PRESENTATION ON

TRAFFIC IMPROVEMENT PLAN OF
OUTER RING ROAD

FROM I I T GATE TO NH-8
&
ITS INFLUENCE AREA

Public Works Department
(Govt of NCT of Delhi)

5th April 2013

(A Government of India Enterprise)
Traffic Scenes at RTR in Peak Hrs. from NH-8 to IIT
Vehicular & Pedestrian Movement Issues

4 ft. high footpath at Olof Palme Marg

Little space for passenger boarding/alighting due to On street parking near Munirka

Bottleneck on Poorvi Marg - ORR Jn. due to a narrow culvert

Underutilized sub way at Munirka Junction

Bottleneck at the mouth of RTR flyover towards Vasant Vihar

Traffic Congestion under RTR flyover from RTR junction to NH8
**Reasons for Overloading of RTR**

**Access to Ring Road (RR)**
- **RTR Marg** provides shortest link between RR and ORR and is only right turning facility between Dhaula Kuan and Africa Avenue towards RR.
- Benito Juarez and Kama Kothi Marg do not have right turning facility to RR.
- Thus, the traffic bound for RR from Southwest Delhi and Gurgaon loads RTR.

**Jamming conditions at Dhaula Kuan (DK)**
- Dhaula Kuan, a major link connecting West with Central & East of Delhi is loaded with traffic from Gurgaon; bound for Central, East Delhi.
- Persistent traffic jams at Cariappa Marg Crossing and detour discourages this traffic to take DK to approach RR.
- Absence of alternatives routes connecting Delhi & Gurgaon.

**Underutilization of Roads**
- BJ Marg is highly underutilized due to non-availability of right turn on RR and ORR.
- San Martin Marg is another highly underutilized Rd due to absence of network connectivity with BJM.
- Nelson Mandela Road, the widest road of the Study Area highly underutilised.
Macro Level analysis of Traffic Problems

- Unprecedented growth of Gurgaon, the IT hub, and high interdependence of Delhi and Gurgaon
- Inadequate mass transport facility for Gurgaon, connecting Delhi and its satellite towns
- This affects the traffic in the Study Area
- Funnel effect created by the traffic bound to Gurgaon on NH8 and Mehrauli Gurgaon Road

Funnel effect of Gurgaon bound traffic converging from all over NCR on the Study Corridor
Approach & Strategy

**Approach**

- Problems of the Study Area are complex & the solutions are difficult
- Stake holders have varied perceptions & expectations to the solutions
- RITES approach is to look into all possible solutions including:
  - Network Connectivity
  - Public Transport
  - Capacity Augmentation
  - Traffic Management
- A judicial mix of all these is required

**Strategy**

- Area wide solutions to distribute the traffic and reduce the load on congested junction(s).
- Options with different constraints to be evaluated on defined criteria.
- Solutions attempt to
  - Improve the network connectivity
  - Put available ROW and under utilized roads to their effective use
  - To address the issue of through traffic without disturbing local connectivity
  - Evolve alternative route(s) for traffic to/from Gurgaon/Airport
Overall Proposal Scheme

Proposals have been categorized into:

a) Accessibility/Network Improvement Proposals
b) Traffic Management Schemes
c) Pedestrian Facility Improvement Measures
d) Public Transport/Mass Transport Proposals

With number of constraints in the Study Area, RITES has formulated a set of Area Level Proposals

The proposals have been formulated through extensive consultative process with UTTIPEC, PWD, RWA’s, Traffic Police and other Stake Holders.
I. Accessibility/Network Improvement Proposals

a) P1: Right Turn at BJ to Ring Road (Signal/Grade Separated)

b) P2: Capacity Augmentation of RTR & ORR (at grade/flyover)

c) P3: New Links for Vasant Vihar Area

d) P4: Develop alternative routes for Delhi Gurgaon movement
   a) P4.1: Ring Road - Right Turn at Vivekanand Marg (Signal/Grade Separated)
   b) P4.2: Intersection Improvement of Baba Ganganath Marg- Munirka Marg junction
   c) P4.3: Bypass to MMR
Existing Traffic pattern & Volume on RTR & BJM

**Existing Pattern:**
- BJ Marg Left In Left Out junction on RR & ORR
- South Campus/BJ Marg traffic route destined to RR
- NH-8 traffic destined to RR
- Vasant Enclave/Vasant Vihar traffic destined to RR
- Ring Road traffic destined towards NH-8
- BJ Marg traffic destined towards NH-8
- Traffic from Shanti Path destined towards NH-8
- Conclusion: Overloads RTR Marg & BJ Marg remains underutilized

