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The Pavement Condition Assessment: Case Study at Pokhara, Nepal

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ABSTRACT: This research is to evaluate the flexible pavement conditions to determine the condition rating and specify the types of the failures in the pavement for the selected road sections of the highway. The significant of this study is to evaluate and identify the causes of the flexible pavement failures and select the proper and best treatment and maintenance type. It had two major and critical goals which covered by considering the following three tasks; the first was the visual evaluation and inspection of existing flexible pavement conditions including the failures, the second is to find out the actual causes of these failures in the flexible pavement, and the third is to select the most and effective treatments and maintenance types. As a case study, three main road section of Pokhara Valley namely Hallanchowk, NewroadandNayabazar road section were selected for evaluation and inspection purposes.The results were the damages and failures in the pavement are serious, extreme surface deformation, cracks, disintegration, and surface defects. These damages and failures are caused by fatigue and other types of failures resulted from the movement of heavy vehicles, poor drainage design, unsuitable pavement layers thickness design, and improper pavement mix design and selected materials.

I. Introduction

1.1 Background

Development of a country depends on the connectivity of various places with adequate road network. Roads are the major channel of transportation for carrying goods and passengers. They play a significant role in improving the socio-economic standards of a region. Roads constitute the most important mode of communication in areas and form the basic infrastructure for the development and economic growth of the country. The benefits from the investment in road sector are indirect, long-term and not immediately visible. Roads are important assets for any nation. However, merely creating these assets is not enough, it has to be planned carefully and a pavement which is not designed properly deteriorates fast. Nepal is a country having huge resource of materials. If these local materials are used properly, the cost of construction can be reduced.

Although the road pavement cost can be reduced the pavement deteriorates over time which is called pavement distress. Pavement distresses are classified into two different categories. The first is known as functional failure. In this case, the pavement does not carry out its intended function without either causing discomfort to passengers or high stresses to vehicles. The second, known as structure failure, includes a collapse of pavement structure or the breakdown of one or more components of the pavement with such magnitude that the pavement becomes incapable of sustaining the loads imposed upon its surface. In some cases, one type of failure may be caused by the other type, but mostly there is only one type of failure. Functional failure depends primarily on the

degree of surface roughness. Structure failure in a flexible pavement may be a result of fatigue, consolidation or shear, developing in the sub grade, sub-base, base course or surface.

Road pavements require continuous maintenance and rehabilitation (M-and-R) works to prevent deterioration caused by repetitive traffic loading and environmental factors. To find out the pavement distress three types of surveys are common i.e. Reconnaissance survey, Condition survey and Evaluation surveys.

Reconnaissance survey is primarily the visual inspection and qualitative judgment can be made about the condition; quantitative values rarely come from the survey. Condition surveys are made to determine condition of the pavement at given time. Detail data on the causes of the distress are not determined. Evaluation survey is made on the specific pavement to find the structural capacity of the pavement. During this survey particular attention is paid to the reasons for pavement distress.

1.2 Rationale of the Study

Pokhara has been the biggest city in Nepal recently. Lots of public vehicles and private vehicles are being operated in the city. Since a large number of vehicles are running on the road per day, it is obvious that the road gets deteriorated every time. If timely maintenance is not taken it may increase the frequency of road accidents and cause loss of life and property. Since DOR is onlythe organization that looks upon the status of road pavement, this research helps them to implement the corrective maintenance measures to inhance the life of the road.

1.3Objectives of the study

The objective of the study were

- To identify the existing road pavement condition of the Pokhara Valley.
- To recommend the corrective maintenance measures based on road pavement condition.

1.4 Scope and Limitation of Study

This research intends to find out the road pavement condition indexof the different road sections of the Pokhara Valley.

The visual Inspection and Photographic survey of the different road sections of the Pokhara Valley was carried out, the experts were consulted to find out the condition rating of the pavement.Based on condition rating of the pavement the reasons for pavement distress will be identified the corrective measures were recommended in compliance of DOR.The rigid pavement that lies in the Prithvi chowk section has not been considered.The study is limited to the flexible pavement of bituminous surface road.The Laboratory testing of the pavement material and pavement surface has not been conducted during the study.

II. Literature Review

Transportation system takes a special role in the economic development of the country. By the means of good transportation system; comfortable, safe, rapid, and convenient and economical travel is possible. Thecomfort means of transportation enables the communication with people for distribution of goods in the country for economical and industrial development. The good highway system is very significant for the developing country to get the way to the modern society. In order to have good transportation system, various factors of failure and deterioration of the highway or road should be taken in consideration. Highway maintenance is very important for the traffic operation and management as a whole. The various defects in the roads resulted from irregular maintenance of transportation system are the main causes of accident. Therefore, a successful and good engineer is a person whose is not only able to design the highway or roads, but also have sufficient skills to maintain the highways and roads. A flexible pavement failure and deterioration is defined by consistence of ruts, cracks, potholes, settlements, localized depression, etc. Normally the localized depression is followed with rising in the proximity. The sequence creates waves in the surface of the pavement. The failure or deterioration of any one or more of flexible pavement structure components creates the corrugation and waves on the surface of the pavement or rutting and shoving. Unleveled flexible pavement may itself consider as a failure and deterioration when it is excrescent. The flexible pavement failure and deterioration subject is considered to be complicated as

several factors participate to its failure and deterioration. The oxidation and aging of asphalt films also causes the failure and deterioration of flexible pavement. Destructive actions in flexible pavement are quickly increased when surplus water is retained in the flexible pavement void spaces.

Flexible pavement failure and deterioration can be considered as functional, structural and material individually and also the combination of the mentioned factors. Structural failure and deterioration is losing the ability of carrying load, when the flexible pavement may not able to absorb, transmit and distribute wheels load through the road structure without causing extra or more failure and deterioration. Functional failure is a boundary term which may refer to the loss of any function of the flexible pavement such as structural capacity, skid resistance, and serviceability on passenger comfort. Material failure results from the loss or disintegration of material characteristics of any of pavement component materials.

Flexible pavement deterioration and failure is defined as a decreasing in the serviceability resulted from the development of surface failure and deterioration such as rutting, cracking and potholes. It was reported that the highway engineers should look into the causes of flexible pavement failure before planning the strategies of the maintenance. It has been noticed that only three factors; rutting, unevenness index and cracking are considered while other failures have been neglected while going to maintenance. The major types of flexible pavement failures are failure of surface texture or deformation failure. Deformation failures and deterioration include rutting, shoving, depression, corrugation and potholes. These failures and deterioration may result from traffic volume (load associated) or environmental influences (non-load associated). It might reflect serious problems in materials or underlying structure that may cause cracking. Failure in the surface texture includes polishing, bleeding, cracking, raveling and stripping. These failures in the flexible pavement show that while the road pavement could be structurally sound, the surface is not functionally performing which designed for, which normally providing skid resistance, water tightness and smooth is running surface. Other various types of flexible pavement failures and deterioration include patching, edge defects and roughness.

Types of Surveys for Maintenance:

The types of surveys conducted to achieve maintenance objective are as follows:

1. Reconnaissance Surveys: Reconnaissance surveys are carried out on a routine basis by most engineers. They are primarily visual inspection and qualitative judgments can be made about condition; quantitative values rarely come from the survey.
2. Condition Survey: Condition surveys are made to determine condition of a pavement at a given time. Detailed data on causes for distress are not determined. This survey is aimed primarily at network analysis and yields information the engineer can use in setting priorities of maintenance over a period of years. Budgetary requirements can be determined from the condition surveys although some reliance must be placed on structural evaluation of the pavement for this.
3. Evaluation Survey: Evaluation surveys are made on specific pavements to determine the structural capacity of the pavement. During this survey particular attention is paid to reasons for pavement distress.

