

Introduction of an Integrated Engineering Solutions to ease the Rapidly Increasing Traffic Condition in Main City Centres: A Case Study of Traffic Simulation at Main Network with Proposed Rajagiriya Flyover

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1. Introduction

Traffic congestion in Colombo, the capital city of Sri Lanka, has been a persistently aggravating issue since 1978, given the increased rate of private vehicle ownership resulting from the introduction of open economic policies. The city's travel demand is enormous: many junctions get congested with static traffic flow especially during peak hours. This has posed a huge financial and economic loss to the country. Industrial development and expansion of businesses seem to have contributed, to a great extent, to congestion, further supported by the growing affordability of private vehicle use due to reduced import taxes, increased per capita incomes, affordable fuel prices, lack of road pricing schemes etc.

Several other factors that would potentially further aggravate the present traffic congestion in the road links of urban and suburban centres can be identified. Among those figure inadequacy of road capacity to cater to increased traffic levels, delays at intersections owing to bottlenecks at intersection approaches, signal delays at main intersections, excessive weaving actions at un-signalised intersections, increased tendency for violation of traffic rules and absence of driver discipline.

Therefore, the mitigation of traffic congestion using integrated engineering solutions (IES), an inter-disciplinary approach combining conventional engineering with humanities, becomes very important in view of optimising the capacity of the already improved road networks in urban areas. These IESs are more appropriate over conventional traffic mitigation methods for their ability to provide proper information to road users in timely manner, and also for their lesser requirement of human involvement, properties and assets to cater for growing demand for capacity, land acquisition which is a deciding factor of great concern, especially in urban city centres.

2. Study Objectives

The main objectives of this study are;

1. To understand available traffic mitigation options inclusive of IESs.
2. To evaluate the level of present traffic congestion and main reasons for such traffic congestions along the Sri Jayawardenapura Road Corridor.
3. To introduce integrated traffic management solutions to overcome intersection delays and overall delay
4. To disclose the present economic loss due to “do nothing approach” and to appraise the possible gains to both users and the national economy through improved traffic conditions expected from integrated traffic management solutions

3. Methodology

The present research focused on the road network between Diyatha Uyana to Devi Balika intersection. Rajagiriya Junction was selected to study the possibility of undertaking traffic mitigation measures and the applicability and feasibility of introducing an integrated engineering solution. It examined the intersection traffic, link traffic, travel time along the associated road network, and attempted to use its results to predict future traffic flows. Installing a Flyover and implementing associated traffic management proposals, were appraised in view of understanding their investment economics and their ability to alleviate the existing traffic congestion and resultant costs along this road corridor.

4. Analysis and Results

Table 1 - Present Traffic at Associated Road Links

| Road Name | Link | Flow Direction | Without Flyover | | | |
|--------------------------|--------------------|--------------------|-----------------|-----------|------|---|
| | | | Traffic (PCUs) | V/C Ratio | LOS | |
| Sri Jayawardenapura Road | Approach to Node 1 | Fr: Colombo | 19,097 | 0.60 | C | |
| | | To Colombo | 26,144 | 0.83 | D | |
| | Node 1 - Node 2 | 1-2 | 24,223 | 0.76 | D | |
| | | 2-1 | 19,167 | 0.61 | C | |
| | Node 2 - Node 3 | 2-3 | 25,924 | 0.82 | D | |
| | | 3-2 | 34,055 | 1.08 | E | |
| | Node 3 - Node 4 | 3-4 | 27,503 | 0.87 | D | |
| | | 4-3 | 28,427 | 0.90 | D | |
| | Old Kotte Road | Node 2 - Node 6 | 6-2 | 7,394 | 0.71 | C |
| | Kotte Road | Approach to Node 2 | | 34,144 | 1.01 | E |
| ButhGamuwu Road | Node 5 - Node 6 | 5-6 | 12,367 | 0.99 | D | |

Table 2 – Traffic Conflicts along the Road

| Jn: No | Junction | Existing Conflicts | | Conflicts With Flyover | | % Reduction of Conflicts | |
|--------|--------------------|--------------------|--------|------------------------|--------|--------------------------|--------|
| | | Total | Direct | Total | Direct | Total | Direct |
| 1 | Nawala Road Jn | 56,173 | 48,696 | 26,822 | 19,345 | 52% | 60% |
| 2 | Welikada Plaza Jn | 76,486 | 52,693 | 43,564 | 22,914 | 43% | 57% |
| 3 | Fuel Station Jn | 37,321 | 34,744 | 37,492 | - | 0% | 100% |
| 6 | Buthgamuwa Road Jn | 18,662 | 3,759 | 16,313 | - | 13% | 100% |

Present traffic levels and conflicts in the study area summarised in Table 1 and Table 2 above, and the morning and evening peak travel time presented in the Figure 2 and Figure 1 below, were used in the analysis.

