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EFFECTIVENESS OF INTEGRATED TRAFFIC MANAGEMENT FOR A COMBINED FLYOVER SYSTEM IN COLOMBO: A MICROSIMULATION APPROACH

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ABSTRACT

Major arterial roads in city centres often face ever-increasing traffic demand periodically addressed through developments to ease congestion on road links and improve integrated road connectivity. Towards this end, three flyovers are proposed in the Slave Island area in Colombo. This high-investment project of the Sri Lankan Government expects the flyovers to prevent peak-hour traffic delays from the frequent road closures at two railway gates while providing for the higher traffic generated from the land use changes in the area. The project also expects to relieve congestion in the adjacent road network.

This research investigates the outcomes expected of integrated traffic management from the project. A traffic analysis was carried out for the entire road network of the project impact area using the PTV Vissim software. Moreover, current and future land use was considered in assessing network connectivity over the design life. Alternative traffic management options were tested to identify the most feasible arrangement for connecting the proposed flyovers. Origin-Destination data from 2018 were used to determine intersection capacities and pedestrian movements. Results reveal that delays due to railway gate closure reduced, though a significant traffic diversion from the proposed flyover network was not evident.

Keywords: *Integrated Traffic Management, Flyovers, Demand Analysis, Congestion Alleviation, Urban Traffic Management, Rail Crossings, Traffic Delay and Queuing*

1. INTRODUCTION

Urban traffic congestion with increased car ownership and the continued growth of cities has become a global challenge. Although the most obvious consequence of congestion is increased travel duration for passengers and freight, it has other social issues and environmental impacts as well. Innovative road infrastructure planning and design can help to reduce the flow of private motorised vehicles onto main roads and ease traffic congestion. Transportation infrastructure such as bus lanes, bike lanes, and sidewalks serve as alternatives to private motorised vehicles. Investment in public transportation can enhance this alternative to yield considerable benefits.

The study area of this research paper is located in an urban setting with many high-rise commercial and residential buildings and more being constructed in a concentrated commercial area of Slave Island, Colombo Fort, Colombo 3 and Galle Face Court etc. The area experiences traffic congestion during peak hours, with trains passing across main roads (causing railway gate closures) at a high frequency. To overcome delays due to railway gate closure and high travel time during peak hours, it was proposed by the Government of Sri Lanka to construct three flyovers at the Slave Island area as an integrated traffic management scheme the construction started in 2021, and is in progress. This study uses a comprehensive traffic demand analysis and forecasts to gauge the effectiveness of the proposed improvements for congestion alleviation in the considered urban road network.

2. LITERATURE REVIEW

Traffic Modelling has become a popular technique in analysing, simulating and predicting traffic levels on main road networks. The technique is useful in developing plans to control and optimise operations [1]. Simulation models describing traffic flow, support the assessment of how road designs influence vehicular movements [2], [3]. Simulation models are of three scales: microsimulation, mesosimulation and macrosimulation. These are classified based on the level of detail of the modelling applications and the specific requirements of the transportation problem to be addressed. Microscopic models simulate individual vehicles and are limited to modelling local areas at a finer resolution, whereas macroscopic models simulate aggregate traffic flows considering larger areas [4].

Microsimulation techniques were used in the Beijing CBD area for traffic management, where scenarios were defined based on possible one-way and two-way arrangements, with travel time, delay, queue length and travel speed being used as evaluating parameters. However, the study did not consider traffic generation and attraction from future infrastructure developments in the study area [5].

Microsimulation was also used to identify traffic management measures for Port Blair City, India. The study considered the possibility of optimising the use of existing infrastructure to minimise the impacts of traffic congestion. It also considered geometric improvements of intersections, turning restrictions and one-way circulation. Suitable measures were identified by comparing travel time and delay parameters [6].

PTV Vissim is a microsimulation software that has been used to model different intersection management interventions such as signalisation [7,8], roundabouts [9,10] and grade separation [11,12]. This study uses static and dynamic assignment options of PTV Vissim [13]. Dynamic traffic assignment provides more realistic driver route selection under complex road networks and time-varying traffic conditions [14], [15].

Forecasting, which is a major activity of planning [16], attempts to predict the most probable future traffic based on certain assumptions [17]. The different development scenarios are the range of possible future conditions [18] considered in forecasting assumptions.

