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STUDY OF ROAD SAFETY ASSESMENT IN THE CONTEXT OF PRESENT CONDITION OF JINAH PARK TO GORA QABRISTAN IN PESHAWAR CITY

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***Abstract*— the present situation of GT road Peshawar shows that no road safety assessment is performed before on the road during construction and design. That is why the road congestion and road accidents are at high rate. This paper presents a study on assessment of existing facilities on basis of which road safety infrastructure planning is established. Considering location, existing road network of GT road in Peshawar, this assessment study was carried out with sample road section (Jinnah Park to Gura Qabristan). The indicators included completion rate of traffic markings and signs, installment rationality of traffic signs and traffic signals, pedestrian crossing facilities, road side conditions and,. Other elements such as guardrails, sight-guiding facilities were also considered. Road safety level was decided on the general score obtained from scoring systems. Such as completeness and rationality. When the final score of situation came out then according to that scoring specific countermeasures were discussed for diversified road sections so as to prevent crashes and improve local road safety**

Keywords: **STUDY OF ROAD SAFETY ASSESMENT IN THE CONTEXT OF PRESENT CONDITION OF JINAH PARK TO GORA QABRISTAN IN PESHAWAR CITY**

Introduction

OBJECTIVE OF STUDY

The objective of this study was to complete a road safety assessment (RSA) leading to proposed safety enhancement for GT road from (Gura Qabristan to Jinnah park). The study area is about 4.2 Km. Due to the crash history of the corridor and earlier project proposal that have not been implemented due to community concerns, RSA team was chosen to conduct the RSA (Road Safety Assessment) to evaluate this safety issues through the corridor.
Road safety assessments are a valuable tool for transportation agencies to evaluate road safety issues contributing to injuries and deaths and to identify opportunities for improvement. RSA are also an effective tool for proactively improving road way roadside safety. As such, The RSA Process may be employed on any type of facility and during any stage of the project development process, including existing facilities that are open to traffic. The FWHA defines an RSA as a 'formal safety performance evaluation of an existing or future road or intersection by an independent, multidisciplinary team." The primary focus of an RSA is safety while working within the context of the other aspects such as mobility, access, surrounding land use, and/or aesthetic. RSAs conducted by a team that is independent of the design and operations of the facility are able to address safety by means of a thorough review of roadway, traffic, environmental and human factors and conditions. By focusing on safety, RSA ensure that potentially hazardous roadway and road side elements don't "Fall through the cracks" RSAs typically follow an eight steps RSA process. Shown below

- ✓ The objective of this study is to examine the proposed section of G.T Road for geometric design, pavement and road side conditions.
- ✓ Any flaws or errors in terms of above parameters should be identified.

- ✓ Sections of the road should be looked at, in detail for fulfilling the road standards in terms of above parameters.
- ✓ Technical recommendations would be proposed to remove the flaws to make it safe passages for the movement of vehicles and people.

STUDY PURPOSE

The purpose of the RSA was to identify safety issues that may be contributing to the reported crashes along the corridor and to identify potential measures to mitigate these issues. Another goal of the RSA was to identify safety issues that have not yet resulted in crashes and suggest proactive improvements to correct or mitigate these issues.

PROJECT BACKGROUND

Within the limits of the study, GT road is a 4 lane road ,providing a connection through Hayatabad and Peshawar motor way.

This road serves a variety of road users and vehicles, including local commuters/residents, tourists, pedestrians, bicyclists, heavy commercial vehicles, and farm equipment.

During the last few years, various interim improvements along the study corridor have been implemented that may have addressed some of the safety concerns that originally triggered a need for an extensive safety project

I. CHAPTER 2

II. LITERATURE REVIEW

A. INTRODUCTION

The present situation of GT road Peshawar shows that no road safety assessment is performed before on the road during construction and design. That is why the road congestion and road accidents are at high rate. So anroad safety assessment is essential to overcome the transportation crisis in Peshawar city. This chapter will provide information about the history, results, features, performance, benefits, component and terms related to RSA system. The chapter is divided into the following sections:

- History of RSA
- Results of RSA worldwide
- SAFETY IMPROVEMENT COUNTERMEASURES

History of RSA

This Road Safety Assessment (RSA) was initiated by the California Department of Transportation (Caltrans). The processes used during the workshop were a combination of the Federal Highway Administration (FHWA) RSA process and Caltrans' Value Analysis tools and techniques.

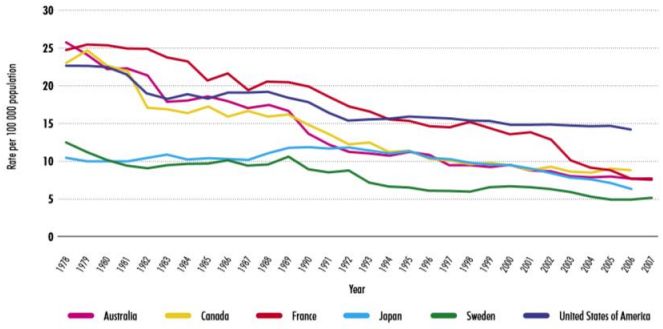
Road Assessment Programs (RAP) are now active in over 70 countries worldwide covering Europe, Asia Pacific, North America, Latin America and the Caribbean, and Africa.

Modeled road traffic injury fatality rates (per 100 000 population), by WHO region and income group

WHO REGION	HIGH-INCOME	MIDDLE-INCOME	LOW-INCOME	TOTAL
AFRICAN REGION[b]	—	32.2	32.3	32.2
REGION OF THE AMERICAS[c]	13.4	17.3	—	15.8
SOUTH-EAST ASIA REGION[b]	—	16.7	16.5	16.6
EASTERN MEDITERRANEAN REGION	28.5	35.8	27.5	32.2
EUROPEAN REGION	7.9	19.3	12.2	13.4
WESTERN PACIFIC REGION	7.2	16.9	15.6	15.6
GLOBAL	**10.3**	**19.5**	**21.5**	**18.8**

[a] 30-day definition.
[b] No high-income countries.
[c] No low-income countries.

Figure 4. Trends in road traffic fatality rates in selected high-income countries



SAFETY IMPROVEMENT COUNTERMEASURES

Road lane:

DIFF:A **lane** is a part of the carriageway within a road marked out for use by a single line of vehicles in such a way as to control and guide drivers for the purpose of reducing traffic conflicts. Most public roads (highways) have at least two lanes, one for traffic in each direction, separated by lane markings. Major highways often have two roadways separated by a median, each with multiple lanes.