   Although the evaluation survey is aimed specifically at the project level, it will also help the engineer make decisions for the network analysis since the thickness of overlay and other items affecting costs can be evaluated in the analysis.

   The evaluation survey and assessment of the flexible pavement roads and highways is advantageous for transportation engineers because of the following reasons:

1. It gives and provides accurate reason of flexible pavement failure and deterioration which makes the maintenance works easy.
2. Will provide good knowledge about flexible pavement failure and deterioration, which make the transportation engineers able to design and make high quality and performance roads and highways flexible pavement.
3. Study the failure and deterioration of flexible pavement in specific area helps in improving the design of flexible pavement which can be more effective in term of safety, quality, and performance in the area. The major factors that influencing the flexible pavement performance:

2.1 Traffic Volume and Load

It is the most significant and influential factor effecting and influencing flexible pavement performance. The flexible pavement performance is mostly affected and influenced by the magnitude of traffic load, loading configuration, and repetitions of number of heavy vehicles load.

2.2. Moisture or Water

Moisture is considerably and significantly affect the flexible pavement by weaken the natural gravel materials especially the subgrade support strength. Moisture or water enter the flexible pavement structure through holes and cracks in pavement surface, laterally (horizontally) through subgrade soil and from the water table (underlying) by the action of capillary. The results of moisture or water entry are lubrication of particles, interlock loss between the particles and later particles displacement which cause flexible pavement failure and deterioration.

2.3. Subgrade Soil

Subgrade is the flexible pavement underlying soil that support and handle the applied vehicles wheel loads. Too weak sub-grade will fail to support and handle the vehicles wheel loads, which cause the pavement to flex extremely which finally cause the failure of the flexible pavement. If the flexible pavement designer not taking the difference in natural composition of sub-grade soil in consideration, significant and important differences in the flexible pavement performance will be witnessed.

4.4. Construction Quality

Failure to provide adequate compaction, inappropriate moisture content or conditions during the pavement construction, materials quality, and providing accurate flexible pavement layers thickness (after the compaction is finished) all mentioned conditions will effect directly on the performance of the flexible pavement. It is very important and significant to provide skillful staff, good and adequate inspection and a procedure of quality control during the construction works.

4.5. Maintenance

Regardless how well the flexible pavement is built, it will start to deteriorate and fail over the time. The performance of flexible pavement depends upon the type of maintenance, time of maintenance, maintenance performed.

Flexible pavement failure and deteriorationtypes: The common types of failure or deterioration in flexible pavement are classified in to the following four major groups:

i. Surface Deformation:Under this category we can take, a)Corrugations,b) Rutting, c) Shoving,d) Shallow depressions, e) Settlement and, f) Upheaval
ii. Cracking: Under this category we can take, a) Fatigue Cracking, b) Transverse Cracking, c) Longitudinal Cracking, (d) Edge Cracking, and e) Reflective Cracking
iii. Disintegration: Under this category we can take, a) Potholes and b) Patches
iv. Surface defects: Under this category we can take, a) Raveling and b) Bleeding

A commercial distress measuring device was described, and compared with the traditional manual condition survey. Hand-mapping the distress on grid paper of a section of pavement 0.1-mile long requires 1 h, according to the paper. There is not enough detail about the image-processing methods used by the PAS 1 device developed by paved. From the description of the results, it appears that the PAS 1 device was not accurate, because it was biased toward transverse cracklings, and it could not detect all alligator cracks. Another statistical approach was presented by Koutsopoulos and Downey, in which they recognized the imperfections of segmentation that cause difficulty in distinguishing pavement distress types, especially between block and alligator cracks. In this method, the original image is enhanced by subtracting an average of a few plain (nondistress) images from the same series, to compensate for the lighting variations. Segmentation is done by

assigning one out of four values to each pixel, based on its probability of being an object pixel. Classification is based on identifying primitives in the segmented image: blank, joint, linear segment, vertical, horizontal, and diagonal. The distress is a block crack if it contains a few joints with several horizontal and vertical primitives. It is an alligator crack if it contains several joints and diagonal primitives.Baker et al. described an effort by the Idaho Transportation Department assisted by VideoComp Corporation to automate the pavement distress data module. A special vehicle was used to record 2,400 lane-miles of interstate highways and 380 lane-miles of principal arterial highways. The team learned important facts about pavement image acquisition: It is not difficult to capture images on videotape at highway speeds, even under heavy traffic; Image quality is better if obtained during the night; Time and cost for data gathering are not high; Images captured on videotapes possess sufficient quality for later digitization and computer analysis.

This study was conducted by the Shamil Ahmed Flamaraz Al- Alwarzi in Kalar, Sulaimanai, Iraq. He conducted this study in the rural highway of Khanaqin- Kalar 2- lane 2 way rural highways. He divided the highway into the 5 different sections and found out the pavement condition status and found out the reason behind it. ClellHarral studied the role of the centralized road maintenance organizations and decentralized road maintenance organizations in developing countries. Jorge E. Pagan –Ortiz under US Department of Transportation, Federal Highway Transportation, Turner-Fairbank Research Center has studied simplified techniques for evaluation and interpretations of pavement deflections for Network level analysis. Eldon J. Yoder, a research engineer conducted the research to find out the condition rating of the roads under the Indiana Department of the roads through the roadmeter. Jannah Salih, Francis Edum Fotwe, Andrew Price conducted the study to investigate the road maintenance performance in developing countries. They studied in detail about the types of maintenance practices that are been used and even conducted the user satisfaction survey on the road users. Prof. Dr. Fareed M.A. Kareem, Dr. Khaled Abdul Haleem Rubasi and Dr. Ali Abdo Saleh found out the Pavement Condition Index of the major roads of Aden city of Yemen and conduction the evaluations survey and recommended its maintenance measures.

III. Methodology

The stated objective can be obtained from theadaptation of proper methodology and its application. The following are the major steps for the study of flexible pavement failure.

3.1 Site Selection

For the purpose of this research the road section of i) Zero Km to Hallanchowk (Hallanchowk), ii) PrithviChowk to Mahendrapool (Nayabazar) and iii) BP chowk to SabhagrihaChowk (Newroad) Section was selected for this purpose.These are the busiest road of Pokhara valley. BP chowk to SabhagrihaChowk(Newroad) and PrithviChowk to Mahendrapool (Nayabazar) is the most prominent business district of Pokhara. Zero to Hallanchowk (Hallanchowk) connects Baglung Highway and touristic place of Pokhara (Lakeside). These road sections attract the massive vehicles and assessment of the pavement condition deems necessary.

3.2 Data Collection

Three sections of road lengthhave been taken for the research study. Thefield-basedsurvey has been conducted on the month of September 2018 with checklist. The detail about the check list used in road survey for the research is attached as ANNEX. The survey was conducted in the interval of 100 m each.