3. PROJECT IMPACT AREA AND FLYOVER LAYOUT

The study area for the research is in the heart of Colombo City. This area, named Slave Island, is the commercial centre of Colombo City which is undergoing significant urban regeneration with the development of the Port City, hotels, high-end residential apartments, and shopping malls, which will increase traffic generation and attraction significantly in the near future. Roads in Slave Island intersect with railways and incur road closures at these railway gates. the impact of delays caused by these closures will increase with the implementation of the proposed Colombo Suburban Railway Project (CSRP). The construction of three flyovers was proposed as a solution to minimise traffic congestion resulting from railway gate closures and congestion along the main roads in the vicinity of the project impact area.

Table 1: Characteristics of Proposed Flyovers at Slave Island Area

No	Flyover Name	Flow Direction	No of Lanes	Length (m)	Width (m)
1	Ring Road Flyover	One Way	2 Lanes	320	11.0
2	Akbar Mawatha Flyover	One Way	2 Lanes	328	8.0
3	Uttarananda Mawatha Flyover	Two Way	2 lanes	435	9.4

All three flyovers are proposed with two-lane capacity, and two of them are designed for unidirectional traffic flow, creating a ring circuit in Slave Island. Flyovers at Justice Akbar Mawatha and Sri Uttarananda Mawatha are connected through a separate branch flyover for left turners. The system will increase connectivity from Galle Road (A002) to Colombo Galle Batticaloa Highway (A004) while increasing the capacity of the road network with minimum disturbance to or from railway operations. One-way- systems introduced with the flyover operations will further reduce the conflict at intersections and will also improve road linkages.

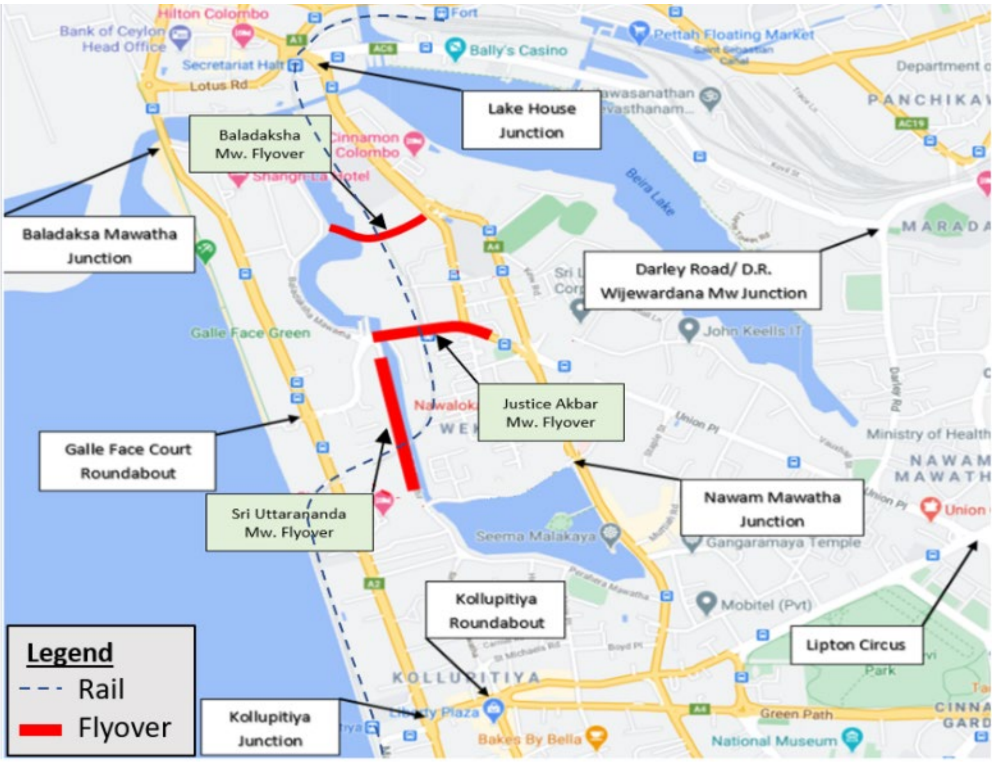

Figure 1: Layout of Proposed Flyovers

4. METHODOLOGY

4.1. Preparatory Work

OD (Origin-Destination) data and MCC (Manual Classified Count) data related to the project area collected in 2018 were used as the main database, due to the reason that they were not distorted with abnormal travel patterns due to pandemic conditions and the country's ongoing economic crisis. The analysis has been made using the database used for traffic forecasting of the Port Access Elevated Highway Project and consists of 24-hour survey data at Galle Road (2,678 OD interviews), Colombo Galle Batticaloa Highway (2,564 OD interviews) and D. R. Wijewardhana Mawatha (1,621 OD interviews).

