Highway Blackspots Inspection

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Outline

• Highway Blackspots Inspection Methodology
  • Inspection methodology
  • Overview of Inspection checklists
  • Summary of inspected blackspots
  • Summary of blackspots location typology
  • Summary of blackspots crash data analysis
  • Typologies considered for categorizing blackspots
  • Summary of 15 Identified blackspots types

• Case Study
  • Observation summary and Recommendation of inspected blackspots
Highway Blackspots Inspection Methodology

Blackspot Inspection Methodology

- **Formation of the inspection team**
- **Preparation of checklists**
- **Selection of inspection route**
- **Typology Analysis**

**Summary of activities at blackspot**

- **Geolocated** blackspots
- **Recorded observations** in checklist
- **Captured photographs**
- **Shot video of the conflicting maneuvers**
- **Measurements of** road design elements
- **Speed measurement** using laser speed gun

Flowchart of the blackspot inspection methodology
Overview of Blackspot Inspection Checklists

Types of Inspection Checklists developed

1. Checklist for midblock section (8 sections)

2. Checklist for Intersection (6 sections)

3. Checklist for the highway segment passing through village/settlement areas (6 sections)
Checklist for Midblock Section

Divided into 8 Sections

- Section 1: Pavement markings
- Section 2: Check for Signages
- Section 3: Median Type and Design
- Section 4: Check on guardrails
- Section 5: Shoulder Type and Design
- Section 6: Check on Lighting Conditions
- Section 7: Plantations (on median)
- Section 8: Overall observation of the inspected location

<table>
<thead>
<tr>
<th>Objective</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Name</td>
<td></td>
</tr>
<tr>
<td>Traffic Flow Direction</td>
<td>From</td>
</tr>
<tr>
<td>GPS Location</td>
<td>Lat</td>
</tr>
<tr>
<td>Date</td>
<td></td>
</tr>
<tr>
<td>Built-up area or not?</td>
<td>LHS</td>
</tr>
<tr>
<td>Road Category</td>
<td></td>
</tr>
<tr>
<td>LHS Measurements</td>
<td></td>
</tr>
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</tr>
</tbody>
</table>
### 1. Check of Pavement Markings as per IRC 35-2015

<table>
<thead>
<tr>
<th>Items to check</th>
<th>Line Colour</th>
<th>Line Type</th>
<th>Width</th>
<th>Continuity</th>
<th>Visibility</th>
<th>Retro-Reflectiveness</th>
<th>Photo Ref (time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Line</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Traffic Lane Line</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Edge line</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directional Arrows (if any)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overtaking Line (if any)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warning Line (if any)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Observation (s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2. Check for Road Signages as per IRC 67-2012

<table>
<thead>
<tr>
<th>Check for Signage type</th>
<th>Mandatory</th>
<th>Cautionary</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinal Placement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retro-Reflectiveness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Obstruction to Sign</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photo Reference (Time)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3. Check of Median Type and Design

<table>
<thead>
<tr>
<th>Type of median</th>
<th>Flushed</th>
<th>Depressed</th>
<th>Raised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (if Raised) in mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width (m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of guard rail</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of plantation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median opening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of median opening (per km)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of hazard(s)</td>
<td>Trees</td>
<td>Poles</td>
<td>Others</td>
</tr>
<tr>
<td>Protection from Hazard</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Any Other Observation

1. Check for roadside guardrail/crash barriers as per IRC 119:2016

<table>
<thead>
<tr>
<th>Type of Crash Barrier</th>
<th>W-beam</th>
<th>T-beam</th>
<th>Cable</th>
<th>New Jersey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for Barrier placement on</td>
<td>Shoulder</td>
<td>Median</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity (Throughout the section)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of Need (m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance from the Carriageway Edge (m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance from the Hazard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flared at approach side</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flared at end side</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retro Reflective tape on it (for night visibility)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is type of crash barrier on curve same as on linear section?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate transitions treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Check on Shoulder Type and Design