3.3 Data Classification and computation

The major concern of the research project was to identify the flexible pavement failure. For this, the expertswere shown the pictures of the pavement. There were asked to rate the condition based on their judgment. Their rating as per the road section was tabulated and rating average was calculated.Based on severity of the road section the evaluation survey was conducted through extensive literature review to find out the cause of the pavement distress. Then maintenance measures based on the DOR maintenance manual is recommended.

3.4 Data Analysis

The data collected from the different experts' are considered and tabulated for different sections of the road and asked to rate on the basis of severity of the sections. The average condition section rating was taken out based on geometric mean of the ratings. Minimum five experts were asked to rate the different sections of different roads. Average condition sections rating of the experts' weremerged through a geometric average to find out the condition rating of the different roads.

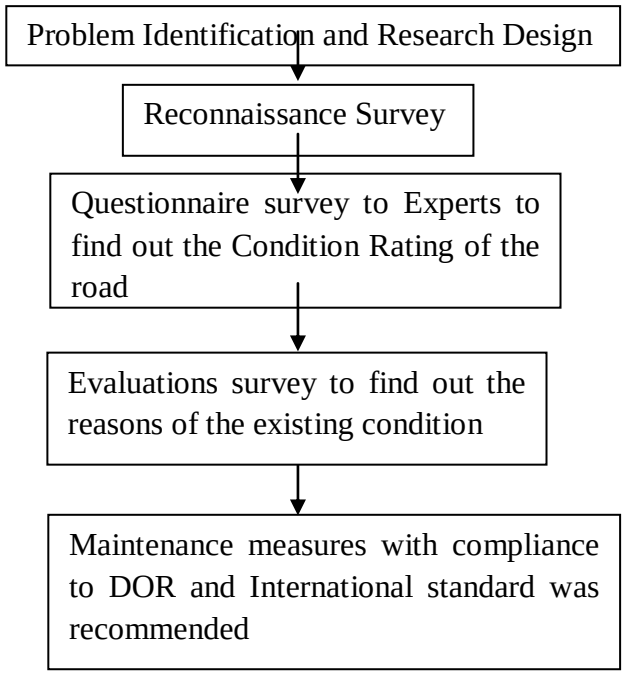
3.5 Data Comparison:

After the experts' opinion and evaluation of the condition rating, the road section having high condition rating value was deemed highly degraded. The condition section rating having highest rating value indicates highly degraded road for the particular section.

3.6 Adaptation of Suitable Corrective Measure:

The condition rating calculation has been adopted and based on the condition rating of the roads the corrective measure was proposed based on guidelines proposed by Department of Roads (DOR). There is no exact national and international methodology and guidelines adopted to correct flexible pavement failure. This can be done based on particular site condition and properties of the road section.

Methodology Flow Chart:



IV. Analysis and result

After assessing to the site collecting the different pictures, experts were consulted to find out the condition section rating and condition rating of the different sections of road. All the results obtained under 4.1 and 4.2 are tabulated below in the Annex I

4.1. Result with counter measures:

From the study conducted on the three different road sections we can say that the quality of the road is not good and requires immediate attention. If we fail to address and correct the problem as soon as possible the huge loss and disaster may occur. The corrective measures recommended as per the guideline of DoR are as follows.

4.1.1 Pot hole filling

i) Each pot-hole and patch repair area shall be inspected and all loose material should be removed. The area shall be trimmed either with jack hammer or hand tools like chisels, pick-axes etc., such that the area is in the shape of a rectangle or square. The edges shall be cut vertically upto the level where the lower layer is stable without any loose material. The area shall be thoroughly cleaned with compressed air or any appropriate method approved by the Engineer to remove all dust and loose particles. The area shall be tacked or primed with cut back or emulsion depending upon whether the lower layer is bituminous or granular in nature.

ii) For backfilling operation, the mix to be used in bituminous patching shall be either hot mix or cold mix or any other approved patching material. The bituminous mixture shall be placed in thicknesses not more than 100 mm (loose) and shall be compacted in layer with roller/plate compactor/hand roller/rammer to the compaction standards specified.

4.1.2 Patching work

i)Preparation of Potholes

Pothole shall be cleaned with a stiff wire brush and all loose material including dust shall be removed with a soft brush. Pothole need not be dry. However, excess water shall be swept off the pothole.

ii) Placing Mix in Potholes

The mix is intended for patching potholes up to 75 mm (3 inches) deep. For deeper potholes, patching mix shall be placed and compacted in 75 mm thick layers.

If the pothole is deep and extends to WMM or granular base, it is recommended to apply a suitable tack coat or prime coat as feasible before placing the patching mix. If angular aggregate (normal size 25mm) is used to partially fill deep potholes, the aggregate should be compacted thoroughly and primed with MC-30 before placing the patching mix. At least 50mm thick pothole patching mix shall be placed at the top.

iii) Compacting the mix

First the outside edge or periphery of the patch shall be compacted with a hand rammer/ small compactor and then compaction shall proceed inwards. To prevent initial pick up of the loose mix by the hand rammer either continue to wet the hand rammer with water or place empty plastic lined bags on the loose mix.

For deep potholes, place the patching mix and compact in 75mm thick layers. After compaction, the compacted patch shall be slightly proud of the existing road surface to allow for further compaction by traffic.

If there are numerous closely spaced patches, it is preferred to use a small roller rather than a hand rammer. If a roller is used, the mix shall be placed and spread slightly proud of the surface so that after rolling the compacted surface shall be flush with the adjoining surface.

Item	Type I (2-3 mm)	Type II (4-6 mm)	Type III (6-8 mm)
Application	Filling of hair cracks	Filling of surface cracks 1-3mm and preventative/ renewal treatment.	Filling of surface cracks 3-6 mm and preventative/ renewal treatment
Quantity* of Slurry (kg/m^2)	4.3 to 6.5	8.4 to 9.8	10.1- 12
Residual binder (% by weight of dry aggregate)	10 to 16	7.5 to 13.5	6.5 to 12

iv) Applicaton of Sand to Prevent Pick up by Traffic

Before opening the compacted patch to traffic, sufficient amount of clean sand shall be sprinkled on the patch to prevent pick up by traffic.

4.1.3 Crack Sealing

According to the severity of the pavement distress, the three types of slurry seal is applicable

i)Surface Preparation for Slurry Seal

The road surface shall be broomed and cleaned of all loose or deleterious material by means of rotary broom and hand broom. A track coat shall be applied at the rate to leave residual bitumen emulsion of 0.20 liter/sq. During spraying there shall be no ponding of binder in hollows or depression and any such excess of binder shall be removed.

ii) Application of Slurry Seal Mix

The slurry seal mix will be applied manually. The mix shall be spread uniformly over the road surface with the help of brooms, spades and other suitable tools so as to ensure that all cracks on road surface are properly filled and sealed and resulting surface becomes impervious to ingress of water.

4. 1. 4 Crack Filling

Crack filing shall be carried out using a binder of a suitable viscosity, normally a slow curing bitumen emulsion. For wider cracks, in excess of an average of 3 mm in width, the application of emulsion shall be preceded by an application of crusher dust, or other fine material or a suitable premix acceptable to the Engineer.

i) Application

If crusher dust or to other graded fine material is to be used it shall be placed in the cracks before the application of binder and the crack filled to a level approximately 5 mm below road surface level. The surface of road shall be swept clear of dust prior to the application of binder or premix. Binder shall be poured into the cracks, taking care to minimize spillage. If spillage onto the road surface does occur, dust shall be applied to the excess bitumen until it is blotted up. Where crack filling mix is used, a squeegee shall be used to force the premix into the cracks wider than 10mm.