In addition to this database, traffic count and other related data were collected during the year 2022 to verify network simulation results with adjustments using time series data available over the last three years. Such traffic surveys were carried out at seven intersections within and around the project impact area to collect turning movement data, travel time data, and pedestrian count data.

Data related to major traffic generators in the project area that were completed after 2018 or are under construction at present were identified, and details required for trip estimation (expected trip generations and attractions) were obtained from Urban Development Authority (UDA).

Public transport interventions impacting the project area, such as the Colombo Suburban Railway Project (CSRP) and their demand variations, were identified, and relevant data were extracted from project reports.

The extent of the road network and the length of the modelling network were decided based on the expected project impact area. Based on the level of detail available in OD data, internal zones were developed at the Grama Niladhari Division/Ward level, and external zones were defined at entry/exit points (nodes) of major links. The centroids of the internal and external zones are given in Figure 2.

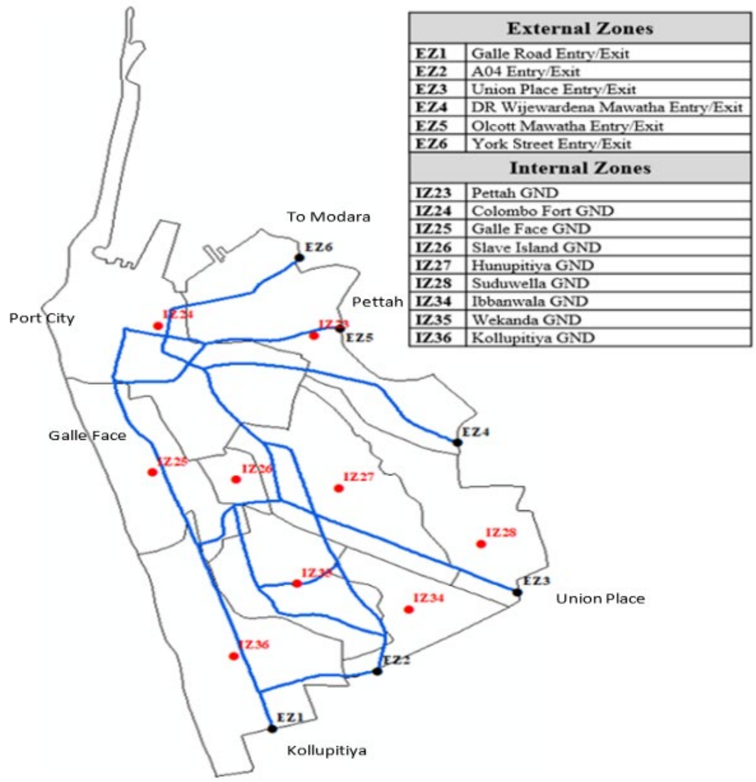

Figure 2: Considered Traffic Analysis Zones

4.2. Development of OD Matrix

Modelling and simulations were carried out for the morning (AM) peak (8 am-9 am) traffic, which was observed as the critical period. Hence OD matrices were developed for AM peak period for each mode of transportation that was modelled (these were Motorcycle, Three-wheeler, Car, Van, Bus, Light Goods Vehicle, Medium Goods Vehicle, and Heavy Goods Vehicle).

The base OD matrix was developed using the OD survey data, and MCC counts, with trips to and from GNDs /wards outside the project area being assigned to the defined external zones based on probabilities calculated from network analysis.

Base ODs were forecasted to reflect the expected and planned operational year of the project: 2023.

Trip generations and attractions were estimated for the major developments identified and distributed among zones based on existing OD patterns in the area. Estimation of trip generation and attraction was carried out based on area use of the development and UDA regulations. Table 2 provides a summary of the estimated traffic movements related to considered major developments.

Table 2: Estimated Traffic Movements of Major Developments

Development	AM Peak Hour Volume (PCU)	
	Out	In
Waterfront Development	342	157
Port City	58	102
Shangri La Colombo	50	42
ITC Colombo One	100	43
Altair	204	37
Colombo City Centre	104	25
Imperial Destiny	296	53
TATA Housing	170	35

The OD developed using survey data and estimated OD for developments were combined to derive the overall final OD matrix.

