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THESIS NO.: T10/080

Pavement Maintenance Prioritization of Urban Roads : A Case Study of Kathmandu Metropolitan City

by

Madhav Kafle

A THESIS

SUBMITTED TO THE DEPARTMENT OF CIVIL ENGINEERING

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

DEGREE OF MASTER OF SCIENCE IN TRANSPORTATION ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

LALITPUR, NEPAL

MAY, 2026

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Head

Department of Civil Engineering

Pulchowk Campus, Institute of Engineering

Pulchowk, Lalitpur

Nepal

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The undersigned certify that they have read, and recommended to the Institute of Engineering for acceptance, a thesis entitled **"Pavement Maintenance Prioritization of Urban Roads : A Case Study of Kathmandu Metropolitan City"** submitted by **Madhav Kafle** in partial fulfillment of the requirements for the degree of Master of Science in Transportation Engineering.

Supervisor : Mr. Anil Marsani
Department of Civil Engineering
Institute of Engineering

External Examiner : Mr. Prabhat Kumar Jha
Deputy Director General
Department of Roads

Program Co-ordinator
M.Sc. in Transportation Engineering
Department of Civil Engineering

Date: 11 May, 2026.

ABSTRACT

Pavement maintenance prioritization is essential to ensure safe, efficient, and cost-effective road networks, especially in urban areas like Kathmandu Metropolitan City (KMC) where roads deteriorate rapidly due to heavy traffic, poor drainage, and frequent utility works. This study develops a methodology for prioritizing roads in KMC by integrating multiple factors, including pavement condition, traffic volume, road width, age of last maintenance, and social and political importance. Visual distress surveys were conducted to assess current road conditions where road were found in good to satisfactory conditions. Results from AHP showed that pavement condition and traffic volume as the most influential criteria, while sub-criteria such as road width $\geq$ 7 m, maintenance age > 4 years, and access to essential services carried high importance. Based on the weighted analysis, Tahachal Marga was ranked highest for maintenance priority, followed by Bishnumati Corridor, Link Marga, and Gyanodaya Marga. The study demonstrates that combining pavement condition with functional and socio-service factors provides a more comprehensive basis for road maintenance prioritization.

Keywords: Road maintenance prioritization, AHP, Urban roads, Pavement Condition Index (PCI)

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my supervisor and M.Sc. Coordinator, Mr. Anil Marsani, for his continuous guidance, encouragement, and valuable suggestions throughout my study and research period. His support, motivation, and academic insight greatly contributed to the successful completion of this work. I am also deeply thankful to the department faculties, Mr. Pradeep Kumar Shrestha and Mrs. Rojee Pradhananga, for their guidance, constructive feedback, and encouragement during different stages of my research. Their valuable suggestions and academic support were very helpful in shaping this study.

I am also grateful to the experts who participated in the AHP survey for their valuable time, insights, and contributions, which were essential to this research. Last but not least, I would like to thank my friends and well-wishers for their continuous support, suggestions, and constructive comments throughout the research process, which motivated me to overcome challenges and successfully reach this stage of my thesis.

Name: Madhav Kafle

Roll No. : 080/MSTrE/010

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LIST OF ABBREVIATIONS

AADT	Annual Average Daily Traffic
AHP	Analytic Hierarchy Process
ASTM	American Society for Testing and Materials
CR	Consistency Ratio
DoR	Department of Roads
KMC	Kathmandu Metropolitan City
MCDM	Multi Criteria Decision Making
MCDA	Multi Criteria Decision Making Analysis
PCI	Pavement Condition Index
PCU	Passenger Car Unit
RI	Random Index
SDI	Surface Distress Index
TOPSIS	Technique for Order Preference by Similarity to Ideal Solution

CHAPTER 1: INTRODUCTION

1.1 Background

Flexible pavements form the core of urban transportation networks and are essential for supporting daily mobility, economic activities, and public services. However, these pavements are highly vulnerable to deterioration caused by increasing traffic loads, inadequate drainage, construction deficiencies, and climatic stresses. Common failures such as cracking, rutting, ravelling, and potholes tend to appear more rapidly in dense urban environments where road structures face continuous pressure and frequent utility excavations. Without systematic maintenance, these deteriorations escalate, leading to higher rehabilitation costs and reduced serviceability. As a result, modern pavement management emphasizes the importance of structured and data-driven maintenance prioritization systems that integrate both pavement condition and operational significance of urban roads.

Kathmandu Metropolitan City, the political and economic center of Nepal, spans approximately 50.67 km² and consists of 32 administrative wards with a 2021 population of about 860,000 and 238,966 households. The urban road network within KMC extends roughly 1,049 km and includes arterial, sub-arterial, and local roads that support the city's dense traffic and high mobility demands. Despite recent investments in asphalt and concrete pavement works, much of this network shows signs of premature deterioration, raising concerns about long-term sustainability and maintenance efficiency.

Roads in KMC frequently exhibit distresses such as cracking, potholes, rutting, edge failures, and surface deformation. These failures occur due to multiple interacting factors like heavy and mixed traffic volumes, overloaded vehicles, cyclical monsoon rains that weaken pavement layers and frequent utility trenching forcing maintenance activities to remain largely reactive rather than preventive. Such conditions increases vehicle operating costs, reduce safety, disrupt mobility, and shorten pavement service life. These issues align with broader national observations that Nepal's urban pavements often deteriorate faster than expected due to inadequate drainage, poor construction quality and absence of systematic maintenance planning (Shrestha et al., 2025).

In contrast to Nepal's Strategic Road Network, where the Department of Roads conducts regular condition surveys and maintains a formal pavement management system, Kathmandu lacks a standardized pavement assessment mechanism such as PCI. Municipal road evaluations are often based on ad-hoc inspections, subjective visual assessments, or complaint-driven interventions, resulting in fragmented data and poor prioritization capacity. Shrestha et al. (2025) study reveals how Nepal's pavement management approaches have matured by mutually reinforcing advances in technology, policy, and analytical techniques but urban municipalities like KMC still face significant gaps in systematic pavement condition monitoring and data-driven maintenance planning.

To address visible deficiencies, KMC has recently implemented targeted programs such as the "Dust-Free Kathmandu" campaign, aimed at improving pavement surfaces and reducing dust pollution, and the "Infrastructure Ambulance" system, which enables rapid deployment of repair materials and response teams to critical road segments. While these initiatives have improved localized maintenance efficiency, they operate without integration into a unified pavement management framework.

Existing literature emphasize effectiveness of structured and multi-criteria decision approaches for pavement maintenance planning. MCDM techniques particularly AHP, TOPSIS, fuzzy logic, and hybrid models have been widely applied to prioritize maintenance interventions by integrating condition indices, traffic loading, economic considerations, and serviceability factors. Ahmed et al. (2017) demonstrated that AHP can effectively prioritize pavement sections by integrating expert judgment with criteria such as distress severity, road type, and traffic demand. Similar Study by Li et al. (2017) and Milad et al. (2018) showed that AHP helps to determine the relative importance of pavement condition, structural strength, and traffic loading in ranking maintenance needs.

Considering KMC's widespread pavement distress, the absence of a standardized assessment tool like PCI, and ongoing dependence on reactive maintenance strategies, the need for a structured maintenance prioritization framework is evident. Such a framework would help optimize the use of municipal budgets while improving overall road performance, urban mobility, and safety within the metropolitan.

1.2 Problem Statement

Road Networks under KMC continues to face widespread pavement problems, including cracks, potholes, rutting, and general surface deterioration as shown in Figure 1.1. These issues persist even after periodic maintenance because roads are exposed to heavy traffic, monsoon rain, frequent utility cuts, and drainage problems. Although KMC has introduced programs such as the "Dust-Free Kathmandu" initiative and "Infrastructure Ambulances" to carry out quick repairs, these efforts focus mainly on emergency responses. As a result, road maintenance remains reactive rather than systematic.

A major challenge is that KMC does not use a consistent, data-based method to assess pavement condition or decide which roads should be repaired first. Important factors like the Pavement Condition Index, traffic volume, road width, age of last maintenance and social and political importance are not evaluated in an organized way. Without a structured prioritization system, maintenance decisions depend mostly on complaints and visible damage, which often leads to inefficient use of resources and repeated deterioration.

In Nepal, some studies have applied basic indicators like the SDI and traffic volume to support maintenance decisions in rural municipalities. However, research focused on pavement maintenance prioritization in urban contexts remains extremely limited. Additionally, decision makers frequently prioritize new construction over maintenance, often due to limited awareness of the long-term economic benefits of timely pavement repair. This imbalance further contributes to reactive maintenance and hinders sustainable road asset management.

Therefore, there is a clear need for a structured, transparent, and evidence-based pavement maintenance prioritization framework for Kathmandu Metropolitan City. A multi-criteria decision-making approach that integrates PCI, traffic characteristics, road width, age of last maintenance and social political importance of road can support maintenance planning, enhance decision-making, and improve long-term pavement performance. This study will help address an important need for KMC and can also guide other urban municipalities in Nepal facing similar challenges by addressing following research questions:

1) **Main Question**: How can urban road maintenance in Kathmandu Metropolitan City be prioritized based on pavement condition, traffic demand, road width, age of last maintenance and social political importance of road network ?

2) **Sub-questions:**
   a. What is the current condition of roads in KMC based on PCI values derived from visual distress surveys ?
   b. How can AHP integrate these factors into a prioritization framework ?
   c. What prioritized ranking of road segments can be recommended for implementation by KMC ?

Figure 1.1 Pavement Failure Observed In Road Network Within KMC

1.3 Objectives

The main objective of the study is to develop a systematic and data-driven pavement maintenance prioritization framework for the urban road network of KMC using multi-criteria decision-making. The specific objectives are enlisted as below:

1. To evaluate pavement condition based on Pavement Condition Index (PCI) for selected road segments using visual distress surveys.
2. To apply AHP to develop a prioritization ranking index for selected urban road segments.

1.4 Scope of Study

This study focuses on developing a pavement maintenance prioritization framework for selected urban road segments within KMC. It includes visual pavement condition assessment using the PCI method and considers key criteria such as traffic volume, road width, age of last maintenance and social political importance of road. Expert judgments will be used to determine criterion weights through the AHP, and these will be integrated to produce a prioritized list of roads for maintenance. The study is limited to surface-level condition assessment and does not include structural evaluation, laboratory testing, or implementation of maintenance interventions. The final output will be a decision-support framework that ranks road segments based on maintenance priority to guide KMC in systematic and evidence-based pavement management.

1.5 Limitation of Study

This study is limited to selected urban road segments within KMC, where visual survey was carried out for pavement condition assessment and does not include structural evaluation. Expert Opinions used in the AHP process and Stakeholders reponses from Likert Scale survey for Socio-political importance may introduce some subjectivity.

1.6 Organization of Report

The project report consists of chapters as follows:

Chapter 1: Introduction

Chapter 2: Literature Review

Chapter 3: Methodology

Chapter 4: Result and Discussions

Chapter 5: Conclusion and Recommedations

References

Appendix

CHAPTER 2: LITERATURE REVIEW

2.1 Flexible Pavement and Failure Types

Flexible pavement is described as a layered pavement system consisting of subgrade, sub-base, base, and surface courses with relatively low flexural strength. Under traffic loads, wheel load stresses are transferred through grain-to-grain contact within the granular layers, and undergoes elastic deformation allowing surface deflections to reflect those of the underlying layers (Khanna & Justo, 2011).

Alligator cracking is a series of interconnected cracks resembling alligator skin, caused by fatigue failure of asphalt or stabilized base under repeated traffic loading (Huang, 2004).

Longitudinal and transverse is cracking parallel and perpendicular to the pavement centreline, caused by temperature shrinkage, asphalt hardening, reflective cracking, or poor lane joint construction (Huang, 2004).

Potholes are caused by surface failure due to fatigue cracking, material disintegration, or environmental effects (Huang, 2004).