4.1.5 Shoulder Maintenance

The work involves:

i) Making up the irregularities/ loss of material by adding suitable gravel and compaction the same; and/or

ii) Stripping extra gravel from the surface to achieve the required grade and level.

5.7. Overlay of Flexible Pavement over flexible pavement

Overlays are used for strengthening or rehabilitation of an existing pavement. Strengthening is required when heavier loads are introduced or when a pavement is no longer capable of supporting the loads for which it was designed. Rehabilitation may include sealing or resealing of cracks, patching, limited reconstruction prior to an overlay, restoration of the surface profile, improvement of skid resistance by a friction course, or improvement of the surface quality.

5.8 International Practices (US)

Work Type	Description
Crack Sealing	Bituminous sealing of cracks wider than 3 mm
Patching works	Patching of potholes by filling with base material and patch with surface dressing
Edge Repair	Repair of Pavement Edges
Surface Dressing	Resurfacing of the pavement surface with a single bituminous surface dressing
Overlay	Resurfacing and reshaping the surface with 30 mm thick asphalt overlay
Reconstruction	Reconstruction of the whole concrete pavement structure
Upgrade	Upgrade the pavement to sealed standard with new sub base, base and surface dressing.

During the study it was found out the international maintenance practices were periodic and conducted labor extensive. However the DOR practices were found to be similar to International practices. After applying the corrective measure the capacity of the road sections can be recovered.

CONCLUSIONS

The road section that was undertaken for the study was divided into the strip of 100 m each. It was found that the Newroad section (B.P. Chowk to Sabhagrigha Chowk) was the most deteriorated road section among all three road section. The B.P. chowk to Sabhagrighachowk road section, B.P. Chowk being the start point, road sections had up to 10 numbers of pavement distress implying 1 pavement distress in 10 m length. Same condition was observed in Prithvichowk –Mahendrapool section i.e. 10 numbers of pavement distress in 100 m strip, whereas case was little different in Zero-Hallanchowk section yet not satisfactory. The pavement distress per 100 m was found to be 8 numbers in a strip. The ratings of the sections were arranged to find out the most severe road section. The study shows that section 1400-1500 is the most severe on PrithiviChowk - Mahendrapool road section. Similarly, 1300-1400 and 1700-1800 sections were found to be the most severe on Zero Km - Hallanchowk road section. B.P. Chowk - SabagrihaChowk road was found to have severe road condition at multiple sections 100-200, 200-300, 800-900, 1000-1100-1200, 1300-1400, 1500-1600 and 1700-1800.

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ANNEX-1

After assessing to the site collecting the different pictures, experts were consulted to find out the condition section rating and condition rating of the different sections of road. All the results obtained are tabulated below

4.1 Condition Rating Survey

Naya Bazar

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	4	4	4	3	3	4	2	-	-	-	3	
2	100-200	4	4	2	3	4	-	-	-	-	-	3	
3	200-300	2	3	3	3	2	2	2	-	-	-	2	
4	300-400	3	4	3	3	2	-	-	-	-	-	3	
5	400-500	3	4	2	2	2	-	-	-	-	-	2	
6	500-600	3	3	3	3	3	3	2	-	-	-	3	
7	600-700	4	3	3	3	3	2	2	-	-	-	3	
8	700-800	3	3	3	3	3	3	4	3	-	-	3	
9	800-900	4	2	3	3	3	3	3	3	2	3	3	
10	900-1000	4	3	2	3	3	-	-	-	-	-	3	
11	1000-1100	4	3	3	2	3	3	3	-	-	-	3	
12	1100-1200	3	4	4	4	2	3	2	-	-	-	3	
13	1200-1300	3	3	3	3	-	-	-	-	-	-	3	
14	1300-1400	4	4	3	3	3	3	3	4	-	-	3	
15	1400-1500	4	3	3	3	-	-	-	-	-	-	3	
16	1500-1600	3	3	3	3	3	3	3	-	-	-	3	
17	1600-1700	3	3	3	3	4	-	-	-	-	-	3	

HallanChowk Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	4	4	4	3	3	2	1	-	-	-	3	
2	100-200	2	1	2	3	4	2	-	-	-	-	2	
3	200-300	2	2	2	3	2	2	-	-	-	-	2	
4	300-400	2	1	1	2	2	-	-	-	-	-	2	
5	400-500	2	3	3	4	3	3	-	-	-	-	3	
6	500-600	2	3	2	-	-	-	-	-	-	-	2	
7	600-700	3	2	4	4	4	2	-	-	-	-	3	
8	700-800	2	2	3	3	-	-	-	-	-	-	2	
9	800-900	2	2	3	3	1	-	-	-	-	-	2	
10	900-1000	2	2	4	4	4	-	-	-	-	-	3	
11	1000-1100	4	3	4	3	3	3	-	-	-	-	3	
12	1100-1200	2	1	3	3	4	4	3	-	-	-	3	

13	1200-1300	2	2	2	3	-	-	-	-	-	-	2	
14	1300-1400	3	4	4	3	4	4	-	-	-	-	4	
15	1400-1500	3	3	4	2	3	3	3	3	-	-	3	
16	1500-1600	3	3	3	4	4	3	-	-	-	-	3	
17	1600-1700	3	3	4	3	3	3	-	-	-	-	3	
18	1700-1800	3	4	3	3	4	4	4	4	-	-	4	
19	1800-1900	3	3	-	-	-	-	-	-	-	-	3	

New Road Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	2	4	3	4	3	4	2	-	-	-	3	
2	100-200	4	4	3	3	4	4	-	-	-	-	4	
3	200-300	4	4	4	4	3	4	-	-	-	-	4	
4	300-400	3	4	3	3	2	-	-	-	-	-	3	
5	400-500	2	4	4	4	-	-	-	-	-	-	3	
6	500-600	4	2	3	3	-	-	-	-	-	-	3	
7	600-700	4	3	3	3	3	3	4	2	2	3	3	
8	700-800	3	4	3	4	2	3	4	3	-	-	3	
9	800-900	4	3	4	4	4	4	4	-	-	-	4	
10	900-1000	4	3	4	2	3	4	4	-	-	-	3	
11	1000-1100	4	3	3	4	4	3	4	4	-	-	4	
12	1100-1200	4	4	4	4	3	3	4	3	4	4	4	
13	1200-1300	4	4	4	4	3	2	-	-	-	-	3	
14	1300-1400	4	4	3	4	4	4	4	4	3	-	4	
15	1400-1500	3	4	4	3	4	3	-	-	-	-	3	
16	1500-1600	4	4	3	4	4	4	-	-	-	-	4	
17	1600-1700	4	3	4	4	4	4	3	4	-	-	4	
18	1700-1800	4	4	4	3	3	3	4	3	3	-	4	