Lane width:

The U.S. Interstate Highway System uses a 12-foot (3.7 m) standard for lane width. 11-foot (3.4 m) lanes are found to be acceptable by the Federal Highway Administration for automobile traffic, but as lane width decreases (9-foot (2.7 m) lanes are found in some areas) traffic capacity decreases.[3] A full-width freeway lane typically has a capacity of 2,000 cars per hour.

In the United Kingdom, many lanes are found in the countryside, and most of these lanes are wide enough for one car at a time and often have a lay by for cars to pass. In general, European laws and road width vary per country, with the minimum widths of lanes being anywhere between 2.5 to 3.25 metres (8.2 to 10.7 ft)

Lane Width: Flexibility in the AASHTO Guidelines

The AASHTO Green Book (2) recognizes the need for flexibility and provides that flexibility, citing how lane width can be tailored, to a degree, to fit the particular environment in which the roadway functions (e.g., low-volume rural roads or residential areas versus higher volume rural or urban facilities). The formulation of these values demonstrates considerable flexibility. The AASHTO Green Book (2) recognizes the need for flexibility and provides that flexibility, citing how lane width can be tailored, to a degree, to fit the particular environment in which the roadway functions (e.g., low-volume rural roads or residential areas versus higher volume rural or urban facilities). The formulation of these values demonstrates considerable flexibility.

For lower speed, lower volume rural roads and highways with little or no truck traffic, lane widths as low as 9 ft (2.7 m) may be acceptable; lane widths substantially less than 12 ft (3.6 m) are considered adequate for a wide range of volume, speed, and other conditions.

For the reconstruction of rural two-lane highways, the AASHTO Green Book (2) notes that less than 12-ft or 3.6-m lane widths may be retained "where alignment and safety record are satisfactory." In other words, widening a narrow existing highway is not mandated if its safety performance is acceptable. Flexibility is also evident for lower-class roads and streets, with recommended narrower lane widths consistent with lower design speeds on such roads.

The discussion of lane width in the AASHTO Green Book (2) for urban areas also reflects a high degree of flexibility. It is noted that lane widths "may vary from 10 to 12 ft (3.0 to 3.6 m) for arterials."

III. SHOULDER WIDTH

DEF: Shoulders provide a number of important functions. Safety and efficient traffic operations can be adversely affected if any of the following functions are compromised:

EXPLANATION

- Shoulders provide space for emergency storage of disabled vehicles (Figure 7). Particularly on high-speed, high-volume highways such as urban freeways, the ability to move a disabled vehicle off the travel lanes reduces the risk of rear-end crashes and can prevent a lane from being closed, which can cause severe congestion and safety problems on these facilities.

- Shoulders provide space for enforcement activities (Figure 7). This is particularly important for the outside (right) shoulder because law enforcement personnel prefer to conduct enforcement activities in this location. Shoulder widths of approximately 8 feet or greater are normally required for this function.

- Shoulders provide an area for drivers to maneuver to avoid crashes (Figure 7). This is particularly important on high-speed, high-volume highways or at locations where there is limited stopping sight distance. Shoulder widths of approximately 8 feet or greater are normally required for this function.

- Shoulders improve bicycle accommodation (Figure 8). For most highways, cyclists are legally allowed to ride on the travel lanes. A paved or partially paved shoulder offers cyclists an alternative to ride with some separation from vehicular traffic. This type of shoulder can also reduce risky passing maneuvers by drivers.

- Shoulders increase safety by providing a stable, clear recovery area for drivers who have left the travel lane. If a driver inadvertently leaves the lane or is attempting to avoid a crash or an object in the lane ahead, a firm, stable shoulder greatly increases

the chance of safe recovery. However, areas with pavement edge drop-offs can be a significant safety risk. Edge drop-offs (Figure 9) occur where gravel or earth material is adjacent to the paved lane or shoulder. This material can settle or erode at the pavement edge, creating a drop-off that can make it difficult for a driver to safely recover after driving off the paved portion of the roadway. The drop-off can contribute to a loss of control as the driver tries to bring the vehicle back onto the roadway, especially if the driver does not reduce speed before attempting to recover.

- Shoulders improve stopping sight distance at horizontal curves by providing an offset to objects such as barrier and bridge piers (Figure 10).

- On highways with curb and enclosed drainage systems, shoulders store and carry water during storms, preventing water from spreading onto the travel lanes.

- On high-speed roadways, shoulders improve capacity by increasing driver comfort.

Shoulders on this urban freeway provide enough width for crash avoidance, storage of disabled vehicles, maintenance activities, and enforcement.

- Figure 7 is a photo of an urban freeway with three lanes in each direction and shoulders on both the outside and median-side that are 10 to 12 feet wide.

TABLE 7

Ranges for Minimum Shoulder Width

Type of Roadway	Rural		Urban	
	US (feet)	Metric (meters)	US (feet)	Metric (meters)
Freeway	4–12	1.2–3.6	4–12	1.2–3.6
Ramps (1–lane)	1–10	0.3–3.0	1–10	0.3–3.0
Arterial	2–8	0.6–2.4	2–8	0.6–2.4
Collector	2–8	0.6–2.4	2–8	0.6–2.4
Local	2–8	0.6–2.4	–	–

Source: A Policy on Geometric Design of Highways and Streets, AASHTO

Horizontal alignment

• It is the design of the road in the horizontal plane
• Consists of a series of straights (tangents), circular curves and transition curves
• Should provide safe travel at a uniform design speed.

Factors Affecting Alignment

• Safety
• Grades
• Design speed
• Cost of resumption of land
• Construction costs.

Operating speed is influenced by all other factors so it is the critical factor to consider.

Alignment Considerations

• Curvature
• Movement on a circular path
• Superelevalation
• Side friction
• Sight distance
• Curve geometry
• Curves with adverse cross-fall
• Short curves
• Small changes in alignment

Super elevation (e)

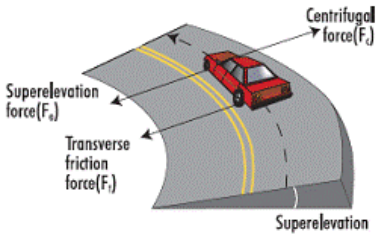
• Superelevation is slope across pavement surface and is fully developed in the circular curve
• e is +ve when road slopes towards centre of curve or –ve (adverse) if road slopes away from the centre of curve.

