway is presented as Fig. 1.1. The Project was:

- Already included for development in the Karachi Master Plan 2020.
- Final Report on "Preparatory Survey on JICA Cooperation Program for Industry Development (Investment Climate Improvement in Karachi)" also considered it as the most viable option among the other competing routes.
- Also recommended for future development in "The Study for Karachi Transport Improvement Project" by JICA.

Upon its completion, the travelling time from the Karachi-Hyderabad Motorway, M-9 to KPT interchange on the main Korangi Road (Formerly known as the Hino Chowk) will be reduced to only 30 minutes. Therefore, the daily commutation between Karachi Port, Industrial areas of Landhi and Korangi, and also between the CBD area, Clifton and DHA (Phase 1 to 8) and the proposed DHA City & the Education City would be more convenient, uninterrupted and economical. The traffic conditions on the urban road network in Karachi would also improve substantially as the external traffic would shift to Malir Expressway.

Traffic Study is a pre-requisite to the planning, design and construction of any transport project as it provides the basic parameters for Project appraisal, planning, design and construction. It is especially more important for a Greenfield Project, like Malir Expressway, that is proposed to be constructed along a new alignment where no such facility exists at present and which would also serve many upcoming developments in the corridor including the DHA City, the Education city and the fast developing Bahria Town. Therefore a comprehensive Traffic Study was undertaken for the Project before moving ahead into Planning and Design stages covering all these aspects and its potential to serve the goods traffic moving between Karachi Ports and Landhi / Korangi Industrial areas and upcountry to interior Sindh, Punjab, KPK and beyond.

A well-conceived analytical framework was developed on the basis of available knowledge-base of the existing development pattern along the corridor, the increasing traffic congestion and delays on the road network in Karachi and the growing demand for another exclusive route for the North – South connectivity, especially for the traffic between Karachi Port including SAPT, KCIT, PICT, Oil Terminal, Landhi / Korangi Industrial areas and the up-country and also for linking the above stated new developments in the Northern suburb with DHA and Clifton areas in the South of the city. Accordingly

three mutually exclusive analysis scenarios were used for calculating the travel demand for the proposed Malir Expressway Project. The main assumptions underlying these scenarios are briefly presented below:

Analysis Scenario – 1:

The analysis scenario -1 presents an optimistic situation for the proposed Malir Expressway Project resulting in a higher traffic diversion to it under the following assumptions:

- The traffic conditions on the existing road network further deteriorate due to increased population and higher traffic volumes,
- There is no significant improvement of the network condition and capacity to handle further traffic especially on the other competing routes,
- The shuttle train service proposed by Pak Rail to transfer container cargo to upcountry via Pipri Marshalling Yard does not become operational
- The Elevated Expressway Project conceived by KPT still remains unexecuted.
- No significant improvement in the public transport system in the city resulting in an even higher level of private transport usage.
- The DHA City, Bahria Town and the Education City schemes develop at a faster pace resulting in additional daily trips between these facilities in the Northern suburbs and the Southern parts of the city especially the CBD and the DHA and Clifton areas. The interaction of traffic between these new developments will most likely result in increased traffic on Malir Expressway.

Analysis Scenario – 2:

The analysis scenario -2 presents a Pessimistic Situation for the proposed Malir Expressway Project resulting in a lower traffic diversion to it under the following assumptions:

- A significant improvement in the public transport system by implementation of the BRT System on the main transit corridors in the city especially the BRT Green, Blue, Red, Yellow and Orange Lines, resulting in a higher level of public transport usage and consequently decrease in private transport usage i.e., lesser volumes of private cars, motorcycles and paratransit vehicles; although so far this has only been in plans.
- The traffic conditions on the existing road network will undergo a remarkable improvement by better traffic management strategies based on the application of modern technology; however, such has not been the case.

- There is significant improvement in the network condition and capacity to handle further traffic especially on the existing competing routes,
- The shuttle train service proposed by Pak Rail to transfer container cargo to upcountry via Pipri Marshalling Yard becomes operational taking away about 40% of the containerized cargo traffic from the road network
- The Elevated Expressway Project conceived by KPT becomes operational and provides a direct connectivity from East Wharf, SAPT and Keamari Oil Terminal to West Wharf and onwards to Northern Bypass. This presumes that the KPT Expressway has proved to be feasible.

Analysis Scenario – 3:

As opposed to the above two extreme situations, the analysis scenario -3 presents a pragmatic situation for the proposed Malir Expressway Project resulting in a more realistic traffic diversion estimate for it under the following assumptions:

- There is some improvement in the public transport system by implementation of the BRT System on the transit corridors already under implementation phase especially the BRT Green and Orange Lines, resulting in a higher level of public transport usage and consequently decrease in private transport usage along these corridors.
- The traffic conditions on the existing road network slightly improved with no significant decrease in travel times and traffic congestion.
- There is also a little improvement in the network condition due to resurfacing of some major roads and construction of a few more flyover / underpass structures adding to their capacity to handle traffic but not necessarily on the existing competing routes,
- The shuttle train service proposed by Pak Rail to transfer container cargo to upcountry via Pipri Marshalling Yard still remains to be implemented.
- The Elevated Expressway Project conceived by KPT becomes operational and provides a direct connectivity from East Wharf, SAPT and Keamari Oil Terminal to West Wharf and onwards to Northern Bypass for traffic destinations towards North East.
- The development of DHA City, Bahria Town and the Education City schemes takes place at a moderate pace resulting in a minor volume of daily traffic between these facilities in the Northern suburbs at one end of the proposed Malir Expressway and the Southern parts of the city especially the CBD and the DHA and Clifton areas at the other end of the Expressway.

- It is a proven phenomenon that high speed facilities such as Malir Expressway function with increased volumes of traffic being the highest class of road and resultantly provide higher speeds and reduced travel time.

The competitive routes and relative distance savings via Malir Expressway for the same origins and destinations i.e., for trips between the Southern parts of the city in the vicinity of Karachi Port, DHA and Clifton, etc and the North Eastern parts i.e., DHA City, Bahria Town, the Karachi – Hyderabad Motorway, M9 for onwards journey up-country, are summarized hereunder:

Existing Route From Keamari Port to the End Point of Malir Expressway	Existing Route Length (Km)	Relative Distance Saving via MEW (KM)
Keamari – Northern Bypass – Motorway, M9	87	33
Keamari – SITE – Sharea Pakistan – Motroway, M9	60	06
Keamari – Mai Kolachi – Korangi Road – Link Road N5 to M9 – Motorway, M9	68	14
Keamari – Lyari Expressway – Motorway, M9	57	03

Travel demand for the proposed Malir Expressway calculated for the year 2019 on the basis of these scenarios is summarized in the following table:

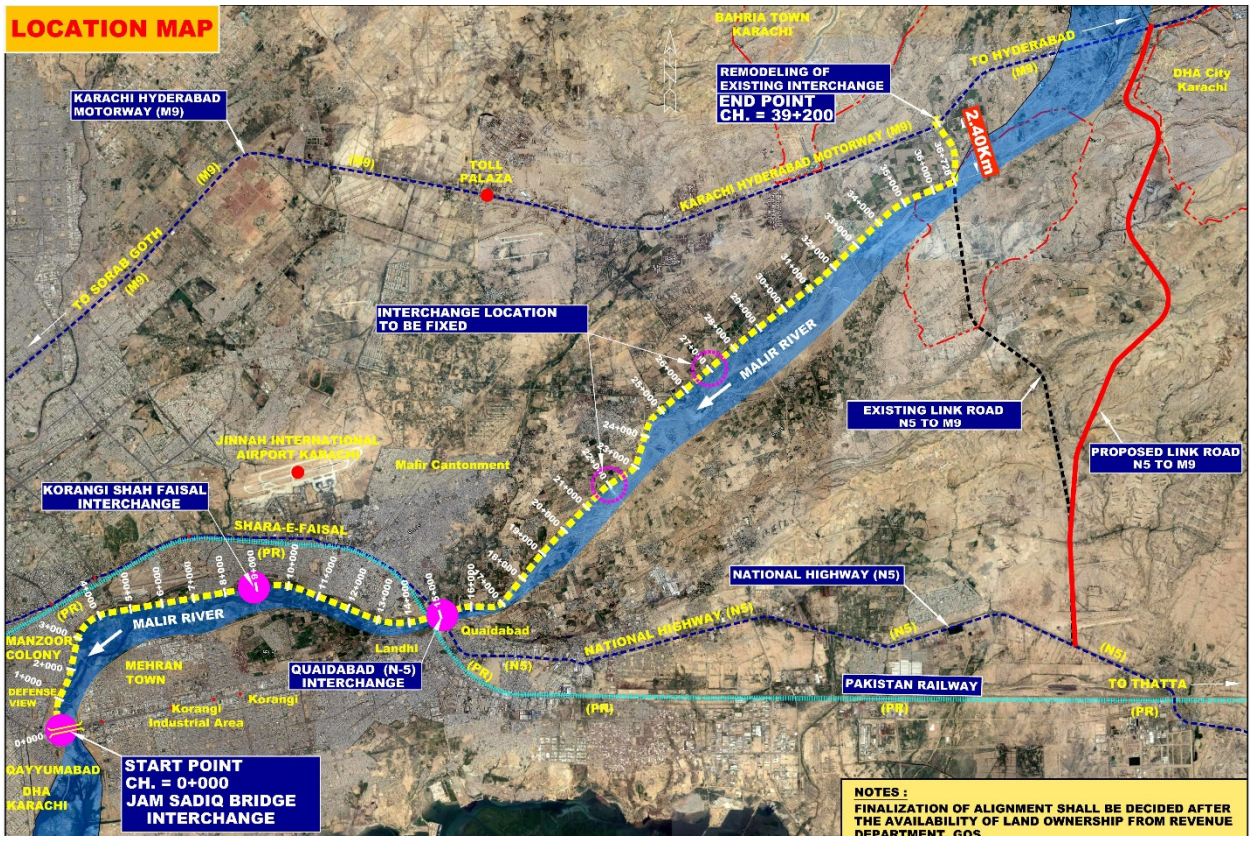
Analysis Scenario – 1				
Details	**Cars, Jeeps, SUVs, Vans**	**Buses & Minibuses**	**Truck and Trailer**	**Traffic Volume (Veh/ Day)**
Traffic Volume (Veh/ Day)	14,247	1,573	17,496	33,316
Travel Time Saved (Min/ Day)	403,865	14,557	107,073	525,495
Analysis Scenario – 2				
Details	**Cars, Jeeps, SUVs, Vans**	**Buses & Minibuses**	**Truck and Trailer**	**Traffic Volume (Veh/ Day)**
Traffic Volume (Veh/ Day)	3,166	977	4,860	9,003
Travel Time Saved (Min/ Day)	89,748	9,041	29,743	128,532
Analysis Scenario – 3				
Details	**Cars, Jeeps, SUVs, Vans**	**Buses & Minibuses**	**Truck and Trailer**	**Traffic Volume (Veh/ Day)**
Traffic Volume (Veh/ Day)	7,915	1,085	9,720	18,720
Travel Time Saved (Min/ Day)	224,370	10,041	59,485	293,895

The salient features of the Traffic Study are presented in this Report along with the main conclusions drawn from it.