Naya Bazar Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	4	4	4	3	3	4	2	-	-	-	3	
2	100-200	4	4	3	3	3	-	-	-	-	-	3	
3	200-300	2	3	3	3	2	2	2	-	-	-	2	
4	300-400	4	4	4	4	3	-	-	-	-	-	4	
5	400-500	3	4	3	3	2	-	-	-	-	-	3	
6	500-600	3	3	2	3	4	4	2	-	-	-	3	
7	600-700	4	3	4	4	4	3	3	-	-	-	4	
8	700-800	3	2	3	3	2	3	4	3	-	-	3	
9	800-900	3	3	3	3	4	3	3	3	2	2	3	
10	900-1000	4	3	2	3	3	-	-	-	-	-	3	
11	1000-1100	4	4	4	2	4	4	4	-	-	-	4	
12	1100-1200	3	4	4	4	2	3	2	-	-	-	3	
13	1200-1300	3	3	3	3	-	-	-	-	-	-	3	
14	1300-1400	4	4	3	3	3	3	3	4	-	-	3	
15	1400-1500	4	4	4	4	-	-	-	-	-	-	4	
16	1500-1600	3	3	3	3	3	3	3	-	-	-	3	
17	1600-1700	3	3	2	3	4	-	-	-	-	-	3	

HallanChowk Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	4	4	4	3	3	2	1	-	-	-	3	
2	100-200	3	2	3	3	3	2	-	-	-	-	3	
3	200-300	2	1	1	3	3	1	-	-	-	-	2	
4	300-400	3	2	2	1	1	-	-	-	-	-	2	
5	400-500	2	3	3	4	3	3	-	-	-	-	3	
6	500-600	2	3	2	-	-	-	-	-	-	-	2	
7	600-700	3	2	4	4	4	2	-	-	-	-	3	
8	700-800	3	3	3	3	-	-	-	-	-	-	3	
9	800-900	2	2	3	3	1	-	-	-	-	-	2	
10	900-1000	2	2	4	4	4	-	-	-	-	-	3	
11	1000-1100	4	3	4	3	3	3	-	-	-	-	3	
12	1100-1200	2	1	3	3	4	4	3	-	-	-	3	
13	1200-1300	2	2	2	3	-	-	-	-	-	-	2	
14	1300-1400	3	4	4	3	4	4	-	-	-	-	4	
15	1400-1500	3	3	4	2	3	3	3	3	-	-	3	
16	1500-1600	3	3	3	4	4	3	-	-	-	-	3	
17	1600-1700	3	3	4	3	3	3	-	-	-	-	3	
18	1700-1800	3	4	3	3	4	4	4	4	-	-	4	
19	1800-1900	3	3	-	-	-	-	-	-	-	-	3	

New Road Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	2	4	3	4	3	4	2	-	-	-	3	
2	100-200	4	4	3	3	4	4	-	-	-	-	4	
3	200-300	4	4	4	4	3	4	-	-	-	-	4	
4	300-400	3	4	3	3	2	-	-	-	-	-	3	
5	400-500	2	4	4	4	-	-	-	-	-	-	3	
6	500-600	4	3	4	4	-	-	-	-	-	-	4	
7	600-700	4	3	3	3	3	3	4	2	2	3	3	
8	700-800	3	4	3	4	2	3	4	3	-	-	3	
9	800-900	4	3	4	4	4	4	4	-	-	-	4	
10	900-1000	4	3	4	2	3	4	4	-	-	-	3	
11	1000-1100	4	3	3	4	4	3	4	4	-	-	4	
12	1100-1200	3	2	3	3	3	3	4	3	4	4	3	
13	1200-1300	4	4	4	4	3	2	-	-	-	-	3	
14	1300-1400	4	4	3	4	4	4	4	4	3	-	4	
15	1400-1500	2	3	3	2	3	2	-	-	-	-	2	
16	1500-1600	4	4	3	4	4	4	-	-	-	-	4	
17	1600-1700	4	4	4	4	4	4	3	4	-	-	4	
18	1700-1800	4	4	4	3	3	3	4	3	3	-	4	

Naya Bazar Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	4	4	3	3	2	4	3	-	-	-	3	
2	100-200	4	4	2	3	2	-	-	-	-	-	3	
3	200-300	2	3	3	3	2	2	2	-	-	-	2	
4	300-400	3	4	3	3	2	-	-	-	-	-	3	
5	400-500	3	4	2	2	2	-	-	-	-	-	2	
6	500-600	3	3	3	3	3	3	2	-	-	-	3	
7	600-700	4	3	3	3	3	2	2	-	-	-	3	
8	700-800	3	3	3	3	3	3	4	3	-	-	3	
9	800-900	4	2	3	3	3	3	3	3	2	3	3	
10	900-1000	4	3	2	3	3	-	-	-	-	-	3	
11	1000-1100	4	3	3	2	3	3	3	-	-	-	3	
12	1100-1200	3	4	4	4	2	3	2	-	-	-	3	
13	1200-1300	3	3	3	3	-	-	-	-	-	-	3	
14	1300-1400	4	4	3	3	3	3	3	4	-	-	3	

15	1400-1500	4	3	3	3	-	-	-	-	-	-	3	
16	1500-1600	3	3	3	3	3	3	3	-	-	-	3	
17	1600-1700	3	3	3	3	4	-	-	-	-	-	3	

HallanChowk Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	4	4	4	3	3	2	1	-	-	-	3	
2	100-200	2	1	2	3	4	2	-	-	-	-	2	
3	200-300	2	2	2	3	2	2	-	-	-	-	2	
4	300-400	2	1	1	2	2	-	-	-	-	-	2	
5	400-500	2	3	3	4	3	3	-	-	-	-	3	
6	500-600	2	3	2	-	-	-	-	-	-	-	2	
7	600-700	3	2	4	4	4	2	-	-	-	-	3	
8	700-800	2	2	3	3	-	-	-	-	-	-	2	
9	800-900	2	2	3	3	1	-	-	-	-	-	2	
10	900-1000	2	2	4	4	4	-	-	-	-	-	3	
11	1000-1100	4	3	4	3	3	3	-	-	-	-	3	
12	1100-1200	2	1	3	3	4	4	3	-	-	-	3	
13	1200-1300	2	2	2	3	-	-	-	-	-	-	2	
14	1300-1400	3	4	4	3	4	4	-	-	-	-	4	
15	1400-1500	3	3	4	2	3	3	3	3	-	-	3	
16	1500-1600	3	3	3	4	4	3	-	-	-	-	3	
17	1600-1700	3	3	4	3	3	3	-	-	-	-	3	
18	1700-1800	3	4	3	3	4	4	4	4	-	-	4	
19	1800-1900	3	3	-	-	-	-	-	-	-	-	3	

New Road Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	2	4	3	4	3	4	2	-	-	-	3	
2	100-200	4	4	3	3	4	4	-	-	-	-	4	
3	200-300	4	4	4	4	3	4	-	-	-	-	4	
4	300-400	3	4	3	3	2	-	-	-	-	-	3	
5	400-500	2	4	4	4	-	-	-	-	-	-	3	
6	500-600	4	2	3	3	-	-	-	-	-	-	3	
7	600-700	4	3	3	3	3	3	4	2	2	3	3	
8	700-800	3	4	3	4	2	3	4	3	-	-	3	
9	800-900	4	3	4	4	4	4	4	-	-	-	4	
10	900-1000	4	3	4	2	3	4	4	-	-	-	3	
11	1000-1100	4	3	3	4	4	3	4	4	-	-	4	

12	1100-1200	4	4	4	4	3	3	4	3	4	4	4	
13	1200-1300	4	4	4	4	3	2	-	-	-	-	3	
14	1300-1400	4	4	3	4	4	4	4	4	3	-	4	
15	1400-1500	3	4	4	3	4	3	-	-	-	-	3	
16	1500-1600	4	4	3	4	4	4	-	-	-	-	4	
17	1600-1700	4	3	4	4	4	4	3	4	-	-	4	
18	1700-1800	4	4	4	3	3	3	4	3	3	-	4	