<table>
<thead>
<tr>
<th>Shoulder Type</th>
<th>Paved</th>
<th>Unpaved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for Shoulder Type</td>
<td>Paved</td>
<td>Unpaved</td>
</tr>
<tr>
<td>Width (m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flush with Carriageway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there any space available after shoulder?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any other observation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Check on Lighting Conditions

<table>
<thead>
<tr>
<th>Yes/No</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Is there any risk that the lighting can be optically misleading and will it have any detrimental effects on traffic signals and signs?</td>
</tr>
<tr>
<td>2.</td>
<td>Are there any static areas that could cause hazards?</td>
</tr>
<tr>
<td>3.</td>
<td>Will an illuminated side road milestone road users on the planned, unlit road?</td>
</tr>
<tr>
<td>4.</td>
<td>Will powerful illumination of adjoining areas or strongly illuminated advertisements cause problems?</td>
</tr>
<tr>
<td>7.</td>
<td>Plantations (on medians)</td>
</tr>
<tr>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>1.</td>
<td>Will plantations obscure visibility?</td>
</tr>
<tr>
<td>2.</td>
<td>Are plantations likely to obscure on markings or lighting?</td>
</tr>
<tr>
<td>3.</td>
<td>Are fully-grown trees a hazard?</td>
</tr>
<tr>
<td>4.</td>
<td>Can maintenance be carried out safely?</td>
</tr>
</tbody>
</table>

8. Overall Observation of the Audited Location or Section

<table>
<thead>
<tr>
<th>Yes/No</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Are the conflicts well managed?</td>
</tr>
<tr>
<td>2.</td>
<td>Is guardrail as per standards also complying the safety requirement?</td>
</tr>
<tr>
<td>3.</td>
<td>Are there enough signs (Frequency/km)</td>
</tr>
<tr>
<td>4.</td>
<td>Is the rearward speed in compliance with the design speed?</td>
</tr>
<tr>
<td>5.</td>
<td>Are the signs correctly positioned, without obstructing sight distances/visibility in any way?</td>
</tr>
<tr>
<td>6.</td>
<td>Are the centre line edge marking appropriate?</td>
</tr>
<tr>
<td>7.</td>
<td>Is service road provided on both side of the road?</td>
</tr>
</tbody>
</table>
Checklist for Intersection/road segment passing through settlement/village

Divided into 6 Sections

- Section 1: General check and road markings
- Section 2: Check for Signages
- Section 3: Speed management measures
- Section 4: Check for guardrail
- Section 5: Lighting Condition
- Section 6: Overall Observations of the inspected location
### Conflict Diagram

1. Will road users coming from all directions be able to see that they are approaching a conflict area?

<table>
<thead>
<tr>
<th>Item(s)</th>
<th>Availability</th>
<th>Width</th>
<th>Colour</th>
<th>Visibility</th>
<th>Retro-Reflectiveness</th>
<th>Photo Reference (Time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop lines on approach road</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directional Markings on exit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crash Cushion(s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chevron Markings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Informatory Sign</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Other Observation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Road Safety Hazard / Object</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Check for Signages as per IRC 07-2012

<table>
<thead>
<tr>
<th>Sign type</th>
<th>Availability</th>
<th>Standard Conformity</th>
<th>Any Obstruction to Sign</th>
<th>Photo Reference (Time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lane indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advance warning sign</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Informatory signage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merge type and stack type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directional sign (on before exit on approach lane)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any other observation (a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Speed management measures on approach lanes of a highway at intersection as per IRC 09-2011

Check on following measures: Yes/No

1. Bar markings
2. Tumble strips
3. Speed limit sign
4. Speed Table / Tabla-top
5. Road Stud/ Cat’s Eye
6. Flashing beacon
7. Any other observation(a)

Any other observation

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18-03-2021
### 4. Check on guardrail/crash barriers as per IRC 11E:2019

<table>
<thead>
<tr>
<th>Type</th>
<th>U-Beam</th>
<th>Slope beam</th>
<th>New-Jersey</th>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retro reflective markings?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is installation correctly?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is guardrail damaged or not?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any other observation</td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