4.3. Microsimulation for Network Assignment

Microsimulation of the traffic assignment for the road network in the study area was carried out using PTV Vissim microsimulation software. The scenarios considered under microsimulation and the adopted modelling approaches are indicated in Table 3.

Table 3: Microsimulation Scenarios and Modelling Approach

Case	Description	Adopted Modelling Approach
Bc 0	Base Case -2018	Modelled the road network traffic assignment for 2018 conditions. Developed vehicle ODs for 2018 were used as traffic data.
Sc 1	Flyover with Original Design	Links related to flyovers (Originally designed flow conditions) and Baladaksha Mawatha were added to the road network. Forecasted vehicle ODs and estimated major development ODs for 2023 were used as traffic data.
Sc 2a	Reverse direction of one-way flyovers	Change the direction of Baladaksha Mw Flyover and Justice Akbar Mawatha Flyover links with additional adjustments at intersections. Sc1 Traffic Data was used.
Sc 2b	All Flyovers Two way	Both Baladaksha Mw Flyover and Justice Akbar Mawatha Flyover links were adjusted as two-way links with additional adjustments at intersections. Sc1 Traffic Data was used.
Sc 3a	Service Roads closed at Railway Crossing	Links related to the At-grade service roads of Justice Akbar Mawatha and Uttarananda Mawatha were adjusted with the restriction of vehicle movement only up to the railway crossings. Sc1 Traffic Data was used.
Sc 3b	Modal Shift to Suburban Railway due to CSRP	Sc 3b Network with reduced OD traffic to reflect the modal shift from road traffic to the improved Railways.

Dynamic traffic assignment was carried out in all cases to capture the change in route choices of vehicle users based on changes in network characteristics. The modelling procedure indicated in Figure 3 was followed for each case.

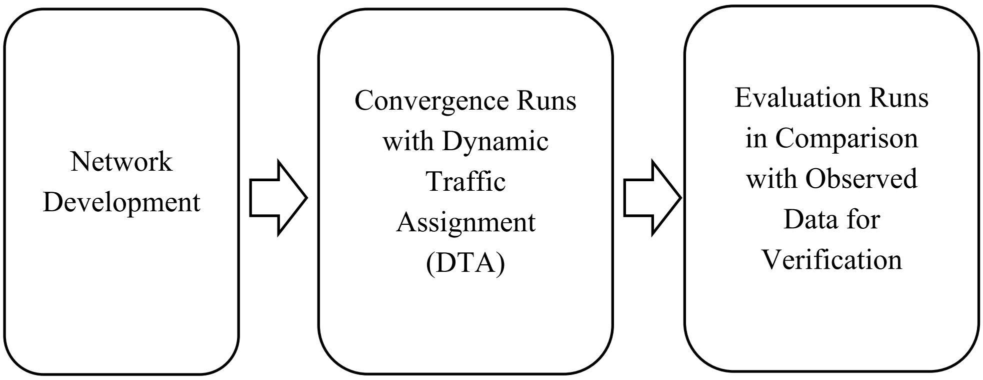

Figure 3: Microsimulation Process

The network was developed with nodes being defined at decision points (intersections, diverging and merging sections). Zones were defined based on entry and exit points to the study area, and zone connectors were added using parking lots. The trip matrices were developed for each mode and were added to the model.

Dynamic assignment parameter settings were adjusted as follows.

- Scale total volume to: 20% (to avoid initial congestion)
- Evaluation Interval: 3600 seconds
- Path Selection Type: Decide repeatedly
- Convergence Condition: Travel Time on Paths: 15% (Required share of converged paths/edges:95%)

With convergence not achieved after 30 runs (or even 50 runs), the total volume was scaled to 70% and was rerun for 30 iterations. It was assumed as converged due to the study area being heavily overloaded. Search for new paths and scaling of volumes was deselected for evaluation runs.

Models were calibrated for local conditions with adjustments to driver behaviour parameters indicated below.

- Look ahead distance (Minimum): 50m
- Look ahead distance (Maximum): 300m
- Look back distance (Minimum): 30m
- Average standstill distance: 0.8m
- Additive part of safety distance: 1
- Multiplicative part of safety distance: 1.5
- Minimum Clearance (front/rear): 0.3m

The base case was validated with available link volume data. The base model that best represents the network conditions in 2018 was developed after several simulation attempts with applicable model calibration. Adjustments (i.e. application of route closures for paths that are not normally used) were carried out after each run.

