

# INTRODUCING A NEW TRAFFIC OPERATIONAL STRATEGY TO MINIMIZE CONGESTION ON GALLE ROAD; DEHIWALA – WELLAWATTA

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**Abstract-** The increase in private traffic demand coupled with a number of issues such as reduced utilization of high occupancy vehicles, lack of capacity of public modes of transportation, inefficient road capacity leads to highly congested roads in Colombo city. Traffic control infrastructure has led to a degradation in the speed of vehicles on the roads of Colombo city resulting in higher operating costs for vehicles and greater congestion and pollution throughout the city. This study intended to suggest proposals to reduce the traffic congestion on Galle road by introducing designing and planning strategies ensuring optimum utilization of Marine Drive. Level of Service (LOS) estimations on Galle Road and Marine Drive clearly indicated that the traffic condition in Galle Road in the section from Dehiwala to Wellawatte, was very poor during peak times. It can be seen that traffic control measures that have already been undertaken, have not answered this traffic congestion problem completely. Even though Marine Drive has been introduced as a solution for this traffic congestion, which has resulted in reducing traffic, should be optimized to take maximum advantage of it. Field observations and Level of Service estimations indicated that the level of utilization of Marine Drive to avoid traffic, was poor. In this case, three proposals have been introduced by this study which are, structural design of Marine Drive extension from Wellawatte to Dehiwala, bus route plan accompanied with re- routing of long distance bus services and intersection plan for Dehiwala junction. Findings and proposals of this project will be helpful to minimize traffic congestion in Galle Road during peak times, at the same time reducing the negative social, economic and environmental impacts.

**Keywords-** Congestion, Traffic Management, Marine Drive

## I. INTRODUCTION

Colombo is named as the commercial capital of Sri Lanka which consists most of the Trip attraction points such as government and private offices, Shopping malls, Hospitals, Hotels, and Schools. The main harbour of the country is also located in Colombo Metropolitan Region (CMR).

However, it has been identified that there is a mobility issue within the Colombo Region. Average travel speed in CMR is limited to 17 km/h. Furthermore it is reduced to 12 km/h in Colombo Municipal Council (CMC). (JICA, 2015) Clearly at these service levels, economic growth is likely to slow down.

According to the JICA (2014) report 1.9 million daily passengers enter the CMC limits each day using 7 corridors: namely, Negombo Road (A3), Kandy Road (A1), Low level Road (B435), Malabe Road (A0-B240), High level Road (A4), Horana Road (B84) and Galle Road (A2). Other than that, 10 million passenger trips generated within the CMR daily. But the problem is with the increase of population, number of private vehicles entering the city is increasing because the public transport share is gradually declining from 65% (1985) to 47% (2013) on the roads (JICA, 2014).

When considering the Galle Road, a huge traffic flow is generated in the morning peak as well as in the evening peak in between Dehiwala and Wellawatta section. Congestion ends in Wellawatta when four lanes are given in one direction and it becomes a one-way road. Marine Drive should be effectively used in order to reduce the traffic congestion on Galle Road.

Considering all those factors, further studying and creating an effective urban plan is highly needed at this moment. For that, all the factors affecting the traffic congestion need to be considered in order to give an effective solution.

The main objective of this study is to identify possible alternatives to improve level of service on Galle road during peak hours with the use of road improvements and new traffic plans.

Structural design of Marine Drive extension from Wellawatte to Dehiwala, bus route plan accompanied with re- routing of long distance bus services and intersection plan for Dehiwala intersection are the proposals which have been introduced by this study.

When deciding a solution, it should have sufficient validity to match with future demand (Wells, 2017). Therefore, demand forecasting is also very important. Megapolis master plan is one of the key projects which will generate more traffic in CMC city limits in the near future. Therefore, it has been considered in this study too.

There are two main issues in current transport conditions in Galle Rd corridor. Even though, Galle Rd corridor has the highest railway modal share among the seven corridors, it has poor availability of feeder services to travel between railway stations and the Galle Rd corridor. The other issue is, the bottleneck in Galle road at Dehiwala fly-over section which generates more traffic in peak hours. In order to eliminate that, bus route plan accompanied with re- routing of long distance bus services and intersection plan for Dehiwala junction has been considered in this study.

## II. METHODOLOGY

Galle Road and Marine Drive were the main two roads considered for this study. Initially the Level of Services

of the above two roads have been estimated according to Highway Capacity Manual 2000 (HCM 2000).

Intersection turning movement counts have been carried out in selected two locations in order to estimate the traffic volumes in Galle Rd and Marine Dr. These data have been used to identify the peak hour where the maximum flow occurred. The influence of large vehicles on vehicular traffic flow have been identified through converting them to passenger car units (pcu). The length of the sampling period depends on the type of count being taken and the intended use of the data recorded.