Rutting refers to depressions in wheel paths due to permanent deformation of pavement layers or subgrade, often caused by traffic loads, poor compaction, or asphalt instability in hot weather (Huang, 2004).

Raveling is the loss of aggregate particles from the pavement surface due to binder deterioration or stripping, resulting in a rough texture (Huang, 2004).

Bleeding is the presence of excess bitumen on the pavement surface forming a shiny, sticky layer due to high asphalt content or low air voids, reducing skid resistance (Huang, 2004).

2.2 Maintenance and Planning practices Adopted in Nepal by DoR

The Department of Roads has specified seven categories of road maintenance activities. a) Routine/Regular maintenance generally include cleaning operations and small repair works continuously carried out on all roads to address deterioration caused by environmental and climatic effects. b) Reactive/Recurrent maintenance is undertaken based on the condition of the road once it reaches a critical level of deterioration. Typical activities under this category include pothole patching, crack sealing, and repair of drains and parapets after defects appear. c) Cyclic/Periodic maintenance is performed at intervals of several years to maintain pavement performance and prolong road life. Such works commonly include fog seal, slurry seal, surface dressing, thin overlay, and ottaseal treatments. d) Responsive maintenance involves activities aimed at rectifying existing defects while ensuring that the road continues to provide the required level of service. e) Roadside maintenance includes works associated with slope stabilization, removal of loose rocks from rock faces, construction and repair of masonry walls and revetments, as well as implementation of road safety measures. f) Emergency maintenance is carried out in urgent situations requiring immediate intervention to prevent disruption or closure of transport services. g) Bridge maintenance comprises activities necessary for maintaining safe and continuous movement of pedestrians and vehicles across rivers, streams, and irrigation crossings.

The periodic maintenance planning procedure followed by the Department of Roads is implemented through a structured sequence of steps, beginning with systematic data collection and ending with an approved maintenance program. Initially, road inventory and condition data are compiled and updated in a Road Register at the divisional level, including details such as traffic volume, surface condition, and road characteristics. This database forms the basis for identifying maintenance needs. The timing of periodic maintenance is then estimated using a standard maintenance cycle, which is further adjusted based on actual pavement condition assessed through indicators such as the Surface Distress Index. Roads that fall due for maintenance are shortlisted as candidates.

These candidate roads undergo a screening process to ensure that periodic maintenance is technically appropriate; roads with severe structural failures are excluded and considered for rehabilitation instead. The remaining roads are then prioritized using a composite Ranking Index (RI), which is calculated by combining three factors: traffic volume (TG), road condition (RC), and strategic importance (SI). Traffic volume reflects the level of usage and economic significance, with higher traffic roads assigned higher scores. Road condition represents the urgency of intervention, where poorer conditions receive higher priority values. Strategic importance captures the role of the road within the overall network, with roads providing key connectivity or national significance receiving higher scores. Each factor is assigned an index value as shown in Table 2.1 - Table 2.3 below and the overall ranking index is obtained as the sum (RI = TG + RC + SI). Roads with higher RI values are given priority for maintenance, ensuring a balanced consideration of both urgency and importance.

Table 2.1 Traffic Index – DoR Standard Procedure for Periodic Maintenance

Traffic Index	Traffic Group – Vehicles per Day		
	Less than 250	Between 250-1500	More than 1500
Index value (TG)	0.15	0.5	0.9

Table 2.2 Road Condition Index – DoR Standard Procedure for Periodic Maintenance

Road Condition Index	Road Condition – Surface Distress Index		
	0-1.7	1.8-3	3.1-5
	Good	Fair	Poor
Index value (TG)	0.15	0.5	0.9

Table 2.3 Strategic Importance Index – DoR Standard Procedure for Periodic Maintenance

Strategic Importance	Low Importance	Medium Importance	High Importance
Index value (SI)	0.0	0.3	0.6

The prioritized lists are first prepared at the divisional level, then reviewed and refined at regional meetings, and finally consolidated at the central level. Based on this process, a rolling periodic maintenance program, usually covering three years, is developed with corresponding budget estimates and annual targets. The program is then approved by higher authorities for implementation. Overall, the procedure provides a clear, data-driven and transparent approach to maintenance planning, ensuring efficient allocation of limited resources while maintaining the functionality and sustainability of the road network.

2.3 Pavement Condition Index (PCI)

Pavement Condition Index (PCI) is a numerical indicator used to assess the condition of a pavement. It is calculated based on the type, severity, and extent of distresses observed during a visual survey. The PCI ranges from 0 to 100, where 0 represents a failed pavement and 100 indicates an excellent condition. According to ASTM D6433, the Pavement Condition Index (PCI) is determined through a systematic process that begins with distress identification, where a visual survey is conducted to record various types of distresses present on the pavement surface. Each identified distress is then evaluated through a severity rating, classifying it as low, medium, or high. Following this, the extent of the distress is measured, typically expressed as the percentage of the total pavement area affected.Based on the severity and extent, a deduct value is assigned to each distress, reflecting its impact on overall pavement condition. The PCI is then computed by summing all deduct values and subtracting the total from 100, yielding a standardized index ranging from 0 (failed pavement) to 100 (excellent condition). Almubarok et al. (2022) used the Pavement Condition Index (PCI) to evaluate road damage on the Trengguli–Welahan segment and found an average PCI score of 54.36. The most common types of damage were patches, longitudinal and transverse cracks, joint cracks, and potholes while correlation analysis showed a strong negative correlation ($r = -0.913$) between the road damage percentage and the PCI value.

2.4 Multi-Criteria Decision Analysis

Multi-Criteria Decision Analysis (MCDA) is a structured decision-making framework used to evaluate and rank alternatives when multiple, often conflicting criteria are involved. MCDA facilitates objective and transparent decisions by combining qualitative and quantitative factors, allowing stakeholders to incorporate technical, economic, and social considerations (Belton & Stewart, 2002). Nautiyal and Sharma (2021) applied a MCDA approach using the Analytic Hierarchy Process (AHP) to prioritize maintenance for low-volume rural roads, identifying pavement condition as the most influential factor, followed by road utility value, traffic volume, and route type. Field surveys showed raveling and cracking as the dominant pavement distresses, reinforcing the value of AHP in combining condition data with functional criteria to support objective maintenance planning.

2.5 Analytical Hierarchy Process (AHP)

Analytic Hierarchy Process (AHP) is a widely applied decision-support method in Multi-Criteria Decision Making (MCDM). It is a mathematical technique developed by Saaty in

1970s to help decision-makers identify the most suitable alternative among several options. AHP is capable of incorporating both qualitative and quantitative information and enables comparisons of alternatives using a ratio scale (Saaty, 1994). AHP consists of three key stages namely hierarchy structuring, priority determination, and consistency evaluation. In the first stage, the decision problem is decomposed into smaller components and organized into a hierarchical structure consisting of criteria, sub-criteria, and alternatives. In the second stage, pairwise comparisons are conducted among elements at the same level to establish their relative importance. These comparisons are used to form pairwise comparison matrices, from which weights are derived using the principal eigen vector method. The third stage involves assessing the consistency of these judgments using the consistency ratio. If the consistency ratio is within the acceptable threshold ($CR \leq 0.1$), the derived priority vector is considered reliable. The normalized principal eigenvector obtained from the consistent pairwise comparison matrix is then taken as the final weight of the criteria (Emrouznejad & Ho, 2018).

2.6 Pavement Maintenance Prioritization

Li et al. (2017) applied the Analytic Hierarchy Process (AHP) to support network-level pavement maintenance decisions and found pavement condition to be the most critical factor, followed by pavement strength and traffic load. Their sensitivity analysis showed that maintenance cost is most strongly influenced by pavement condition, while pavement age primarily affects the remaining service life. The study concluded that AHP offers a practical and reliable framework for highway agencies to systematically prioritize maintenance needs across large road networks.

Ahmed et al. (2017) used an objective-based Analytic Hierarchy Process (AHP) to prioritize pavement maintenance sections and found pavement condition or distress to be the most important criterion, followed by traffic volume, surface roughness, and maintenance cost. Their study demonstrated that objective-based AHP provides a systematic and transparent framework for integrating technical pavement data with operational factors, enabling more maintenance decision-making.

Poudel (2021) developed a data-efficient methodology to prioritize local road maintenance in Nepal, aiming to overcome limitations of subjective and worst-first practices. Using the Analytic Hierarchy Process (AHP) and the OPTime tool, the study incorporated maintenance effectiveness, road utility, traffic volume, and route type, and applied the method to Ramgram Municipality to evaluate its practicality. The results showed that maintenance effectiveness was the dominant criterion, producing more cost-effective and timely prioritization than existing approaches. The study recommends that municipalities adopt multi-criteria, effectiveness-based frameworks and improve pavement data collection to support preventive maintenance planning.

2.7 Use of Socio Economic Parameter in Pavement Maintenance Prioritization

Godoy et al. (2015) emphasized that traditional urban pavement maintenance prioritization methods primarily rely on technical and economic criteria such as pavement condition and traffic levels, while socio-political considerations are rarely formally incorporated into decision-making processes. Their study on Chilean urban pavement networks highlighted that, in practice, factors such as public perception of road conditions, the population benefited by the road, proximity to important facilities, and the availability of alternative routes often influence maintenance decisions. The authors therefore proposed the inclusion of these socio-political criteria within urban pavement management frameworks to improve transparency and ensure that maintenance prioritization reflects not only engineering requirements but also broader social impacts within the context of Pavement Management.

Gunathilaka and Amarasingha (2020) examined the prioritization of pavement maintenance and rehabilitation projects in Sri Lanka by incorporating both social and economic factors into the decision-making process. The study applied the Analytic Network Process as a multi-criteria decision-making tool to evaluate three road maintenance projects. Data were collected through pairwise comparisons and expert interviews with professionals from the Road Development Authority. The findings revealed that the existing project prioritization method mainly focuses on economic criteria, which may overlook important social considerations. By incorporating social and economic dependencies through the ANP approach, the study demonstrated a more comprehensive and effective framework for ranking pavement maintenance projects. The authors concluded that integrating multi-criteria evaluation methods can improve infrastructure planning and decision-making in road maintenance management.

2.8 Likert Scale

Likert scale is a psychometric instrument for measuring individuals' attitudes, opinions, or perceptions by asking respondents to indicate their level of agreement or disagreement with a set of statements using ordered response categories, typically ranging from "strongly disagree" to "strongly agree" (Koo & Yang, 2025).

Alghuson (2023) examined the sustainability performance of transport infrastructure projects in Saudi Arabia. The study aimed to evaluate the environmental, social, and economic impacts of transportation infrastructure development and to identify potential areas for improvement. Data were collected through a Likert-scale questionnaire survey of 197 professionals involved in construction and transportation projects, and the responses were analyzed using statistical techniques such as Cronbach's alpha and Spearman correlation with SPSS. The findings highlighted the importance of integrating sustainability principles into transport infrastructure planning and development to minimize environmental impacts, enhance social benefits, and improve economic efficiency.

2.9 Gaps in Existing Research

Systematic pavement maintenance prioritization using PCI and AHP is well-established internationally but remains largely unexplored in Nepal, especially for urban road networks. No existing study has applied a PCI-AHP framework for maintenance prioritization in complex urban setting like Kathmandu Metropolitan City, leaving a clear gap in urban pavement management research.

The Department of Roads (DoR) follows a standard procedure for periodic maintenance planning based on technical indicators such as traffic index, SDI-based road condition index, and strategic importance index. However, such structured frameworks are largely absent at the local government level. Existing research has not adequately addressed this gap by integrating technical parameters with relevant social factors suitable to local contexts. This study helps address the issue by proposing a combined framework that incorporates both technical indicators and context-specific social parameters, supporting more balanced, transparent, and evidence-based decision-making at the local level.

CHAPTER 3: METHODOLOGY

3.1 Research Design

The research design adopted for the study is as shown in Figure 3.1.