1 INTRODUCTION

1.1 Project Location & Background

The Malir Expressway Project is located along the Malir River corridor starting near KPT Interchange at Korangi Road and ending at Motorway, M9 near Kathore. The location m of the Project is attached as Fig. 1.1.



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During the last few decades, Karachi has mostly grown towards the North and many new residential areas, housing schemes and towns have been developed in the Northern suburbs to accommodate the increasing population and provide a relief to the already congested and overcrowded city areas. Besides residential and commercial areas, there have been some other initiatives like the shifting of vegetable and fruit whole sale market (Subzi Mandi) from University Road to its present location near Toll Plaza on M-9, development of new industrial areas including Super highway Industrial Area and North Karachi Industrial Area, a number of educational institutions planned in the Education City, new amusement parks and resorts like Dreamworld, Fiesta Water Park, Cosy Water Park, etc.

Most of this expansion has taken place along the Karachi – Hyderabad Motorway, M9, including the Bahria Town, DHA City and Education City. Due to higher costs and lucrative prospects in these projects, the residents of posh areas of Clifton and Defence have substantially invested in them and upon their completion, there will be a good deal of commute between these areas. On the other hand the existing road network is already under a heavy burden of increasing traffic volumes resulting in severe traffic congestion, higher travel times and often deteriorating security conditions. Therefore, the provision of an exclusive, high speed access controlled corridor with modern facilities along the bank of Malir River is seen as an effective solution to link the new developments like the DHA City, Bahria Town, Gulshan-e-Maymar and other adjoining areas to the posh areas of Clifton and DHA Phases 1 to 8.

The Govt. of Sindh has therefore conceived the Malir Expressway Project along the bank of Malir River from the Motorway, M9 to Korangi Road near KPT Interchange to provide a direct route to facilitate this traffic between the posh areas in the Southern end of Karachi and the upcoming Northern developments. In addition to light traffic, this route will also serve the heavy traffic generating from the Karachi Port and the Landhi - Korangi Industrial area and going towards Motorway, M9 for onwards journey upcountry. Accordingly, the traffic study carried out for the Project has taken into account the light traffic as well as the heavy traffic. While the heavy traffic already plies through different available routes, much of the light traffic will be generated over a period of time, depending upon the pace of development of the aforementioned schemes along M9.

1.2 Project Objectives

The main objectives of this project are as under:

- To establish a direct Southern transport link between the Karachi Port including the allied facilities of SAPT, PICT, KICT and the Keamari Oil Terminal and the Karachi – Hyderabad Motorway, M9.
- To facilitate the movement of goods between Karachi Port and its allied facilities, Industrial areas of Landhi and Korangi and the up-country locations.
- To provide a safer and faster link between the planned developments of the Education City, the DHA City and Bahria Town in along the Motorway M9 in the Northern suburbs of the city to the main business center (CBD area) near the Karachi Port and also to the DHA and Clifton areas.
- To link Malir Cantonment directly to the Karachi – Hyderabad Motorway, M9 through a faster route for swift and easier movement of military troops in case of any emergency situation.
- To help reduce traffic congestion, delays, economic losses and environmental pollution on the city road network by exclusion of the external-external traffic i.e.,

traffic having both its origins and destinations outside the city or on its periphery, from the present routes to the proposed Malir Expressway.

1.3 Objectives and Scope of Traffic Study

The main objective of Traffic Study is to estimate classified traffic volume likely to use different sections of the proposed Malir Expressway Project during the 25years post-construction period.

The study also provides the necessary traffic input for the Geometric and Pavement Design and financial modelling of the project.

The following activities were therefore undertaken by the Consultant in connection with the planning and design of the proposed Malir Expressway Project:

- Collection and review of historic traffic data / previous studies for the project,
- Fresh traffic surveys including
  - Classified traffic counts at strategic locations for 24 hours for two days
  - Origin-Destination Surveys at the above locations,
  - Daily traffic movement data from truck stands, existing container terminals PICT, KICT, SAPT / Deep Water Container Port, Oil Terminal at Keamari and entry / exit gates of Karachi Port.
  - Travel Time and Delay Study on the existing routes serving the traffic likely to use the proposed project,
- Analysis of these data leading to the Design Annual Average Daily Traffic (AADT) for each section of the Project;
- Analysis and application of traffic growth rates;
- Traffic volume forecast for 25 years after the construction;
- Capacity analysis comprising determination of the year-wise level of service and lane requirements for each section and the proposed interchanges;
- Calculation of pavement design traffic load, and finally
- The preparation and submission of Traffic Study Report.

1.4 References & Sources of Data

The various sources of data and documents referred during the study included:

- Historic traffic data obtained from various sources including the Traffic Engineering Bureau, KDA and the previous studies by the then T&CD, CDGK.
- Reconnaissance Survey carried out along the entire project route from M9 to the KPT Interchange at Korangi Road

- Fresh Traffic Surveys carried out for the Project by the Consultant
- Notional Review of:
    - Education City Master Plan,
    - Bahria Town Master Plan and
    - DHA City Master Plan
- Various previous studies for Malir Expressway Project
- PC-I Document for Malir Expressway Project dated July 2016, PPP Unit, Govt. of Sindh
- JICA Study 2012 for Karachi Transport Improvement Plan
- Traffic Study for Karachi – Hyderabad Motorway, M9, Final Report, July 2012
- Update of Feasibility Study - Karachi Harbor Crossing Project– Final Report, April 2011

1.5 Acknowledgements

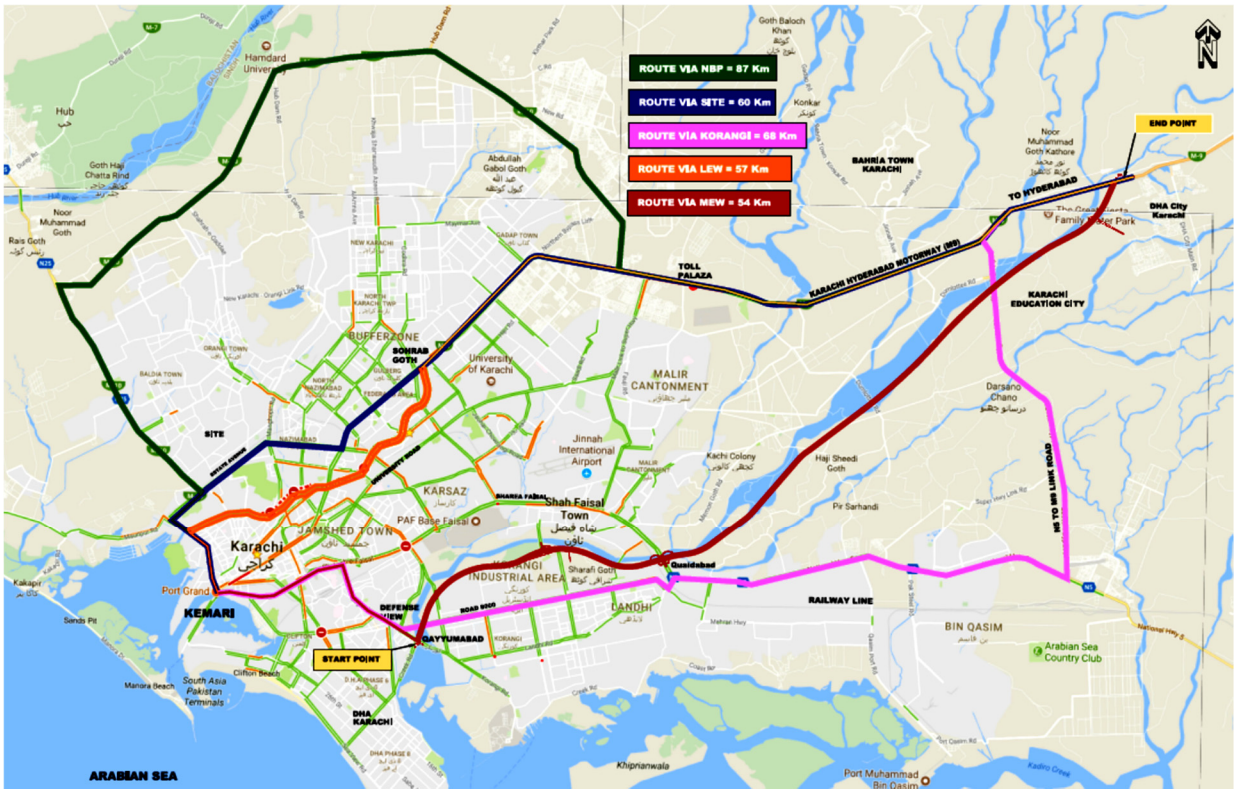
The cooperation extended by various Departments of the Govt. of Sindh, especially the TEB, KDA, KMC & the PPP Unit, Finance Department in the preparation of this Report is gratefully acknowledged.

2 ALIGNMENT AND COMPETITIVE ROUTES STUDY

2.1 Reconnaissance Study

A detailed reconnaissance study of the proposed route alignment was undertaken by the Consultant in connection with the Traffic Study focusing on the areas being served by the proposed Malir Expressway, the existing travel pattern and traffic movement characteristics in the corridor to be served by it, the main roads and drainage features crossing the alignment, the upcoming residential schemes along the route or in its close vicinity and other relevant features.

The main roads crossing the proposed alignment of Malir Expressway are Korangi Road (Road 8000) near the start point, EBM Causeway link, National Highway, N5 near Quaidabad, Link Road between N5 and M9 and finally the Motorway, M9 at the end point. A number of other local roads also touch the alignment including the Shah Faisal Colony – Korangi Road with its long bridge over Malir River, Memon Goth / Malir - Shah Latif Town Road, Haji Sheedi Goth Road, Dumlotee Road, etc. These roads carry the localized traffic mostly consisting of light vehicles that may or may not directly feed the Expressway.



2.2 Start Point

The Start point of the proposed Malir Expressway is located on Main Korangi Road, near the existing Jam Sadiq Bridge & KPT Interchange.

At the start point an interchange is being proposed to provide direct access to Malir Expressway to facilitate movement of vehicles without any conflict with traffic of Korangi Road and Creek Avenue. From Start point to left bank of river, there will be a bridge having about 1.5 km length. In this 1.5 km elevated portion, the alignment will also overpass the existing Jam Sadiq Bridge. From this point on, the alignment remains on the left side of the river.

At a short distance from the start point, a four-lane dual carriageway, Creek Avenue joins the Main Korangi Road and links it to DHA via Khayaban-e-Ittehad and further ahead to Clifton Via Sea-view Road and thereafter to the SAPT / Shirin Jinnah Colony, Keamari via Marine Prominade.