Superelevation (e)

When being applied to the road need to take into account
• Safety
• Comfort
• Appearance
• Design speed
• Tendency for slow vehicles to track towards centre
• Difference between inner and outer formation levels
• Stability of high laden vehicles
• Length of road to introduce superelevation
• Provision for drainage

Superelevation (e)

Maximum Superelevation



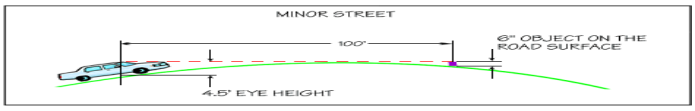
• Max range from flat to mountainous of 0.06 – 0.12 respectively but most authorities limit to 0.10
• In urban areas limit max values to 0.04-0.05 Minimum Superelevation
• Should be elevated to at least the cross-fall on straights i.e 3% (0.03)

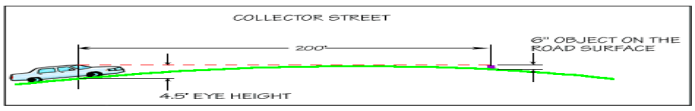
Sight Distance Standards

Design Speed[1] (mph)	Stopping[2] (ft)	Passing (ft)
20	125	800
25	150	950
30	200	1,100
35	250	1,300
40	300	1,500
45	360	1,650
50	430	1,800
55	500	1,950
60	580	2,100
65	660	2,300
70	750	2,500
75	840	2,600
80	930	2,700

Vertical Alignment

• Specifies the elevations of points along a roadway.
• Elevations are determined by need to provide proper drainage and driver safety.
• A primary concern of vertical alignment is to establish a transition between two roadway grades by means of a vertical curve.





Two types of Vertical Curves:
1. Crest Vertical Curves.
2. Sag Vertical Curves

Sight distance

Def.:

Sight distance is the continuous length of highway ahead, visible to the highway user.

Explanation: Road geometry affects the sight distance available to the driver. Sight distance, in the context of road design, is defined as "the length of roadway ahead visible to the driver."[1] Sight distance is how far a road user (usually a vehicle driver) can see before the line of sight is blocked by a hill crest, or an obstacle on the inside of a horizontal curve or intersection. Insufficient sight distance can adversely affect the safety or operations of a roadway or intersection.

The sight distance needed for a given situation is the distance travelled during the two phases of a driving maneuver: perception-reaction time (PRT), and maneuver time (MT). Perception-reaction time is the time it takes for a road user to realize that a reaction is needed to a road condition, decided what maneuver is appropriate, and start the maneuver. Maneuver time is the time it takes to complete the maneuver. The distance driven during perception-reaction time and maneuver time is the sight distance needed.

During highway design and traffic safety investigations, highway engineers compare the available sight distance to how much sight distance is needed for the situation. Depending on the situation, one of three types of sight distances will be used:

Primary Stopping Sight Distance Factors

• Perception-reaction time
• Driver eye height
• Object height
• Vehicle operating speed
• Pavement coefficient of friction
• Deceleration rates
• Roadway grade

Current Design Perception- Reaction Time

Human factors research defined perception-reaction times for (1):
• design 2.5 sec
• operations/control 1.0 sec

These perception reaction times were based on observed behavior for the 85th percentile driver; that is, 85% of drivers could react in that time or less. More recent research has shown these times to be conservative for design.

Wortman and Mathias (2) reported both the “surprise” and alerted 85th percentile perception reaction times. This was in an urban environment; the time was measured after the yellow indication until brake lights appeared.

The Wortman et al. research found:
• alerted 85% perception-reaction time 0.9 sec
• "surprise" 85% perception-reaction time 1.3 sec

(1) AASHTO, "Policy on Geometric Design of Streets and Highways," Washington, DC,
1984, 1990, and 1994.
(2) Wortman, R.H., and J.S. Matthias, "Evaluation of Driver Behavior at Signalized
Intersections," Transportation Research Record 904, T.R.B, Washington, D.C., 1983.

1) Stopping sight distance

Stopping sight distance is the distance traveled during perception-reaction time (while the vehicle driver perceives a situation requiring a stop, realizes that stopping is necessary, and applies the brake), and maneuver time (while the driver decelerates and comes to a stop). Actual stopping distances are also affected by road conditions, the mass of the car, the incline of the road, and numerous other factors. For design, a conservative distance is needed to allow a vehicle traveling at design speed to stop before reaching a stationary object in its path. Typically the design sight distance allows a below-average driver to stop in time to avoid a collision.

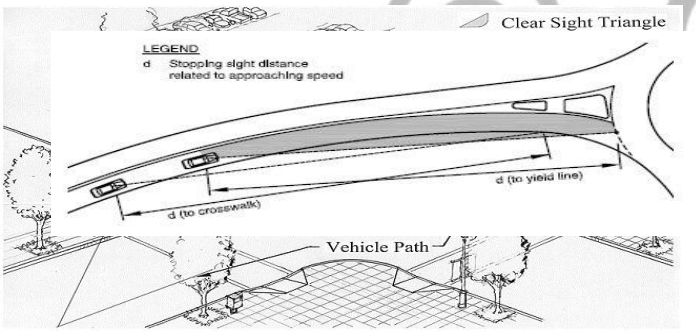


Table 2. Design Coefficients of Friction for Stopping Sight Distance

Design Speed		Running Speed		AASHTO Coefficient of Friction
30 kph	(20 mph)	32 kph	(20 mph)	0.40
50 kph	(30 mph)	45 kph	(28 mph)	0.35
65 kph	(40 mph)	58 kph	(36 mph)	0.32
80 kph	(50 mph)	71 kph	(44 mph)	0.30
100 kph	(60 mph)	84 kph	(52 mph)	0.29
115 kph	(70 mph)	93 kph	(58 mph)	0.28

2) Decision sight distance

Decision sight distance is used when drivers must make decisions more complex than stop or don't stop. It is longer than stopping sight distance to allow for the distance traveled while making a more complex decision. The decision sight distance is "distance required for a driver to detect an unexpected or otherwise difficult-to-perceive information source or hazard in a roadway environment that may be visually cluttered, recognize the hazard or its threat potential, select an appropriate speed and path, and initiate and complete the required maneuver safely and efficiently Ideally, roads are designed for the decision sight distance, using 6 to 10 seconds for perception-reaction time and 4 to 5 seconds to perform the right maneuver.

AASHTO Decision Sight Distance

The decision sight distance as defined by the AASHTO Green Book is "the distance required for a driver to detect an unexpected or otherwise difficult-to-perceive information source or hazard in a roadway environment that may be visually cluttered, recognize the hazard or its threat potential, select an appropriate speed and path, and initiate and complete the required maneuver safely and efficiently." According to AASHTO, the decision sight distance requires about 6 to 10s to detect and understand the situation and 4 to 4.5s to perform the appropriate maneuver. The sight distance is typically measured from a 1070 mm (3.5 ft.) height of eye to 150 mm (6 in.) object; however, this should depend on the condition that requires the decision sight distance. A table showing the recommended decision sight distances for various maneuvers is given in
Table.