Naya Bazar Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	4	4	4	3	3	4	2	-	-	-	3	
2	100-200	4	4	2	3	4	-	-	-	-	-	3	
3	200-300	2	3	3	3	2	2	2	-	-	-	2	
4	300-400	3	4	3	3	2	-	-	-	-	-	3	
5	400-500	3	4	2	2	2	-	-	-	-	-	2	
6	500-600	3	3	3	3	3	3	2	-	-	-	3	
7	600-700	4	3	3	3	3	2	2	-	-	-	3	
8	700-800	3	3	3	3	3	3	4	3	-	-	3	
9	800-900	4	2	3	3	3	3	3	3	2	3	3	
10	900-1000	4	3	2	3	3	-	-	-	-	-	3	
11	1000-1100	4	3	3	2	3	3	3	-	-	-	3	
12	1100-1200	3	4	4	4	2	3	2	-	-	-	3	
13	1200-1300	3	3	3	3	-	-	-	-	-	-	3	
14	1300-1400	4	4	3	3	3	3	3	4	-	-	3	
15	1400-1500	4	3	3	3	-	-	-	-	-	-	3	
16	1500-1600	3	3	3	3	3	3	3	-	-	-	3	
17	1600-1700	3	3	3	3	4	-	-	-	-	-	3	

HallanChowk Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	4	4	4	3	3	2	1	-	-	-	3	
2	100-200	2	1	2	3	4	2	-	-	-	-	2	
3	200-300	2	2	2	3	2	2	-	-	-	-	2	
4	300-400	2	1	1	2	2	-	-	-	-	-	2	
5	400-500	2	3	3	4	3	3	-	-	-	-	3	
6	500-600	2	3	2	-	-	-	-	-	-	-	2	
7	600-700	3	2	4	4	4	2	-	-	-	-	3	
8	700-800	2	2	3	3	-	-	-	-	-	-	2	
9	800-900	2	2	3	3	1	-	-	-	-	-	2	
10	900-1000	2	2	4	4	4	-	-	-	-	-	3	
11	1000-1100	4	3	4	3	3	3	-	-	-	-	3	
12	1100-1200	2	1	3	3	4	4	3	-	-	-	3	
13	1200-1300	2	2	2	3	-	-	-	-	-	-	2	

14	1300-1400	3	4	4	3	4	4	-	-	-	-	4	
15	1400-1500	3	3	4	2	3	3	3	3	-	-	3	
16	1500-1600	3	3	3	4	4	3	-	-	-	-	3	
17	1600-1700	3	3	4	3	3	3	-	-	-	-	3	
18	1700-1800	3	4	3	3	4	4	4	4	-	-	4	
19	1800-1900	3	3	-	-	-	-	-	-	-	-	3	

New Road Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	2	4	3	4	3	4	2	-	-	-	3	
2	100-200	4	4	3	3	4	4	-	-	-	-	4	
3	200-300	4	3	3	4	3	4	-	-	-	-	3	
4	300-400	3	4	3	3	2	-	-	-	-	-	3	
5	400-500	2	4	4	4	-	-	-	-	-	-	3	
6	500-600	4	2	3	3	-	-	-	-	-	-	3	
7	600-700	4	3	3	3	3	3	4	2	2	3	3	
8	700-800	3	4	3	4	2	3	4	3	-	-	3	
9	800-900	4	3	4	4	4	4	4	-	-	-	4	
10	900-1000	4	3	4	2	3	4	4	-	-	-	3	
11	1000-1100	4	3	3	4	4	3	4	4	-	-	4	
12	1100-1200	4	4	4	4	3	3	4	3	4	4	4	
13	1200-1300	4	4	4	4	3	2	-	-	-	-	3	
14	1300-1400	4	4	3	4	4	4	4	4	3	-	4	
15	1400-1500	3	4	4	3	4	3	-	-	-	-	3	
16	1500-1600	4	4	3	4	4	4	-	-	-	-	4	
17	1600-1700	4	3	4	4	4	4	3	4	-	-	4	
18	1700-1800	4	4	4	3	3	3	4	3	3	-	4	

Naya Bazar Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	4	4	3	3	3	4	3	-	-	-	3	
2	100-200	3	4	2	3	4	-	-	-	-	-	3	
3	200-300	3	3	3	3	3	3	3	-	-	-	3	
4	300-400	4	4	4	4	3	-	-	-	-	-	4	
5	400-500	3	4	2	2	2	-	-	-	-	-	2	
6	500-600	3	3	3	3	3	3	2	-	-	-	3	
7	600-700	4	3	3	3	3	2	2	-	-	-	3	
8	700-800	3	3	3	3	3	3	4	3	-	-	3	
9	800-900	4	2	3	3	3	3	3	3	2	3	3	
10	900-1000	4	2	2	2	2	-	-	-	-	-	2	
11	1000-1100	4	3	3	2	3	3	3	-	-	-	3	
12	1100-1200	3	4	4	4	2	3	2	-	-	-	3	

13	1200-1300	4	4	4	3	-	-	-	-	-	-	4	
14	1300-1400	4	4	3	3	3	3	3	4	-	-	3	
15	1400-1500	4	4	4	4	-	-	-	-	-	-	4	
16	1500-1600	3	3	3	3	3	3	3	-	-	-	3	
17	1600-1700	3	3	3	3	4	-	-	-	-	-	3	

HallanChowk Section

S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	4	4	4	3	3	2	1	-	-	-	3	
2	100-200	2	1	2	3	4	2	-	-	-	-	2	
3	200-300	2	2	2	3	2	2	-	-	-	-	2	
4	300-400	2	1	1	2	2	-	-	-	-	-	2	
5	400-500	2	3	3	4	3	3	-	-	-	-	3	
6	500-600	2	3	2	-	-	-	-	-	-	-	2	
7	600-700	3	2	4	4	4	2	-	-	-	-	3	
8	700-800	2	2	3	3	-	-	-	-	-	-	2	
9	800-900	2	2	3	3	1	-	-	-	-	-	2	
10	900-1000	2	2	4	4	4	-	-	-	-	-	3	
11	1000-1100	4	3	4	3	3	3	-	-	-	-	3	
12	1100-1200	2	1	3	3	4	4	3	-	-	-	3	
13	1200-1300	2	2	2	3	-	-	-	-	-	-	2	
14	1300-1400	3	4	4	3	4	4	-	-	-	-	4	
15	1400-1500	3	3	4	2	3	3	3	3	-	-	3	
16	1500-1600	3	3	3	4	4	3	-	-	-	-	3	
17	1600-1700	3	3	4	3	3	3	-	-	-	-	3	
18	1700-1800	3	4	3	3	4	4	4	4	-	-	4	
19	1800-1900	3	3	-	-	-	-	-	-	-	-	3	