2.3 Interchanges En-route

As per conceptual design of the proposed Malir Expressway, interchanges have been proposed at the following locations:

Location of the Proposed Interchanges
1. At start point near KPT Interchange Main Korangi Road
2. Korangi – Shah Faisal Colony Road
3. Sharea-Faisal/N5 near Quaidabad Bridge
4. Link to Bahria Town
5. Link to DHA Phase-IX / Link Road from N5 to M9
6. At the end point i.e. M9 (about 25 km from the now demolished Toll Plaza of M9)

2.4 End Point

The end point of the proposed Malir Expressway is at M-9, about 14 km from the main gate of Bahria Town and about 25 km from the now demolished Toll Plaza on M-9. At the End Point a Trumpet type interchange is proposed.

2.5 Link to KPT

The proposed Malir Expressway will be linked to the Karachi Port via Korangi Road – Sunset Boulevard / Khayaban-e-Jami – Boat Basin - Mai Kolachi Bypass – Jinnah Bridge – M.A. Jinnah Road.

Similarly it will also be linked with the South Asia Pakistan Deep Water Container Terminal (SAPT) via Shahrah-e-Ghalib / Marine Prominade - Khayaban-e-Saadi – Balawal Chowrangi – Boat Basin – Mai Kolachi Bypass – Khayaban-e-Jami / Sunset Boulevard– Korangi Road.

A direct link to SAPT may also be improved in future by connecting it with the Creek Road through an alignment passing along the Marine Prominade – Sea view Road along DHA Phase VIII and onwards to the Creek Road.

2.6 Competitive Routes and Distance Savings Via Malir Expressway

The competitive routes and relative distance savings via Malir Expressway for the same origins and destinations i.e., for trips between the Southern parts of the city in the vicinity of Karachi Port, DHA and Clifton, etc and the North Eastern parts i.e., DHA City, Bahria Town, the Karachi – Hyderabad Motorway, M9 for onwards journey up-country, are summarized hereunder:

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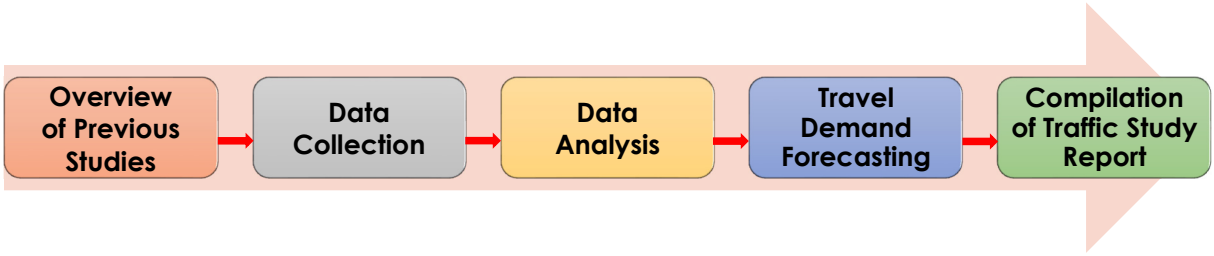
Keamari – SITE – Sharea Pakistan – Motroway, M9	60	06
Keamari – Mai Kolachi – Korangi Road – Link Road N5 to M9 – Motorway, M9	68	14
Keamari – Lyari Expressway – Motorway, M9	57	03

3 TRAFFIC DATA AND ANALYSIS

3.1 Approach & Methodology

The approach and methodology for traffic study is primarily focused on a systematic evaluation of travel demand forecast on the basis of available traffic and socio-economic data, study of the proposed alignment and the existing competitive routes, knowledge of the on-going projects of relevance to the Malir Expressway Project, and network-based comparative analysis using modern computer applications. Therefore the study involved the following main steps:



3.2 Overview of Previous Studies

The Karachi Master Plan 2020 has already recognized the ring road concepts in Karachi thereby creating an opportunity to bypass the congested radially oriented road system and from time to time many studies were undertaken and proposals were developed for construction of Malir Expressway Project including:

Dec 2010	Malir River Expressway concept initiated
Jul 2011	Project concept moves to CDGK to initiate on BOT
Aug 2012	Approval by the then CM for project on BOT basis
May 2014	New initiative by Military Authorities
July 2014	Principle approval given as part of Mega projects of Karachi
Aug 2014	Feasibility / PC-1 initiated to aid in fast tracking of Malir Expressway project
Nov 2014	Concept & PC-1 presented to NHA for review/approval
Feb 2015	Rationalized PC-1 prepared, presented & submitted to NHA
Mar 2015	Project announced by the then Prime Minister during the ground breaking Ceremony for the construction of Karachi – Hyderabad Motorway, M9
July 2016	Revised PC-I by the PPP Unit, Govt. of Sindh

In addition to the above, the Project was also considered it as the most viable option among the other competing routes in the Final Report on "Preparatory Survey on JICA Cooperation Program for Industry Development (Investment Climate Improvement in Karachi)" and was also recommended for future development in "The Study for Karachi Transport Improvement Plan" by JICA.

Besides the above studies, the following documents were also referred during the study:

- Traffic Study for Karachi – Hyderabad Motorway, M9, Final Report, July 2012
- Update of Feasibility Study - Karachi Harbor Crossing Project– Final Report, April 2011

The Final Report on JICA Study 2012 for "Karachi Transport Improvement Plan" provides a comprehensive analysis of the transport systems environment in the city and was therefore duly referred during this study. According to this Report (Table 4-3-3: Future Population by Town / Cantonment), Karachi's population is projected to grow from 18.9million in 2010 to around 31.6million in 2030 thereby making it the fastest growing city in the World.

Table 4-3-3 Future Population by Town / Cantonment

Town		2010	2020	2020/2010	2030	2030/2010
1	Keamari	762,000	1,914,000	2.51	2,290,000	3.01
2	S.I.T.E	854,000	895,000	1.05	895,000	1.05
3	BALDIA	864,000	1,110,000	1.28	1,110,000	1.28
4	ORANGI	1,338,000	1,429,000	1.07	1,523,000	1.14
5	LYARI	939,000	969,000	1.03	969,000	1.03
6	SADDAR	1,104,000	1,123,000	1.02	1,233,000	1.12
7	JAMSHED	1,397,000	1,560,000	1.12	1,713,000	1.23
8	GULSHAN-E-IQBAL	1,458,000	2,373,000	1.63	2,684,000	1.84
9	SHAH FAISAL	602,000	612,000	1.02	647,000	1.07
10	LANDHI	1,353,000	1,822,000	1.35	1,822,000	1.35
11	KORANGI	1,286,000	1,826,000	1.42	1,826,000	1.42
12	NORTH NAZIMABAD	917,000	979,000	1.07	1,044,000	1.14
13	NEW KARACHI	1,226,000	1,247,000	1.02	1,328,000	1.08
14	GULBERG	838,000	895,000	1.07	954,000	1.14
15	LIAQUATABAD	1,002,000	1,035,000	1.03	1,035,000	1.03
16	MALIR	781,000	907,000	1.16	937,000	1.20
17	BIN QASIM	518,000	2,032,000	3.92	2,697,000	5.21
18	GADAP West	263,000	1,058,000	4.02	1,715,000	6.52
	GADAP Central	146,000	1,512,000	10.36	2,522,000	17.27
	GADAP East	128,000	508,000	3.97	823,000	6.43
	GADAP Total	537,000	3,078,000	5.73	5,060,000	9.42
19	Karachi Cantonment	88,000	90,000	1.02	96,000	1.09
20	Clifton Cantonment	559,000	771,000	1.38	821,000	1.47
21	Faisal Cantonment	248,000	352,000	1.42	363,000	1.46
22	Malir Cantonment	206,000	400,000	1.94	414,000	2.01
23	Manora Cantonment	10,000	10,000	1.00	10,000	1.00
24	Korangi Cantonment	47,000	122,000	2.60	130,000	2.77
	Total	18,934,000	27,551,000	1.46	31,601,000	1.67

Source: Estimated in KTIP

This rapid increase in population has put a lot of pressure on the city's infrastructure especially the urban transport system (UTS) which is not yet organized in a modern manner, and therefore barely caters to the mobility needs of the mega city. With limited infrastructure and low level of public services coupled with other factors such as weak traffic management, lack of modern mass transit network, a rapid level of

motorization of roads has been observed during the last two decades resulting in severe traffic congestion and unnecessary delays, noise and air pollution along the main corridors of travel in the city and impeding the economic efficiency and growth.

3.2.1 Main Problems Observed in the Transport System of Karachi

Based on the above studies, the main problems of the transport system in Karachi can be summarized as follows:

- Need for increasing the transport infrastructure with respect to capacity and quality in view of the increasing travel demand and expansion of the city in population and area.
- Failure of the public transport system to cater for increased travel demand especially for the lower and middle income groups.
- Poor condition of the road network and its unbalanced distribution and configuration due to non-implementation of development plans within their selected planning horizons.
- Increasing traffic congestion has become a serious problem within the city center (CBD area) and around Karachi Port.
- No defined and well-connected outer ring roads to bypass this city congestion.
- Demand – supply gap of parking spaces causes further reduction in road capacity due to roadside parking of vehicles especially near the main traffic generator areas, busy shopping centres, transport terminals and places of recreations.
- Lack of proper and effective traffic management system and enforcement of traffic rules and regulations in the city.
- Complex institutional and organizational structure to handle the various transport and traffic related matters. Administratively Karachi is divided into:
    - 18 Towns
    - 6 Cantonments
    - 178 Union Councils
- Land use anomalies and unplanned expansion of the city.
- Rapidly increasing car / motorcycle ownership

Year	No. of Cars / 1000 population	No. of Motorcycles / 1000 population
Vehicle ownership in 2010	50	48
Vehicle ownership in 2020*	60	73
Vehicle ownership in 2030*	84	115