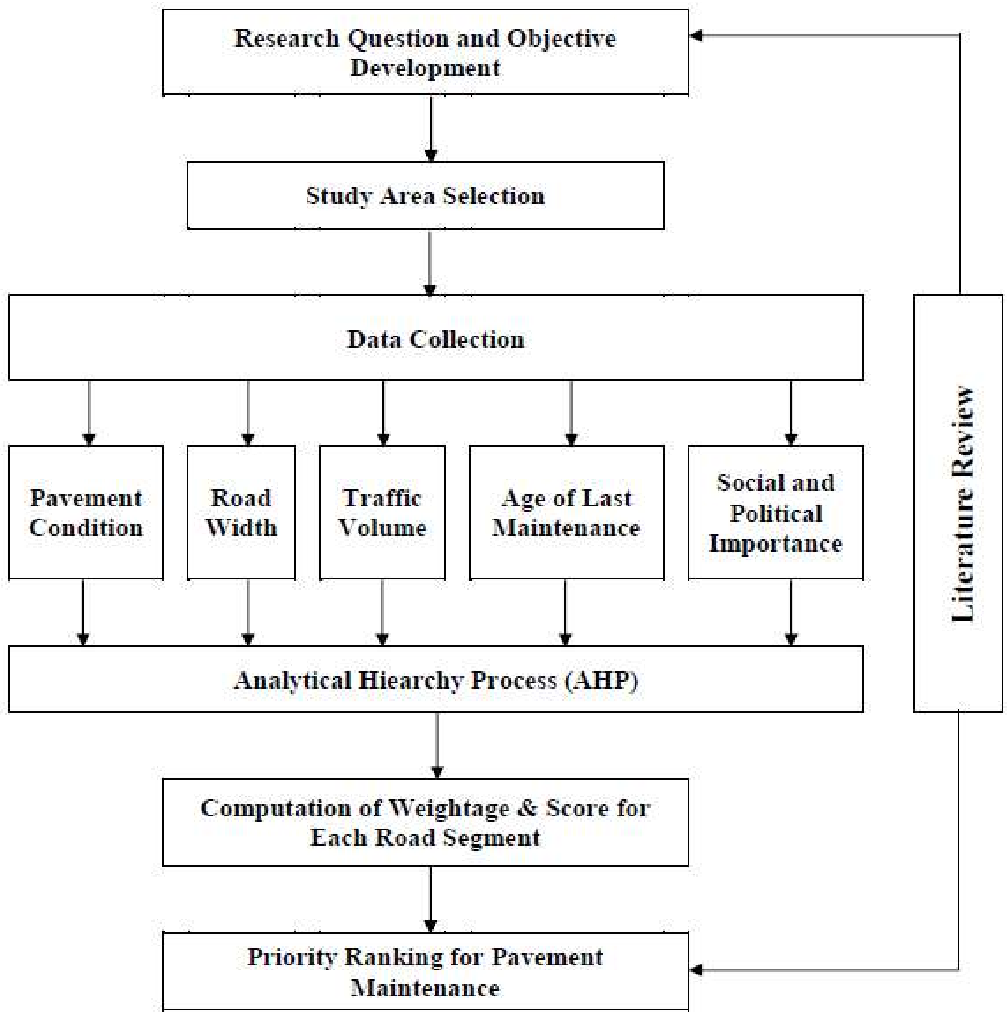

Figure 3.1 Research Design

The process began with the development of research questions and objectives to define the focus of the study. After that, the study area and road network were selected. Data were then collected for the main factors influencing pavement maintenance needs. These factors included Pavement Condition, road width, traffic volume, age of last maintenance, and social and political factors. A continuous literature review was conducted throughout the process to provide a theoretical foundation, identify methodological gaps, and support analytical decisions.

After data collection, analysis is carried out using the Analytic Hierarchy Process (AHP), a multi-criteria decision-making method used to determine the relative importance of each factor. Based on this analysis, weights were assigned to each parameter and scores were calculated for each road segment. Finally, the road segments were ranked according to their priority for pavement maintenance. The resulting prioritization list provides a transparent and evidence-based tool to assist decision-makers in allocating resources efficiently and planning pavement maintenance systematically.

3.2 Study Area

The study area is confined to Kathmandu Metropolitan City, whose administrative boundary and ward divisions are as shown in Figure 3.2. A representative section of urban roads was selected for detailed surveys and analysis. A total of 28 sample sections of the urban road network were included in the study, covering roads with different traffic volumes, classifications, and pavement conditions. This sampling approach was intended to provide a comprehensive understanding of pavement performance under diverse usage and environmental conditions, allowing the findings to be broadly generalizable to the wider KMC road network and useful for future maintenance planning and decision-making.

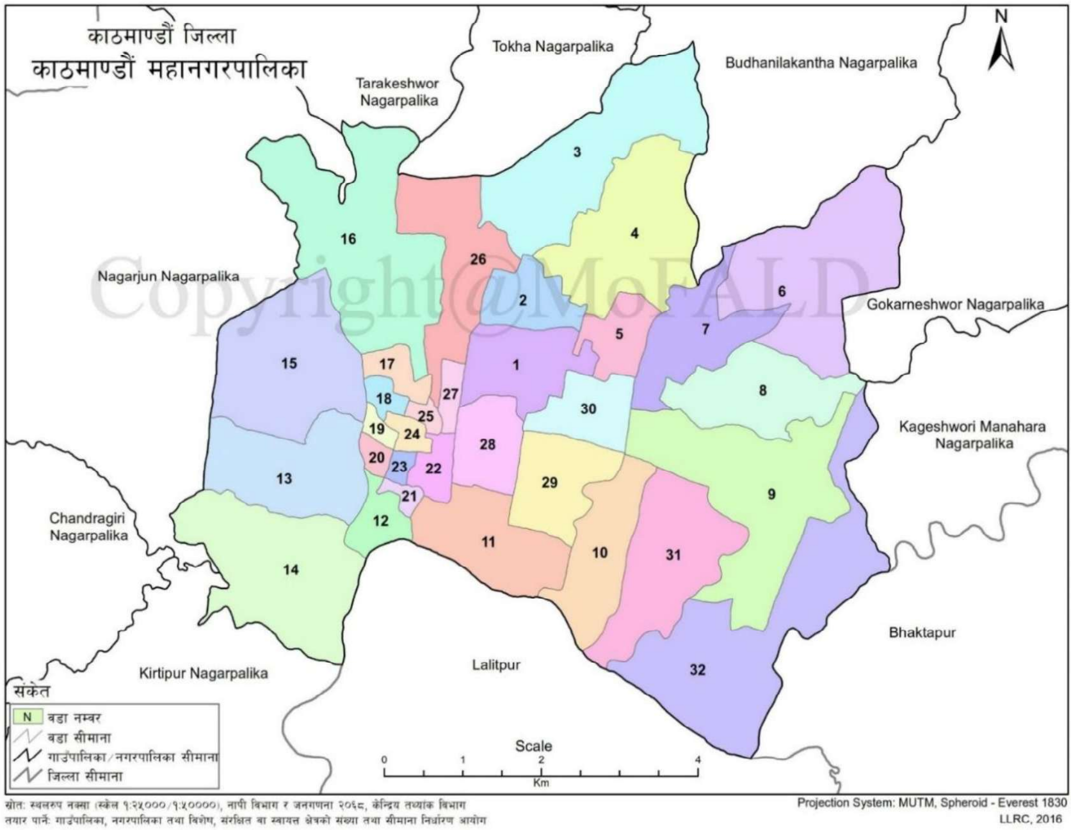

Figure 3.2 Study Area: Kathmandu Metropolitan City

(Source : https://www.nepalarchives.com/content/kathmandu-metropolitan-city-kathmandu-profile/)

3.3 Design Criteria and Data Collection

3.3.1 Pavement Condition Index

In this study, the Pavement Condition Index (PCI) is used as one of the main criteria, and data were collected through a visual distress survey following ASTM D6433 standards. To ensure systematic assessment, each selected road section was divided into 100-meter subsections where different types of pavement distress such as cracks, potholes, and surface deformations were identified and measured. Each distress was classified according to its severity level (low, medium, or high), and its density was calculated by dividing the area of the distress by the total area of the pavement subsection.

Based on the recorded severity and density, a deduct value was determined for each distress type based on their deduct value chart as shown in Figure 3.3. When multiple distress types were present, corrected deduct values were applied to ensure a balanced representation of the overall pavement condition. PCI for each subsection was then calculated by subtracting the maximum corrected deduct value from 100, and the pavement condition was rated based on the classification shown in , producing a standardized and comparable measure of pavement condition across all surveyed sections.sections. Finally, the minimum PCI value among the selected road networks was assigned a value of 100, and the others were adjusted proportionately for analysis and decision-making.

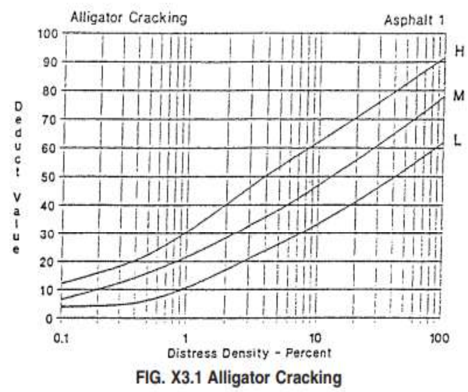

Figure 3.3 Sample Deduct Curve Chart
(Source: ASTM 6433)

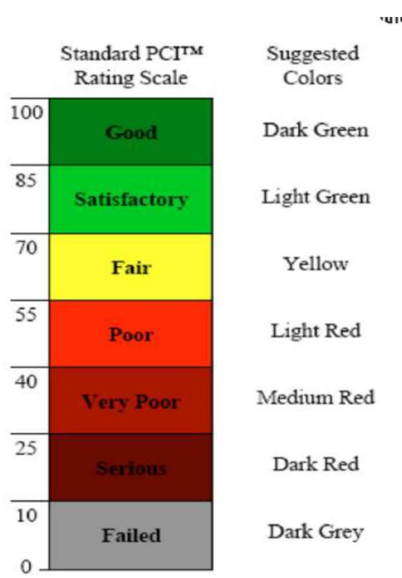

Figure 3.4 PCI Classification
(Source: ASTM 6433)

3.3.2 Road Width

Road width, measured as average width (in meters), is used as a main criterion in the AHP analysis to reflect functional classification and guide maintenance strategies. Road width data were obtained through field measurements at selected locations. The average road width reflects the capacity and functional importance of the road. For the AHP analysis, road width was categorized into three subclasses: ≤ 3.5 m, 3.5–7 m, and > 7 m. Based on these categories, weights were assigned to each subclass according to their relative importance. The road segments were then classified into the respective width categories, and weighted values were calculated for each segment.

3.3.3 Traffic Volume

Traffic volume, measured in PCU/day, is used as a main criterion in the AHP analysis. Traffic surveys were conducted using manual vehicle counts and/or video camera recordings at selected locations. The Passenger Car Unit (PCU) is a standardized measure that represents different vehicle types based on their relative impact on traffic flow and capacity. For the AHP analysis, the road segment with the highest PCU/day value was assigned a score of 100, and proportional values were then calculated for all other road segments based on their respective traffic volumes.

3.3.4 Age of Last Maintenance

Age of Last Maintenance refers to the time elapsed since the most recent major maintenance work carried out on a road. It is used as one of the main criteria in the AHP analysis. This includes both corrective maintenance activities such as patching and thin overlay, as well as major works such as rehabilitation or reconstruction. For the AHP analysis, the age of last maintenance was categorized into three sub-criteria: less than 2 years, 2–4 years, and greater than 4 years. Based on these categories, weights were assigned and the corresponding scores for each road segment were calculated.