New Road Section

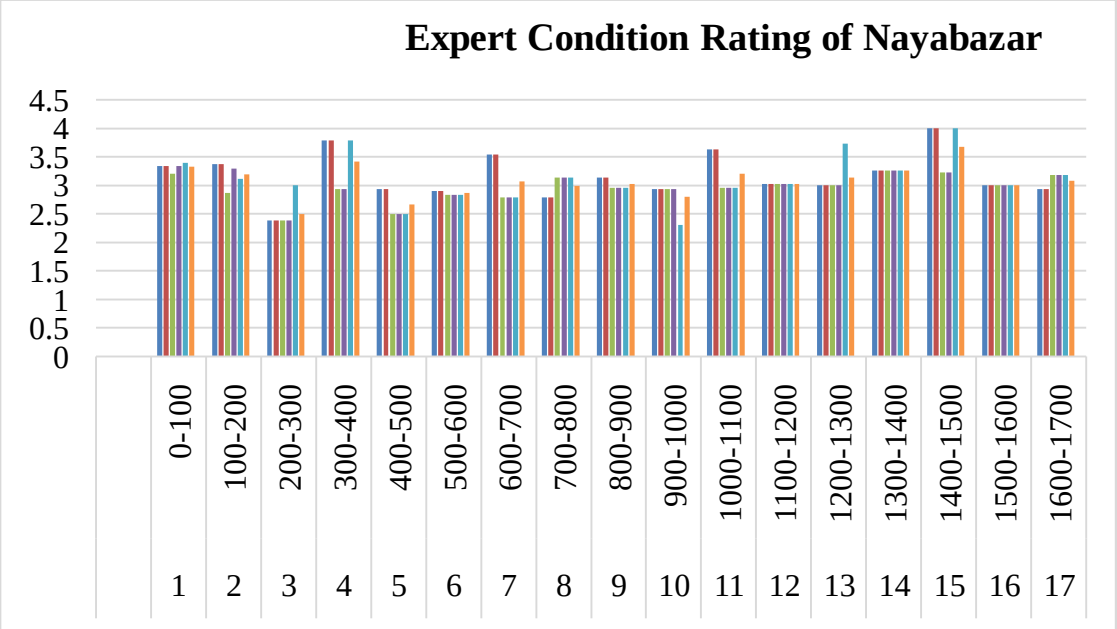
S.N	Road Section	Condition Section Rating										Condition Average Rating	Remarks
		1	2	3	4	5	6	7	8	9	10		
1	0-100	2	3	3	3	3	4	2	-	-	-	3	
2	100-200	4	4	4	4	4	4	-	-	-	-	4	
3	200-300	4	4	4	4	3	4	-	-	-	-	4	
4	300-400	3	4	3	2	2	-	-	-	-	-	3	
5	400-500	3	4	4	4	-	-	-	-	-	-	4	
6	500-600	4	2	4	3	-	-	-	-	-	-	3	
7	600-700	4	3	4	3	3	2	4	2	2	2	3	
8	700-800	4	4	4	4	2	4	4	3	-	-	4	
9	800-900	3	3	4	2	4	4	4	-	-	-	3	
10	900-1000	4	3	4	2	3	4	4	-	-	-	3	
11	1000-1100	4	3	3	4	4	3	4	4	-	-	4	

12	1100-1200	4	4	4	4	3	3	4	3	4	4	4	
13	1200-1300	4	4	4	4	3	2	-	-	-	-	3	
14	1300-1400	4	4	3	4	4	4	4	4	3	-	4	
15	1400-1500	3	4	4	3	4	3	-	-	-	-	3	
16	1500-1600	4	4	3	4	4	4	-	-	-	-	4	
17	1600-1700	4	2	2	2	2	3	3	4	-	-	2	
18	1700-1800	4	4	4	3	3	3	4	3	3	-	4	

During the survey it was found that PrithiviChowk-Mahendrapool Road section 800-900 contains10 numbers'ofseveritiy. Similarly,Zero Km-Hallanchowk Road section1400-1500 and 1700-1800 has the maximum 8 number of severity. The B.P. Chowk-SabagrihaChowk Roadof600-700 and 1100-1200 has contains 10 number of severity.

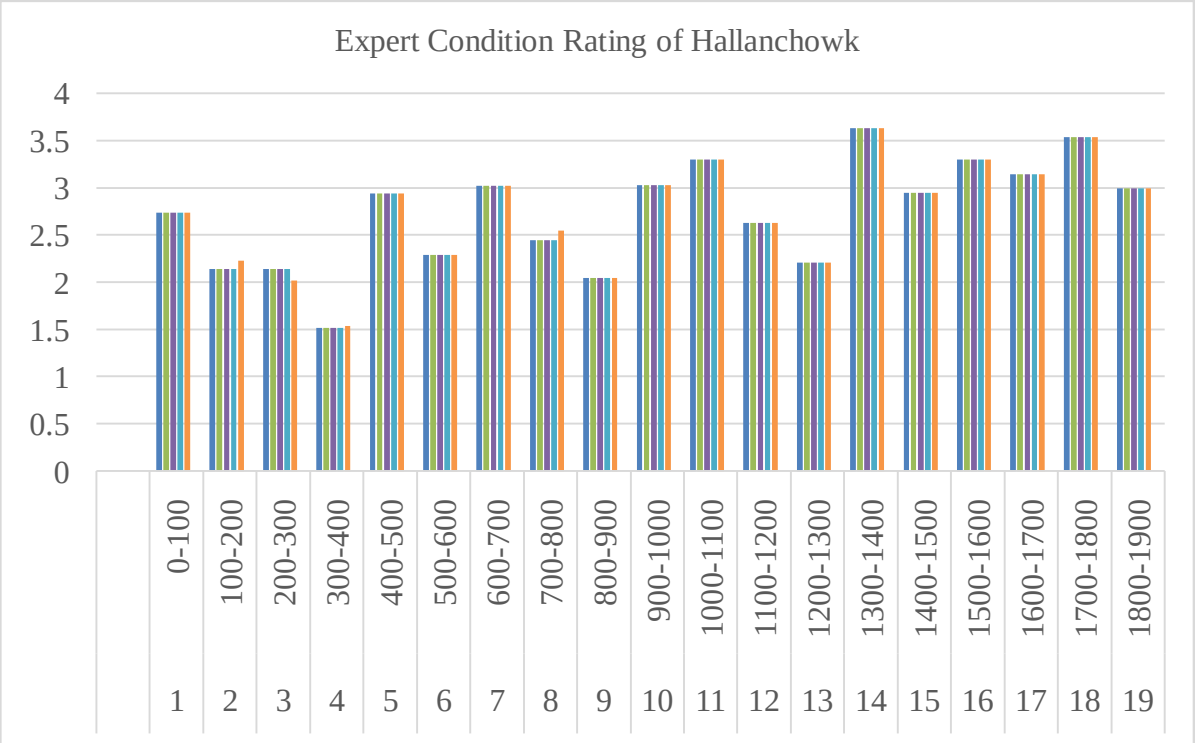
Naya Bazar
Mahendra Pool to PrithviChowk

S.N	Road Section	Expert Condition Rating					Average Rating	Remarks
		1	2	3	4	5		
1	0-100	3	3	3	3	3	3	
2	100-200	3	3	3	3	3	3	
3	200-300	2	2	2	2	3	2	
4	300-400	4	4	3	3	4	3	
5	400-500	3	3	2	2	2	3	
6	500-600	3	3	3	3	3	3	
7	600-700	4	4	3	3	3	3	
8	700-800	3	3	3	3	3	3	
9	800-900	3	3	3	3	3	3	
10	900-1000	3	3	3	3	2	3	
11	1000-1100	4	4	3	3	3	3	
12	1100-1200	3	3	3	3	3	3	
13	1200-1300	3	3	3	3	4	3	
14	1300-1400	3	3	3	3	3	3	
15	1400-1500	4	4	3	3	4	4	
16	1500-1600	3	3	3	3	3	3	
17	1600-1700	3	3	3	3	3	3	