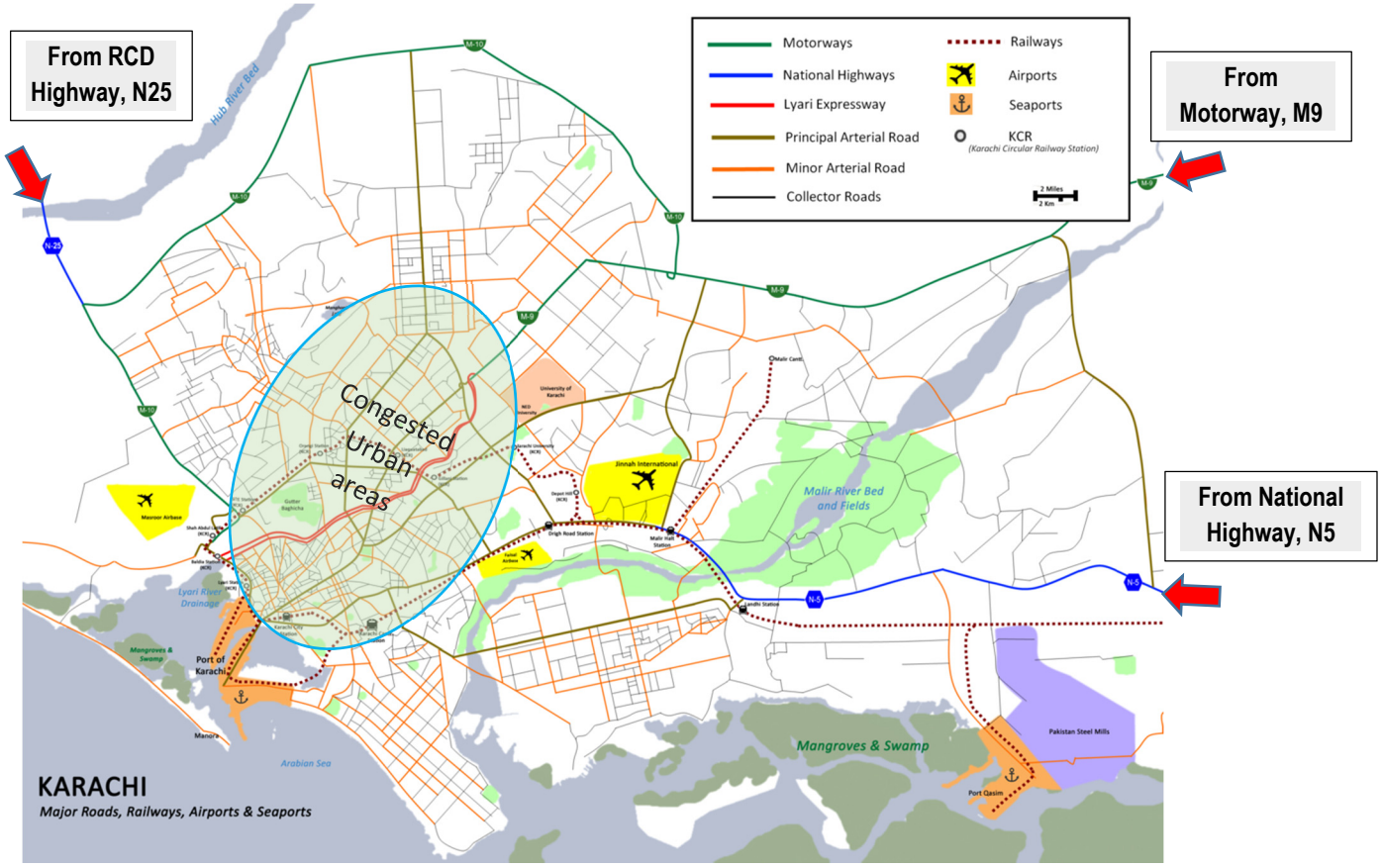
* Projected

- Increased urbanization in Karachi from 80,000 ha today projected to be 158,000 ha by 2030.
- Rapidly increasing population due to high rate of in-migration from up-country; from 18million to 31million by 2030.

- The KPT presently handles 19.2million tons of cargo per year; it is projected to increase to 112 million tons per year by 2030.

3.2.2 Main Access Routes for Karachi

At present Karachi has three main corridors linking it to rest of the country namely: the Karachi – Hyderabad Motorway, M9 (Superhighway) / Shahrah-e-Pakistan corridor, the National Highway N5 / Sharea Faisal corridor and the RCD Highway, N25 / Hub River Road corridor.



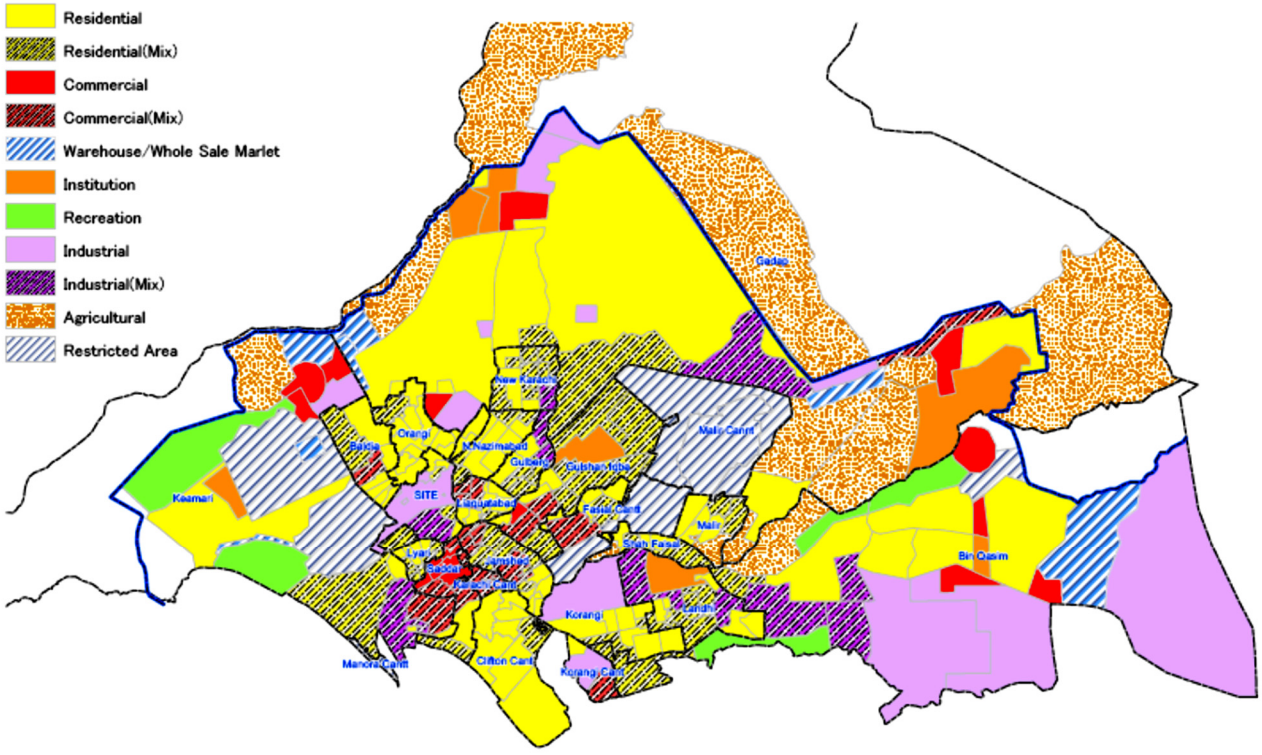
However, upon entering the urban limits these corridors become highly congested due to the increasing volume of internal traffic in the city with a substantial volume of light vehicles consisting of private cars, vans, rickshaws and motorcycles and public transport vehicles including buses, minibuses and coaches besides the frequent pedestrian movements across the roads conflicting with smooth & uninterrupted flow of traffic.

In addition to the above impeding factors, another serious issue is that during the day time movement of heavy vehicles is mostly restricted on them.

Therefore with the passage of time as the volume of external traffic between the upcountry destinations in Sindh, Punjab, KPK and beyond, and the Karachi Port, the CBD area, DHA / Clifton areas in the South and the industrial areas of Landhi and Korangi in the South Eastern part of the city increased, the need for a high speed expressway directly linking the entry point on the Karachi – Hyderabad Motorway, M9 (Superhighway) with these areas without mingling with the city traffic became evident and the concept of an exclusive high speed access controlled facility along the banks of Malir River (like the earlier constructed Lyari Expressway) was initiated.

3.2.3 Future Land Use Plan - 2030

The future Land Use Plan – 2030 presented in the JICA Study as Fig.4-3-5 is reproduced below:



Source: KTIP

Figure 4-3-5 Future Land Use Plan, 2030

3.3 Analytical Framework & Underlying Assumptions

A well-conceived analytical framework was developed on the basis of available knowledge-base of the existing development pattern along the corridor, the historic / existing traffic volumes, congestion and delays on the road network in Karachi and the growing demand for another exclusive route for the North – South connectivity, especially for the traffic between Karachi Port including SAPT, KCIT, PICT, Oil Terminal,

Landhi / Korangi Industrial areas and the up-country and also for linking the new developments in the Northern suburb with the city center (CBD area), DHA and Clifton areas in the South of the city. Accordingly three mutually exclusive analysis scenarios were used for calculating the travel demand for the proposed Malir Expressway Project.

The three operational scenarios and the main assumptions underlying these scenarios are briefly presented below:

3.3.1 Analysis Scenario – 1:

The analysis scenario -1 presents an optimistic situation for the proposed Malir Expressway Project resulting in a higher traffic diversion to it under the following assumptions:

- The traffic conditions on the existing road network further deteriorate due to increased population and higher traffic volumes,
- There is no significant improvement of the network condition and capacity to handle further traffic especially on the other competing routes,
- The shuttle train service proposed by Pak Rail to transfer container cargo to upcountry via Pipri Marshalling Yard does not become operational
- The Elevated Expressway Project conceived by KPT still remains unexecuted.
- No significant improvement in the public transport system in the city resulting in an even higher level of private transport usage.
- The DHA City, Bahria Town and the Education City schemes develop at a faster pace resulting in additional daily trips between these facilities in the Northern suburbs and the Southern parts of the city especially the CBD and the DHA and Clifton areas. The interaction of traffic between these new developments will most likely result in increased traffic on Malir Expressway.

3.3.2 Analysis Scenario – 2:

The analysis scenario -2 presents a Pessimistic Situation for the proposed Malir Expressway Project resulting in a lower traffic diversion to it under the following assumptions:

- A significant improvement in the public transport system by implementation of the BRT System on the main transit corridors in the city especially the BRT Green, Blue, Red, Yellow and Orange Lines, resulting in a higher level of public transport usage and consequently decrease in private transport usage i.e., lesser volumes of private cars, motorcycles and paratransit vehicles; although so far this has only been in plans.
- The traffic conditions on the existing road network will undergo a remarkable improvement by better traffic management strategies based on the application of modern technology; however, such has not been the case.

- There is significant improvement in the network condition and capacity to handle further traffic especially on the existing competing routes,
- The shuttle train service proposed by Pak Rail to transfer container cargo to upcountry via Pipri Marshalling Yard becomes operational taking away about 40% of the containerized cargo traffic from the road network
- The Elevated Expressway Project conceived by KPT becomes operational and provides a direct connectivity from East Wharf, SAPT and Keamari Oil Terminal to West Wharf and onwards to Northern Bypass. This presumes that the KPT Expressway has proved to be feasible.