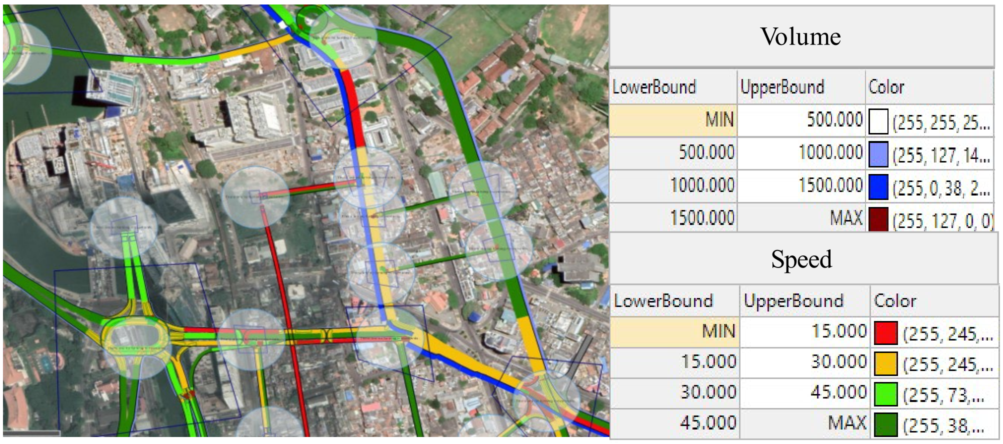

Figure 4: Microsimulation of Scenario 1

4.4. Analysis

Results for the simulated scenarios were analysed by deriving V/C ratios and LOS for each link. Further, based on the proximity to the project area, the links were categorised as core area and external area to better understand the overall impacts. The core area is considered as the flyovers and the adjoining road links to them, while external areas are considered as road links in the network beyond this (adjoining Links) and within proximity.

The design life of the flyovers is estimated at 50 years for the structures. However, the capacity analysis and the pavement designs are conducted for a 10 - 15 year period as per the economical design requirements of the road infrastructure designs. Hence the flyover links capacity analysis was forecasted for 15 year time period to further understand the change in LOS during the design lifetime.

5. RESULTS AND DISCUSSION

The feasibility study reported on the total delay at railway crossings over a 12-hour (7 am-7 pm) period. At Justice Akbar Mawatha, the total delay during the 12 hours had been observed as 2 hours and 20 minutes. This was recorded as 2 hours and 8 minutes at Uttarananda Mawatha. The total time loss observed due to gate closure during the morning peak hour (7.00 am to 8.00 am) at Justice Akbar Mawatha was 20 minutes, with a maximum queue length of 120 metres. This is a percentage of 14.3% (20min/ 2:20:15hours) of 12 hours total of the gate closure. The total time loss due to gate closure during the morning peak hour at Uttarananda Mawatha was 25 minutes, with a maximum queue length of 80 metres. This is a percentage of 19.4% (25min / 2:08:36 hours) of 12 hours total of the gate closure These values are expected to grow as train frequency increases under the Colombo Suburban Railway Project to take place shortly. The addition of flyovers across two railway crossings is expected to significantly reduce these.

5.1. Link Volumes and V/C Ratios

Table 4 indicates the results from microsimulation analysis for the flyovers and service road links under the scenarios considered. As per the network simulation for traffic volumes under the scenarios described, it is observed that there is no high-volume increment of the traffic flows in the flyover network compared with original traffic flows, indicating that system support for traffic diversions seems to be somewhat local. Traffic levels (demand) in the proposed flyover network are slightly increased when all the flyovers are made two-way. The flyovers are not significantly impacted by the closure of the service roads at railway crossings under Colombo

Suburban Railway Project developments as the observed insignificant present demand at the roadside at such small stretches.