**Traffic Pattern**
- Out of the total left turn traffic only 20% is destined to RK Puram
- Remaining 80% is destined for Ring Road
- BJ M & San Martin with only personalised vehicle movement
- 30% of the traffic at Dhaula Kuan & 25% of the RTR traffic is contributed by Gurgaon/Airport
- In the absence of alternative routes from Gurgaon/Airport, Dhaula Kuan & RTR are being overloaded
- Underutilised BJ M & San Martin Marg are being explored
P1 Right Turning Facility from BJM to Ring Road

Three options

- P1.1: Installation of traffic signal at BJM-RR junction
- P1.2: Constructing underpass from BJM to Saint Martin and Ring Road; Ring Road operates as it is
- P1.3: Constructing underpass on Ring Road; RR traffic moves below; signal installed at BJM-RR junction
Merits & Demerits of proposal P1

MERITS

- Will decongest both D.Kuan/NH-8 and RTR Marg through traffic distribution
- Queue Length at NH-8 & RTR Marg reduces considerably while the journey speeds increase
- Reduced Signal Cycle Length for RTR-ORR, BJ-ORR and RTR-Ring Road junctions
- Better utilization of underutilized BJ Marg and San Martin Marg
- Provides access to public transport for all residents/institutional areas around BJ Marg
- Will give relief to Vasant Enclave residents
- Safe segregated pedestrian movement

DEMERITS

- Additional Costs will be incurred in developing the infrastructure
- In case of signalized intersection, queue lengths and delays will be observed at Ring Road
BJM – Ring Road

Entry to BJM from RR

Extensive On-street parking on BJM

Exit to RR from BJM

MRTS Phase III alignment along RR
P1: Right Turning facility at BJ-RR Junction

P1.1 : Through Traffic Signal

- Junction at BJ-ORR & BJ-RR will open with Traffic Signal at both Junctions
- BJ Marg will operate in both directions
- Signal Synchronization of both RTR-ORR and BJ-ORR to minimize queue lengths
- Strengthening of NMV facilities for NMV movement

- Right turns not allowed:
  - Ring Road (AIIMS) to Saint Martin
  - Saint Martin to Ring Road (DK)
  - Ring Road (DK) to BJ M
  - ORR (IIT) to BJ M
MERITS & DEMERITS OF P1.1
Traffic Signal at BJM-RR Junction

■ MERITS
- Right turning movement open from BJM to Ring Road
- Traffic distribution on RTR and BJM
- No construction required

■ DEMERITS
- Will disrupt the flow of traffic on Ring Road which is signal free at present
- Long Q length on Ring Road are expected
- Chaos at Dhaula Kuan clover leaf due to short distance between DK and BJM
P1.2
Underpass at BJ M for Right turn towards Ring Road & Saint Martin (SM)

i. One way underpass
ii. Three arms
iii. Entry at BJ M
iv. Exit 1 at Ring Road: for traffic moving towards AIIMS on Ring Road
v. Exit 2 at Saint Martin: for traffic destined towards Central Delhi
vi. At grade and grade separated facilities connecting Dhaula Kuan Metro Station with various land uses at BJM, existing FOB at RR and St. Martin Marg
P1.2 BJ M Underpass – Entry at BJ M

i. BJ M widens before VKT quarters entry

ii. Underpass entrance starts after VKT quarters entry

iii. Left lane spared for at grade traffic

iv. Movement of traffic towards ORR uninterrupted

v. Available CW:
   i. At grade: 3 lanes
   ii. Underpass: 3 lanes
   iii. Footpath: 4 m both sides
P1.2 BJM Underpass – Exit at Ring Road

- Exit opens at Service Road on RR having a length of 250m
- Positioned beyond footpath

- Dispersal of traffic from underpass to Ring Road via subsequent punctures in the Service Road
P1.2 BJM Underpass
- Exit at SM

i. Underpass starts ascending before Army premise entrance

ii. No direct conflict with up-down at grade movements

iii. Traffic exits underpass before culvert

iv. Available ROW
   - CW At grade: 2 lanes
   - CW Underpass: 3 lanes
   - Footpath: 2m both sides

v. 4.5 mt sky walk for pedestrian and cycle movement proposed.
P1.2 BJM Underpass – Under Ring Road

- Underpass turns at two sections to accommodate smooth turning of traffic (turning radius 90m or above)

- Underpass flares into two exits:
  - Exit 1 towards Ring Road
  - Exit 2 towards Saint Martin

- Major Concern: Underpass alignment conflicts with Dhaula Kuan metro station in Ph-3
Coordination with DMRC

- The construction of the Dhaula Kuan Metro station at the intersection of Ring Road and BJ M has already started by DMRC.