3.3.3 Analysis Scenario – 3:

As opposed to the above two extreme situations, the analysis scenario -3 presents a pragmatic situation for the proposed Malir Expressway Project resulting in a more realistic traffic diversion estimate for it under the following assumptions:

- There is some improvement in the public transport system by implementation of the BRT System on the transit corridors already under implementation phase especially the BRT Green and Orange Lines, resulting in a higher level of public transport usage and consequently decrease in private transport usage along these corridors.
- The traffic conditions on the existing road network slightly improved with no significant decrease in travel times and traffic congestion.
- There is also a little improvement in the network condition due to resurfacing of some major roads and construction of a few more flyover / underpass structures adding to their capacity to handle traffic but not necessarily on the existing competing routes,
- The shuttle train service proposed by Pak Rail to transfer container cargo to upcountry via Pipri Marshalling Yard still remains to be implemented.
- The Elevated Expressway Project conceived by KPT becomes operational and provides a direct connectivity from East Wharf, SAPT and Keamari Oil Terminal to West Wharf and onwards to Northern Bypass for traffic destinations towards North East.
- The development of DHA City, Bahria Town and the Education City schemes takes place at a moderate pace resulting in a minor volume of daily traffic between these facilities in the Northern suburbs at one end of the proposed Malir Expressway and the Southern parts of the city especially the CBD and the DHA and Clifton areas at the other end of the Expressway.
- It is a proven phenomenon that high speed facilities such as Malir Expressway function with increased volumes of traffic being the highest class of road and resultantly provide higher speeds and reduced travel time.

3.3.4 Special Traffic Generators for Malir Expressway Project

It is to be appreciated that the following constitute the special traffic generators in the area of influence of the proposed alignment of Malir Expressway:

- KPT (including the SAPT, KICT, PICT and the Oil Terminal at Shirin Jinnah Colony, Keamari)
- PQA and Steel Mills
- DHA City
- Bahria Town
- Education City
- Korangi Industrial Area
- Landhi Industrial Area
- Export Processing Zone (EPZ)
- Jinnah International Airport (JIAP), Karachi

3.3.5 Town areas to be served by Malir Expressway:

A study of the available road network, relative location of the various towns and the origins and destinations of the traffic shows that the following areas are likely to be served by the proposed Project:

S. No.	Name of Town / Cantonment	Remarks
1.	Bahria Town	Yes
2.	Bin Qasim Town	Yes
3.	Central Business District (CBD area / Saddar, II Chundirgar Road)	Yes
4.	Clifton Cantonment	Yes
5.	DHA Karachi (Phases 1 – 8)	Yes
	DHA City (Phase 9)	Yes
6.	Export Processing Zone (EPZA), Karachi	Yes
7.	Faisal Cantonment (Drigh Road CT)	Yes
8.	Gadap Town	Yes
9.	Gulshan-e-Maymar / Ahsanabad	Yes
10.	Ibrahim Hyderi Fishing Village / Fishing Jetty	Yes
11.	Jamshed Town	Yes
12.	Jinnah International Airport (JIAP), Karachi and adjoining areas	Yes
13.	Karachi Cantonment	Yes
14.	Keamari Town Including the entire Karachi Port Area, Container Terminals (SAPT, KICT, PICT) and the Oil Terminal at Shirin Jinnah Colony.	Yes
15.	Korangi Industrial Area	Yes
16.	Korangi Cantonment (Korangi Creek Cantt.)	Yes
17.	Landhi Industrial Area	Yes
18.	Malir Cantonment /Other areas of Malir	Yes
19.	Manora Cantonment	Yes
20.	Shah Faisal Colony	Yes

3.4 Data Collection

The data collection exercise comprised the following activities in connection with this study:

- Collection of historic traffic data
- Collection of other socio-economic data
- Fresh Traffic Surveys (based on Origins – Destinations served by MEW).

3.4.1 Historic Traffic Data

As stated above, Malir Expressway Project has been under active consideration for some time now and therefore, there are a number of Studies & Reports which give a focus on its traffic prospects with varying level of detail and reliability. The data was collected and carefully reviewed for its relevance and applicability for the present study. It was also very helpful in analyzing the growth in traffic over the years. The historic data were also used for validating and substantiating the O-D Survey results. Therefore, the historic traffic data provided valuable support in a rationalized analysis of the current data and drawing a representative picture of traffic conditions along the corridor. A summary of the various historic traffic data collected for the study is presented at Annexure "A".

3.4.2 Fresh Traffic Surveys

Fresh traffic surveys included:

- Classified traffic counts at strategic locations for 24 hours for two days
- Origin-Destination Surveys at the above locations,
- Daily traffic movement data from truck stands, existing container terminals PICT, KICT, SAPT / Deep Water Container Port, Oil Terminal at Keamari and entry / exit gates of Karachi Port.
- Travel Time and Delay Study on the existing routes serving the traffic likely to use the proposed project.

The data were used for developing the travel pattern on the existing road network and the travel desire lines presented at Annexure "B".

3.5 Data Analysis

A network based data analysis was carried out with the help of computers to compute the annual average daily traffic (AADT) on the existing network and the travel desire pattern, the traffic growth rates during the last 10 years, the present routes of travel for the external traffic likely to be served by the proposed Malir Expressway and the travel demand forecast for the Project, the projected traffic over the 25 years post-construction period and the capacity analysis including determination of number of

lanes and operational level of service on the facility and also the impact of this traffic shift on the existing urban road network.

3.5.1 Traffic on the Existing Network

The desire line diagrams showing the travel pattern on Karachi's urban road network developed from the above traffic data are presented at Annexure "B".

3.5.2 Travel Demand Forecast for Malir Expressway

Based on the above data and analysis, the following travel demand volumes have been determined for the year 2019 under the three operational scenarios analyzed for the Project:

Analysis Scenario – 1				
Details	**Cars, Jeeps, SUVs, Vans**	**Buses & Minibuses**	**Truck and Trailer**	**Traffic Volume (Veh/ Day)**
Traffic Volume (Veh/ Day)	14,247	1,573	17,496	33,316
Travel Time Saved (Min/ Day)	403,865	14,557	107,073	525,495
Analysis Scenario – 2				
Details	**Cars, Jeeps, SUVs, Vans**	**Buses & Minibuses**	**Truck and Trailer**	**Traffic Volume (Veh/ Day)**
Traffic Volume (Veh/ Day)	3,166	977	4,860	9,003
Travel Time Saved (Min/ Day)	89,748	9,041	29,743	128,532
Analysis Scenario – 3				
Details	**Cars, Jeeps, SUVs, Vans**	**Buses & Minibuses**	**Truck and Trailer**	**Traffic Volume (Veh/ Day)**
Traffic Volume (Veh/ Day)	7,915	1,085	9,720	18,720
Travel Time Saved (Min/ Day)	224,370	10,041	59,485	293,895

3.5.3 Traffic Growth Rates Applied

After a detailed analysis of the previous trends of traffic growth in the city and the various factors likely to affect the growth of traffic on the proposed project, the following traffic growth rates were applied for traffic projections:

Applied Traffic Growth Rates (%)				
Years		**Cars, Jeeps, SUVs, Vans**	**Buses & Minibuses**	**Trucks and Trailers**
2019	**2020**	5.0%	5.0%	5.0%
2021	**2026**	10.0%	4.0%	4.0%
2027	**2036**	6.0%	4.0%	4.0%
2037	**2047**	3.5%	3.5%	3.5%

3.5.4 Projected Traffic

The projected traffic for Malir Expressway under the three analytical scenarios, as discussed in the foregoing sections, is presented below:

Analysis Scenario – 1				
Year	Traffic Volume (Veh/ Day)			
	Cars, Jeeps, SUVs, Vans	Buses & Minibuses	Truck and Trailers	Total
2019	14,247	1,573	17,496	33,316
2020	14,959	1,652	18,371	34,982
2021	16,455	1,718	19,106	37,279
2022	18,101	1,787	19,870	39,758
2023	19,911	1,858	20,665	42,434
2024	21,902	1,932	21,492	45,326
2025	24,092	2,009	22,352	48,453
2026	26,501	2,089	23,246	51,836
2027	28,091	2,173	24,176	54,440
2028	29,776	2,260	25,143	57,179
2029	31,563	2,350	26,149	60,062
2030	33,457	2,444	27,195	63,096
2031	35,464	2,542	28,283	66,289
2032	37,592	2,644	29,414	69,650
2033	39,848	2,750	30,591	73,189
2034	42,239	2,860	31,815	76,914
2035	44,773	2,974	33,088	80,835
2036	47,459	3,093	34,412	84,964
2037	49,120	3,201	35,616	87,937
2038	50,839	3,313	36,863	91,015
2039	52,618	3,429	38,153	94,200
2040	54,460	3,549	39,488	97,497
2041	56,366	3,673	40,870	100,909
2042	58,339	3,802	42,300	104,441
2043	60,381	3,935	43,781	108,097
2044	62,494	4,073	45,313	111,880
2045	64,681	4,216	46,899	115,796
2046	66,945	4,364	48,540	119,849
2047	69,288	4,517	50,239	124,044

Analysis Scenario – 2				
Year	Traffic Volume (Veh/ Day)			
	Cars, Jeeps, SUVs, Vans	Buses & Minibuses	Truck and Trailers	Total
2019	3,166	977	4,860	9,003
2020	3,324	1,026	5,103	9,453
2021	3,656	1,067	5,307	10,030
2022	4,022	1,110	5,519	10,651
2023	4,424	1,154	5,740	11,318
2024	4,866	1,200	5,970	12,036
2025	5,353	1,248	6,209	12,810
2026	5,888	1,298	6,457	13,643
2027	6,241	1,350	6,715	14,306
2028	6,615	1,404	6,984	15,003
2029	7,012	1,460	7,263	15,735
2030	7,433	1,518	7,554	16,505
2031	7,879	1,579	7,856	17,314
2032	8,352	1,642	8,170	18,164
2033	8,853	1,708	8,497	19,058
2034	9,384	1,776	8,837	19,997
2035	9,947	1,847	9,190	20,984
2036	10,544	1,921	9,558	22,023
2037	10,913	1,988	9,893	22,794
2038	11,295	2,058	10,239	23,592
2039	11,690	2,130	10,597	24,417
2040	12,099	2,205	10,968	25,272
2041	12,522	2,282	11,352	26,156
2042	12,960	2,362	11,749	27,071
2043	13,414	2,445	12,160	28,019
2044	13,883	2,531	12,586	29,000
2045	14,369	2,620	13,027	30,016
2046	14,872	2,712	13,483	31,067
2047	15,393	2,807	13,955	32,155

Analysis Scenario – 3				
Year	Traffic Volume (Veh/ Day)			
	Cars, Jeeps, SUVs, Vans	Buses & Minibuses	Truck and Trailers	Total
2019	7,915	1,085	9,720	18,720
2020	8,311	1,139	10,206	19,656
2021	9,142	1,185	10,614	20,941
2022	10,056	1,232	11,039	22,327
2023	11,062	1,281	11,481	23,824
2024	12,168	1,332	11,940	25,440
2025	13,385	1,385	12,418	27,188
2026	14,724	1,440	12,915	29,079
2027	15,607	1,498	13,432	30,537
2028	16,543	1,558	13,969	32,070
2029	17,536	1,620	14,528	33,684
2030	18,588	1,685	15,109	35,382
2031	19,703	1,752	15,713	37,168
2032	20,885	1,822	16,342	39,049
2033	22,138	1,895	16,996	41,029
2034	23,466	1,971	17,676	43,113
2035	24,874	2,050	18,383	45,307
2036	26,366	2,132	19,118	47,616
2037	27,289	2,207	19,787	49,283
2038	28,244	2,284	20,480	51,008
2039	29,233	2,364	21,197	52,794
2040	30,256	2,447	21,939	54,642
2041	31,315	2,533	22,707	56,555
2042	32,411	2,622	23,502	58,535
2043	33,545	2,714	24,325	60,584
2044	34,719	2,809	25,176	62,704
2045	35,934	2,907	26,057	64,898
2046	37,192	3,009	26,969	67,170
2047	38,494	3,114	27,913	69,521

3.5.5 Capacity Analysis

Capacity analysis was performed on the basis of procedures outlined in the Highway Capacity Manual, TRB, USA. It consisted in determination of the number of lanes required and the Level of service analysis for the three traffic scenarios for the 6-lane access controlled facility.