DECISION SIGHT DISTANCE (Continued)

Table 4A. Decision Sight Distance (meters)

Design Speed (km/h)	Decision Sight Distance for Avoidance Maneuver, (meters) A	B	C	D	E
50	75	160	145	160	200
60	95	205	175	205	235
70	125	250	200	240	275
80	155	300	230	275	315
90	185	360	275	320	360
100	225	415	315	365	405
110	265	455	335	390	435
120	305	505	375	415	470

*Note: Avoidance Maneuvers
1. Avoidance maneuver A: Stop on rural road
2. Avoidance maneuver B: Stop on urban road
3. Avoidance maneuver C:Speed/path/direction change on rural road
4. Avoidance maneuver D: Speed/path/direction change on suburban road
5. Avoidance maneuver E: Speed/path/direction change on urban road

Various operating conditions require different maneuvers in response to a situation. The perception-reaction times are shorter for the less complex rural conditions than for urban.

3) Intersection sight distance

Intersection sight distance is the sight distance needed to safely proceed through an intersection. The distance needed depends on the type of traffic control at the intersection (uncontrolled, yield sign, stop sign or signal), and the

maneuver (left turn, right turn, or proceeding straight). All-way stop intersections need the least, and uncontrolled intersections require the most. Intersection sight distance is a key factor in whether no control or yield control can be safely used, ot more restrictive control in needed.

a) Corner sight distance

Corner sight distance (CSD) is the road alignment specification which provides a substantially clear line of sight so that the driver of a vehicle, bicyclist or pedestrian waiting at the crossroad may safely anticipate the driver of an approaching vehicle. Corner sight provides an adequate time for the waiting user to either cross all lanes of through traffic, cross the near lanes and turn left, or turn right, without requiring through traffic to radically alter their speed.

ROAD MARKING

Road surface marking is any kind of device or material that is used on a road surface in order to convey official information. They can also be applied in other facilities used by vehicles to mark parking spaces or designate areas for other uses.

Road surface markings are used on paved roadways to provide guidance and information to drivers and pedestrians. Uniformity of the markings is an important factor in minimizing confusion and uncertainty about their meaning, and efforts exist to standardize such markings across borders.
However, countries and areas categorize and specify road surface markings in different ways.

Road surface markings are mechanical, non-mechanical, or temporary. They can be used to delineate traffic lanes, inform motorists and pedestrians or serve as noise generators when run across a road, or attempt to wake a sleeping driver when installed in the shoulders of a road.
Road surface marking can also indicate regulation for parking and stopping.

Road markings
The following section provides information on the different road markings recommended for rural Roads. The following details are provided:
Dimensions:
The color, width and length of stripe and/or gap if applicable.
Requirements:
The desirable minimum width and absolute minimum width of sealed road required to provide the Marking. The minimum traffic volume (VPD) above which the marking should normally be applied.
Special conditions:
Any special conditions which apply, which would make it desirable to provide markings on roads below the recommended requirements.

Accident reduction:
The reduction in accidents expected from the installation of the marking and typical benefit cost ratio (BCR), where known, together with the reference. Obviously the BCR for specific projects can be calculated from the road's accident history and the expected accident reductions (refer Appendix 2). The typical BCR is shown for indicative reasons only.
Note: While the recommended values for seal width should be followed, local road controlling Authorities can use lower minimum traffic volume thresholds. If this occurs it is essential that the Lower criteria be applied in a consistent manner and special care be taken on roads that cross into Adjacent authorities. It is also essential that a consistent treatment be provided along a road whose Width varies. Generally the minimum width sections will dictate the standard of marking which Should be applied.

Centerlines

A center line is used to define the portion of a two way sealed roadway available for travelling in Each direction. It also provides a simple and continuous form of delineation, however its Effectiveness can be reduced at night and in wet weather. Overseas research (see section 9, reference 1) has also shown that marking center lines on very narrow roads may increase accident numbers.
Dimensions:
The centerline shall be a dashed line marked as follows:
Color: White
Width: 100mm
Stripe: 3m
Gap: 7m
Note: The visibility of centerline markings at night can be improved by using reflectorized paint.
The use of reflectorized centerline markings is recommended on roads with a high proportion of Night time accidents. The average percentage of night time accidents is as follows:
Rural state highways 37%
Local rural roads 42%
Dashed center line: (isolated sections) [Type B*]
Total route marking of dashed Centre lines on lower volume roads is not normally necessary,
However special circumstances may exist where the marking of isolated sections of centerlines is Desirable:
• Where there are frequent horizontal and/or vertical curves
• At sub-standard curves
• Over sections where the accident record indicates a need
• To maintain continuity on a route or with an adjacent road.
It is recommended that centerlines be marked on isolated sections of roads meeting the following criteria:

Desirable minimum width 5.5m
Absolute minimum width
5.0m……..Minimum volume 100 VPD

No overtaking lines
No overtaking lines are used at vertical and, on rare occasions, horizontal curves where overtaking
Must be prohibited because of restricted visibility or other hazardous conditions. The lines also
Serve a similar function to centerlines in that they define the center of the road and delineate the
Alignment.

Dimensions:
The no overtaking line shall be a continuous line marked as follows:
Color: Reflectorized Yellow
Width: 100mm
Stripe: Continuous

Requirements:
No overtaking lines are recommended for all sealed roads meeting the following criteria:
Desirable minimum width 5.5m
Absolute minimum width 5.0m
Note: Details for the marking of no overtaking lines are provided in the *Manual of Traffic Signs and Markings* (Part Il Markings). No minimum traffic volume is specified, however, no overtaking
Lines are generally only recommended on roads where the traffic volume criteria for centerlines
Apply and a centerline is marked

Edge lines

Edge lines delineate the edge of the traffic lane and, in situations where the shoulder is paved, edge
Lines separate the shoulder from the traffic lane. They provide a useful guide to motorists at night
and in foggy or misty conditions. Where roadway shoulders are unsealed, the provision of edge
lines not only enhances road safety but can reduce wear and maintenance of the shoulder.

Dimensions:
The edge line shall be a continuous line marked as follows:
Color: White
Width: 75mm
Stripe: Continuous
Note: The visibility of edge line markings at night can be improved by using reflectorized paint.
The use of reflectorized edge lines is recommended on roads with a high proportion of night time
Accidents. The average percentage of night time accidents is as follows:

Rural state highways 37%

Local rural roads 42%

Intersection markings
Highlighting the presence of side roads to main road traffic with the use of road markings serves
Two useful purposes. Firstly, the presence of the side road is easier to identify and motorists are
Therefore more likely to be aware of the possible hazards associated with an intersection, such as
turning traffic. Secondly, the markings act as a useful guide for turning traffic.