Bus volume survey was carried out to analyse the number of busses entering the Colombo city via Galle Corridor and to identify the variation of their capacity with the demand. The long distance busses and short distance busses have been recorded separately along with their cluster type and the number of seats occupied. The location for the bus volume survey was decided as Dehiwala junction (under the flyover) due to the proper visibility, space, and ease of counting. Separate survey form was prepared to record the route, time, cluster type and occupancy level etc. This survey was carried out for both directions that is from Colombo to Dehiwala and from Dehiwala to Colombo. Data collected from bus volume survey has been classified into hourly basis and route basis. Bus demand per each hour is calculated thereby and the count of demand is defined according to a certain criterion of value adopted. The buses travel across the provincial boundaries were considered as long-distance buses and they were sorted out separately. The total passenger demand of long distance buses has been calculated in hourly basis. The data of the long-distance buses has summarized in hourly basis, taking the bus count and the calculated passenger demand as shown in the following table.

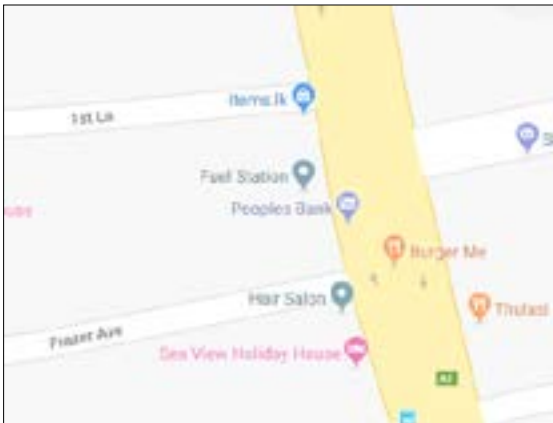
Intersection turning movement counts were taken to collect traffic data which was required for LOS determination of the Marine Drive and Galle Rd. Surveys has been conducted in both morning peak and evening peak for selected two locations. From the preliminary site visits, the most effective places to take turning movement counts were identified. These locations were selected based on higher frequency of utilization and less difficulties in counting.

Location 01: In Galle road, near Frazer Avenue (one of the most congested intersection in the Galle road as per the preliminary site observations).

**Table 1: Evaluation of passenger loadings for long distance buses (Dehiwala to Colombo direction)**

Hour	Number of buses	Total hourly demand
7:30-8:30	23	1115
8:30-9:30	37	1591
9:30-10:30	25	981
10:30-11:30	23	863
11:30-12:30	24	1079
12:30-13:30	22	700
13:30-14:30	20	686
14:30-15:30	21	610
15:30-16:30	17	537
16:30-17:30	20	687
17:30-18:30	22	933
18:30-19:30	20	606
<b>Total for 12 hours</b>	<b>274</b>	<b>10387</b>

Location 01:



*Figure 1: Turning movement at location 1*

Collected data for 15 minutes time intervals were used to evaluate hourly traffic volumes which were required for LOS calculations. Level of Service was estimated according to the HCM 2000. The Geometric data of the Marine drive and Galle road were obtained from RDA

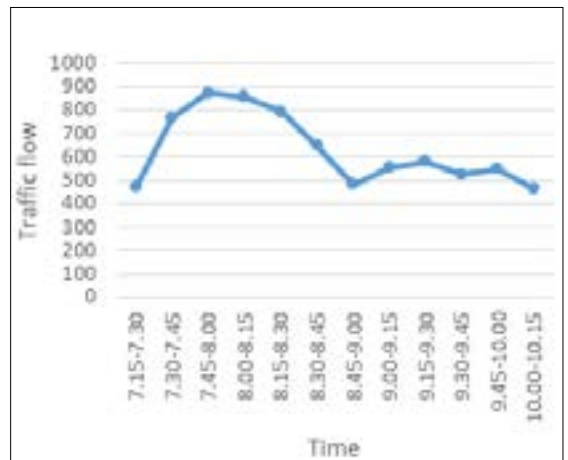
Location 02: In Marine drive near the Ramakrishna Road



*Figure 2: Turning movement at location 2*

and CMC respectively. Required vehicular flow data were gathered through the traffic surveys and free flow speed was estimated using the base free flow speed which has been taken by considering the speed limits given for the roads with the adjustments given in HCM 2000.

Galle road morning peak LOS calculations are shown as follows as a sample. Collected data for 15 minutes time intervals have been evaluated in order to find out the peak hour factor.