Zero Km to Hallanchowk

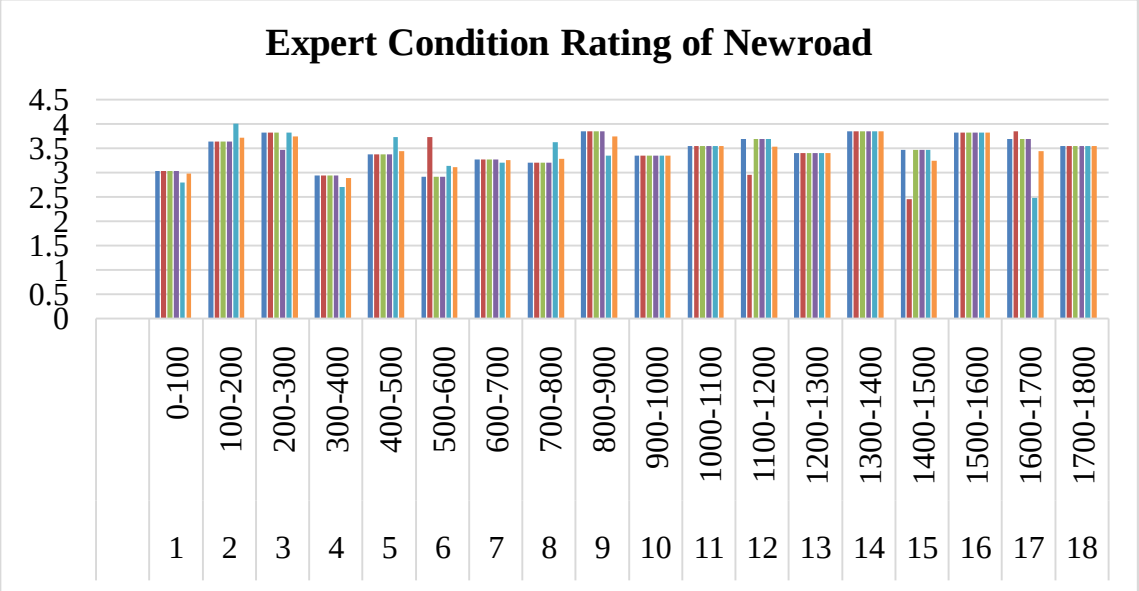
S.N	Road Section	Expert Condition Rating					Average Rating	Remarks
		1	2	3	4	5		
1	0-100	3	3	3	3	3	3	
2	100-200	2	3	2	2	2	2	
3	200-300	2	2	2	2	2	2	
4	300-400	2	2	2	2	2	2	
5	400-500	3	3	3	3	3	3	
6	500-600	2	2	2	2	2	2	
7	600-700	3	3	3	3	3	3	
8	700-800	2	3	2	2	2	3	
9	800-900	2	2	2	2	2	2	
10	900-1000	3	3	3	3	3	3	
11	1000-1100	3	3	3	3	3	3	
12	1100-1200	3	3	3	3	3	3	
13	1200-1300	2	2	2	2	2	2	
14	1300-1400	4	4	4	4	4	4	
15	1400-1500	3	3	3	3	3	3	
16	1500-1600	3	3	3	3	3	3	
17	1600-1700	3	3	3	3	3	3	
18	1700-1800	4	4	4	4	4	4	
19	1800-1900	3	3	3	3	3	3	



Newroad

SabhaGrihaChowk to B.P Chowk, Chipledhunga

S.N	Road Section	Expert Condition Rating					Average Rating	Remarks
		1	2	3	4	5		
1	0-100	3	3	3	3	3	3	
2	100-200	4	4	4	4	4	4	
3	200-300	4	4	4	3	4	4	
4	300-400	3	3	3	3	3	3	
5	400-500	3	3	3	3	4	3	
6	500-600	3	4	3	3	3	3	
7	600-700	3	3	3	3	3	3	
8	700-800	3	3	3	3	4	3	
9	800-900	4	4	4	4	3	4	
10	900-1000	3	3	3	3	3	3	
11	1000-1100	4	4	4	4	4	4	
12	1100-1200	4	3	4	4	4	4	
13	1200-1300	3	3	3	3	3	3	
14	1300-1400	4	4	4	4	4	4	
15	1400-1500	3	2	3	3	3	3	
16	1500-1600	4	4	4	4	4	4	
17	1600-1700	4	4	4	4	2	3	
18	1700-1800	4	4	4	4	4	4	



Experts view and suggestion on road condition rating based on site photographs were collected for different sections of road. The ratings of the sections were arranged to find out the most severe road section. The study shows that section 1400-1500 is the most severe on PrithiviChowk – Mahendrapool road section. Similarly, 1300-1400 and 1700-1800 sections were found to be the most severe on Zero Km – Hallanchowk road section.

B.P. Chowk – SabagrihaChowk road was found to have severe road condition at multiple sections 100-200-300, 800-900, 1000-1100-1200, 1300-1400, 1500-1600 and 1700-1800.

4.2 Evaluation Survey

After completion of condition rating survey theevaluation survey was carried out. For evaluation survey the site was observed and tried to find out the reasons behind the failure. The main reasons and the type of failure are shown in table below.

Type of Failure	**Causes**
Alligator cracking	➢ Fatigue failure due toflexible/brittle base. ➢ Inadequatepavementthickness.
Block cracking	➢ Reflection ofjoints crackinginunderlying base.
Longitudinal cracking	➢ Reflectioncracking. ➢ Poorpavinglane joint. ➢ Pavementwidening. ➢ Cut/fill differentialsettlement. Fatigue failure ofasphaltconcrete.
Transverse cracking	➢ Reflection ofshrinkage cracking. ➢ Constructionjoints.
Rutting	➢ Inadequatepavementthickness. ➢ Post constructioncompaction. ➢ Instabilityofbasesurfacing.
Shoving	➢ Poorbond betweenlayers. ➢ Lackofedgecontainment. ➢ Inadequatepavementthickness.
Depression	➢ Settlement ofservicetrench or embankment. ➢ Isolatedconsolidation. Volume change ofsubgrade
Corrugation	➢ Instabilityofasphaltconcrete orbase course.
Edge drop	➢ Inadequatepavementwidth. ➢ Erodible material(lackof plasticity).
Edge break	➢ Inadequatepavementwidth. ➢ Inadequate edge support. ➢ Traffic travellingonshoulderedge drop. Weaksealcoat/lossofadhesion.
Raveling	➢ Itis a resultofinsufficientadhesion betweenthe asphaltcementandthe aggregate. ➢ Initiallya fine aggregate breakloose and leaves small,roughpatches in thesurfaceofthepavement.

Potholes	➢ Potholes are oftenlocatedinareas ofpoor drainage. ➢ Potholes are formedwhenthe pavement disintegrates undertraffic loading, due to inadequate strengthening one ormore layersofthe pavement, usuallyaccompaniedby the presence ofwater.
Polishing	➢ Caused bytrafficmovement (vehicles movement).
Patches	➢ Fillingthe holes withasphaltconcrete withoutcleaning andpreparinganddoing the required works formaintenance. ➢ Fillingthe holes withoutdoingproper leveling andcompaction.