STUDY ON TRAFFIC FLOW CHARACTERISTICS AT WORK ZONES USING SIMULATION
INTRODUCTION

- Rapid growth of India’s urban population has put enormous strain on transport systems.
- The vehicle population in metropolitan cities is increasing tremendously in recent years leading to congestion in urban areas.
- Construction of public transport facilities, especially Metro rail, Mono rail are under progress in many major cities.
- Handling traffic in work zones is a challenge because the work activity presents an abnormal and often disruptive environment to the motorist.
- Quantification of impact is essential.
Work Zone

• Work zone is defined as an area of a highway in which maintenance and construction operations are taking place that will affect the operational characteristics of traffic flowing through the area.

Based on the lane closure:

• Partial closure
• Crossover closure

Based on the duration of work:

• Long term stationary work
• Intermediate term stationary work
• Short term stationary work
• Mobile work
Need For The Study

- Work zones may reduce capacity, increase the travel time delays, queue length, fuel consumption, number of forced merges, and roadway accidents.
- It is essential that the existing traffic flow pattern and change in pattern during construction period has to be studied in detail for better planning.
- To assess the pros and cons of different methods and duration of construction.
Objectives

• To study the traffic characteristics and accident occurrence before and during work zone creation for construction purposes.

• To simulate traffic flow on the formulated scenarios and evaluate their performance in terms of travel time and delay.

• To study the VOC aspects
Inefficient operation of traffic at work zone areas typically leads to an increase in travel time delays, queue length, number of forced merges, and roadway accidents.

GPS is an efficient tool in recording vehicle position and speed values.

Planned lane closures in work zone can accelerate work operations, reducing the duration of impacts to road users.

Microscopic simulation software is the important tools to assess the impact of work zones.

It is essential that the existing traffic flow pattern and change in pattern during construction period and their impact on traffic for different traffic conditions.
METHODOLOGY

Identification of the problem

Formulation of Objectives

Literature Review

Study Area Selection

Data collection

Primary Data:
- Travel Time Survey during Construction phase.

Secondary Data
- Road Geometrics of the section and adjoining roads
- Traffic Volume count, composition and speed details before construction stage.

Analysis for various Scenarios

Simulation of Traffic Flow

Preparation of basic simulation model before road width restriction

Validation of basic Simulation Model

Findings and Recommendations
Study Area

Study Stretch in EVR Salai

Study Stretch in JN Road
Data Collection

The data have been collected for the study are:

• The locations where and when the lane closure/ road width restrictions are proposed in the study area road network were identified and topographical and physical details collected.

• Traffic volume count, turning movement survey details

• Speed/Travel Time survey for before and during restriction.
# Traffic Volume Details: EVR Salai

<table>
<thead>
<tr>
<th>Station</th>
<th>PH Traffic (PCU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KMC</td>
<td>9,682</td>
</tr>
<tr>
<td>Barnaby Road</td>
<td>4825</td>
</tr>
<tr>
<td>Taylor’s Road</td>
<td>2435</td>
</tr>
<tr>
<td>Mc Nichols Road</td>
<td>5960</td>
</tr>
<tr>
<td>Flowers Road</td>
<td>1983</td>
</tr>
</tbody>
</table>

**Traffic Composition on EVR**

- **TW**: 59%
- **Car**: 37%
- **HGV**: 2%
- **Bus**: 2%

*In front of KMC*
# Traffic Volume Details - JN Road

<table>
<thead>
<tr>
<th>Station</th>
<th>PH Traffic (PCU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Police Training College</td>
<td>8905</td>
</tr>
<tr>
<td>Rajan Salai</td>
<td>5408</td>
</tr>
<tr>
<td>II Avenue</td>
<td>3018</td>
</tr>
<tr>
<td>Vadapalani</td>
<td>9178</td>
</tr>
</tbody>
</table>

## Traffic Composition on JN Road

- TW: 58%
- CAR: 37%
- BUS: 3%
- HGV: 2%
Travel Time Survey – EVR Salai

Observed Journey Speed (kmph) along EVR Salai

<table>
<thead>
<tr>
<th>Direction</th>
<th>Morning Peak Hour</th>
<th>Non Peak Hour</th>
<th>Evening Peak Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Towards Egmore</td>
<td>10.6</td>
<td>18.2</td>
<td>11.1</td>
</tr>
<tr>
<td>Towards Poonamalle</td>
<td>14.8</td>
<td>19.7</td>
<td>13.9</td>
</tr>
</tbody>
</table>
Travel Time Survey- JN ROAD

Observed Journey Speed (kmph) along JN Road

<table>
<thead>
<tr>
<th>Location</th>
<th>Morning Peak Hour</th>
<th>Non Peak Hour</th>
<th>Evening Peak Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashok Pillar to Vadapalani</td>
<td>19.12</td>
<td>27.8</td>
<td>22.37</td>
</tr>
<tr>
<td>Vadapalani to Ashok Pillar</td>
<td>20.25</td>
<td>26.7</td>
<td>22.58</td>
</tr>
</tbody>
</table>
Simulation of Traffic Flow

- VISSIM is a microscopic, time step and behavior -based simulation model developed to model urban traffic and public transit operations.