#### 5. Lighting Conditions

<table>
<thead>
<tr>
<th>Illumination</th>
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</thead>
<tbody>
<tr>
<td>Spacing of Light Poles</td>
<td></td>
</tr>
<tr>
<td>Unprotected Lighting Poles</td>
<td></td>
</tr>
</tbody>
</table>

#### 6. Overall Observation of the Audited Location or Section

<table>
<thead>
<tr>
<th></th>
<th>Yes/No</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td></td>
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<tr>
<td>5</td>
<td></td>
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<td>6</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
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</tbody>
</table>

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**Summary of Inspected Blackspots**
## Summary of the Inspected BS

<table>
<thead>
<tr>
<th>Date of audit</th>
<th>Zone</th>
<th>Zone wise total blackspot locations</th>
<th>Districts</th>
<th>District wise total no. of blackspot locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.2.20</td>
<td>Meerut</td>
<td>09</td>
<td>Meerut</td>
<td>06</td>
</tr>
<tr>
<td>11.2.20</td>
<td>Baghpat</td>
<td>03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.2.20</td>
<td>Saharanpur</td>
<td>04</td>
<td>Saharanpur</td>
<td>03</td>
</tr>
<tr>
<td>12.2.20</td>
<td>Muzaffarnagar</td>
<td></td>
<td>Muzaffarnagar</td>
<td>01</td>
</tr>
<tr>
<td>13.2.20</td>
<td>Bijnor</td>
<td>08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.2.20</td>
<td>Moradabad</td>
<td>04</td>
<td>Moradabad</td>
<td>04</td>
</tr>
<tr>
<td>14.2.20</td>
<td>Moradabad</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.2.20</td>
<td>Rampur</td>
<td>05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.2.20</td>
<td>Amroha</td>
<td>03</td>
<td></td>
<td></td>
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<td>15.2.20</td>
<td>Hapur</td>
<td>02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.2.20</td>
<td>Ghaziabad</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.2.20</td>
<td>Bulandshahr</td>
<td>07</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>52</strong></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>52</strong></td>
</tr>
</tbody>
</table>

*2 BSs were under construction

## Spatial distribution of the blackspots

**Total 4 Zones:**
- Meerut
- Saharanpur
- Moradabad
- Bulandshahr

**Total 11 districts**
- Meerut
- Baghpat
- Saharanpur
- Muzaffarnagar
- Bijnor
- Moradabad
- Rampur
- Amroha
- Hapur
- Ghaziabad
- Bulandshahr

Total number blackspots audited = 50*
Blackspots Crash Data Analysis

Summary of BS as per location typology

Distribution of BS based on Location Typologies

- X Intersection: 32%
- Midblock: 18%
- Staggered Junction: 18%
- Y Junction: 10%
- T Junction: 22%

Distribution of types of Junctions

- Cross-intersection (4 legs intersection): 35%
- Staggered junction: 24%
- T-junction: 26%
- Y-junction: 15%

Majority (82%) of the BS were junctions.

Four leg intersection have the highest share among the junction types.
Summary of BS as per location typology

Distribution of Identified BS location as per settlement or non-settlement typology

- BS location with non-settlement: 47%
- BS Locations with Settlement: 53%

53% of the BS are passing through the settlement or near the settlement.

Intersecting major and minor road typologies of BSs

Distribution of major road category
- ODR: 17%
- NH: 23%
- MDR: 21%
- SH: 39%

Distribution of minor road category
- MDR: 11%
- VR: 40%
- ODR: 49%

Distribution of junction type based on intersecting road categories
- NH-ODR: 24%
- MDR-ODR: 13%
- ODR-VR: 2%
- MDR-ODR: 11%
- SH-ODR: 13%
- SH-MDR: 9%
- SH-VR: 22%

41% of the junction are having VR as one of intersecting roads.
**Distribution of BS as per number of fatal crashes and fatalities**