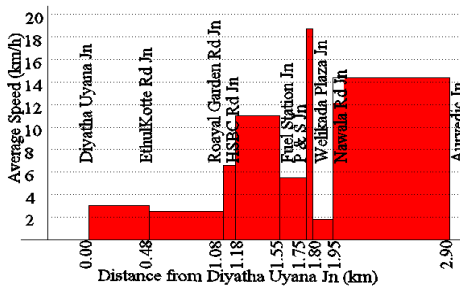


Figure 2 - Travel Speed during Morning Peak

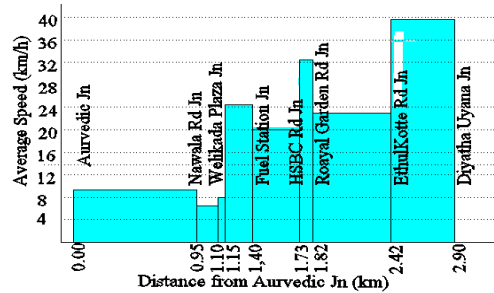


Figure 1: Travel Speed during Evening Peak

The expected economic benefits and outcomes, in terms of reduced travel time and other associated costs that are expected through the introduction of the proposed flyover are presented in Table 3.

Table 3 - Economic Benefits and Outcomes

| Item No | Item Description | Amount (Rs.) |
|--|---------------------------------------|-----------------------|
| 1 | Savings in VOT in 12 hours | 5,283,451 |
| 2 | Savings in VOC in 12 hours | 1,179,194 |
| 4 | Savings in Extra Emission in 12 hours | 18,777 |
| 5 | Accident Cost (Not collected) | - |
| Total Savings in 12 hours Period | | 6,481,422 |
| Annual Total (2016) | | 2,093,499,384 |
| Estimated Total Savings due to the proposed improvements in next 20 years | | 41,869,987,681 |

As per the calculations, EIRR of the intervention would be 47.5 % while a B/C Ratio of 15 could be expected. Furthermore, a Net Profit Value (NPV) of Benefits was estimated to be Rs 17,737 Million and the investment could be recovered within 3 years.

5. Conclusion and Recommendations

The study outcome suggests that the proposed flyover, combined with the associated traffic management plans, could possibly be highly beneficial, both in terms of traffic and financial benefits that would be accrued to the users of the Colombo – Sri Jayewardenepura road corridor, and in terms of national economic benefits. The travel speeds would significantly improve from the present magnitudes in this corridor, resulting in very high economic gains. It was also revealed that the proposed flyover option would alleviate the major problem of conflicting traffic movements at main nodes along this corridor yielding significant traffic congestion alleviation benefits. Closure of the centre median and one-way traffic flow would complement the derived benefits from the proposed flyover option.

It is also observed that a flyover alone is unlikely to provide a proper and lasting solution to the existing traffic congestion problem in Rajagiriya junction. Several other ways and means are thus proposed, such as signal design as an integrated intersection, roundabout designs, alternative elevated highway in parallel to the road corridor, and long term solutions such as public transport improvements including BRT and railway options; implementation of which is likely to much longer time than would be desired.

References

1. Assessing Public Investment in the Transport Sector, National Planning Department, T.L. Gunaruwan et al, 2001.
2. Mututantri P.L et al “Design of a Flyover and Roundabout underneath it to ease the Traffic Congestion at the Rajagiriya Junction” Engineer No 04, Pp (34-47), 2015.
3. Tissa U. Liyanage and Amal S. Kumarage “Flyovers as a Measure to Improve Intersection Capacity” Annual Sessions IESL, 2009.

Key Words: *Improved Traffic Conditions, Integrated Traffic Management, Flyovers*