3.3.5 Social and Political Factor

Social and political factors represent the importance of the road from a social and administrative perspective. In this study, this factor is used as one of the main criteria in the AHP analysis and was evaluated using four sub-criteria: population served by the road, accessibility to essential services, public sensitivity, and availability of alternative routes. Population served by the road refers to the number of people who benefit from or regularly use the road. Accessibility to essential services indicates the importance of the road in providing access to facilities such as commercial areas, educational institutions, government offices, and health centers. Public sensitivity reflects the level of concern or complaints raised by the public regarding the road condition. Availability of alternative routes refers to the presence of other roads that can be used as substitutes if the road becomes unusable or deteriorated. Data for these sub-criteria were collected through a stakeholder survey, where respondents rated each road using a Likert scale. The respondents consisted of ward chairpersons, ward members, and ward officials. The average rating obtained from the respondents was then used to calculate the score for each road segment, which was combined with the weightage obtained from the AHP analysis..

3.4 Multi Criteria Decision Analysis With AHP

AHP is a systematic method used to make decisions when several factors must be considered together. In this study, AHP is used to prioritize road maintenance by evaluating important criteria such as PCI, Road Width, Traffic Volume, Age of Last Maintenance and Social and Political Factor. Experts compared these criteria in pairs using Saaty's scale shown in Table 3.1, answering questions like "Which is more important for pavement maintenance prioritization: PCI Traffic Volume?". Their responses form a pairwise comparison matrix, which is a symmetrical table where each criterion is compared with all others and the diagonal values are 1. From this matrix, mathematical calculations produce an eigenvector that represents the weightage of each criterion. A consistency check using the Consistency Index, Random Index, and Consistency Ratio ensures the expert judgments are logical. After determining the weights, each road section is scored for each criterion, and the final priority ranking is computed using Ranking Index = Σ (Weight × Score). The higher the value, the higher the priority for maintenance.

The AHP model adopted for this study is shown in the Figure 3.5, where the key evaluation criteria include pavement condition, road width, traffic volume, age of last maintenance, and social and political factors. These criteria were used to systematically evaluate and rank urban road alternatives to determine maintenance priorities.

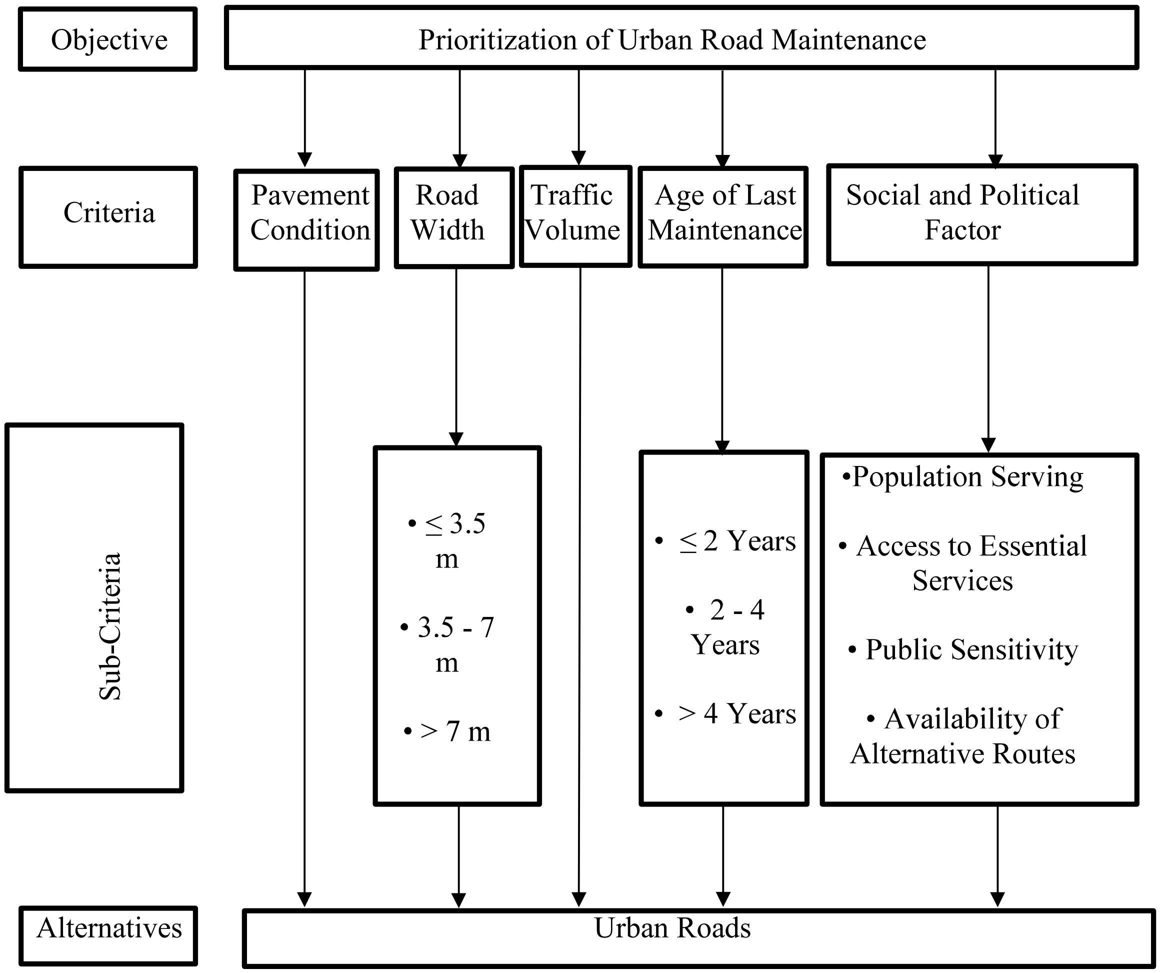

Figure 3.5 AHP Model for the Study

The procedure of determining weightages as proposed by Saaty is presented below (Farhan & Fwa, 2009). The results of pairwise comparisons are represented in the form of a positive reciprocal matrix $A=(a_{ij})$ where each diagonal elemets equals 1 ($a_{ii}=1$) and each element is the reciprocal of its counterpart ($a_{ij}=1/a_{ji}$) for all i, $j \leq n$, as shown in Equation 3.1 .

$$A = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ 1/a_{12} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ 1/a_{1n} & 1/a_{2n} & \dots & 1 \end{bmatrix} \qquad \text{Equation 3.1}$$

Where:

n = number of alternatives being compared within one set of pairwise comparisons,

a_{ij}=importance of alternative i over alternative j,

a_{ji}=importance of alternative j over alternative i

The next step involves converting the judgments in matrix A into a priority vector w, which reflects the relative weights of the elements. This is commonly achieved using Saaty's eigenvector method. In this approach, the principal eigenvector w′, corresponding to the maximum eigen value (λ_{max}) of matrix A, is computed as shown in Equation 3.2 .

$$A_{w\prime} = \lambda_{max} w' \qquad \text{Equation 3.2}$$

here λ_{max} is ≥ n and $w' = [w_1\ w_2\ ...\ w_n]^T$, where T refers to the transpose of a matrix. The final priority vector w is obtained by normalizing the principal eigenvector w′, and is therefore referred to as the normalized principal eigenvector. This vector is calculated for each criterion, sub-criterion, and for the alternatives under each sub-criterion. The overall priority weight of each alternative is then determined using Equation 3.3.

$$V_i = \Sigma_j W_j X_{ij} \qquad \text{Equation 3.3}$$

Where:

V_i = overall priority weight of alternative i,

W_j = weight assigned to criterion j, and

X_{ij} = weight of alternative i given criterion j.

AHP permits 10% inconsistency in human judgments. To evaluate the consistency of the decision-maker's judgments, Saaty introduced the Consistency Ratio (CR), which is calculated as the ratio of the Consistency Index (CI) to the Random Consistency Index (RI), as given in Equation 3.4.

$$CR=CI/RI \qquad \text{Equation 3.4}$$

Where Consistency Index (CI) is computed using Equation 3.5 , where n is the size of the matrix.

$$CI = (\lambda_{max} - n) / (n-1) \quad \text{Equation 3.5}$$

Random Consistency Index (RI) is obtained as standard value as shown in Table 3.2, which provides the Consistency Index (CI) values for randomly generated matrices based on the number of criteria. A pairwise comparison matrix is considered consistent only if CR is ≤ 0.1.

Table 3.1 Satty's Scale

Score Value	Definition	Explanation
1	Equal Importance	Both criteria contribute equally
3	Moderate Importance	One criterion is moderately more important
5	Strong Importance	One criterion is strongly more important
7	Very Strong Importance	Dominance of one criterion proved in practice
9	Extreme Importance	The Highest order dominance of one element over another
2,4,6,8 can be used to express intermediate Values.		

Table 3.2 Random Consistency Index

N	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

N = Nos. of Criteria

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Pavement Condition of Selected Road Segments

Pavement Condition Index (PCI) is used to evaluate pavement condition of the selected road sections for which visual distress survey was conducted in accordance with ASTM D6433 guidelines. During the field survey, different types of pavement distresses were visually identified, recorded, and classified according to their severity levels within each sample unit along the selected road segments. The collected distress data were then used to calculate the PCI values following the standard procedure. Detailed calculations for sample unit are presented in the APPENDIX G, while the summarized PCI values for the selected road sections are presented in Table 4.1, which show that the pavement condition of the surveyed roads ranges from Fair to Good, indicating most road sections are currently in acceptable condition but may require routine maintenance to prevent further deterioration and maintain serviceability.

Table 4.1 Pavement Condition Index of Selected Road Segments

S.N	Road Name	PCI	Rating
1	Link Marga	69.74	Fair
2	Tahachal Marga	71.14	Satisfactory
3	Tribeni Marga	77.25	Satisfactory
4	Gyanodaya Marga	79.87	Satisfactory
5	Sunar Gaun Marga	82.6	Satisfactory
6	Gyaneshwor Marga	83.34	Satisfactory
7	Kichandwo Marga	85.57	Good
8	Bijay Marga	86.17	Good
9	Chetanshil Marga	86.71	Good
10	Bagaicha Marga	87.83	Good
11	Shahid Marga	88.67	Good
12	Rani Devi Marga	88.75	Good
13	Dakshinkali Marga	89.67	Good

Table 4.1 Pavement Condition Index of Selected Road Segments (Continued)

S.N	Road Name	PCI	Rating
14	Godhar Gaun Marga	90.25	Good
15	Jaldhara Marga	91.11	Good
16	Bidhyalaya Marga	91.34	Good
17	Alka Basti Marga	92.4	Good
18	Sidhhi Ganesh Marga	92.62	Good
19	Gauri Shankar Marga	93.2	Good
20	Lamtangin Marga	94.27	Good
21	Kuleshwor Aawas Marga	94.3	Good
22	Tilingtar Marga	94.44	Good
23	Devi Marga	94.75	Good
24	Shital Marga	96.5	Good
25	Aanandamaya Marga	96.67	Good
26	Radhe Marga	98.33	Good
27	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	98.54	Good
28	Bishnumati Corridor (Shobha Bhagwati -Balaju)	98.93	Good

4.2 Weightage for Prioritization Criteria

The Analytic Hierarchy Process (AHP) was used to determine the weights of the maintenance prioritization criteria. For this purpose, a questionnaire survey was conducted with 14 experts, for which consistency check was also carried out to ensure that the judgments made by the experts were reliable. 10 responses were within acceptable consistency and were used to develop pairwise comparison matrices, which are presented in Table 4.2-Table 4.5. The detailed steps involved in the weight calculation are provided in the APPENDIX E. It was found that the Consistency Ratio (CR) values for both the main criteria and sub-criteria were less than 0.1, indicating that the comparisons are consistent and acceptable. Based on these results, the final weights for the criteria and sub-criteria were determined and are presented in Table 4.6-Table 4.7 below. The weights obtained from the Analytic Hierarchy Process show the relative importance of criteria for road maintenance prioritization. Pavement condition (0.385) is the most important factor, followed by traffic volume (0.226), Social and political factor (0.216) have moderate influence, while age of last maintenance (0.100) and road width (0.072) have lower importance. Overall, pavement condition, traffic volume and social political importance play the major role in prioritizing roads for maintenance.