- The proposal was discussed on site with DMRC officials and their consultant.

- The major issues lies in adjusting the underpass alignment between footing of a column and the viaduct.

- Considering the site conditions DMRC modified our proposal and came up with two options:
  - Option 1 had space for underpass of only 9.5 m (clear width of 8.3m) which was not agreed by PWD/RITES.
  - Option 2 has width of 11 meters with reverse curve between two curves.
i. Available space for underpass: **11.0m**

ii. Adjustments suggested by DMRC to accommodate underpass between viaduct and column footing

iii. Alignment of Underpass changed from left aligned to center aligned at BJ M

iv. One arm opening at Saint Martin Road to facilitate traffic from NH8 towards Central Delhi decongesting Dhaula Kuan
MERITS & DEMERITS P1.2 BJ M-SM-RR UNDERPASS

**MERITS**
- Right turning from BJ M without hindering Ring Road traffic
- Alternate option via Saint Martin for traffic moving towards Central Delhi
- Existing BJ M is put to effective use
- The two sides of south campus are connected with pedestrian walkways
- Construction along with metro
- Negligible existing traffic on BJ M and Saint Martin
- More space for NMV by redistribution of ROW
- Continuous grade separated NMV facility connecting existing FOB and proposed Metro Station to various land use

**DEMERITS**
- At grade across movement on BJ M not allowed
- On street parking on BJ M to be removed
- Conflict with proposed Dhaula Kuan Metro Station structure
P1.3 Underpass at Ring Road

- Two way underpass on Ring Road
- Underpass starts before Dhaula Kuan in North and Moti Bagh flyover in South
- Provision of at grade signalized junction for BJM-RR-Saint Martin allowing all possible movements
- Straight Ring road traffic movement via underpass
**Physical Constraints - Length**

i. Available length for ramp towards DK (from mouth of DK flyover to mid ROW of BJ M): 320m

ii. Space required at BJ M for at grade junction: 50m

iii. Space required for ramp: 210m@1:30 gradient for 7 m height

iv. Distance between mouth of DK and BJ M underpass: 65m

v. This length is insufficient

vi. Traffic movement from AIIMS towards Gurgaon and traffic from Sardar Patel Marg towards AIIMS hindered

vii. No such issues towards Moti Bagh
P1.3 Underpass at Ring Road

Physical Constraints - Width

- Towards Dhaula Kuan
- Available ROW 75 m
- Required for underpass: 30 m
- Removal of bus terminal and acquisition of Army service road
- Towards AIIMS
  - No major constraint
  - Acquisition of service road etc.
  - Ramp location between Moti Bagh flyover and Gurudwara
- Redistribution of ROW required at both sides
- **Major constraint: Proposed Metro Alignment**
  - If fully constructed, no scope of redistribution of Ring Road ROW
Merits & Demerits Of P1.3 Underpass On Ring Road

- **MERITS**
  - Arterial ring road dipped instead of collector BJ M/Saint Martin
  - At grade traffic signal installed at BJ M-RR junction for right turning

- **DEMERITS**
  - Heavy traffic disruption during construction
  - Insufficient diverging space for traffic moving from AIIMS to Gurgaon and insufficient merging space for traffic coming from Sardar Patel Marg and Naraina
  - Dhaula Kuan bus terminal need to be acquired to make space for at grade movement
P2: Capacity Augmentation of RTR & ORR

- **P 2.1 : At-Grade Improvements** - Creation of dedicated 3 lanes on surface for straight movement from IIT - NH-8
  - Due to limited space availability, the option involves the land from service lane on Vasant Vihar side

- **P 2.2 : Grade Separated Improvements** -
  - Creation of an additional 3 lane flyover parallel to the existing flyover
Existing 9 mt Flyover to be used for movement from NH-8 to IIT gate

1.0 mt service Belt & 3.0 mt Footpath on Vasant vihar Side

At-grade 15 mt for mixed traffic of:
- Straight movement from IIT Gate to NH-8
- Right movement from ORR to RTR Marg
- U-Turning traffic from Vasant Vihar towards IIT under the flyover