Types of markings
Three types of markings can be used:
• Continuous centerline
• Edge line
• Continuity line.
Details for line size and layout for rural side roads are shown in the *Manual of Traffic Signs and Markings (*Part II, Markings) and in Figure 2 of this guideline. An example of localized seal
Widening is shown in Transit New Zealand *Planning for a Safe and Efficient Highway Network under*
The Resource Management Act, diagram 4, page 64 (June 1992). Although this diagram refers to a
Property access similar widening is considered appropriate for side roads

Delineation devices
DEF: Road delineation is a term used to describe elements used to provide guidance to road users. Such elements include road markings, signage and raised pavement markings

Standard delineation features for Arterial and Tourist category roads will include:

• Centre line
• Edge Lines – 100mm Wide
• RRPM's
• Edge Marker Posts
• Full markings for Single Lane Bridges
• Flag Lights
• Hazard Markers (where required)
• Intersection Controls – on all side roads
• Curve Warning Signs (where warranted)
• Road Name Blades with larger 160mm lettering
• Advance Intersection Signage
• Chevrons
• Guardrails (where warranted)

• Centre line
• Edge Lines - 75mm Wide
• RRPM's – at locations with safety issues
• Edge Marker Posts – isolated
• Full markings for Single Lane Bridges
• Hazard Markers (where required)
• Intersection Controls – on all side roads
• Curve Warning Signs (where warranted)
• Road Name Blades with 120mm lettering
• Chevrons
• Sight rails most likely instead of Guardrails (where warranted)

Standard delineation features for Local Roads will include:

• Centre line – Isolated due to road alignment
• Edge Lines – Isolated due to safety issues
• Edge Marker Posts – Isolated sections due to safety issues including road alignment
• Full markings for Single Lane Bridges where practicable
• Hazard Markers (where required)
• Intersection Controls – on main road where required or safety issue
• Curve Warning Signs (where warranted)
• Road Name Blades with 120mm lettering
• Chevrons
• Sight rails most likely instead of Guardrails (where warranted)

IV. CHAPTER 3

V. METHODOLOGY AND DATA COLLECTION

In order to achieve the above mentioned objectives the proposed section of G.T road would be divided in 100m sections and each section would be examinine
Field observation as well as videos of each 100 m section would be closely in sighted and the problems would be identified.
Each problem would be mentioned in the form of charts which will give us high risky sections of the proposed road.
Lastly recommendation on each issue would be discussed to make it safe sections of the road for users.

STEPS INVOLVED:

1) Field visits
2) Performing video
3) Measurements
4) Comparison of Parameters with AASHTO GREEN BOOK standards
5) Scoring
6) Charts

1) FIELD VISITS:

The RSA team visit the road section (Gora Qabristan Jinnah Park) in which they have to examine different parameters .such as

- They examine the undulations are there on the road
- They examine the condition of the pavement surface in terms of lane marking, line width etc.
- They examine other parameters such as shoulder width, lane width, slope of road, horizontal and vertical alignments, road markings..etc.
- They examine the road side conditions. in terms of provision for the pedestrians.

2) PERFORMING VIDEOS:

The RSA team performs a video of Road Surface and Road side conditions
RSA team performs video of each 100 meter section in the proposed section of GT Road.
The video should be perform in such a way that all the required parameters on the roadway may be visible.(such as left ,right side and front).

3) Measurement with Tap:

The RSA team measure all the Road section each and every 100 meter section in terms of lane width, shoulder width etc. It helps them while comparing it with the AASHTO GREEN BOOK standards.

4) Comparison with the Standards:

After the collection of data with the help of video and after its study the RSA teams will compare the parameters included in the proposed road section with the standards of AASHTO.
This will help in finding the critical portion of the proposed road section.
With the help of AASHTO guide lines the correct values of roads parameters can be achieved.

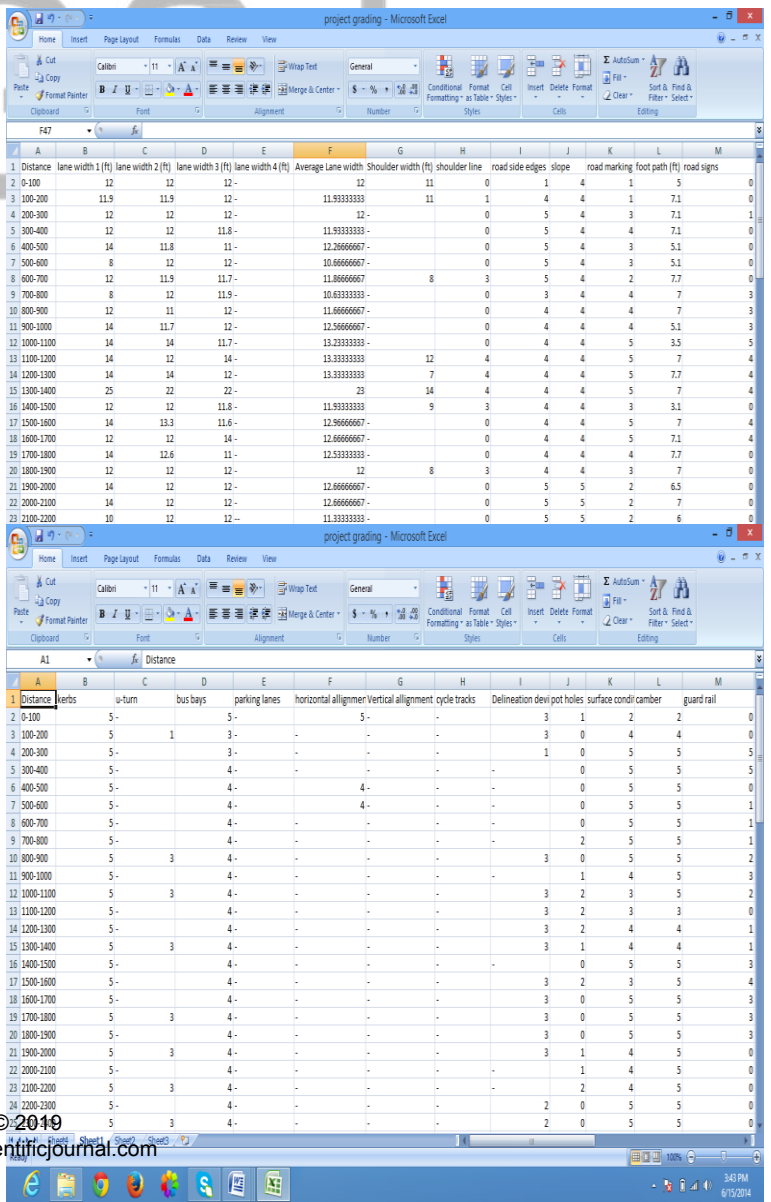
5) Scoring:

The RSA team did scoring after the comparison of the parameters with the standards.
The scoring is in the form of table. in which there will be Parameters, AASHTO standards, and the current condition of the road.
The scoring is in the form of digits from (0-5).which will show poor, good, fair, excellent condition of the road in term of parameters.