Base Data Required for Simulation:

- Acceleration and Deceleration Functions
- Desired Speed Distribution
- Vehicle Type, Class and Category
- Traffic Composition
- Total simulation period
The formulated three scenarios along EVR Periyar Salai are as follows:

- Scenario-1 Study stretch without road width restriction before construction stage.
- Scenario-2 Two-way flow at work zone during construction phase.
- Scenario-3 One-way flow at work zone stretch during construction phase.
### Results of EVR Salai Simulation Model (Scenario 1)

<table>
<thead>
<tr>
<th>Travel Time section</th>
<th>Observed Speed (kmph)</th>
<th>Estimated Speed (kmph) using VISSIM</th>
<th>Difference in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Towards Egmore (A-B)</td>
<td>14.8</td>
<td>14.4</td>
<td>2.7</td>
</tr>
<tr>
<td>Towards Poonamalle (B-A)</td>
<td>15.9</td>
<td>15.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>
Scenario 2 Two-Way Flow at Work Zone during Construction Phase.

Results of EVR Salai Simulation Model (Scenario 2)

<table>
<thead>
<tr>
<th>Travel Time section</th>
<th>Observed Speed (kmph) using GPS</th>
<th>Estimated Speed (kmph) using VISSIM</th>
<th>Difference in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Towards Egmore (A-B)</td>
<td>10.6</td>
<td>10</td>
<td>5.6</td>
</tr>
<tr>
<td>Towards Poonamalle (B-A)</td>
<td>14.8</td>
<td>13.9</td>
<td>6</td>
</tr>
</tbody>
</table>
Scenario 3-One-Way Flow at Work Zone Stretch during Construction Stage.
Comparison of Scenarios in EVR Salai

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Towards Egmore (A-B)</td>
<td>14.4</td>
<td>10</td>
</tr>
<tr>
<td>Towards Poonamalle (B-A)</td>
<td>15.5</td>
<td>13.9</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Towards Egmore (A-B)</td>
<td>547.9</td>
<td>791.4</td>
</tr>
<tr>
<td>Towards Poonamalle (B-A)</td>
<td>509.4</td>
<td>567.7</td>
</tr>
</tbody>
</table>

- Towards Egmore (A-B)
- Towards Poonamalle (B-A)
EVR Salai- Inferences

• Towards Egmore direction, the speed reduction along the stretch after road width reduction (scenario 2) was in the order of 30.56% when compared with scenario 1.
• For the scenario 3 as one-way system was adopted the speed increased by 7% than that of scenario 1.
• Towards Ponnamallee direction, the speed reduction along the stretch after road width reduction (scenario 2) was in the order of 11.3% when compared with scenario 1.
• For the scenario 3 as one-way system was adopted the speed increased by 30.9% than that of scenario 1.
• The travel time for travel along EVR Salai towards Egmore direction for scenario 2 and scenario 3 was more than that of Scenario 1 by 44.4% and 35% respectively and travel time in reverse direction for scenario 2 and scenario 3 was more than that for Scenario 1 by 11.4% and 51.3% respectively.
Scenario 1 Study Stretch Without Road Width Restriction
Before Construction Stage
Scenario 2 - Study Stretch with Road Width Restriction during Construction Stage

Results of JN Road Simulation Model (Scenario 2)

<table>
<thead>
<tr>
<th>Travel Time section</th>
<th>Observed Speed (kmph) using GPS</th>
<th>Estimated Speed (kmph) using VISSIM</th>
<th>Difference in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashok Pillar to Vadapalani (C-D)</td>
<td>19.12</td>
<td>17.9</td>
<td>6.3</td>
</tr>
<tr>
<td>Vadapalani to Ashok Pillar (D-C)</td>
<td>20.25</td>
<td>19.2</td>
<td>5.1</td>
</tr>
</tbody>
</table>
Comparison of Scenarios in JN Road

### Speed Comparison
- **Scenario 1**: 26.8 km/h (Ashok Pillar to Vadapalani), 17.9 km/h (Vadapalani to Ashok Pillar)
- **Scenario 2**: 27.2 km/h, 19.2 km/h

### Travel Time Comparison
- **Scenario 1**: 264 sec (Towards Vadapalani (C-D)), 395.3 sec (Towards Ashok Pillar (D-C))
- **Scenario 2**: 260.42 sec, 369 sec
Inferences JN Road

• Speed- Scenario 1 to 2, 33% and 30% respectively for towards Vadapalani & towards Pillar

• In scenario 2 towards Vadapalani the travel time is increased by 49% when compared to scenario 1. Towards Ashok Pillar direction (D-C) the travel time is increased by 42% when compared to scenario 1.
CONCLUSION

• Due to creation of work zones road width has been reduced to four lanes from its original width of six lanes. Due to which the speed was reduced by 25-30% along the study stretches.

• Quantification can be used as a tool for future selection of type of construction with respect to construction period

• Microscopic traffic simulation is a best tool to provide an environment where different scenarios can be introduced and evaluated in a controlled setting without disrupting traffic conditions on the road.
THANK YOU