- **Distribution of BS based on number of fatal crashes**
  - 5 fatal crashes: 16%
  - 10 fatal crashes: 39%
  - 15 fatal crashes: 31%
  - 20 fatal crashes: 16%
  - 25 fatal crashes: 4%
  - 30 fatal crashes: 2%
  - 35 fatal crashes: 2%

- **Distribution of BS based on number of fatalities**
  - 5 fatalities: 18%
  - 10 fatalities: 37%
  - 15 fatalities: 18%
  - 20 fatalities: 12%
  - 25 fatalities: 2%
  - 30 fatalities: 2%
  - 35 fatalities: 4%
  - Greater than 40 fatalities: 2%

**69% of the BS are having more than 5 fatal crashes.**

**82% of the BS are having fatalities more than 5.**

**Source:** Data provided by UP PWD

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**Crashes analysis using FIR data**

- **87 total crashes FIR copies analyzed for the last three years.**

- The cases include both fatal as well as non-fatal crashes.

- **Bijnor and Moradabad** district only.

- One BS of **Hapur district** (BS 37’s) crash data was available.

**72% of the total crashes are fatal crashes.**

**Source:** Data source UP Police and provided by UPPWD
Distribution of fatal crashes

- **77%** of the fatal crashes are **vehicle to vehicle crashes** types.

Distribution of fatal crashes as per Daytime and Nighttime

- More than half of the fatal crashes took place in daytime.

Distribution of striking vehicle type and road users/pedestrian

- The chart shows the number of times striking vehicle hit the victim, categorized by road user and vehicle type.
Typologies considered for categorizing BS

**Typologies**

- **Area Type**
  - Rural
  - Urban
- **Location Typology**
  - Midblock
  - Intersection
  - Settlement or Non-Settlement
- **Junction Typology**
  - Cross Intersection (X)
  - T Junction
  - Y Junction
  - Staggered Junction
- **Road Typology**
  - National Highway (NH)
  - State Highway (SH)
  - Major District Road (MDR)
  - Other District Road (ODR)
  - Village Road (VR)
### Total 15 BS Type Identified

<table>
<thead>
<tr>
<th>BS Type</th>
<th>BS type based on location typology</th>
<th>No. of total BSs</th>
<th>BS No.</th>
<th>Details</th>
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<tbody>
<tr>
<td>Type 1</td>
<td>Midblock*</td>
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<tr>
<td>Type 2</td>
<td>Midblock (Through Settlement)</td>
<td>2</td>
<td>43, 50</td>
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<tr>
<td>Type 3</td>
<td>Midblock (Near Settlement)</td>
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<td>Type 4</td>
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<tr>
<td>Type 5</td>
<td>Staggered junction (Through settlement)</td>
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<tr>
<td>Type 6</td>
<td>Staggered junction (Near Settlement)</td>
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<tr>
<td>Type 7</td>
<td>T Intersection*</td>
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<td>Type 8</td>
<td>T (Through Settlement)</td>
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<td>Type 10</td>
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<td>Type 11</td>
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<tr>
<td>Type 12</td>
<td>Y (Near settlement)</td>
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<td>Nil</td>
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<tr>
<td>Type 13</td>
<td>X Intersection*</td>
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<td>5, 17</td>
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<tr>
<td>Type 14</td>
<td>X (Through Settlement)</td>
<td>11</td>
<td>1, 7, 23, 27, 28, 29, 35, 36, 41, 49, 53</td>
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<tr>
<td>Type 15</td>
<td>X (Near Settlement)</td>
<td>3</td>
<td>15, 19, 24</td>
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</tbody>
</table>

* This category includes BS of non-settlement as well as far from settlement typologies.

### Distribution of BS Types

**BS type 14 and Type 8 are having the highest BS type.**

**BS type 14 is four leg intersection passing through the settlement.**

**BS type 8 is T junction passing through the settlement.**
Case Study of Blackspot Inspection

Mohiddinpur Sugar Mill Blackspot (BS1)

Type 14
BS 1: Major observations

Major Road observations

- Raised median was obstructing the pedestrian crossing.
- Non-standard rumble strip on both approach lanes to the junctions.
- Non-standard bar markings on both approach lanes of the junction.
- Edge drop between pavement and soft shoulder.
- Flashing beacon was non-functional.