The analysis for the earlier discussed three traffic scenarios is shown in Tables 3.5.5.1 – 3.5.5.3 respectively attached at the end of the Report. A summary of the Levels of Service (LoS) in various years after construction under the three operational scenarios is presented below:

Analysis Scenario	Years	Level of Service (LoS)	Reference
1	2023 – 2029	C	Table 3.5.5.1
	2030 – 2033	D	
	2034 onward	E	
2	2023 – 2029	B	Table 3.5.5.2
	2030 – 2037	C	
	2038 – 2043	D	
	2044 – 2047	E	
3	2023 – 2028	B	Table 3.5.5.3
	2029 – 2036	C	
	2037 – 2042	D	
	2043 – 2047	E	

3.5.6 Impact on Traffic Conditions on the Urban Road Network

The construction of Malir Expressway along the proposed alignment will have a positive impact on traffic conditions on the urban road network as:

- It will be more convenient and desirable for entry and exit from the central business area (CBD) for the external traffic (i.e., traffic to/from outside the city) as compared to the urban arterials which remain congested during the day and are not suitable for movement of heavy traffic.
- It will provide a direct linkage between Jinnah International Airport (Karachi airport) and the southern parts of the city including the DHA / Clifton areas.

- It will also help improve the traffic conditions on the existing urban road network and its capacity by providing an exclusive alternate diversion route for the

external traffic and by serving an estimated 42% of the population in various areas lying along the corridor serving as a bypass for the Southern half of the city.

- It will also facilitate operation of public transport especially for the inter-city travel of people living in the Southern parts of the city like Landhi, Korangi, Shirin Jinnah Colony, Keamari, etc.

- With the reduction in traffic on urban roads network due to shift of external traffic to Malir Expressway, there is likely to be a reduction in traffic accidents especially those involving the heavy goods vehicles.

- There will be substantial improvement in the environmental conditions in the city due to reduction in air and noise pollution on the urban road network.

4 CONCLUSION

On the basis of the foregoing Traffic Study, it is concluded that:

1. Malir Expressway Project is amongst the important transport development projects for the city of Karachi as it would provide numerous benefits to the daily commuters especially between the southern parts of the city mainly Clifton and DHA to the Motorway M9 and beyond. It will essentially constitute the Southern Bypass for Karachi City.

2. It will be more convenient and desirable for entry and exit from the central business area (CBD) for the external traffic (i.e., traffic to/from outside the city) as compared to the urban arterials which remain congested during the day and are not suitable for movement of heavy traffic.

3. It will provide a direct linkage between Jinnah International Airport (Karachi airport) and the southern parts of the city including the DHA / Clifton areas.

4. It will also help improve the traffic conditions on the existing urban road network and its capacity by providing an exclusive alternate diversion route for the external traffic and by serving an estimated 42% of the population in various areas lying along the corridor serving as a bypass for the Southern half of the city.

5. No right-of-way acquisition / property compensation will be required as land is already available along the banks of Malir River without any encroachments along the proposed alignment.

6. Access / Exit ramps will be strategically placed with interchanges provided at the main arterials crossing the alignment.

7. It will also facilitate operation of public transport especially for the inter-city travel of people living in the Southern parts of the city like Landhi, Korangi, Shirin Jinnah Colony, Keamari, etc.

8. A substantial volume of heavy vehicles would be attracted by the Expressway besides the normal passenger traffic consisting of light vehicles consisting of cars, vans, jeeps, station wagons, and public transport vehicles including minibuses, coaches, coasters & large buses.

9. It is by necessity that no motorcycles and rickshaws should be allowed on the Expressway in view of the long distance, high speed movement of traffic and avoidance of unnecessary traffic hindrance and safety hazards.

10. The traffic level on the proposed Malir Expressway will vary depending upon the operational scenario, transport infrastructure development policies in effect and the overall socio-economic and geopolitical conditions prevailing at the time of its completion and opening.

11. According to the three operational scenarios envisaged for the proposed expressway, the total AADT will vary from 33,000vpd for the most optimistic scenario to 9,000vpd under the most pessimistic scenario. A more pragmatic estimate of travel demand along the proposed Expressway under the scenario-3 will be around 19,000vpd.

12. The capacity analysis based on the procedures outlined in the Highway Capacity Manual, TRB, USA, shows that during the 25 years post construction analysis period, the Expressway will offer an acceptable Level of Service most of the time. However, towards the last few years the Level of Service may drop down to LoS "E" as highlighted in section 3.5.5.

13. However, a number of feasibility studies for various transport projects are presently underway whose implementation is likely to influence travel demand on the Malir Expressway Project; these include:
    a. KPT Expressway dedicated for cargo movement in / out of the KPT area.
    b. Pak Rail to expand capacity by railway connectivity to evacuate Port Traffic by rail.
    c. Eight mass transit corridors still in various stages of planning; only Green and Orange Line BRT systems expected to go in service by the end of 2018.

14. There will be reduced vehicle operating costs and reduced travel time due to uninterrupted movement at higher speeds than experienced on the existing urban arterials network.

15. There will be substantial improvement in the environmental conditions in the city due to reduction in air and noise pollution on the urban road network.

16. There will be potential for increased economic activities along the corridor and the area of influence of the project.

17. There will also be a potential to use the ROW for the expressway (along the shoulders / embankment) for laying parallel pipe lines (for LNG, Gas, etc)

18. With the reduction in traffic on urban roads network due to shift of external traffic to Malir Expressway, there will also be a reduction in traffic accidents especially those involving the heavy goods vehicles.

MALIR EXPRESSWAY PROJECT
TRAFFIC STUDY REPORT

ANNEXURE

A. HISTORIC TRAFFIC DATA

B. TRAVEL DESIRE LINES

C. ROAD INFRASTRUCTURE IN KARACHI & RELATIVE SPEEDS.

D. Tables 3.5.5.1 – 3.5.5.3 (Capacity Analysis)

ANNEXURE A

HISTORIC TRAFFIC DATA

National Highway Authority
Traffic Data Summary Form (24 Hours)
SUMMARY (3 Days Daily Average)

Direction: Karachi-Kathor (Both Directions) Location Karachi - Toll Plaza

Date: 26-01-2009 to 29-01-2009 Day Monday/Thursday

Time: From: 0600 hrs To 0600 hrs

Time	Cars/Jeeps	Wagons/ Pick ups	Coasters/ Mini Trucks	Buses	Trucks (Rigid)		Articulated			Total
					2-Axles	3-Axles	4-Axles	5-Axles	6-Axles	
0600-0700	79	58	18	38	67	98	78	11	38	485
0700-0800	155	82	31	56	121	164	95	19	36	759
0800-0900	200	113	15	56	102	134	100	31	39	790
0900-1000	234	124	24	63	98	139	101	28	33	843
1000-1100	277	120	31	63	112	110	92	18	33	857
1100-1200	346	83	35	59	99	111	92	16	27	868
1200-1300	344	71	25	53	87	87	58	12	42	778
1300-1400	341	102	28	62	104	113	80	21	29	880
1400-1500	322	102	26	59	144	129	91	14	16	903
1500-1600	357	140	23	82	147	130	57	15	17	968
1600-1700	384	123	54	78	173	155	81	28	29	1106
1700-1800	469	121	39	79	133	149	114	25	20	1149
1800-1900	467	113	41	74	127	74	80	13	25	1014
1900-2000	384	81	33	58	165	201	94	24	31	1070
2000-2100	341	109	31	48	170	226	131	19	52	1127
2100-2200	311	66	35	35	176	259	79	10	25	996
2200-2300	257	71	65	43	189	264	136	22	30	1077
2300-2400	196	40	44	44	182	283	153	25	37	1003
0000-0100	161	44	47	31	223	263	206	27	43	1045
0100-0200	127	40	30	12	171	216	173	23	48	841
0200-0300	76	31	47	6	151	271	150	27	45	804
0300-0400	55	71	4	5	137	211	140	16	48	686
0400-0500	47	51	11	17	129	182	114	9	18	579
0500-0600	68	54	13	42	126	144	120	12	27	606
Total	**6001**	**2010**	**750**	**1162**	**3331**	**4110**	**2615**	**465**	**791**	**21235**
%age	**28.26**	**9.47**	**3.53**		**40.51**			**18.23**		**100**

Source:

Commercial Feasibility Report for Conversion of 4-Lane to 6-Lanes, Karachi – Hyderabad Motorway, M9 Project – Presented along with RFP Nov 2013