Table 4: Simulated AM Peak Traffic Volume Under Different Scenarios of Flyover Configurations

Link No	Road / Flyover Selection	Traffic Flow Direction	Traffic Volume Under Different Scenarios (Year 2023)						
			Forecasted From Observed Data	Simulation -No Flyovers	Flyover with Original Design	Change One-way on Opposite Direction	All Flyovers Two way	Service Roads Closed at RW Crossing	Sc 3a + Modal Shift to Suburban Railway
				Bc0	Sc1	Sc2a	Sc2b	Sc3a	Sc3b
CORE AREA									
Flyovers & Service Roads									
1	Baladaksha Mw Flyover	To Gardiner Mw			659		560	625	634
		From Gardiner Mw				24	28		
2	Justice Akbar Mw Flyover	From Malay Street			387		218	568	415
		To Malay Street				337	267		
3	Justice Akbar Mw Branch Flyover	To Uttarananda Mw			60		19	21	18
4	Justice Akbar Mw Service Road (West Bound)-1	Upto Railway Crossing	801	409	272	419	332	131	119
5	Justice Akbar Mw Service Road (West Bound)-2	After Railway Crossing		409	359	494	433	191	187
6	Justice Akbar Mw Service Road (East Bound)-1	Upto Railway Crossing	609	410	167	228	158	37	71
7	Justice Akbar Mw Service Road (East Bound)-2	After Railway Crossing		408	248	322	223	80	72
8	Uttarananda Mw Flyover	From Waterfront Junction			564	452	619	557	513
		To Waterfront Junction			582	35	657	232	416
9	Uttarananda Mw Service Road (Northern End)	North Bound	454	276	21	4	1	0	0
		South Bound	446	260	13	9	35	0	0
10	Uttarananda Mw Service Road (Southern End)	North Bound		513	21	4	1	0	0
		South Bound		91	12	7	34	0	0

This is also mainly because none of these road links is used as bus routes, and present land use conditions involve few trucks on the road. The expected improved suburban railway project will have significant impacts on locally generated traffic and will cause a significant reduction in traffic flows on the flyover network. The utilisation of the branch flyover is limited to some locally generated traffic under the proposed design setup and does not appear to be economically used under the given present land use conditions.

Further V/C ratios were calculated for each link and are indicated in Table 5. It is seen that the road links in the core area are not fully utilised as per the expected traffic flow except for the two-way configured Uttarananda Mawatha Flyover, which has utilised over 60% of its capacity at the beginning of the operations.