Table 4.2 Pairwise Comparison Matrix for Main Criteria

	Pavement Condition	Road Width	Traffic Volume	Age of Last Maintenance	Social and Political Factor
Pavement Condition	1	5.251	1.998	3.777	1.576
Road Width	0.19	1	0.349	0.628	0.35
Traffic Volume	0.501	2.865	1	2.441	1.223
Age of Last Maintenance	0.265	1.592	0.41	1	0.431
Social and Political Factor	0.635	2.857	0.818	2.32	1

Table 4.3 Pairwise Comparison Matrix for Sub Criteria Road Width

	≤ 3.5 m	3.5 - 7 m	≥ 7 m
≤ 3.5 m	1	0.313	0.184
3.5 - 7 m	3.195	1	0.347
≥ 7 m	5.435	2.882	1

Table 4.4 Pairwise Comparison Matrix for Sub Criteria Age of Maintenance

	< 2	2-4	> 4
< 2	1	0.375	0.169
2-4	2.667	1	0.286
> 4	5.917	3.497	1

Table 4.5 Pairwise Comparison Matrix for Social and Political Factor

	SP1	SP2	SP3	SP4
SP1	1	0.543	1.008	2.601
SP2	1.842	1	1.479	4.215
SP3	0.992	0.676	1	3.351
SP4	0.384	0.237	0.298	1

Table 4.6 Weights for Main Criteria

Criteria	Weights
Pavement Condition	0.385
Road Width	0.072
Traffic Volume	0.226
Age of Last Maintenance	0.100
Social and Political Factor	0.216

Table 4.7 Weights for Sub Criteria

Criteria	Criteria Weights	Sub Criteria	Sub Criteria Weights
Road Width	0.072	≤ 3.5 m	0.1
		3.5 - 7 m	0.266
		≥ 7 m	0.635
Age of Last Maintenance	0.100	< 2	0.099
		2-4	0.227
		> 4	0.674
Social and Political Factor	0.216	Population Served	0.239
		Access to essential Services	0.403
		Public Sensitivity	0.269
		Availablity of Alternative Routes	0.089

4.3 Aggregation of Weightage and Prioritization Ranking of Road Segments

After determining the weights of the criteria and sub-criteria using AHP, the score for each criterion was calculated and the ranking of the selected road segments for maintenance prioritization was carried out by aggregating the individual scores.

For the Pavement Condition criterion, the values obtained from the visual distress survey were normalized by assigning the lowest PCI value a score of 100. The normalized PCI values were then multiplied by the corresponding criterion weight from AHP as presented in Table 4.6 to obtain the criterion score, as presented in Table 4.8.

Table 4.8 Score for Pavement Condition

S.N	Road Name	PCI	Normalized PCI	Criteria Weightage	Criteria Score
1	Rani Devi Marga	88.75	78.580	0.385	30.253
2	Tilingtar Marga	94.44	73.846	0.385	28.431
3	Jaldhara Marga	91.11	76.545	0.385	29.47
4	Aanandamaya Marga	96.67	72.142	0.385	27.775
5	Lamtangin Marga	94.27	73.979	0.385	28.482
6	Shital Marga	96.5	72.269	0.385	27.824
7	Bijay Marga	86.17	80.933	0.385	31.159
8	Bidhyalaya Marga	91.34	76.352	0.385	29.396
9	Bagaicha Marga	87.83	79.403	0.385	30.57
10	Kichandwo Marga	85.57	81.501	0.385	31.378
11	Gyanodaya Marga	79.87	87.317	0.385	33.617
12	Tahachal Marga	71.14	98.032	0.385	37.742
13	Link Marga	69.74	100.000	0.385	38.5
14	Sidhhi Ganesh Marga	92.62	75.297	0.385	28.989
15	Sunar Gaun Marga	82.6	84.431	0.385	32.506
16	Gauri Shankar Marga	93.2	74.828	0.385	28.809
17	Kuleshwor Aawas Marga	94.3	73.955	0.385	28.473
18	Godhar Gaun Marga	90.25	77.274	0.385	29.75
19	Bishnumati Corridor (Shobha Bhagwati - Balaju)	98.93	70.494	0.385	27.14
20	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	98.54	70.773	0.385	27.248
21	Alka Basti Marga	92.4	75.476	0.385	29.058
22	Chetanshil Marga	86.71	80.429	0.385	30.965

Table 4.8 Score for Pavement Condition (Continued)

S.N	Road Name	PCI	Normalized PCI	Criteria Weightage	Criteria Score
23	Dakshinkali Marga	89.67	77.774	0.385	29.943
24	Tribeni Marga	77.25	90.278	0.385	34.757
25	Radhe Marga	98.33	70.924	0.385	27.306
26	Devi Marga	94.75	73.604	0.385	28.338
27	Gyaneshwor Marga	83.34	83.681	0.385	32.217
28	Shahid Marga	88.67	78.651	0.385	30.281

The road width data obtained from field measurements are provided in the APPENDIX F. For analysis, road width was classified according to the sub-criteria defined during the AHP survey. Each road segment was assigned a base value of 100, which was then multiplied by the respective sub-criteria and criteria weights from AHP as presented in Table 4.6 and Table 4.7 to calculate the criterion score, as shown in Table 4.9.

Table 4.9 Score for Road Width

S.N	Name of the Road	Road Width (m)	Score	Sub Criteria weightage	Criteria Weightage	Road Width Weightage
1	Rani Devi Marga	6.03	100	0.266	0.072	1.92
2	Tilingtar Marga	6.86	100	0.266	0.072	1.92
3	Jaldhara Marga	5.09	100	0.266	0.072	1.92
4	Aanandamaya Marga	5.14	100	0.266	0.072	1.92
5	Lamtangin Marga	5.77	100	0.266	0.072	1.92
6	Shital Marga	5.66	100	0.266	0.072	1.92
7	Bijay Marga	3.7	100	0.100	0.072	0.72
8	Bidhyalaya Marga	3.76	100	0.100	0.072	0.72
9	Bagaicha Marga	3.77	100	0.100	0.072	0.72
10	Kichandwo Marga	5.2	100	0.266	0.072	1.92
11	Gyanodaya Marga	5.95	100	0.266	0.072	1.92

Table 4.9 Score for Road Width (Continued)

S.N	Name of the Road	Road Width (m)	Score	Sub Criteria weightage	Criteria Weightage	Road Width Weightage
12	Tahachal Marga	6.36	100	0.266	0.072	1.92
13	Link Marga	5.32	100	0.266	0.072	1.92
14	Sidhhi Ganesh Marga	6.27	100	0.266	0.072	1.92
15	Sunar Gaun Marga	4.47	100	0.266	0.072	1.92
16	Gauri Shankar Marga	5.35	100	0.266	0.072	1.92
17	Kuleshwor Aawas Marga	6.16	100	0.266	0.072	1.92
18	Godhar Gaun Marga	3.82	100	0.100	0.072	0.72
19	Bishnumati Corridor (Shobha Bhagwati - Balaju)	8.26	100	0.635	0.072	4.57
20	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	9.93	100	0.635	0.072	4.57
21	Alka Basti Marga	3.68	100	0.100	0.072	0.72
22	Chetanshil Marga	5.24	100	0.266	0.072	1.92
23	Dakshinkali Marga	4.05	100	0.266	0.072	1.92
24	Tribeni Marga	4.63	100	0.266	0.072	1.92
25	Radhe Marga	5.38	100	0.266	0.072	1.92
26	Devi Marga	5.24	100	0.266	0.072	1.92
27	Gyaneshwor Marga	5.32	100	0.266	0.072	1.92
28	Shahid Marga	5.08	100	0.266	0.072	1.92

The traffic volume data were obtained from a 24-hour traffic survey conducted using video recording, and the detailed data are provided in the APPENDIX F. For normalization, the road segment with the maximum PCU/day was assigned a value of 100, and the scores for the remaining segments were calculated proportionally. The final criterion score as shown in Table 4.10 was obtained by applying the corresponding weights from Table 4.6.

Table 4.10 Score for Traffic Volume

S.N.	Name of Road	Daily Traffic Volume (PCU)	Normalized PCU	Criteria Weightage	Criteria Score
1	Rani Devi Marga	10131.50	69.356	0.226	15.674
2	Tilingtar Marga	6342.50	43.418	0.226	9.812
3	Jaldhara Marga	2521.50	17.261	0.226	3.901
4	Aanandamaya Marga	2757.00	18.873	0.226	4.265
5	Lamtangin Marga	3022.50	20.691	0.226	4.676
6	Shital Marga	1632.50	11.175	0.226	2.526
7	Bijay Marga	1499.50	10.265	0.226	2.320
8	Bidhyalaya Marga	1517.50	10.388	0.226	2.348
9	Bagaicha Marga	1817.00	12.438	0.226	2.811
10	Kichandwo Marga	1865.00	12.767	0.226	2.885
11	Gyanodaya Marga	7911.50	54.159	0.226	12.240
12	Tahachal Marga	10151.00	69.489	0.226	15.705
13	Link Marga	3222.00	22.056	0.226	4.985
14	Sidhhi Ganesh Marga	1544.50	10.573	0.226	2.389
15	Sunar Gaun Marga	2006.00	13.732	0.226	3.103
16	Gauri Shankar Marga	2018.00	13.814	0.226	3.122
17	Kuleshwor Aawas Marga	3212.00	21.988	0.226	4.969
18	Godhar Gaun Marga	1134.00	7.763	0.226	1.754
19	Bishnumati Corridor (Shobha Bhagwati - Balaju)	14608.00	100.000	0.226	22.600
20	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	9786.50	66.994	0.226	15.141
21	Alka Basti Marga	2477.50	16.960	0.226	3.833
22	Chetanshil Marga	1602.00	10.967	0.226	2.479
23	Dakshinkali Marga	1436.00	9.830	0.226	2.222

Table 4.10 Score for Traffic Volume (Continued)

S.N.	Name of Road	Daily Traffic Volume (PCU)	Normalized PCU	Criteria Weightage	Criteria Score
24	Tribeni Marga	1310.00	8.968	0.226	2.027
25	Radhe Marga	2048.00	14.020	0.226	3.169
26	Devi Marga	2360.50	16.159	0.226	3.652
27	Gyaneshwor Marga	2329.00	15.943	0.226	3.603
28	Shahid Marga	2207.50	15.112	0.226	3.415

For the age of last maintenance, maintenance records obtained from Kathmandu Metropolitan City are provided in the APPENDIX F. For analysis, the data were classified according to the defined criteria and sub-criteria. Each category was assigned a value of 100, and the respective weights from Table 4.6 and Table 4.7 were applied to calculate criterion score as presented in Table 4.11.