After RTR Marg intersection
- Existing Footpath retained
- At-grade 3 Lanes for uninterrupted straight movement from IIT Gate to NH-8
- Segregated 2 lanes for U turn traffic from NH-8 & Right turn traffic from RTR Marg

The proposed new road will facilitate the left in left out movement at RTR Marg

Proposed Pedestrian FOB on RTR Marg for movement between school and bus stop
P2 – Capacity Augmentation at BJ-ORR At Grade Improvements

- Existing 9 mt Flyover to be used for movement from NH-8 to IIT gate
- At-grade 16 mt for mixed traffic:
  - Straight movement from IIT Gate to NH-8
  - Right Turning traffic from IIT to BJ Marg
  - U-Turning traffic from Vasant Enclave towards IIT under the flyover
- At-grade 3 Lanes for uninterrupted straight movement from IIT Gate to NH-8 after BJ Marg intersection
- At grade right turn from RTR to NH8
- 3.5 mt Footpath & MUZ at Vasant Enclave Side
- Signal phasing to be synchronised with RTR junction signal to facilitate entry/exit of Vasant Enclave residents on ORR
Merits & Demerits of proposal P2-Alternative 1

**MERITS**

- Visual Aesthetics of the area is retained in At Grade Improvement measures
- Sufficient footpath to facilitate pedestrian movement
- Cost Effective Measure as no additional infrastructure is required

**DEMERITS**

- Vasant Vihar Service Lane will be acquired
- 100 sq mt of Park Land near BJ Marg intersection is needed
- Delay at junctions are expected due to long signal cycle
- Capacity of the junction is expected to saturate by 2016
P 2.2: Grade Separated Facility at RTR

- 3 lane flyover on portal structure is proposed parallel to the existing flyover
- 7.5 m CW for traffic under the flyover
- Space available on Vasant vihar side
  - CW: 11 m,
  - Footpath: 2 m
  - Service lane: 4-7.5 m
P2.2 : Portal Flyover as an extension of Munirka flyover

- Proposal of portal flyover as an extension of one leg to the existing flyover over Poorvi Marg
- The proposed flyover will cater to the movement between IIT gate to NH-8
- U turning traffic towards IIT and right turning traffic to RTR/BJ will move in 2 lanes under the portal
- Existing Poorvi Marg flyover to function normally
- Proposed Signages on the existing Poorvi Marg flyover to segregate traffic going towards NH-8 and traffic bound for VVA, RK Puram, Moti Bagh etc
Merits and Demerits of P2.2 Flyover on Portal Structure

**MERITS**

- Dedicated grade separated 3 lanes for traffic from IIT to NH8
- Service road is retained on Vasant Vihar side
- No Disturbance on Malai Mandir Side as well
- Signal Cycle time at RTR-ORR and BJ-ORR junction will get reduced as the through traffic will move on to the flyover
- Intermixing of through and local traffic will get reduced considerably

**DEMERITS**

- Staggering of the flyover w.r.t. to existing flyover required
- Disruption of traffic during implementation
- Option involves expenditure due to the construction of the flyover
P3.1: New Link from service road/Vasant Enclave booster pump opposite RTR to provide right turn facility to VVA

The proposed link to connect FIBR road

Vasant Enclave booster pump at the mouth of the intersection needs to be relocated 150 mts away from existing location

RTR intersection will be a 4 arm signalised junction.

P3.1(a) = Alternatively this new link can also be streamlined for left in left out entry/exit without a right turn facility at ORR

P3.2 = U Turn Facility for traffic after BJ-NH-8 Intersection
P3: Improving Local Network Connectivity—New link for entry/exit to NMR from VV Area

- P3.3=A new link connecting ORR and NH-8 passing through green area near the mosque

- Connections to Vasant Vihar & Vasant Enclave Roads with the proposed new road

- P3.4=New road connecting Metro station road, and NMR with one way movement to facilitate smooth traffic movement after opening of metro station
Merits & Demerits of proposal P3.1, 3.2, 3.3

**MERITS**

- P3.1 will give right turn facility on ORR to Vasant Vihar Area (VVA) in lieu of the banned right turn at Paschimi Marg due to the ORR-RTR flyover
- P3.1 & 3.1(a) will also give access to Vasant Enclave residents
- P3.1(a) will not add to the signal cycle length/time as the new link will only cater to the let in left out entry/exit
- P3.2 will give traffic from FIBR/Niryat Bhawan/Vasant Enclave residents access to ORR towards IIT
- P3.3 will give a direct access from VVA to NH-8
- P3.4 will decongest Munirka Marg. It is proposed to operate one way from NMR to Poorvi Marg. Other direction traffic will move from new link. It will facilitate the movement after the proposed metro station comes up.