Table 5: V/C Ratios Under Different Scenarios

Link No	Road / Flyover Selection	Traffic Flow Direction	Road Link Utilization (V/C Ratio) Under Different Scenarios (Year 2023)						
			Forecasted From Observed Data	Simulation - No Flyovers	Flyover with Original Design	Change One-way on Opposite Direction	All Flyovers Two way	Service Roads Closed at RW Crossing	Sc 3a + Modal Shift to Suburban Railway
				Bc0	Sc1	Sc2a	Sc2b	Sc3a	Sc3b
CORE AREA									
Flyovers & Service Roads									
1	Baladaksha Mw Flyover	To Gardiner Mw			0.29		0.49	0.27	0.28
		From Gardiner Mw				0.01	0.02		
2	Justice Akbar Mw Flyover	From Malay Street			0.17		0.19	0.25	0.18
		To Malay Street				0.15	0.23		
3	Justice Akbar Mw Branch Flyover	To Uttarananda Mw			0.05		0.02	0.02	0.02
4	Justice Akbar Mw Service Road (West Bound)-1	Upto Railway Crossing	0.38	0.19	0.24	0.37	0.29	0.12	0.1
5	Justice Akbar Mw Service Road (West Bound)-2	After Railway Crossing		0.23	0.31	0.43	0.38	0.17	0.16
6	Justice Akbar Mw Service Road (East Bound)-1	Upto Railway Crossing	0.29	0.23	0.15	0.2	0.14	0.03	0.06
7	Justice Akbar Mw Service Road (East Bound)-2	After Railway Crossing		0.19	0.22	0.28	0.2	0.07	0.06
8	Uttarananda Mw Flyover	From Waterfront Junction			0.49	0.4	0.54	0.49	0.45
		To Waterfront Junction			0.51	0.03	0.58	0.2	0.37
9	Uttarananda Mw Service Road (Northern End)	North Bound	0.25	0.15	0.02	0	0	0	0
		South Bound	0.25	0.14	0.01	0.01	0.03	0	0
10	Uttarananda Mw Service Road (Southern End)	North Bound		0.27	0.02	0	0	0	0
		South Bound		0.05	0.01	0.01	0.03	0	0
Connected Links									
11	Baladaksha Mw (South End)	From Water front Junction			0.29	0.02	0.22	0.27	0.26
		To Water front Junction			0.05	0.09	0.1	0.1	0.09
12	Baladaksha Mw (North End)	To Galle Road			0.03	0.03	0.02	0.02	0.02
		From Galle Road			0.06	0.06	0.09	0.11	0.1
13	Sir Chittampalam A. Gardiner Mw (A04)	To Fort	0.59	0.74	0.79	0.71	0.78	0.76	0.79
		From Fort	0.65	0.39	0.42	0.45	0.43	0.28	0.43
14	Kumaran Rathnam Rd (A04)	From Fort		0.25	0.32	0.37	0.35	0.26	0.37
15	Malay St (A04)	To Fort		0.74	0.64	0.75	0.66	0.64	0.67
16	Justice Akbar Mw (A04)	To Fort		0.76	0.76	0.68	0.68	0.8	0.79
17	Sir Mohomad Macan Markar Mw	From Galle Road		0.07	0.08	0.19	0.16	0.1	0.05
		To Galle Road		0.07	0.23	0.2	0.31	0.28	0.21
18	Nawam Mw	To A04 Road		0.48	0.46	0.35	0.48	0.45	0.41
		From A04 Road		0.08	0.38	0.07	0.8	0.22	0.22
19	Siri Uttarananda Mw (Nawam Mw-Perahera Mw)	To Perahera Mawatha		0.05	0.16	0.06	0.1	0.12	0.12
		From Perahera Mawatha		0.24	0.23	0	0	0.13	0.21
EXTERNAL AREA									
20	Galle Rd (A02) (Before Kollupitiya Jn)	From Bambalapitiya		0.48	0.51	0.51	0.51	0.50	0.47
21	Galle Rd (A02) (Kollupitiya Jn - Galle Face Court RA)	To Galleface		0.93	0.96	1.01	0.99	0.94	0.89
		From Galleface		0.64	0.64	0.57	0.55	0.71	0.54
22	Galle Rd (A02) (Galle Face Court RA - Baladaksha Mw)	To Galleface	0.77	0.92	1.05	1.02	1.07	1.00	0.98
		From Galleface	0.55	0.57	0.57	0.51	0.50	0.66	0.44
23	Galle Rd (A02) (Baladaksha Mw - Galle Face RA)	To Galleface	0.62	0.92	1.01	1.04	1.02	0.97	0.98
		From Galleface	0.74	0.59	0.63	0.57	0.59	0.79	0.53
24	Sir James Peiris Mw (A04) (Pittala Jn - Perahera Mw)	To Kollupitiya		0.16	0.22	0.26	0.25	0.14	0.28
		From Kollupitiya		0.46	0.77	0.67	0.72	0.59	0.67
25	Sir James Peiris Mw (A04) (Perahera Mw - Nawam Mw)	To Kollupitiya		0.17	0.27	0.33	0.34	0.14	0.30
		From Kollupitiya		0.48	0.57	0.64	0.72	0.42	0.51
26	Sir James Peiris Mw (A04) (Nawam Mw - Slave Island Jn)	To Kollupitiya		0.13	0.38	0.34	0.37	0.27	0.38
		From Kollupitiya		0.36	0.43	0.51	0.43	0.49	0.55
27	Union Pl	To Townhall		0.17	0.34	0.32	0.33	0.33	0.31
		From Townhall		0.66	0.72	0.54	0.59	0.70	0.61
28	D.R. Wijewardena Mw (AC6)	To Fort	0.75	0.94	0.94	0.86	0.84	0.81	0.93
		From Fort	0.35	0.26	0.28	0.29	0.29	0.28	0.27
29	Perahara Mw	To A04 Road		0.20	0.35	0.09	0.12	0.28	0.24
		From A04 Road		0.52	0.59	0.19	0.16	0.36	0.46

Many roads in the external area road network remain congested or nearly congested. The adjoining road network benefits from slight capacity improvements with the introduction of the flyovers. A two-way configuration for all flyovers will yield slightly better results compared with the other options. However, these findings do not reflect a high economic benefit relative to the cost incurred. These results indicate that the impact of the proposed flyovers is only limited to the locality and will not cause much change in traffic levels on the external road network. Therefore, it is observed that this is only a solution to ease congestion at railway crossings with some network improvements to the adjoining traffic environment.

5.2. Traffic Forecasting Results for Flyovers and Service Roads

Forecasting was carried out assuming the present trend of the traffic growth rate of 2% under general conditions. This assumption reasonably extrapolates the past data, and the results are indicated in Table 6.