Table 4.11 Score for Age of Last Maintenance

S.N	Name of the Road	Age of last maintenance (Years)	Score	Sub Criteria weightage	Criteria Weightage	Road Width Weightage
1	Rani Devi Marga	2-4	100	0.227	0.10	2.27
2	Tilingtar Marga	< 2	100	0.099	0.10	0.99
3	Jaldhara Marga	< 2	100	0.099	0.10	0.99
4	Aanandamaya Marga	< 2	100	0.099	0.10	0.99
5	Lamtangin Marga	< 2	100	0.099	0.10	0.99
6	Shital Marga	< 2	100	0.099	0.10	0.99
7	Bijay Marga	2-4	100	0.227	0.10	2.27
8	Bidhyalaya Marga	2-4	100	0.227	0.10	2.27
9	Bagaicha Marga	< 2	100	0.099	0.10	0.99
10	Kichandwo Marga	2-4	100	0.227	0.10	2.27
11	Gyanodaya Marga	2-4	100	0.227	0.10	2.27
12	Tahachal Marga	2-4	100	0.227	0.10	2.27

Table 4.11 Score for Age of Last Maintenance (Continued)

S.N	Name of the Road	Age of last maintenance (Years)	Score	Sub Criteria weightage	Criteria Weightage	Road Width Weightage
13	Link Marga	> 4	100	0.674	0.10	6.74
14	Sidhhi Ganesh Marga	< 2	100	0.099	0.10	0.99
15	Sunar Gaun Marga	2-4	100	0.227	0.10	2.27
16	Gauri Shankar Marga	< 2	100	0.099	0.10	0.99
17	Kuleshwor Aawas Marga	2-4	100	0.227	0.10	2.27
18	Godhar Gaun Marga	2-4	100	0.227	0.10	2.27
19	Bishnumati Corridor (Shobha Bhagwati - Balaju)	< 2	100	0.099	0.10	0.99
20	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	< 2	100	0.099	0.10	0.99
21	Alka Basti Marga	2-4	100	0.227	0.10	2.27
22	Chetanshil Marga	< 2	100	0.099	0.10	0.99
23	Dakshinkali Marga	2-4	100	0.227	0.10	2.27
24	Tribeni Marga	< 2	100	0.099	0.10	0.99
25	Radhe Marga	< 2	100	0.099	0.10	0.99
26	Devi Marga	< 2	100	0.099	0.10	0.99
27	Gyaneshwor Marga	< 2	100	0.099	0.10	0.99
28	Shahid Marga	< 2	100	0.099	0.10	0.99

The social and political factor data were obtained through a survey using a Likert scale, and the responses are presented in the APPENDIX F. The responses from the participants were averaged and normalized by assigning the highest value a score of 100. The corresponding main criteria and sub criteria weights from Table 4.6 and Table 4.7 were used to compute final score for this criterion as shown in Table 4.12

Table 4.12 Score for Social and Political factor

S.N	Name of the Road	Normalized Value				Weightage Score
		Population Served by the Road	Accessibility to Essential Services	Public Sensitivity	Availability of Alternative Routes	
1	Rani Devi Marga	100	95.65	81.82	86.96	19.91
2	Tilingtar Marga	95.65	82.61	100	73.91	19.36
3	Jaldhara Marga	78.26	73.91	68.18	43.48	15.27
4	Aanandamaya Marga	82.61	73.91	59.09	95.65	15.97
5	Lamtangin Marga	91.3	82.61	100	52.17	18.72
6	Shital Marga	73.91	78.26	81.82	34.78	16.05
7	Bijay Marga	65.22	52.17	54.55	78.26	12.58
8	Bidhyalaya Marga	65.22	52.17	54.55	78.26	12.58
9	Bagaicha Marga	65.22	65.22	59.09	86.96	14.15
10	Kichandwo Marga	65.22	52.17	59.09	86.96	13.01
11	Gyanodaya Marga	100	100	81.82	100	20.54
12	Tahachal Marga	100	100	81.82	100	20.54
13	Link Marga	100	100	81.82	65.22	19.88
14	Sidhhi Ganesh Marga	65.22	56.52	59.09	65.22	12.97
15	Sunar Gaun Marga	78.26	56.52	59.09	69.57	13.73
16	Gauri Shankar Marga	78.26	65.22	72.73	65.22	15.2
17	Kuleshwor Aawas Marga	78.26	65.22	72.73	65.22	15.2
18	Godhar Gaun Marga	65.22	56.52	59.09	65.22	12.97
19	Bishnumati Corridor (Shobha Bhagwati - Balaju)	78.26	86.96	81.82	52.17	17.37

Table 4.12 Score for Social and Political factor (Continued)

S.N	Name of the Road	Normalized Value				Weightage Score
		Population Served by the Road	Accessibility to Essential Services	Public Sensitivity	Availability of Alternative Routes	
20	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	100	86.96	95.45	47.83	19.2
21	Alka Basti Marga	86.96	78.26	68.18	100	17.19
22	Chetanshil Marga	69.57	65.22	54.55	91.3	14.19
23	Dakshinkali Marga	78.26	65.22	54.55	86.96	14.56
24	Tribeni Marga	69.57	65.22	50	86.96	13.85
25	Radhe Marga	65.22	52.17	68.18	86.96	13.54
26	Devi Marga	65.22	56.52	68.18	86.96	13.92
27	Gyaneshwor Marga	65.22	73.91	77.27	91.3	16.05
28	Shahid Marga	65.22	56.52	54.55	86.96	13.13

Finally, the scores obtained for all criteria were aggregated to determine the overall score for each road segment using Equation 4.1-Equation 4.6.

$$\text{Ranking Index} = \text{PCI Score} + \text{Road Width Score} + \text{Traffic Volume Score} + \text{Age of Last Maintenance Score} + \text{Social and Political Factor Score} \quad \text{Equation 4.1}$$

Where,

$$\text{PCI Score} = 0.385 * \text{Normalized PCI} \quad \text{Equation 4.2}$$

$$\text{Road Width Score} = 0.072 * \text{Width Sub Criteria Value} \quad \text{Equation 4.3}$$

$$\text{Traffic Volume Score} = 0.226 * \text{Normalized Traffic Volume} \quad \text{Equation 4.4}$$

Age of Last Maintenance Score	=	0.1 * Age Sub Criteria Value	Equation 4.5
Social and Political Factor Score	=	0.051 * Population Served Score + 0.087 * Access to essential Services Score + 0.058 * Public Sensitivity Score + 0.019 * Availability of Alternative Route Score	Equation 4.6

Based on the aggregated scores, the maintenance priority ranking was established, where the road segment with the highest score was assigned Priority 1, and the remaining roads were ranked accordingly as shown in Table 4.13.

Table 4.13 Prioritized Rank of selected road segments

S.N	Name of the Road	PCI Score	Road Width Score	Traffic Volume Score	Age of Last Maintenance Score	Social and Political Factor Score	Total	Rank
1	Tahachal Marga	37.742	1.92	15.705	2.27	20.54	78.177	P1
2	Bishnumati Corridor (Shobha Bhagwati - Balaju)	27.14	4.57	22.6	0.99	17.37	72.670	P2
3	Link Marga	38.5	1.92	4.985	6.74	19.88	72.025	P3
4	Gyanodaya Marga	33.617	1.92	12.24	2.27	20.54	70.587	P4
5	Rani Devi Marga	30.253	1.92	15.674	2.27	19.91	70.027	P5
6	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	27.248	4.57	15.141	0.99	19.2	67.149	P6
7	Tilingtar Marga	28.431	1.92	9.812	0.99	19.36	60.513	P7
8	Lamtangin Marga	28.482	1.92	4.676	0.99	18.72	54.788	P8
9	Gyaneshwor Marga	32.217	1.92	3.603	0.99	16.05	54.780	P9

Table 4.13 Prioritized Rank of selected road segments (Continued)

S.N	Name of the Road	PCI Score	Road Width Score	Traffic Volume Score	Age of Last Maintenance Score	Social and Political Factor Score	Total	Rank
10	Tribeni Marga	34.757	1.92	2.027	0.99	13.85	53.544	P10
11	Sunar Gaun Marga	32.506	1.92	3.103	2.27	13.73	53.529	P11
12	Alka Basti Marga	29.058	0.72	3.833	2.27	17.19	53.071	P12
13	Kuleshwor Aawas Marga	28.473	1.92	4.969	2.27	15.2	52.832	P13
14	Jaldhara Marga	29.47	1.92	3.901	0.99	15.27	51.551	P14
15	Kichandwo Marga	31.378	1.92	2.885	2.27	13.01	51.463	P15
16	Aanandamaya Marga	27.775	1.92	4.265	0.99	15.97	50.920	P16
17	Dakshinkali Marga	29.943	1.92	2.222	2.27	14.56	50.915	P17
18	Chetanshil Marga	30.965	1.92	2.479	0.99	14.19	50.544	P18
19	Gauri Shankar Marga	28.809	1.92	3.122	0.99	15.2	50.041	P19
20	Shahid Marga	30.281	1.92	3.415	0.99	13.13	49.736	P20
21	Shital Marga	27.824	1.92	2.526	0.99	16.05	49.310	P21
22	Bagaicha Marga	30.57	0.72	2.811	0.99	14.15	49.241	P22
23	Bijay Marga	31.159	0.72	2.32	2.27	12.58	49.049	P23
24	Devi Marga	28.338	1.92	3.652	0.99	13.92	48.820	P24
25	Godhar Gaun Marga	29.75	0.72	1.754	2.27	12.97	47.464	P25
26	Bidhyalaya Marga	29.396	0.72	2.348	2.27	12.58	47.314	P26
27	Sidhhi Ganesh Marga	28.989	1.92	2.389	0.99	12.97	47.258	P27
28	Radhe Marga	27.306	1.92	3.169	0.99	13.54	46.925	P28

CHAPTER 5: CONCLUSION AND RECOMMENDATION

This study evaluated the condition of selected roads segments in KMC using the Pavement Condition Index (PCI) and prioritized them using the Analytic Hierarchy Process (AHP). The PCI analysis showed that selected road segments are in fair to good condition. The AHP results indicated that pavement condition (0.385) , traffic volume (0.226) and social and political factors (0.216) are the most influential criteria, followed by age of last maintenance (0.10), and road width (0.072).

Among the sub-criteria, road width ≥ 7 m (0.653) has the highest importance within road width, while maintenance age > 4 years (0.674) indicates a greater need for maintenance. Under social and political factors, access to essential services (0.403) and Public Sensitivity (0.269) were the most significant aspects. These results demonstrate that combining pavement condition with functional and socio-service factors provides a more comprehensive basis for road maintenance prioritization.

Pavement condition evaluation in this study is based on visual distress surveys and does not incorporate structural assessment so further studies can include these parameters for a more comprehensive condition evaluation. Alternative multi-criteria decision-making techniques such as TOPSIS and fuzzy logic can be explored to compare outcomes with AHP approach to enhance the prioritization framework. Additionally, the integration of GIS-based spatial analysis can reduce subjectivity and improve the assessment of the social and political importance of road segments.

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APPENDIX A : AHP SURVEY FORM

AHP Survey Form – Urban Road Maintenance Priority Assessment

Surveyed By : Madhav Kafle

M.Sc in Transportation Engineering, Pulchowk Campus, IOE

Analytic Hierarchy Process (AHP) is a structured decision-making method that uses pairwise comparisons to determine the relative importance of criteria. In the following section, you are provided with tables that are used for this purpose. The criterion in the column A is to be compared with the criteria in column B. The score value can range from 1 to 9 and their meanings are explained in the Table 1 below. AHP Model for the study is as shown in Figure 1 below.