6) CHARTS:

The RSA team prepares a Bar chart and a Graph chart after collection of data.

After scoring the RSA team prepares graph chart which show them the critical portion of the road.



Chapter 4

I. Analysis and Result

All of the data is collected according to the above mentioned methodology. The data include charts of every section in the proposed section of the road which is about 4.2 km. The data is collected depending upon the above given parameters such as lane width, shoulder width, etc. some of the charts are analyzed according to the grading system which is shown in the table below.

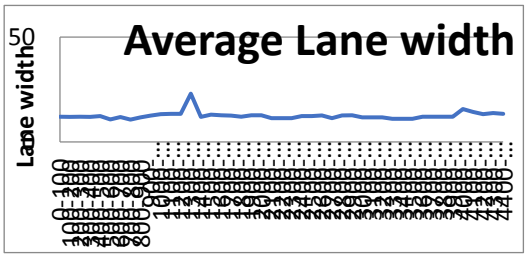
Table: Grading system

Not at all	0
Very poor	1
Poor	2
Fine	3
Good	4
Excellent	5

Where the charts for lane width, shoulder width etc. Are shown according to the AASHTO Standards.
These graphs are given bellow for each of the parameter discussed in the literature review.

Average Lane width

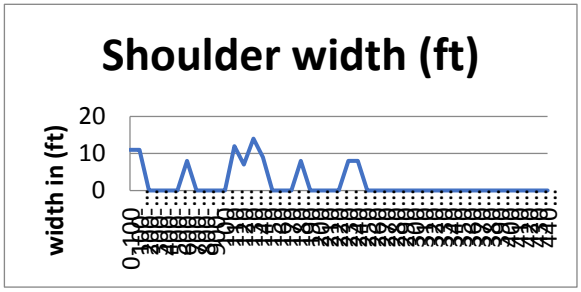
As in our proposed section (Gora Qabristan to Jinnah Park) there are 3 lanes in most of the sections but are having 4 lanes in some of the section so by taking the average of all of the lanes width we get an average lane width. Which is analyses graphically as shown in the figure.



AASHTO STANDARDS: Lane width =12 ft
Remarks: from the figure it is clear that the standard lane width is 12ft and in our proposed sections (Jinnah Park to Gora Qabristan) most of the section of the road is not according to the standard given by AASHTO.

Shoulder width

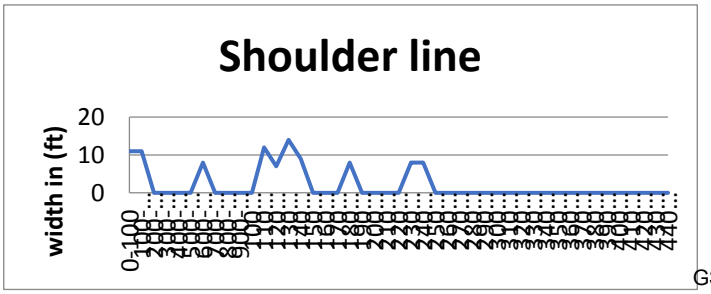
The graph of the shoulder width in different section of the road is given below.

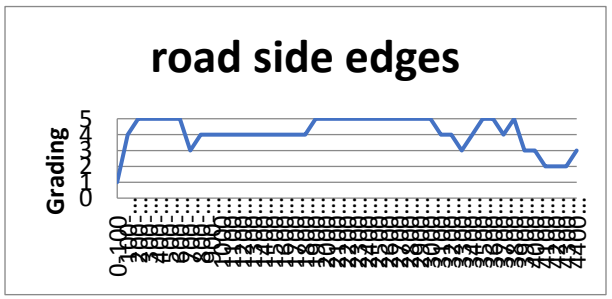


AASHTO STANDARD: Shoulder width = 10ft or preferable 12ft
Remarks: from the above figure it is clear that the standard shoulder width is 10ft but is preferable up to 12ft .In our proposed road section (Jinnah Park to Gura Qabristan) most of the sections are not according to standard given by AASHTO.
In graph above most of the sections are free spaced because of no shoulder were available there.

Shoulder line

The graph for the shoulder line is given below. Is according to the grading system as discussed above. The visible and non-visible shoulder lines in the road sections are defined through the grading system. By plotting the values we get the graph below.





Remarks: According to the grading system the sections which are having excellent shoulder line marking which are clearly visible on the road surface are shown by the no.5 on y – axis .where is the section with good and fair shoulder line are shown by no.4 and no.3 on the y- axis of the graph.
The purpose of the graph is to identify the sections with visible shoulder line on the proposed section (Jinnah park to GuraQabristan).

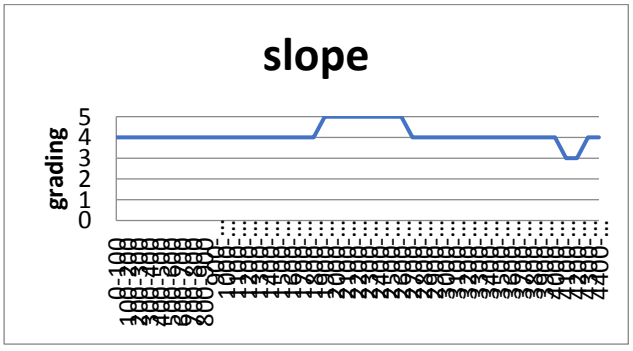
Road Side Edges

The current road section is checked in term of road side edges then after that our RSA Team analyzed the data in the form of grading system.by plotting the data in excel the RSA Team get the following graph for different sections.

Remarks: According to the grading system the sections that are having excellent road side edges which looks better while sighting it on the road are shown by the no.5 on y – axis .where is the section with good and fair road side edges are shown by no.4 and no.3 on the y- axis of the graph.
The purpose of the graph is to identify the sections with the current road side edges condition on the proposed section (Jinnah park to Gura Qabristan).