Table 6: Forecasted Traffic Demand and LOS for Flyovers and Service Roads

Link No	Road / Flyover Selection	Capacity	Flyover with Original Design (Sc1)							
			Volume (Veh/hr)				LOS			
			Y0	Y05	Y10	Y15	Y0	Y05	Y10	Y15
1	Baladaksha Mw Flyover	2280	659	727	803	887	A	A	A	A
2	Justice Akbar Mw Flyover	2280	388	428	472	522	A	A	A	A
3	Justice Akbar Mw Branch Flyover	1140	60	66	73	81	A	A	A	A
4	Justice Akbar Mw Service Road (West Bound)	1140	315	348	384	424	A	A	A	A
6	Justice Akbar Mw Service Road (East Bound)	1140	208	229	253	279	A	A	A	A
8	Uttarananda Mw Flyover	2280	1146	1266	1397	1543	B	B	C	C
9	Uttarananda Mw Service Road (Northern End)	2280	34	37	41	45	A	A	A	A

The traffic levels at the end of the 15 years also show that the level of service of Baladaksha Mawatha Flyover and Justice Akbar Mawatha Flyover with its service roads can be maintained at LOS "A". The prediction under this traffic growth expects that the flyover capacity shall not be exceeded for the next 30 years unless there are more land use changes taking place in the locality, which will need access from the flyover network. Further, it is observed that the branch flyover connecting Justice Akbar Mawatha Flyover and Sri Uttarananda Mawatha will function well below capacity utilising less than 7% of its capacity during the initial operation period and continue the same unless there is a significant land use change to attract traffic onto this branch flyover.

In the case of Uttarananda Mawatha Flyover being configured for two-way traffic, its capacity will be comparatively better utilised with expected LOS at "B" at the start of the operations and level "C" after 10-15 years. The service roads of the flyover will provide access to low-density developments along Uttarananda Mawatha (between Waterfront Junction and Nawam Mawatha) and hence is expected to have a low traffic level with LOS expected to be maintained at "A" over the 15 years unless more specific land use changes take place in the locality.

6. CONCLUSIONS

The study was carried out utilising past data that had not been impacted by COVID-19 pandemic and the adverse economic conditions currently prevailing in the country. Major traffic generators in the project area were identified, and trip estimations were carried out and combined with the derived ODs from survey data. Six scenarios were defined based on possible flyover operational orientations and significant public transport improvement intervention plans in the project area. Microsimulation was carried out for each scenario using PTV Vissim software utilising dynamic assignment. The base case model development was verified with observed traffic and several simulations with calibrations, and adjustments were conducted at the beginning to make the base case model results compatible with the observed values.

The simulation was carried out for several main design scenarios to check the most beneficial design concept to have the optimum utilisation of the proposed flyover structures, and it was observed as per the simulation results that the design of flyovers with all flyovers being two-way provided the highest utilisation and the benefits. Also, it is observed that the traffic diversions into the proposed flyover network are mainly from the locality. The network improvements are mainly limited to the links with the flyovers and the immediately adjoining road network. This seems to be a result of characteristic land use behaviours in the locality as a highly dense commercial area with easy connectivity to the main road network. The simulation outcomes of the link flow indicate clearly that the flyovers and the immediately adjacent roads initially have very much higher capacity while the main road network in the vicinity beyond this is still congested or near-congested, without much improvement to traffic conditions. The capacities of flyovers seem to be more than adequate for the next 30 years under the present traffic growth rates and design configurations.

The flyover carrying more traffic as per the simulation results will be the Uttarananda Mawatha Flyover with its two-lane, two-way design capacities. All flyovers experience higher volumes of traffic if configured for two-way traffic, but the increment in volumes is not a significant variation compared with the original one-way design. The branch flyover connecting the Akbar Mawatha to Uttarananda Mawatha experiences the least traffic volume per lane per hour, indicating that its utilisation is not optimal with the present land use. This was also observed in the logical analysis of the demand from Akbar Mawatha to Uttarananda Mawatha, as the existing network has enough connection to the land use on Uttarananda Mawatha and the commercial area at Nawam Mawatha with many shortcuts to the main road network.

The traffic from major developments yet to come into operation is considered in this analysis as trip generators and attractors. There were no clear future land use plans that could be used in the analysis as the limitations of such data as of now. The main benefit of the flyovers to the network seems to be the relief from the extreme delay experienced due to the railway gate closure at two main road links. Future railway operations with modernised electrification of railway systems will further reduce road traffic in the locality once that is implemented as planned.

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