*Figure 3: Traffic flow - Galle Road (Dehiwala to Kollupitiya)*

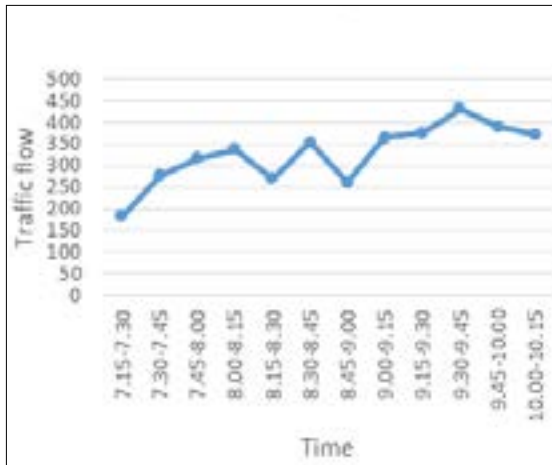


Figure 4: Traffic flow - Galle Road (Kollupitiya to Dehiwala)

From figure 3 and figure 4 peak 15 minute volume and peak hour factor can be calculated as table 2.

Table 2: Peak hour factor calculation

For both directions	
Peak hourly volume	4080
Peak 15min volume	1195
Peak hour factor	0.853556

Then the LOS has been calculated as shown in the table 4 and it has been shown in table 3.

### III. RESULT AND DISCUSSION

From Table 3, it can be seen that the traffic condition in Galle Road during peak hours is heavily congested compared to Marine Drive. As a solution, extension

Table 3: Existing LOS details of Galle Rd and Marine Drive

Direction	Dehiwala to Colombo	Colombo to Dehiwala
hourly peak vehicle volume (veh/h) in one direction (V)	2965	1570
number of travel lanes in one direction (N)	2	2
driver population factor (fp) - for commuter traffic	1	1
Peak Hour Factor (PHF)	0.854	0.854
decimal portion of trucks/buses – Pt	0.069	0.16
decimal portion of recreational vehicles – Pr	0	0
passenger car equivalents (trucks/buses) – Et	1.5	1.5
passenger car equivalents ( recreational vehicles) – Er	1.2	1.2
heavy-vehicle adjustment factor (fHV)	0.967	0.926
15-minute passenger-car equivalent flow rate (pc/h/ln) - vp	1796	993
base free-flow speed (mi/h) – BFFS	75	75
Lane width (m)	3.3	3.3
Adjustment for lane width (km/h) (Exhibit 21-4) – fLW	3.1	3.1
Lateral clearance from the right edge of travel lanes (m)	0.25	0.25
Lateral clearance from the left edge of travel lanes (m)	0.75	0.75

Direction	Dehiwala to Colombo	Colombo to Dehiwala
Total lateral clearance (m)	1	1
Adjustment for lateral clearance (km/h) (Exhibit 21-5) - f <sub>LC</sub>	3.93	3.93
Adjustment for median type (km/h)(Exhibit 21-6) - f <sub>M</sub>	0	0
No of access	122	38
Length of the road segment (km)	5.8	2.2
Access point density (No. of access points/km)	21	17
Adjustment for access-point density (km/h) (Exhibit 21-7)- f <sub>A</sub>	14	11.3
estimated free-flow speed (mi/h) – FFS	53.97	56.67
Average passenger car travel speed (km/h) – S	74.6	56.67
Density (pc/km/ln) – D	24.1	17.5
From Exhibit 21-2: Level of Service	E	D

**Table 4: LOS calculations**

Road	Time	Maximum density (D)	LOS
Galle Road			
Dehiwala to Colombo	Morning peak	24.1	E
	Evening peak	20.1	D
Colombo to Dehiwala	Morning peak	17.5	D
	Evening peak	25.6	E
Marine Drive			
Dehiwala to Colombo	Morning peak	20.4	D
	Evening peak	14.5	C
Colombo to Dehiwala	Morning peak	9.2	B
	Evening peak	16.4	D

of Marine Drive up to Dehiwala intersection has been designed to cater a new traffic plan which was tested for its potential to reduce the congestion in Galle road during peak hours.

It can be seen that the vehicles passing the Dehiwala junction without using flyover make much traffic on the Galle Road. It has been identified that the main reason for this traffic is the restriction for buses and other heavy vehicles to use the flyover. After the extension of Marine drive up to Dehiwala, Station road will be used as the main access to Marine

drive. Proposed extension of Marine drive will connected to Dehiwala junction as a two lane road.