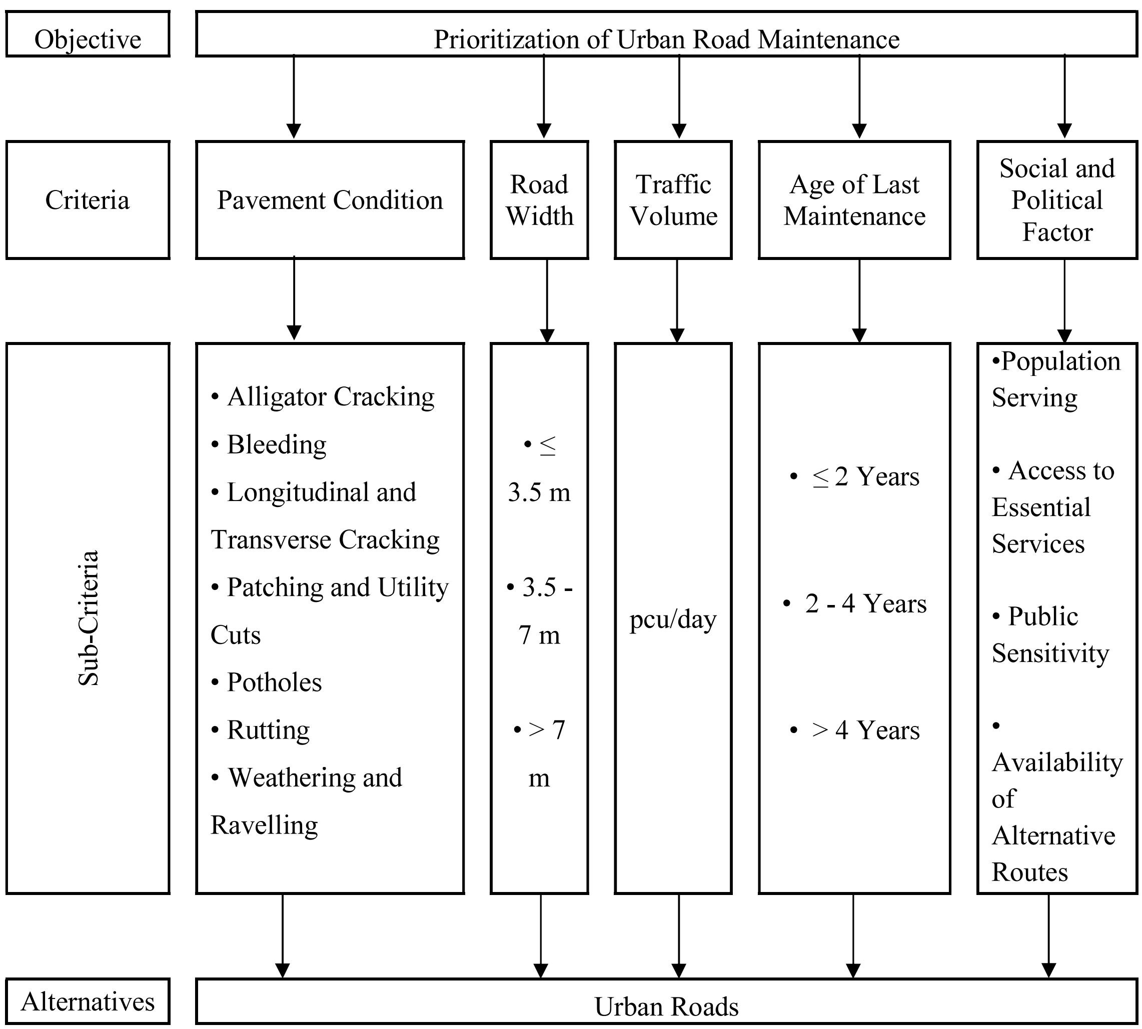

Figure 1: AHP model for the survey

Table 1 : Satty's 9 Point Scale of Importance

Score Value	Definition	Explanation
1	Equal Importance	Both criteria contribute equally
3	Moderate Importance	One criterion is moderately more important
5	Strong Importance	One criterion is strongly more important
7	Very Strong Importance	Dominance of one criterion proved in practice
9	Extreme Importance	The Highest order dominance of one element over another
2,4,6,8 can be used to express intermediate Values.		

Table 2 : Pairwise Comparison table for Main Criteria

Pairwise Comparison	More Important Criterion	Value (1–9)
Pavement Condition vs Road Width		
Pavement Condition vs Traffic Volume		
Pavement Condition vs Age of Last Maintenance		
Pavement Condition vs Social & Political Factor		
Road Width vs Traffic Volume		
Road Width vs Age of Last Maintenance		
Road Width vs Social & Political Factor		
Traffic Volume vs Age of Last Maintenance		
Traffic Volume vs Social & Political Factor		
Age of Last Maintenance vs Social & Political Factor		

Table 3 : Pairwise Comparison table for Sub-Criteria Road Width :

A	B	More Important (A or B ?)	Score (1-9)
≤ 3.5 m	3.5 - 7 m		
	≥ 7 m		
3.5 - 7 m	≥ 7 m		

Table 4 : Pairwise Comparison table for Sub-Criteria Pavement Condition

Criteria	Alligator	Bleeding	Depression	Long. & Trans. Cracking	Patching	Potholes	Rutting	Weathering & Ravelling
Alligator Cracking	1							
Bleeding		1						
Depression			1					
Long. & Trans. Cracking				1				
Patching & Utility Cuts					1			
Potholes						1		
Rutting							1	
Weathering & Ravelling								1

Table 5 : Pairwise Comparison table for Sub-Criteria Age of Last Maintenance

A	B	More Important (A or B ?)	Score (1-9)
Less than 2 Years	2-4 Years		
	Greater than 4 Years		
2-4 Years	Greater than 4 Years		

Table 6 : Pairwise Comparison table for Sub-Criteria Social and Political Factor

A	B	More Important (A or B ?)	Score (1-9)
Population Served	Access to essential Services		
	Public Sensitivity		
	Availablity of Alternative Routes		
Access to essential Services	Public Sensitivity		
	Availablity of Alternative Routes		
Public Sensitivity	Availablity of Alternative Routes		

Explanation:

Pavement Condition

Pavement condition represents the current physical state of the road surface, which is evaluated based on the type and severity of pavement distresses. The assessment includes common distress types such as alligator cracking, bleeding, longitudinal and transverse cracking, patching and utility cuts, potholes, rutting, and weathering and ravelling.

Road Width

Road width refers to the average width of the road measured along its length. It reflects the capacity and functional importance of the road.

Traffic Volume

Traffic volume represents the number of vehicles using the road, measured in Passenger Car Units per day (PCU/day).

Age of Last Maintenance

Age of last maintenance refers to the time elapsed since the most recent major maintenance intervention on the road. This includes both corrective maintenance activities such as patching and thin overlay, and major works such as rehabilitation or reconstruction.

Social and Political Factor

Social and political factors represent the importance of the road from a social and administrative perspective.

Population Served by the Road

Population served by the road refers to the number of people who benefit from or regularly use the road.

Accessibility to Essential Services

Accessibility to essential services indicates the importance of the road in providing access to key facilities such as commercial areas, educational centers, government offices, and health institutions.

Public Sensitivity

Public sensitivity reflects the level of concern or complaints raised by the public regarding the road condition.

Availability of Alternative Routes

Availability of alternative routes refers to the presence of other roads that can be used as substitutes if the road becomes unusable or deteriorated.

Respondant Information

Name :

Signature :

APPENDIX B: SOCIAL & POLITICAL SURVEY FORM

Survey Form: Social and Political Importance of Road Section

Surveyed By : Madhav Kafle

M.Sc in Transportation Engineering, Pulchowk Campus, IOE

Instructions: Please rate each parameter using the Likert scale below based on the importance of the road section.

Likert Scale: 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Very High

Name of the Road :

Location:

S.N	PARAMETER	STATEMENT	RATING
1	Population Served by the Road	Number of people who benefit from or regularly use the road.	
2	Accessibility to Essential Services	Access to key facilities such as commercial areas, educational centers, government offices, and health institutions.	
3	Public Sensitivity	Level of concern or complaints raised by the public regarding the road condition.	
4	Availability of Alternative Routes	Presence of other roads that can be used as substitutes if the road becomes unusable or deteriorated.	

Respondant Information :

Name :

Designation :

Signature :

APPENDIX C: PAIRWISE COMPARISON MATRIX

Pair-Wise Comparison Matrix : Main Criteria

Step I : Aggregation of Expert Judgments and Computation of Geometric Mean for Normalization

	PC : RW	PC:TV	PC:AM	PC:SP	RW:TV	RW:AM	RW:SP	TV:AM	TV:SP	AM:SP
R1	5	1	5	1/2	1/3	1/3	1/4	3	1/2	1/4
R2	5	3	7	3	1	3	1/3	5	1	1/5
R3	3	1	5	1/3	1/5	3	1/3	3	1	1/7
R4	5	3	5	3	1/3	1	1/5	4	3	1/5
R5	5	1/2	5	1/3	1/2	3	1/5	5	1/3	1/7
R6	5	3	3	3	1/5	1/3	1/3	3	3	1/3
R7	7	1	3	9	1/7	1/7	1/3	5	9	7
R8	9	5	1	1	1	1/3	1/3	1/3	1/3	1/3
R9	9	5	5	7	1/4	1/5	2	1/3	5	7
R10	3	3	3	1	1/3	1/3	1/3	5	1/3	1/5
Geometric Mean	5.251	1.998	3.777	1.576	0.349	0.628	0.35	2.441	1.223	0.431

Step II : Pair-wise Comparison Matrix based on Geometric Mean which represents collective judgment of all experts

	Pavement Condition	Road Width	Traffic Volume	Age of Last Maintenance	Social and Political Factor
Pavement Condition	1	5.251	1.998	3.777	1.576
Road Width	0.19	1	0.349	0.628	0.35
Traffic Volume	0.501	2.865	1	2.441	1.223
Age of Last Maintenance	0.265	1.592	0.41	1	0.431
Social and Political Factor	0.635	2.857	0.818	2.32	1

Pair-Wise Comparison Matrix : Sub – Criteria Road Width

RW1	≤ 3.5 m
RW2	3.5 - 7 m
RW3	≥ 7 m

	RW1:RW2	RW1:RW3	RW2:RW3
R1	1/3	1/5	1/3
R2	1/5	1/7	1/3
R3	1/3	1/5	1/3
R4	1/2	1/3	1/2
R5	1/3	1/5	1/3
R6	1/3	1/7	1/3
R7	1/3	1/7	1/3
R8	1/3	1/5	1/3
R9	1/3	1/5	1/3
R10	1/5	1/7	1/3
Geometric Mean	0.313	0.184	0.347

	≤ 3.5 m	3.5 - 7 m	≥ 7 m
≤ 3.5 m	1	0.313	0.184
3.5 - 7 m	3.195	1	0.347
≥ 7 m	5.435	2.882	1

Pair-Wise Comparison Matrix : Sub – Criteria Age of Last Maintenance

AM1	Less than 2 Years
AM2	2-4 Years
AM3	Greater than 4 Years

	AM1:AM2	AM1:AM3	AM2:AM3
R1	1/3	1/5	1/3
R2	1/5	1/7	1/3
R3	1/3	1/5	1/3
R4	1/3	1/7	1/3
R5	1/5	1/7	1/3
R6	1/3	1/7	1/3
R7	1/3	1/7	1/5
R8	1	1/5	1/5
R9	1/3	1/5	1/3
R10	1	1/5	1/5
Geometric Mean	0.375	0.169	0.286

	< 2 Years	2-4 Years	> 4 Years
< 2 Years	1	0.375	0.169
2-4 Years	2.667	1	0.286
> 4 Years	5.917	3.497	1

Pair-Wise Comparison Matrix : Sub – Criteria Social and Political Factor

SP1	Population Served
SP2	Access to essential Services
SP3	Public Sensitivity
SP4	Availablity of Alternative Routes

	SP1:SP2	SP1:SP3	SP1:SP4	SP2:SP3	SP2:SP4	SP3:SP4
R1	1/2	3	3	2	5	3
R2	1/3	1	5	3	5	3
R3	1	3	3	5	5	3
R4	1/3	1/3	1/3	1	3	3
R5	1/5	3	5	5	9	3
R6	3	1	3	1/3	5	5
R7	1/5	1/5	7	1	7	7
R8	1/3	1/5	3	1	5	7
R9	1	3	3	1	3	3
R10	1	1	1	1	1	1
Geometric Mean	0.543	1.008	2.601	1.479	4.215	3.351

	SP1	SP2	SP3	SP4
SP1	1	0.543	1.008	2.601
SP2	1.842	1	1.479	4.215
SP3	0.992	0.676	1	3.351
SP4	0.384	0.237	0.298	1

APPENDIX D: CONSISTENCY CHECK FOR INDIVIDUAL RESPONSES

<u>Expert 1</u>

Consistency Check for Main Criteria

Step I : From Pair Wise Comparison Matrix Compute Sum of Each Column

	Pavement Condition	Road Width	Traffic Volume	Age of Last Maintenance	Social and Political Factor
Pavement Condition	1.000	5.000	3.000	7.000	3.000
Road Width	0.200	1.000	1.000	3.000	0.333
Traffic Volume	0.333	1.000	1.000	5.000	1.000
Age of Last Maintenance	0.143	0.333	0.200	1.000	0.200
Social and Political Factor	0.333	3.003	1.000	5.000	1.000
Sum	2.009	10.336	6.200	21.000	5.533