BS 1: Minor Road Observation

Minor Road observations

- Non-standard rumble strips on minor road
- Speed limit sign on minor road
- Give way sign was present
- Paved shoulder with roadside activity
BS 1: Minor Road Observations

Minor Road observations

- Non-standard rumble strips on minor road
- Speed limit sign on minor road
- Give way sign present
- Paved shoulder with roadside activity

Hazardous Situations:

1. **Pedestrians** are facing conflict from oncoming vehicles while crossing the road.

2. **Passengers of a bus and para transit** are facing a risk of getting hit by other vehicles while boarding and deboarding at the informal stop.

3. The **risk to cyclists and pedestrians** from fast & wrong side moving vehicles.

4. **Obstruction of sight distance** due to overloaded sugarcane vehicles specially for cyclists and motorcyclists.

Recommendations BS 1

- **Change of texture with the help of cut stones.**

- **Sequential application** of interventions such as:
  - Set of bar markings as per the design speed
  - Rumble strips as per the standard.

- Provide **continuous zebra-crossing.**

- **Design of bus stop** as per the Draft IRC 80 section 4, Figure 1.

- **Road marking** as per IRC:35-2015.

- **Repair the non-functional flashing** beacon present on the major road.

- Provide lightings.

**Minor Road:** Install the **rumble strips and speed breaker** on the minor road with adequate road signages and markings (as per IRC:99-2018).

Option 1:

- Change of texture with the help of cut stones for at least 250 m of the intersection.

Option 2:

- **Provide the median** (as shown in the figure) to streamline the traffic.
- U-turn on both sides is proposed at 250m away from intersection
- Provide 50m gap for u-turn for tractors to access the sugar mill.
Rithani Peer Blackspot (BS 4)

Type 8

BS 4: Major Road observations:

- Pedestrian crossing is wrongly placed before the rumble strips.

- Conflicting movements at the junction.

- Raised median is obstructing the crossing.

- Concrete block is acting as hazard.

- Edge drop between pavement and soft shoulder.
BS 4 Minor road observations

• Non-standard speed breaker is present

• Stop sign is present.

• Road-side activities are present.

Hazardous Situations:

1. Pedestrians are facing conflict from oncoming vehicles while crossing the road.

2. Passengers of a bus and paratransit transport are facing a risk of getting hit by other vehicles while boarding and deboarding at the informal stop.

3. The risk to cyclists and pedestrians due to fast moving vehicles.
Recommendations BS 4

- **Change of texture** with the help of cut stones.
- **Sequential application** of interventions such as:
  - Set of bar markings as per design speed
  - Rumble strips as per standard.
- **Pedestrian crossing** for the zones passing through the settlement.
- Design of bus stop as per the Draft IRC 80 section 4, Figure 1 for rural four lane highway intersection.
- Increase the lumen intensity for the nighttime visibility at the intersection.
- May install flashing beacon on the major road
- **Minor Road**: May install the combination of Rumble strips and speed breaker on the minor road with road signages.

Jai Puliya Blackspot (BS 5)

**Type 13/ Rural Intersection**
BS 5: Major Road observations

- **No speed** reduction measures.

- **Bar markings** (1 set on each side) present on both side of the intersection.

- **No warning/informatory sign** to users on main road regarding intersection ahead.

- **Earthen shoulder** is not well maintained.

- **No lighting** facility for nighttime.

BS 5 Minor roads observations

- Rumble strip was not present.

- No other measures were present.

- New overlay layer was done.

- Masking of signages
BS 5 Minor roads observations

- Rumble strip is not present.

**Hazardous Situations:**

1. **Pedestrians** are facing conflict from oncoming vehicles while crossing the road.
2. The **risk to cyclists and pedestrians** due to fast moving vehicles.
3. **Risk of the crash** due to conflicting traffic maneuver at the intersection.