**DEMERITS**

- P3.1 will add to the signal cycle time and may result in delay
- P3.3 passes through the Ridge Area. The approval for the same may be difficult to obtain
P4. 1: Right Turning Facility on RR - Vivekanand (VVK) Marg Junction with Signal / Underpass

a) This right turning facility from VVK Marg will develop an alternative route between Gurgaon and Delhi through NH-8-NMR-VVK Marg.

b) Will facilitate the Vasant Kunj-Central Sec BRT corridor
Merits & Demerits of proposal P4.1

**MERITS**

- Facilitate the Vasant kunj-Central Secretariat proposed BRT Corridor
- Will decongest Africa Avenue, RTR Marg and Sangam Marg
- Queue Length at Africa Avenue, Sangam Marg & RTR Marg will reduce & the journey speeds will increase
- Puts underutilised Vivekakand Marg to its effective use

**DEMERITS**

- Relocation of petrol pumps will be required in case of underpass facility
- Additional Costs will be incurred in developing the underpass infrastructure
- In case of signalised intersection, queue lengths and delays will be observed at Ring Road
**P4.2: Intersection improvements of Baba Ganganath Marg and Munirka Marg Junction**

- Self regulatory roundabout to be formed at present hillock
- Improvement of the road geometry
- Munirka Marg to be connected with NMR at culvert to accommodate rotary

**MERITS**

- Will remove the bottleneck at Baba Ganganath-NMR junction due to faulty Road Geometry
- Will facilitate movement between NH-8-NMR

**DEMERITS**

- The squatters will need to be relocated
P4.3: Bypass from Mehrauli Mahipalpur Road-NH8

- PWD Proposal of New link for bypassing traffic from Mehrauli Mahipalpur road to NH-8 is not feasible due to land acquisition issues
  - Another 6 lane road connecting NH-8 bifurcates Mahipalpur on the northern side.
  - Only a small missing link has to be added to connect this new link.
  - This link will provide alternative to PWD proposal.
  - Access to expressway at NH-8 needs to be provided to make it effective.
II. Traffic Management Schemes

a) Streamlining of Entry/Exit of Vasant Vihar Bus depot

b) Relocation of On street Vasant Vihar Bus Terminal to Defunct Pit at Munirka Marg

c) Removal of On street Parking wherever required

d) Signal Synchronization wherever required
III. Pedestrian Facility Improvement Measures

- Provision of FOB’s at:
  - Kendriya Vidyala on RTR Marg
  - Malai Mandir on ORR
  - Jia Sarai on ORR
  - NIHFW on ORR
  - Opp 100 ft wide road on Aurobindo Marg near Chatarpur

- Pedestrian Signals at:
  - All Signals at Intersections proposed to have a pedestrian phase
  - Aadyant School & Gurudwara at Sec C pocket 1 V Kunj on NMR

Proposed Pedestrian Facilities are designed as per UTTIPEC street design guidelines
IV. Public Transport/Mass Transport Proposals

Approach adopted for proposing Feeder Bus Routes

- To improve public transport accessibility of residential areas, institutional areas such as DU, IIT, JNU etc falling in the study area.
- To connect all four metro lines in the study area from the nearest possible routes.
- To improve the sustainability of the metro system.
- The proposed feeder routes cover major arterial & sub-arterial roads of the study area.
- Existing bus terminals have been used for starting/terminating of the feeder routes to maximum possible extent.
- Approximately 100 buses are required to run on these feeder routes at a frequency of 8 mins.
# Model Evaluation Parameter Results