SUMMARY OF TRAFFIC DATA - YEAR 2017

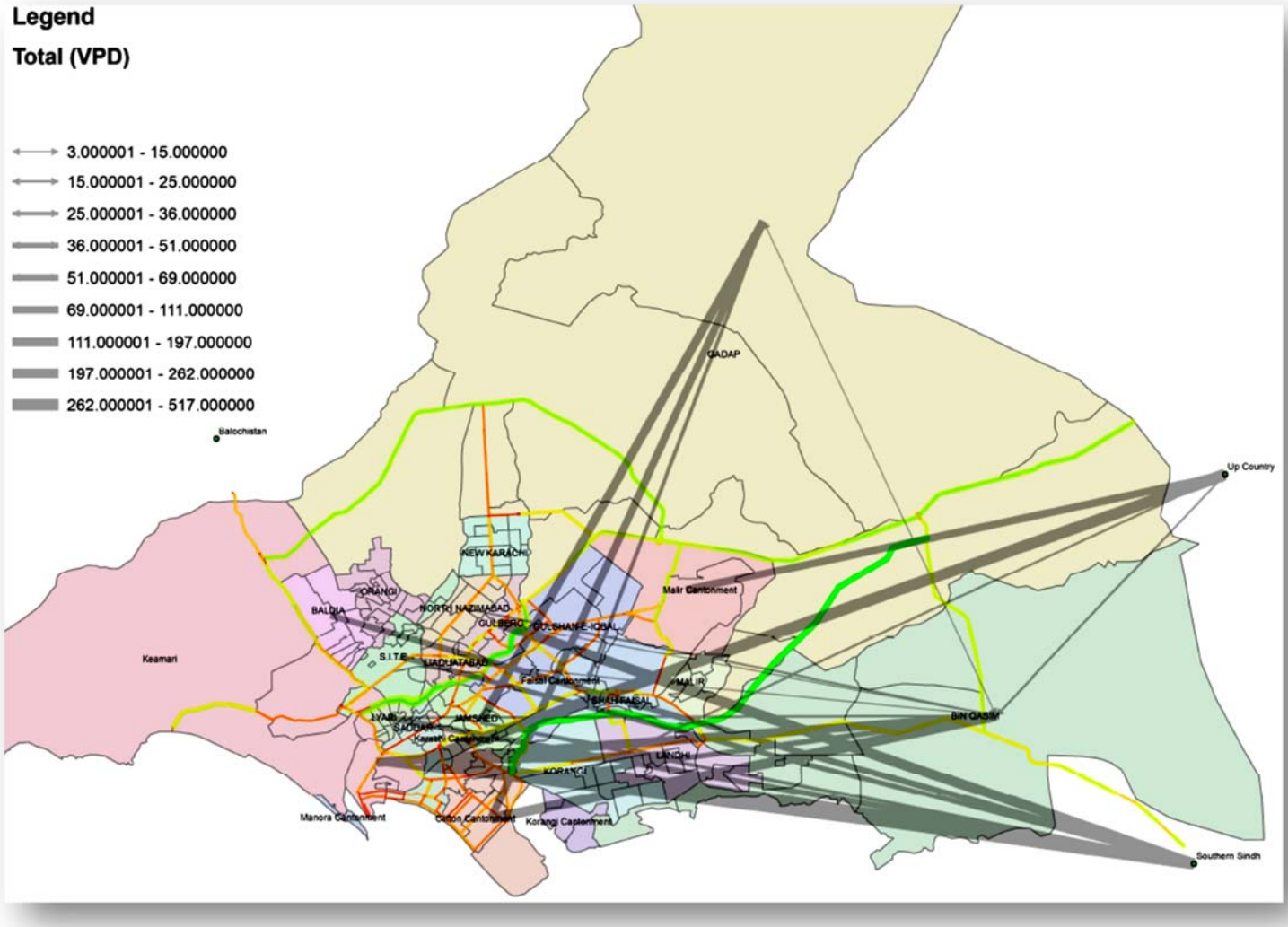
LOCATION	DIRECTION		CARS, JEEPS, TAXIS, VANS	MINI BUSES	LARGE / INTER CITY BUSES	TRUCKS 2-3 AXLES	TRUCKS WITH TRAILERS >4AXLES	TOTAL
	FROM	TO						
RCD HIGHWAY, N-25	Hub	Karachi	5304	577	313	2995	752	9941
	Karachi	Hub	3886	397	370	3189	718	8560
	Both		9190	974	683	6184	1470	18501
	Composition		50%	5%	4%	33%	8%	
NATIONAL HIGHWAY, N-5	Thatt	Karachi	4461	377	141	1770	452	7201
	Karachi	Thatta	4471	429	134	1649	348	7031
	Both		8932	806	275	3419	800	14232
	Composition		63%	6%	2%	24%	6%	
KARACHI - HYDERABAD MOTORWAY, M9	Karachi	Hyderabad	5942	21	827	4219	3570	14579
	Hyderabad	Karachi	8290	24	1184	5206	3359	18063
	Both		14232	45	2011	9425	6929	32642
	Composition		44%	0.14%	6%	29%	21%	

ANNEXURE B

TRAVEL DESIRE LINES

ANNEXURE B

TRAVEL DESIRE LINES

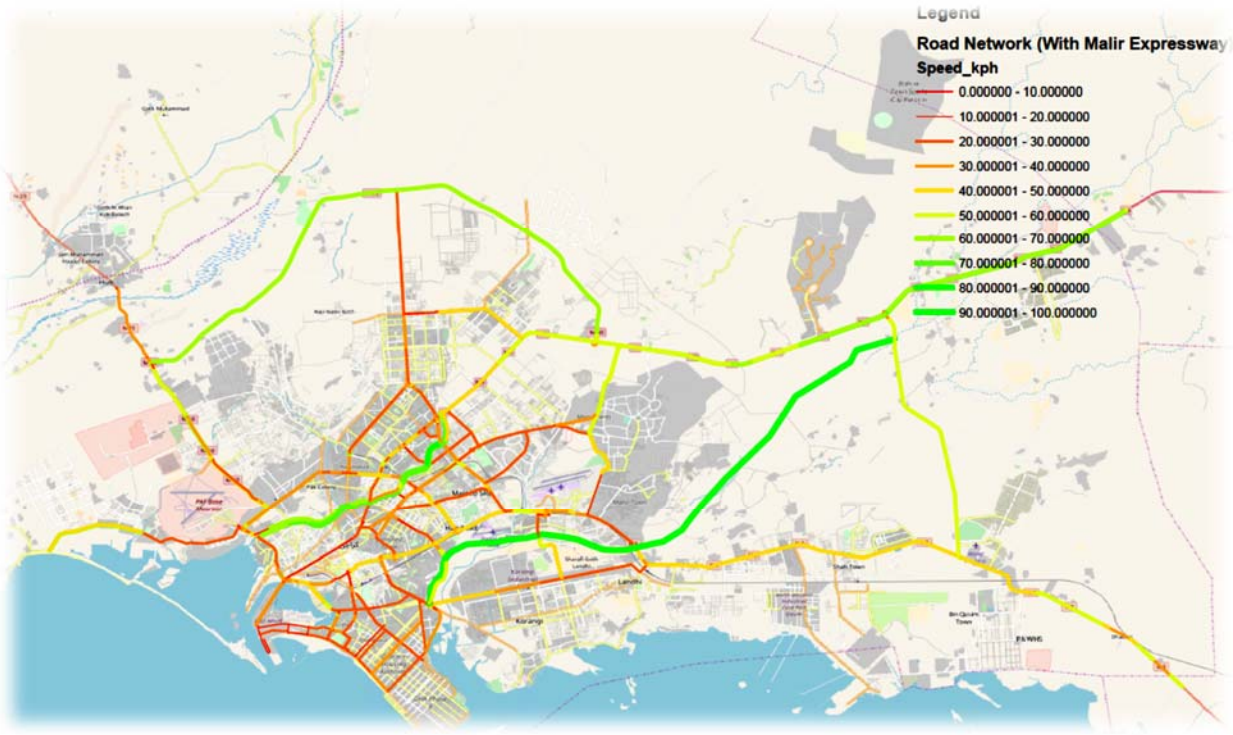


ANNEXURE C

ROAD INFRASTRUCTURE IN KARACHI & RELATIVE SPEEDS.

ANNEXURE C

ROAD INFRASTRUCTURE IN KARACHI & RELATIVE SPEEDS.


Legend
Road Network (With Malir Expressway
Speed_kph
0.000000 - 10.000000
10.000001 - 20.000000
20.000001 - 30.000000
30.000001 - 40.000000
40.000001 - 50.000000
50.000001 - 60.000000
60.000001 - 70.000000
70.000001 - 80.000000
80.000001 - 90.000000
90.000001 - 100.000000

CONSTRUCTION OF MALIR EXPRESSWAY
FROM MOTORWAY M9 TO KPT INTERCHANGE
KARACHI

C A P A C I T Y A N A L Y S I S
(UNDER IMPROVED UNINTERRUPTED FLOW CONDITION ON ACCESS CONTROLLED FACILITY)

Table 3.5.5.1

DESIGN CRITERIA :

HIGHWAY CLASSIFICATION 6-Lane Freeway	LATERAL CLEARANCE	TERRAIN TYPE: LEVEL	DRIVER POPULAT COMMUTERS
DESIGN SPEED: 100km/hr (60 mph)	ROAD SIDE 2M	DIRECTION :	ANALSYSIS SCENARIO: 1
FREE FLOW SPEED: 80.45 km / hr (50 mph)	MEDIAN VARIES		

NO. LANES ON THE PROPOSED FACILITY (N)	= 3	V/C RATIO ---------- LOS A =	-
ADJUSTMENT FACTOR FOR DRIVER POPULATION (fp)	= 1.00	V/C RATIO ---------- LOS B =	0.490
LANE ADJUSTMENT FACTOR (fw)	= 1.00	V/C RATIO ---------- LOS C =	0.690
PC EQUIVALENT BUSES (E_B)	= 1.60	V/C RATIO ---------- LOS D =	0.840
PC EQUIVALENT TRUCKS AND TRAILERS (ET)	= 1.70	V/C RATIO ---------- LOS E =	1.000

(v/c from Table 3-1, for 60 mph Design Speed)

Note : *This analysis is based on the procedures outlined in the Highway Capacity Manual - 1994 Edition (Special Report 209), published by the Transportation Research Board, National Research Council, U.S.A. Necessary Adjustments, as already mentioned, have been made to reflect the actual project conditions.*

YEAR		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
						1st Year of Operation	Uninterrupted Traffic Flow Condition								10th Year of Operation										20th Year of Operation					25th Year of Operation
Total Volume of Traffic Mix	**VPD**	33316	34982	37279	39758	42434	45326	48453	51836	54440	57179	60062	63096	66289	69650	73189	76914	80835	84964	87937	91015	94200	97497	100909	104441	108097	111880	115796	119849	124044
	PCU'S	46287	48602	51444	54489	57754	61260	65024	69069	72363	75819	79448	83257	87257	91456	95868	100501	105365	110475	114341	118343	122485	126771	131208	135800	140554	145473	150565	155835	161290
PERCENT BUSES		0.065	0.065	0.064	0.063	0.061	0.060	0.058	0.057	0.057	0.056	0.056	0.055	0.055	0.054	0.054	0.053	0.053	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052
PERCENT TRUCKS		0.540	0.540	0.529	0.518	0.507	0.496	0.485	0.473	0.469	0.466	0.462	0.458	0.454	0.450	0.446	0.442	0.438	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434
FACTOR FOR HEAVY VEHICLE (f_{HV})		0.71	0.71	0.71	0.71	0.72	0.72	0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
ALLOWABLE FLOW RATES*																														
SERVICE FLOW RATE - LOS A																														
SERVICE FLOW RATE - LOS B		2075	2075	2087	2100	2113	2126	2139	2153	2158	2163	2167	2172	2177	2182	2187	2192	2197	2202	2202	2202	2202	2202	2202	2202	2202	2202	2202	2202	2202
SERVICE FLOW RATE - LOS C		2922	2922	2939	2957	2975	2993	3012	3032	3038	3045	3052	3059	3066	3073	3080	3087	3094	3101	3101	3101	3101	3101	3101	3101	3101	3101	3101	3101	3101
SERVICE FLOW RATE - LOS D		3557	3557	3578	3599	3621	3644	3667	3691	3699	3707	3715	3724	3732	3741	3749	3758	3766	3775	3775	3775	3775	3775	3775	3775	3775	3775	3775	3775	3775
SERVICE FLOW RATE - LOS E		4235	4235	4259	4285	4311	4338	4366	4394	4404	4413	4423	4433	4443	4453	4463	4473	4483	4494	4494	4494	4494	4494	4494	4494	4494	4494	4494	4494	4494
Peak hour percentage factor "K"	0.070																													
Directional distribution factor "D"	0.500																													
Hourly Volume at the freeway (In one direction)		1620	1701	1801	1907	2021	2144	2276	2417	2533	2654	2781	2914	3054	3201	3355	3518	3688	3867	4002	4142	4287	4437	4592	4753	4919	5092	5270	5454	5645
Peak Hour Factor, PHF		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Actual Flow rate at the highway (in one direction)		1761	1849	1957	2073	2197	2331	2474	2628	2753	2884	3022	3167	3320	3479	3647	3823	4008	4203	4350	4502	4660	4823	4992	5166	5347	5534	5728	5929	6136