Recommendations BS 5

- **Change of texture** with the help of cut stones.
- **Sequential application** of interventions such as:
  - Set of bar markings as per design speed
  - Rumble strips as per standard.
- **Install red road studs** (per IRC:35-2015).
- **Design of kerb side bus stop** as per the Draft IRC 80 section 5, clause 5.6 and figure 5 for rural two-lane highway.
- **Install flashing beacon** on the major road to warn the driver.
- **Provide lighting** at the intersection for the nighttime traffic.
- **Minor Road**: Install the combination of rumble strips and speed breaker with road signages.
Mawana Khurd Basuhuma Bypass Blackspot (BS 6)  
**Type 10**

BS 6: Major Road observations

- **Crash cushion** not present at conflicting section.

- **Merging as well as diverging section** having conflicting movements.

- **No measures to reduce speed** on the approach side of the junction for traffic coming from Meerut.

- No formal bus stop **facility** was available.
BS 6: Major Road observations

- **Roadside hazards** such as poles, trees are present.

- **30 kmph speed limit** sign was present.

- Give way sign **wrongly placement** on major road.

- **No lightings** for nighttime.

- **No measures on minor road.**

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**Hazardous Situations**

1. **Passengers of a bus and para transit** transport are facing the risk of getting hit by other vehicles while boarding and deboarding at an informal stop.

2. **Pedestrians** are facing conflict from oncoming vehicles while crossing the road.

3. The **risk to cyclists and pedestrians** due to fast moving vehicles.

4. **Risk of the crash** due to conflicting traffic maneuver at the junction.

5. **Wrong side movements** near the junction is causing conflict.

- **No measures on minor road.**

- **No lightings** for nighttime.
Recommendations BS 6

- Improve traffic management to reduce possible conflicts by redesigning the junction.
- Close the road Mawana road approaching the Y junction from Mawana town direction.
- Change of texture with the help of cut stones.
- Sequential application of interventions such as:
  - Set of bar markings as per design speed
  - Rumble strips as per standard.
- Provide lighting at the intersection for the nighttime traffic.
- Design of bus stop as per the Draft IRC 80 section 4.
- Minor Road: install the combination of rumble strips and speed breaker with road signages.
BS 10: Observations

- **No facility** for pedestrians and cyclist was provided.

- **Bare minimum speed** reduction measures are taken in front of college to reduce speed.

- **High speed** was observed.

- **No facility** for bus and paratransit stop.

Gayatri College to Kalindi College Blackspot (BS 11)

**Type 13**
BS 11: Observations

• Sight distance issue at the sharp curve

• On sharp curve no speed measures reduction measures taken.

• Pedestrians and cyclist movement was observed.

• No measures on the minor road.

Hazardous Situations

1. Pedestrians are facing conflict from high-speed vehicles.

2. Passengers of a bus and paratransit transport are facing a risk of getting hit by other vehicles while boarding and deboarding at informal stops.

3. The risk to cyclists due to fast moving vehicles.

4. Sight distance obstruction at the curve
**Recommendation BS 10 & BS 11**

- **Change of texture** with the help of cut stones.

- **Refuge island** should be provided to segregate the traffic.

- **Sequential application** of interventions such as:
  - Set of bar markings as per design speed
  - Rumble strips as per standard.

- **Entry and exit treatment** at the entrance of the college.

- Design of far side (Kerb side) bus stop as per the Draft IRC 80 section 5.

- Rumble strips may also be provided on the approaches of college.

- Provide adequate road marking.

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**Kalsiya Tiraha Blackspot (BS 14)**

**Type 7**

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**BS 14: Major roads observations**

- **Crash cushion and chevron marking** is not present at diverging section.

- No crossing facility for school children in front of the school.

**Other observations:**
- No lighting at intersection for nighttime.
- **Roadside activity** on roadsides.
- Cyclist were present.