## Scenario 1: With BJM Underpass to RR & San Martin Marg

<table>
<thead>
<tr>
<th>SR/NO</th>
<th>PARAMETER</th>
<th>Field Data</th>
<th>Modeled BASE CASE in VISSIM (Without BJ M Right Turn)</th>
<th>Scenario 1 (With BJ M BJ M Underpass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Volume at BJ M-RR, Right Turn</td>
<td>NA</td>
<td>NA</td>
<td>1430</td>
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<tr>
<td>2</td>
<td>Average Speed on NH-8 from ORR to Dhaula Kuan (km/hr)</td>
<td>12.24</td>
<td>10.3</td>
<td>17.1</td>
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<tr>
<td>3</td>
<td>Average Speed on RTR Marg from ORR to RR (km/hr)</td>
<td>6.3</td>
<td>6.1</td>
<td>15.9</td>
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<td>4</td>
<td>Reduction of vehicles at Cariyapa Marg Junction (Mahipalpur approach arm)</td>
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<td>NA</td>
<td>636</td>
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<tr>
<td>5</td>
<td>Reduction of vehicles at RTR-RR Junction (ORR approach arm)</td>
<td>NA</td>
<td>NA</td>
<td>595</td>
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<tr>
<td>6</td>
<td>Queue Length on NH-8 at Cariappa Marg junction (m)</td>
<td>485</td>
<td>480</td>
<td>340</td>
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<td>7</td>
<td>Queue Length on RTR marg at RTR-RR junction (m)</td>
<td>250</td>
<td>271</td>
<td>160</td>
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<td>8</td>
<td>Signal cycle time at RTR-RR junction (Sec)</td>
<td>290</td>
<td>290</td>
<td>270</td>
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</tbody>
</table>

- Will also result in reduction of Signal Cycle Length for RTR-ORR & BJ-ORR junctions
- With RTR-ORR flyover in place, BJM-RR underpass volume increases to 1790 vehicles
## Model Evaluation Parameter Results

### Scenario 2: With BJM-RR & RR-San Martin Signal (at-grade)

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<tr>
<th>SR/NO</th>
<th>PARAMETER</th>
<th>Field Data</th>
<th>Modeled BASE CASE in VISSIM (Without BJ M Right Turn)</th>
<th>Scenario 2 (With BJ M Right Turn- Signal)</th>
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<tr>
<td>1</td>
<td>Volume at BJ M-RR, Right Turn</td>
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<td>2</td>
<td>Average Speed on NH-8 from ORR to Dhaulia Kuan (km/hr)</td>
<td>12.24</td>
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<tr>
<td>3</td>
<td>Average Speed on RTR Marg from ORR to RR (km/hr)</td>
<td>6.3</td>
<td>6.1</td>
<td>10.92</td>
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<td>4</td>
<td>Reduction of vehicles at Cariyapa Marg Junction (Mahipalpur approach arm)</td>
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<td>220</td>
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<td>5</td>
<td>Reduction of vehicles at RTR-RR Junction (ORR approach arm)</td>
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<td>NA</td>
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<td>Queue Length on NH-8 at Cariappa Marg junction (m)</td>
<td>485</td>
<td>480</td>
<td>471</td>
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<td>Queue Length on RTR marg at RTR-RR junction (m)</td>
<td>250</td>
<td>271</td>
<td>204</td>
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<tr>
<td>8</td>
<td>Delay on BJ M at BJ M-RR junction (Sec)</td>
<td>NA</td>
<td>NA</td>
<td>84</td>
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<td>9</td>
<td>Queue Length on San Martin marg at San Martin -RR junction (m)</td>
<td>NA</td>
<td>NA</td>
<td>139</td>
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<td>10</td>
<td>Delay on San Martin marg at San Martin -RR junction (Sec)</td>
<td>NA</td>
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## Model Evaluation Parameter Results

### Scenario 3: With BJM-RR & RR-San Martin Signal (at-grade) & RR underpass

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<th>SR/NO</th>
<th>PARAMETER</th>
<th>Field Data</th>
<th>Modeled BASE CASE in VISSIM (Without BJ M Right Turn)</th>
<th>Scenario 3 (With BJ M Right Turn at grade- RR Underpass)</th>
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<td>Volume at BJ M-RR, Right Turn</td>
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<td>Average Speed on NH-8 from ORR to Dhaula Kuan (km/hr)</td>
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<tr>
<td>3</td>
<td>Average Speed on RTR Marg from ORR to RR (km/hr)</td>
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<td>6.1</td>
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<td>Reduction of vehicles at Cariyapa Marg Junction (Mahipalpur approach arm)</td>
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<td>Reduction of vehicles at RTR-RR junction (ORR approach arm)</td>
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<td>Queue Length on NH-8 at Cariappa Marg junction (m)</td>
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<td>480</td>
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<tr>
<td>7</td>
<td>Queue Length on RTR marg at RTR-RR junction (m)</td>
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<td>8</td>
<td>Delay on BJ M at BJ M-RR junction (Sec)</td>
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<tr>
<td>9</td>
<td>Delay on San Martin marg at San Martin -RR junction (Sec)</td>
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<td>NA</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>Signal cycle time at RTR-RR junction (Sec)</td>
<td>290</td>
<td>290</td>
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THANK YOU