Slope In the Proposed Road Sections

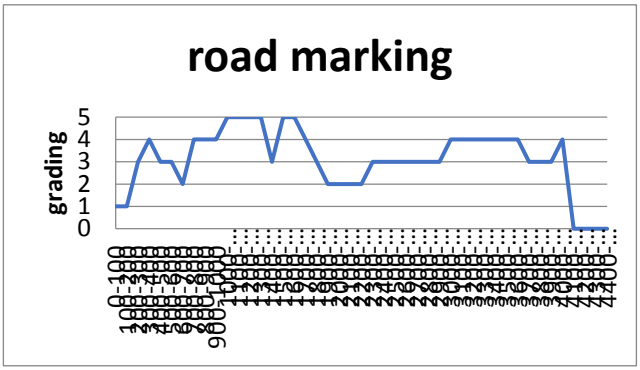
Slope of all the sections are observed through visualization. As the RSA Team also find the road slope through surveying in few of the sections. By recording all the data based on the road slope throughout the sections we analyzed it through grading system and by plotting we get the flowing graph showing different slopes at different sections.



AASHTO STANDARD: 1% to 2% Slope is preferable
Remarks: According to the grading system the sections which are according to standard are shown by the graph with a no.5 on the y-axis. The sections which are having good slope or which are fair according to AASHTO standards are shown by no.3 and no.4 the Y-axis of the graph.
The purpose of the graph is to compare the AASHTO standards with the current road conditions

Road Marking

Road marking were observed during the field visit. Then it is analyzed through grading system. The section with the best Road marking conditions showing the peak value in the graph below.



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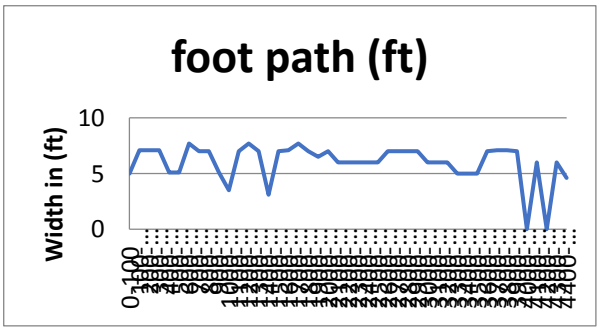
Remarks: According to the grading system the sections are defined as poor, fair, and good and excellent, in terms of road marking. It means that the marking on the road surface is clearly visible or not at different sections and at different inter section . As the marking on the road sections are described according to grading system as 0, 1,2,3,4,5 in the graph on the Y-axis.
The section (4200-4500) does not include any road mark which is shown in the figure as a clear space.

Footpaths

During the field visit it is measured with tap throughout all the sections and then the data recorded is compared with AASHTO standards and finally a graph is plot for it. The line in the center of graph is showing the standard value of AASHTO for Footpath.

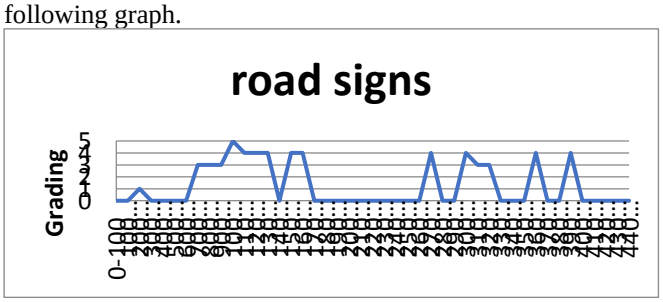


AASHTO STANDARD: Foot path width = 5ft or 8ft is

preferable
Remarks: from the above figure it is clear that the standard footpath width is 5ft but is preferable up to 8ft. The purpose of the graph is to identify the sections of the road in term of footpath so that to compare it with the standards according to AASHTO .

Road signs

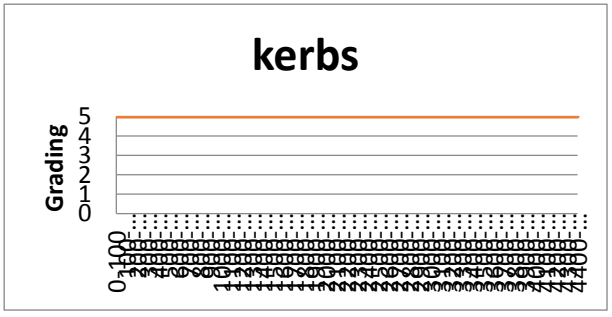
During the field visit the road signs such as traffic sign boards, weighing bridge sign boards, information signs, Road name signs etc. are observed and then it is recorded in the form of grading system. Then we plot the following graph.



Remarks: According to the grading system the sections are defined as poor, fair, and good and excellent, in terms of road sign. It means that the sign on the road surface is clearly visible or not at different sections and at different inter section such as sign boards. As the sign on the road sections are described according to grading system as 0,1,2,3,4,5 in the graph on the Y-axis.

Kerbs

Kerbs on the road side edges are sighted and then it is recorded in the list according to grading system .the section that is having kerbs in good condition is showing the peak value in the graph below. The red line in the graph is showing that all the sections are having kerbs in good condition.

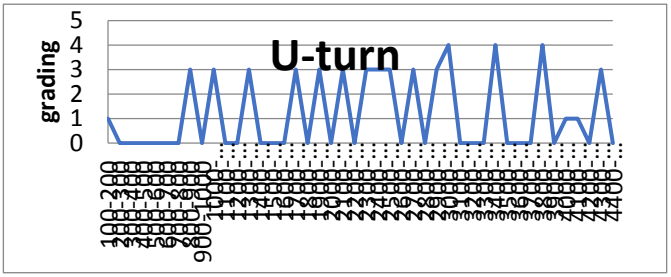


Remarks: According to the grading system the sections which are having kerbs on the road edges for preventing traffic .the kerbs which looks better while sighting it on the road edges are shown by the no.5 on y – axis .where is the section with good and fair kerbs at road side edges are shown by no.4 and no.3 on the y- axis of the graph.
The purpose of the graph is to identify the sections with the current kerbs condition on the road side edges in the proposed section (Jinnah park to Gura Qabristan).

The U-Turn

During the field visit the U-turns are observed by the RSA team. And then did its analysis with the grading system. The U-turns which were more suitable in all of the section are shown in a graph having peak value.

Remarks: According to the grading system the sections which are having U-turn on the road for facilitating traffic while entering another road is shown by the grading system from 0-5 on the y-axis of the graph .The U-turn which looks better while observing it on the road and within a good condition are shown by the no.5 on y – axis .where is the

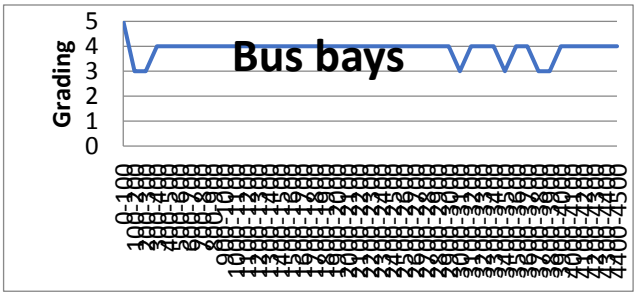


section with good and fair U-turn at road are shown by no.4 and no.3 on the y- axis of the graph.
The purpose of the graph is to identify the sections of the road with U-turn in the proposed section (Jinnah Park to Gura Qabristan).