* Cj=2000

LEVEL OF SERVICE	B	C	D	E

CONSTRUCTION OF MALIR EXPRESSWAY
FROM MOTORWAY M9 TO KPT INTERCHANGE
KARACHI

C A P A C I T Y A N A L Y S I S
(UNDER IMPROVED UNINTERRUPTED FLOW CONDITION ON ACCESS CONTROLLED FACILITY)

Table 3.5.5.2

DESIGN CRITERIA :

HIGHWAY CLASSIFICATION 6-Lane Freeway	LATERAL CLEARANCE	TERRAIN TYPE: LEVEL	DRIVER POPULAT COMMUTERS
DESIGN SPEED: 100km/hr (60 mph)	ROAD SIDE 2M	DIRECTION :	ANALSYSIS SCENARIO: 2
FREE FLOW SPEED: 80.45 km / hr (50 mph)	MEDIAN VARIES		

NO. LANES ON THE PROPOSED FACILITY (N)	= 3	V/C RATIO ---------- LOS A =	-
ADJUSTMENT FACTOR FOR DRIVER POPULATION (fp)	= 1.00	V/C RATIO ---------- LOS B =	0.490
LANE ADJUSTMENT FACTOR (fw)	= 1.00	V/C RATIO ---------- LOS C =	0.690
PC EQUIVALENT BUSES (E_B)	= 1.60	V/C RATIO ---------- LOS D =	0.840
PC EQUIVALENT TRUCKS AND TRAILERS (ET)	= 1.70	V/C RATIO ---------- LOS E =	1.000

(v/c from Table 3-1, for 60 mph Design Speed)

Note : *This analysis is based on the procedures outlined in the Highway Capacity Manual - 1994 Edition (Special Report 209), published by the Transportation Research Board, National Research Council, U.S.A. Necessary Adjustments, as already mentioned, have been made to reflect the actual project conditions.*

YEAR		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
						1st Year of Operation	Uninterrupted Traffic Flow Condition								10th Year of Operation										20th Year of Operation					25th Year of Operation
Total Volume of Traffic Mix	**VPD**	9003	9453	10030	10651	11318	12036	12810	13643	14306	15003	15735	16505	17314	18164	19058	19997	20984	22023	22794	23592	24417	25272	26156	27071	28019	29000	30016	31067	32155
	PCU'S	12855	13497	14236	15025	15867	16767	17731	18760	19628	20538	21491	22491	23540	24639	25792	27000	28267	29598	30634	31706	32815	33964	35153	36382	37656	38975	40341	41753	43215
PERCENT BUSES		0.0651	0.0651	0.0638	0.0625	0.0611	0.0598	0.0584	0.057	0.0566	0.0561	0.0557	0.0551	0.0547	0.0542	0.0537	0.0533	0.0528	0.0523	0.0523	0.0523	0.0523	0.0524	0.0523	0.0523	0.0524	0.0523	0.0524	0.0524	0.0524
PERCENT TRUCKS		0.5398	0.5398	0.5291	0.5182	0.5072	0.496	0.4847	0.4733	0.4694	0.4655	0.4616	0.4577	0.4537	0.4498	0.4458	0.4419	0.438	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434	0.434
FACTOR FOR HEAVY VEHICLE (f_{HV})		0.71	0.71	0.71	0.71	0.72	0.72	0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
ALLOWABLE FLOW RATES*																														
SERVICE FLOW RATE - LOS A																														
SERVICE FLOW RATE - LOS B		1971	1971	1983	1995	2007	2019	2032	2045	2050	2054	2059	2064	2068	2073	2078	2082	2087	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092	2092
SERVICE FLOW RATE - LOS C		2776	2776	2792	2809	2826	2844	2862	2880	2887	2893	2899	2906	2912	2919	2926	2932	2939	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946	2946
SERVICE FLOW RATE - LOS D		3379	3379	3399	3419	3440	3462	3484	3506	3514	3522	3530	3538	3546	3554	3562	3570	3578	3586	3586	3586	3586	3586	3586	3586	3586	3586	3586	3586	3586
SERVICE FLOW RATE - LOS E		4023	4023	4046	4071	4096	4121	4147	4174	4183	4193	4202	4211	4221	4230	4240	4250	4259	4269	4269	4269	4269	4269	4269	4269	4269	4269	4269	4269	4269
Peak hour percentage factor "K"	0.150																													
Directional distribution factor "D"	0.560																													
Hourly Volume at the freeway (In one direction)		1080	1134	1196	1262	1333	1408	1489	1576	1649	1725	1805	1889	1977	2070	2167	2268	2374	2486	2573	2663	2756	2853	2953	3056	3163	3274	3389	3507	3630
Peak Hour Factor, PHF		0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Actual Flow rate at the highway (in one direction)		1200	1260	1329	1402	1481	1565	1655	1751	1832	1917	2006	2099	2197	2300	2407	2520	2638	2762	2859	2959	3063	3170	3281	3396	3515	3638	3765	3897	4033
* Cj=1900																														
LEVEL OF SERVICE		**B**											**C**								**D**						**E**			

FROM MOTORWAY M9 TO KPT INTERCHANGE
KARACHI
C A P A C I T Y A N A L Y S I S
(UNDER IMPROVED UNINTERRUPTED FLOW CONDITION ON ACCESS CONTROLLED FACILITY)

Table 3.5.5.3

DESIGN CRITERIA :

HIGHWAY CLASSIFICATION 6-Lane Freeway	LATERAL CLEARANCE	TERRAIN TYPE: LEVEL	DRIVER POPULAT COMMUTERS
DESIGN SPEED: 100km/hr (60 mph)	ROAD SIDE 2M	DIRECTION :	ANALSYSIS SCENARIO: 3
FREE FLOW SPEED: 80.45 km / hr (50 mph)	MEDIAN VARIES		

NO. LANES ON THE PROPOSED FACILITY (N)	= 3	V/C RATIO ---------- LOS A =	-
ADJUSTMENT FACTOR FOR DRIVER POPULATION (fp)	= 1.00	V/C RATIO ---------- LOS B =	0.490
LANE ADJUSTMENT FACTOR (fw)	= 1.00	V/C RATIO ---------- LOS C =	0.690
PC EQUIVALENT BUSES (E_B)	= 1.60	V/C RATIO ---------- LOS D =	0.840
PC EQUIVALENT TRUCKS AND TRAILERS (ET)	= 1.70	V/C RATIO ---------- LOS E =	1.000

(v/c from Table 3-1, for 60 mph Design Speed)

Note : *This analysis is based on the procedures outlined in the Highway Capacity Manual - 1994 Edition (Special Report 209), published by the Transportation Research Board, National Research Council, U.S.A. Necessary Adjustments, as already mentioned, have been made to reflect the actual project conditions.*

YEAR		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
						1st Year of Operation	Uninterrupted Traffic Flow Condition								10th Year of Operation										20th Year of Operation					25th Year of Operation
Total Volume of Traffic Mix	**VPD**	18720	19656	20941	22327	23824	25440	27188	29079	30537	32070	33684	35382	37168	39049	41029	43113	45307	47616	49283	51008	52794	54642	56555	58535	60584	62704	64898	67170	69521
	PCU'S	26024	27324	28916	30621	32450	34411	36518	38782	40629	42565	44599	46734	48973	51327	53798	56393	59119	61980	64150	66395	68720	71125	73615	76193	78860	81620	84476	87433	90493
PERCENT BUSES		0.035	0.035	0.034	0.033	0.032	0.031	0.031	0.030	0.029	0.029	0.029	0.029	0.028	0.028	0.028	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027
PERCENT TRUCKS		0.519	0.519	0.507	0.494	0.482	0.469	0.457	0.444	0.440	0.436	0.431	0.427	0.423	0.418	0.414	0.410	0.406	0.402	0.401	0.402	0.402	0.402	0.402	0.402	0.402	0.402	0.402	0.402	0.402
FACTOR FOR HEAVY VEHICLE (f_{HV})		0.72	0.72	0.73	0.73	0.74	0.74	0.75	0.75	0.75	0.76	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
ALLOWABLE FLOW RATES*																														
SERVICE FLOW RATE - LOS A																														
SERVICE FLOW RATE - LOS B		2018	2018	2031	2045	2059	2073	2087	2102	2107	2112	2117	2122	2127	2132	2138	2143	2148	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153	2153
SERVICE FLOW RATE - LOS C		2841	2841	2860	2879	2899	2919	2939	2960	2967	2974	2981	2988	2996	3003	3010	3017	3025	3032	3032	3032	3032	3032	3032	3032	3032	3032	3032	3032	3032
SERVICE FLOW RATE - LOS D		3459	3459	3482	3505	3529	3554	3578	3603	3612	3621	3629	3638	3647	3656	3664	3673	3682	3691	3691	3691	3691	3691	3691	3691	3691	3691	3691	3691	3691
SERVICE FLOW RATE - LOS E		4118	4118	4145	4173	4201	4230	4260	4290	4300	4310	4321	4331	4342	4352	4362	4373	4384	4394	4394	4394	4394	4394	4394	4394	4394	4394	4394	4394	4394
Peak hour percentage factor "K"	0.085																													
Directional distribution factor "D"	0.520																													
Hourly Volume at the freeway (In one direct		1150	1208	1278	1353	1434	1521	1614	1714	1796	1881	1971	2066	2165	2269	2378	2493	2613	2740	2835	2935	3037	3144	3254	3368	3486	3608	3734	3865	4000
Peak Hour Factor, PHF		0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Actual Flow rate at the highway (in one dire		1250	1313	1389	1471	1559	1653	1754	1863	1952	2045	2143	2245	2353	2466	2585	2709	2840	2978	3082	3190	3302	3417	3537	3661	3789	3921	4059	4201	4348

* Cj=1900

LEVEL OF SERVICE	B	C	D	E