**Hazardous Situations**

- **Vehicle-Pedestrian conflict:** Passengers boarding and alighting near the intersection due to presence of Nehru Inter college, religious buildings and bus / autorickshaw/E-rickshaw stand.

- **Vehicle-Cyclist conflicts:** cyclists and pedestrians are using the main carriageway due to non-availability of separate space for them.

- **Pedestrians** are facing conflict from oncoming vehicles while crossing the road.

- **Passengers of a bus and paratransit transport** are facing a risk of getting hit by other vehicles while boarding and deboarding at informal stop

- **Wrong side moving vehicles** are conflicting with pedestrians, cyclists and other road users.

- Table top on all legs.
**Recommendations BS 14**

- **Change of texture** with the help of cut stones.
- **Design of bus stop** as per the Draft IRC 80 section 5.
- **Sequential application** of interventions such as:
  - Set of bar markings as per design speed
  - Rumble strips as per standard
  - Tabletop as per standard (with raised pedestrian crossing)
- **A raised pedestrian crossing** should be provided on all the legs.
- **Provide a roundabout** instead of the triangular island and median on Shaharanpur-Behat road (SH).
- **Provide lightings for the nighttime traffic** at the intersection.
- **Provide adequate road markings** as per IRC:35-2015.

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**Sahapurkala Blackspot (BS 35)**

**Type 14**
BS 35: Major roads observations

- Signages were masking each other.
- Rumble strips were non-standard.
- Pedestrians movement such as crossing the road.
- Roadside activities
- Shoulder was not maintained.

BS 35: Minor roads observations

- Stop sign present on minor road.
- Warning sign such as T-junction sign is present.
- Due to adjoining structure sight distance is obscured.
- Rumble strip provided on minor road. However, it is in damaged condition.
BS 35: Minor roads observations

Hazardous Situations

1. Vehicle-Pedestrian conflict: As vehicles are not stopping at the designated stop there is a possibility of vehicle-pedestrian conflict crashes.

2. Vehicle-Cyclist conflicts: cyclists and pedestrians are using the same carriageway due to non-availability of separate space for them.

3. Risk of possible conflicts such as rear-end, and side-wipe collision is high for vehicles entering on the major road from the minor road.

4. Sight distance issue on minor roads as it is merging perpendicularly on the major road, also sight distance obstruction due to bus-stop near the intersection and school boundary wall.

5. The sudden appearance of domesticated animals on road roads.

6. Risk of serious road crashes due to vehicles coming from all directions.

Recommendation BS 35

• Change of texture with the help of cut stones.

• Create an adequate speed zone as per IRC:99-2018.

• Sequential application of interventions such as:
  - Set of bar markings as per design speed
  - Rumble strips as per standard.

• Design of bus stop as recommended by the Draft IRC 80 as per Clause 3 and Table 1.

• Provide adequate road markings as per IRC:35-2015.

• Lighting conditions at the junction must be improved.

• Minor Road: Install the combination of rumble strips and speed breaker with adequate road signages (as per IRC:99-2018).
BS 38: Major roads observations

- Non-standard and damaged speed breaker is present.
- Bar markings present just at the location of T-junction.
- Road studs are wrongly placed on the edge line.
- Standalone zebra-crossing is provided.
- Sharp edge drop between pavement and shoulder was found.
**BS 38: Minor road observations**

- No road markings present.
- No signs were present on minor road.
- No speed calming measures were present.

**Recommendation BS 38**

- Sequential application of interventions at junction and curve section:
  - Set of bar markings as per design speed
  - Rumble strips as per standard.

- **Chevron boards** should be provided along the curve section.
- Guardrails should be provided before and after the canal.

- Provide adequate road signages at the curve section as per IRC:67-2012.
- Provide adequate road markings as per IRC:35-2015.
- Delineators should be present for better nighttime visibility.

- **Shoulder** should be maintained to deal with steep edge drop too close to the edge line.

- **Minor Road**: install the combination of rumble strips and speed breaker with adequate road signages.
Thanks!

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