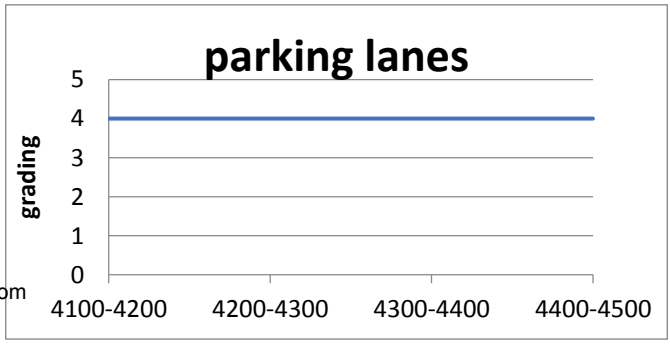
Bus bays

During the field visit our RSA Team studies all the sections in term of bus bays for the local busses. we found the bus bays varying in various conditions in term of its width. We then make a record of each and every section in term of bus bays for the local large size vehicles and analyze the data with the help of grading system by plotting a graph.

Remarks: According to the grading system the sections which are having Bus bays for the transport of busses on the road for the good and passenger transport and for other



purposes .the Bus bays which looks better while sighting and observing it on the road are shown by the no.5 on y – axis .where is the section with good and fair Bus bays at road are shown by no.4 and no.3 on the y- axis of the graph.
The purpose of the graph is to identify the sections with the current Bus bays condition on the road in the proposed section (Jinnah Park to Gura Qabristan).



Parking lanes

During the study of the proposed road section we found the parking lanes at various sections not at all sections such as from (4100-4500m) section. Then the data is collected in the form of grading system and a graph is plotted as shown below

Remarks: According to the grading system the sections which are having Parking Lanes for the parking of vehicles on the road side used as a facility for drivers to park the vehicle in a safe zone. The Parking lanes which look better while sighting and observing it on the road side are shown by the no.5 on y – axis .where is the section with good and fair Parking lanes at the road side are shown by no.4 and no.3 on the y- axis of the graph.
The section from (4100- 4500) is shown in the figure above because these are the only sections which are having parking lanes in the proposed section (Jinnah Park to Gura Qabristan).
The purpose of the graph is to identify the sections with the current Parking lanes condition on the road sides in the proposed section (Jinnah Park to Gura Qabristan).

CONCLUSION AND RECOMMENDATIONS

- ✓ During our study on Road Safety Assessment we had find different flaws at different sections which are not matching the recommended standards of AASHTO.
- ✓ Such study helps us finding the critical sections on the proposed road section (Gora Qabristan to Jinnah Park).
- ✓ So through scouring of every section and with the help of graphs we know all the points needing Safety assessment. The section on which no safety assessment has been done before.
- ✓ From different reports after giving scoring and drawing graphs of each sections we compared that the design of such sections were not according to the design of AASHTO.
- ✓ After finding such flaws in each section we are now recommended that these sections must be according to the Standard of AASHTO and must be re treated if not then these standards should be applied in new making roads so that there must be less chance of road accidents.

We give further recommendation for the improvement of road safety assessments which including average lane width, shoulder width, road signs etc. we first indicate these problems in our study and then we give the recommendation about these parameter according to standards.

Chapter 6

PROBLEMS AND RECOMMENDATIONS

PROBLEMS	RECOMMENDATIONS
AVERAGE LANE WIDTH: The average lane width is not according to AASHTO standards as also shown in the graph at different sections.	The average lane width should be provided according to the AASHTO standard which is 12ft.
SHOULDER WIDTH: No shoulder width is provided at some sections which are not according to the standards of AASHTO.	Shoulder width should be provided at each sections according to the AASHTO standard which is 10ft.
SHOULDER LINE: Shoulder lines were not visible at most of the sections.	Road lines such as shoulder line will be visible so that drivers may enter the shoulder line in safe conditions or in safe motions.
ROAD MARKING: Road marking were not given at most of the sections of the road.	It should be provided at each sections so that to minimize road accidents while crossing the routes.
FOOTPATH: The footpath at some sections is not according to the standards. Which provide most of the problems for the pedestrians.	It should be according to the Standards of AASHTO which is 5-8ft.it should be given in the road section.
ROAD SIGN: The road sign were not given at most of the section.	Road signs should be provided so that the drivers will come to know the direction of the road and while entering from one route to other.
U-TURNS: The U-turns were not provided at some sections. Causing the problems for the drivers while driving for a long distance so to enter another route.	U-turns should be provided at minimum distance so that to reduce the effort of drivers to travel large distance for a single turn.

PROBLEMS	RECOMMENDATION
POT HOLES: The existing surface of the road is having much more pot holes at different sections. This is providing problems for the road users while driving.	The road surface should be treated at least in 6 months for the pot holes. So that to provide safe road for the road users.
HORIZONTAL ALIGNMENT: When the drivers drives the vehicles at high speed on the curves the chances of accident increases because of bad condition of horizontal alignment in few sections. Providing less skid resistance to wheels.	For safe driving of the road users proper horizontal alignment should be provided at the sections needed. So that to reduce the chances of Accidents in the proposed road section.
DELINEATION DEVICES: These devices were not provided at some sections due to which the road edges are not visible at night for the road users.	These should be provided in the proposed sections so that to minimize the chances of road side accidents at night and for providing safe ride.
SKID RESISTANCE: On the horizontal curves when the vehicles turn causing slip to vehicle tires.	So proper skid resistance surface should be provided in the overall proposed section so to minimize the problems occurring from such surface conditions.
CAMBER: Camber condition was bad at different sections. The proper drainage condition through it was bad during high rainy season which causes potholes ditches at different sections of the road surface.	Proper camber should be provided according to AASHTO guide lines so that proper drainage of rain water through it is possible.
GUARD RAILS: Guard rails were not provided at some sections.	It should be provided so to make the road sections for the vehicles and road drivers safer. So that the sides of the road are clearly visible to drivers.

References

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4) Towards safer roads (published July 2011) by Supersedes Nil.
5) AASHTO Green book 2011 (policy on design of highway).
6) AASHTO guide for design pavement structure

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