Currently there are more trip attraction points on Dehiwala junction such as Banks, ATMs, textile shops market, post office, apartments. So that land acquisition might be a massive problem. According to the new implementation, land from Northern side of the station road up to 100m from the junction may have to acquire since several movements will occur towards the station road. Currently bus stops are occupied on the Galle road near to the flyover. With new proposal the bus stop for the long distance busses towards Colombo will be moved to the station road. All the other vehicles travel towards Colombo and Galle will use the flyover except buses and the traffic flow indicate by green colour in the below figure will always flow without any interruption. Then the flow indicated from blue, yellow and red will flow respectively with the control of the traffic lights. With proposed Marine drive extension, all the long distance busses travelling towards Colombo will be directed to the Marine drive. So that width of the station road may not be enough for the traffic flow. Hence the proposed land must be acquired for station road expansion.

With the Marine Drive extension, all the vehicles coming from the Marine Drive directly move towards Dehiwala junction. Near to the Dehiwala junction it is preferred to control the entrance of vehicles to Galle road by

traffic lights because crossing of Galle road will increase the traffic condition. All the long distance busses which travel towards Colombo will be shifted to the extension of Marine drive from Dehiwala intersection. Bus Stop for long distance buses will be located on Station road in order to avoid the generation of traffic due to loading and unloading. Passengers who needs to travel on Galle road whose destinations are located along the Galle road can be shifted to the buses of route numbers 100, 101, 154, 155 from Dehiwala. Long distance buses will travel through the Marine Drive with limited stops near the railway stations situated along the Marine drive. Ultimately it will reduce the travel time for the public bus users who travel towards Colombo Fort and it will promote the use of public vehicles in the city.

The access roads connecting the Marine drive and the Galle road has been selected by considering the visual observation and land use patterns of the area. Following Figure illustrates the access road restriction plan for the proposed extension of Marine Drive. Marine Drive extension will be four lane road and Frazer Avenue road is two lane road. Senanayake road, Ferlaine road, Rodrigo Lane and Gregory Lane can used to enter to the Marine Drive due to the residential Availability. If the vehicles need to access the Galle road, they can use the Station road.

According to the proposed plan Station Road and Frazer Avenue roads are open for both ways. De Alwis Place and Muhandiram Lane can also be used to enter the Galle Road. These alternative roads can reduce the amount of traffic entering to Dehiwala intersection from Marine Drive at once. Peter's Lane is a short distance dead end road and it can be used only by residents. Due to limited availability of space in all roads, it is effective to use minor access roads as one way roads. Frazer Avenue can be used as a two way road because of the availability of space. This traffic plan has been proposed by visual observation considering the lane width of the particular connectors and to minimize conflicts in turning movements at junctions. It has also concerned about the existing residencies of those minor access roads and less impact for them.

Table 5 indicates the number of lanes, lane width and right of way (ROW) of the connecting roads.

## V. CONCLUSION

The traffic congestion in Galle Road in the section from Dehiwala to Wellawatte in the peak hours have resulted

**Table 5: Details of connecting roads**

Road Name	No. of Lanes	Lane width (m)	ROW (m)
Frazer Avenue	2	2.6	2.0
Rathnakara Place	2	2.6	0.5
Intium Place	1	4.0	0.5
Albert Place	1	5.0	0.5
Camble Place	1	2.7	0.5
2nd Lane	1	4.2	0.5
Peters Lane	1	4.0	0.5
Muhandiram Lane	1	2.5	0.0
Vandwart Place	1	3.9	0.5
De Alwis Place	1	1.5	0.0
Fair line Road	1	3.5	0.5
Rodrigo Lane	1	2.5	0.5
Gregory Lane	1	2.0	1.0
Station Road	2	3.3	3.5
Senanayake place	1	3.9	0.5
Ramanathan Ave	2	3.0	0.5

numerous negative social, economic and environmental impacts in the recent past. LOS studies of this study prove that the need of a proper transport plan in order to cater the future traffic generation with the mass development of the city. It can be seen that traffic control measures that have already been undertaken, could not answer this traffic congestion problem completely. Therefore, this study was focused on introducing a new traffic operational strategy to minimize congestion on Galle Road by optimum utilization of Marine Drive. Three measures have been introduced that ensure the effective use of Marine Drive in order to reduce the traffic congestion on Galle Road. Which are;

- Design of Marine Drive extension from Wellawatta to Dehiwala intersection
- Bus Route Plan accompanied with re-routing of long distance bus services

- Intersection plan for Dehiwala intersection where the new access road for the Marine Drive extension would be located.

With the proposed solutions, it will reduce the travel time of the road users specially who use public transport services for travelling. It will ultimately increase the use of public transportation and reduce the number of vehicles entering the Colombo city. If the proposed transport plan will be implemented with the help of relevant authorities, it will ultimately reduce traffic congestion in Galle Road during peak times, and at the same time reducing the negative social, economic and environmental impacts.

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