Step II : Divide Each Cell by their respective Column Sum (Example for Road Width Vs Pavement Condition Cell : 0.2/2.009 = 0.1)

	Pavement Condition	Road Width	Traffic Volume	Age of Last Maintenance	Social and Political Factor
Pavement Condition	0.498	0.484	0.484	0.333	0.542
Road Width	0.1	0.097	0.161	0.143	0.06
Traffic Volume	0.166	0.097	0.161	0.238	0.181
Age of Last Maintenance	0.071	0.032	0.032	0.048	0.036
Social and Political Factor	0.166	0.291	0.161	0.238	0.181
Sum	1.001	1	1	1	1

Step III : Compute Eigen Value and Check For Consistency

	PC	RW	TV	AM	SP	Average	λ	λ_{max}	CI	RI	CR	
PC	0.498	0.484	0.484	0.333	0.542	**0.468**	5.265	5.265	0.066	1.12	0.059	Ok
RW	0.1	0.097	0.161	0.143	0.06	**0.112**	5.139					
TV	0.166	0.097	0.161	0.238	0.181	**0.169**	5.112					
AM	0.071	0.032	0.032	0.048	0.036	**0.044**	5.078					
SP	0.166	0.291	0.161	0.238	0.181	**0.207**	5.257					
Sum	1.001	1	1	1	1							

Consistency Check for Sub Criteria : Road Width

	≤ 3.5 m	3.5 - 7 m	≥ 7 m
≤ 3.5 m	1	0.2	0.14
3.5 - 7 m	5	1	0.33
≥ 7 m	7	3	1
Sum	13	4.2	1.47

n= 3

	≤ 3.5 m	3.5 - 7 m	≥ 7 m	Average	λ	λ_{max}	CI	RI	CR	
≤ 3.5 m	0.077	0.048	0.095	0.073	3.008	3.107	0.054	0.58	0.093	Ok
3.5 - 7 m	0.385	0.238	0.224	0.282	3.048					
≥ 7 m	0.538	0.714	0.68	0.644	3.107					
Sum	1	1	1							

Consistency Check for Sub Criteria : Age of Last Maintenance

	< 2 Years	2-4 Years	> 4 Years
< 2 Years	1	0.2	0.14
2-4 Years	5	1	0.33
> 4 Years	7	3	1
Sum	13	4.2	1.47

n= 3

	< 2	2-4	> 4	Average	λ	λ_{max}	CI	RI	CR	
< 2	0.077	0.048	0.095	0.073	3.008	3.107	0.054	0.58	0.093	Ok
2-4	0.385	0.238	0.224	0.282	3.048					
> 4	0.538	0.714	0.68	0.644	3.107					
Sum	1	1	1							

Consistency Check for Sub Criteria : Social and Political Factor

	Population Serving	Access to Essential Services	Public Sensitivity	Availability of Alternative Routes
Population Serving	1	0.33	1	5
Access to Essential Services	3	1	3	5
Public Sensitivity	1	0.333	1	3
Availability of Alternative Routes	0.2	0.2	0.333	1
Sum	5.2	1.866	5.333	14

n= 4

	SP1	SP2	SP3	SP4	Average	λ	λ_{max}	CI	RI	CR	
SP1	0.192	0.179	0.188	0.357	**0.229**	4.111	4.181	0.06	0.9	0.067	Ok
SP2	0.577	0.536	0.563	0.357	**0.508**	4.181					
SP3	0.192	0.178	0.188	0.214	**0.193**	4.151					
SP4	0.038	0.107	0.062	0.071	**0.07**	4.024					
Sum	1.00	1.00	1.00	1.00							

Expert 2

Consistency Check for Main Criteria

Step I : From Pair Wise Comparison Matrix Compute Sum of Each Column

	Pavement Condition	Road Width	Traffic Volume	Age of Last Maintenance	Social and Political Factor
Pavement Condition	1.000	9.000	5.000	1.000	1.000
Road Width	0.111	1.000	1.000	0.333	0.333
Traffic Volume	0.200	1.000	1.000	0.333	0.333
Age of Last Maintenance	1.000	3.000	3.000	1.000	0.333
Social and Political Factor	1.000	3.000	3.000	3.000	1.000
Sum	3.311	17.000	13.000	5.667	3.000

Step II : Divide Each Cell by their respective Column Sum (Example for Road Width Vs Pavement Condition Cell : 0.111/3.311 = 0.034)

	Pavement Condition	Road Width	Traffic Volume	Age of Last Maintenance	Social and Political Factor
Pavement Condition	0.302	0.529	0.385	0.176	0.333
Road Width	0.034	0.059	0.077	0.059	0.111
Traffic Volume	0.06	0.059	0.077	0.059	0.111
Age of Last Maintenance	0.302	0.176	0.231	0.176	0.111
Social and Political Factor	0.302	0.176	0.231	0.529	0.333
Sum	1	1	1	0.999	1

Step III : Compute Eigen Value and Check For Consistency

	PC	RW	TV	AM	SP	Average	λ	λ_{max}	CI	RI	CR	
PC	0.302	0.529	0.385	0.176	0.333	**0.345**	5.319	5.386	0.097	1.12	0.087	Ok
RW	0.034	0.059	0.077	0.059	0.111	**0.068**	5.151					
TV	0.06	0.059	0.077	0.059	0.111	**0.073**	5.219					
AM	0.302	0.176	0.231	0.176	0.111	**0.199**	5.386					
SP	0.302	0.176	0.231	0.529	0.333	**0.314**	5.347					
Sum	1	1	1	0.999	1							

Consistency Check for Sub Criteria : Road Width

	≤ 3.5 m	3.5 - 7 m	≥ 7 m
≤ 3.5 m	1.00	0.33	0.20
3.5 - 7 m	3.00	1.00	0.33
≥ 7 m	5.00	3.00	1.00
Sum	9	4.333	1.533

n= 3

	≤ 3.5 m	3.5 - 7 m	≥ 7 m	Average	λ	λ_{max}	CI	RI	CR	
≤ 3.5 m	0.111	0.077	0.13	0.106	3.012	3.07	0.035	0.58	0.060	Ok
3.5 - 7 m	0.333	0.231	0.217	0.26	3.035					
≥ 7 m	0.556	0.692	0.652	0.633	3.07					
Sum	1	1	1							

Consistency Check for Sub Criteria : Age of Last Maintenance

	< 2 Years	2-4 Years	> 4 Years
< 2 Years	1.00	0.33	0.20
2-4 Years	3.00	1.00	0.33
> 4 Years	5.00	3.00	1.00
Sum	9	4.333	1.533

n= 3

	< 2	2-4	> 4	Average	λ	λ_{max}	CI	RI	CR	
< 2	0.111	0.077	0.13	0.106	3.012	3.07	0.035	0.58	0.06	Ok
2-4	0.333	0.231	0.217	0.26	3.035					
> 4	0.556	0.692	0.652	0.633	3.07					
Sum	1	1	1							

Consistency Check for Sub Criteria : Social and Political Factor

	Population Serving	Access to Essential Services	Public Sensitivity	Availability of Alternative Routes
Population Serving	1.00	1.00	1.00	1.00
Access to Essential Services	1.00	1.00	1.00	1.00
Public Sensitivity	1.00	1.00	1.00	1.00
Availability of Alternative Routes	1.00	1.00	1.00	1.00
Sum	4.00	4.00	4.00	4.00

n= 4

	SP1	SP2	SP3	SP4	Average	λ	λ_{max}	CI	RI	CR	
SP1	0.25	0.25	0.25	0.25	**0.25**	4	4	0	0.9	0.000	Ok
SP2	0.25	0.25	0.25	0.25	**0.25**	4					
SP3	0.25	0.25	0.25	0.25	**0.25**	4					
SP4	0.25	0.25	0.25	0.25	**0.25**	4					
Sum	1.00	1.00	1.00	1.00							

APPENDIX E : WEIGHT CALCULATIONS AND CONSISTENCY CHECK FOR AHP

Weightage Calculation : Main Criteria

Step I : From Pair Wise Comparison Matrix Compute Sum of Each Column

	Pavement Condition	Road Width	Traffic Volume	Age of Last Maintenance	Social and Political Factor
Pavement Condition	1	5.251	1.998	3.777	1.576
Road Width	0.19	1	0.349	0.628	0.35
Traffic Volume	0.501	2.865	1	2.441	1.223
Age of Last Maintenance	0.265	1.592	0.41	1	0.431
Social and Political Factor	0.635	2.857	0.818	2.32	1
Sum	2.591	13.565	4.575	10.166	4.58

Step II : Divide Each Cell by their respective Column Sum (eg: for cell : Pavement Condition Vs Road Width : 5.251/13.565 = 0.387)

	PC	RW	TV	AM	SP
PC	0.386	0.387	0.437	0.372	0.344
RW	0.073	0.074	0.076	0.062	0.076
TV	0.193	0.211	0.219	0.24	0.267
AM	0.102	0.117	0.09	0.098	0.094
SP	0.245	0.211	0.179	0.228	0.218
Sum	0.999	1	1	1	1

Step III : Compute Eigen Value and Check For Consistency

	PC	RW	TV	AM	SP	Average	λ	λ_{max}	CI	RI	CR	
PC	0.386	0.387	0.437	0.372	0.344	**0.385**	5.021	5.034	0.008	1.12	0.007	Ok
RW	0.073	0.074	0.076	0.062	0.076	**0.072**	5.034					
TV	0.193	0.211	0.219	0.24	0.267	**0.226**	5.015					
AM	0.102	0.117	0.09	0.098	0.094	**0.100**	5.025					
SP	0.245	0.211	0.179	0.228	0.218	**0.216**	5.014					
Sum	0.999	1	1	1	1	0.999						

Here , after dividing each cell by their respective column sum , cell value obtained is weightage and average value of row weights is computed which represents the weightage of the criteria . Example for Pavement Condition , Weightage = Average of (0.386,0.387,0.437,0.372,0.344) = 0.385

Then, the eigen value for each criteria is found. The eigen value for each criteria can be found by matrix multiplication of row matrix of pair wise comparison matrix and column matrix of average weight divided by corresponding weight.

For example, the eigen value for Pavement Condition criteria is found as:

λ=(1*0.385+5.251*0.072+1.998*0.226+3.777*0.10+1.576*0.216)/0.385= 5.021

Similarly, other eigen values for other criterias are found. The maximum value among these values is λ_{max}.

Now, CI is calculated from the formula Equation 3.5 . Here, the value of n is 5.

CI = (5.034-5)/(5-1) = 0.008

The random index for the value of n=5 is taken from table 3.2.

Here, RI = 1.12

Then using CR= CI/RI = 0.008/1.12 = 0.007 < 0.1, Hence the data is consistent and no further calculation is required.

In Similar way , Weightage of each sub criterion is computed.

Sub Criteria : Road Width

	≤ 3.5 m	3.5 - 7 m	≥ 7 m
≤ 3.5 m	1	0.313	0.184
3.5 - 7 m	3.195	1	0.347
≥ 7 m	5.435	2.882	1
Sum	9.63	4.195	1.531

n= 3

	≤ 3.5 m	3.5 - 7 m	≥ 7 m	Average	λ	λ_{max}	CI	RI	CR	
≤ 3.5 m	0.104	0.075	0.12	**0.1**	3.001	3.063	0.032	0.58	0.055	Ok
3.5 - 7 m	0.332	0.238	0.227	**0.266**	3.029					
≥ 7 m	0.564	0.687	0.653	**0.635**	3.063					
Sum	1	1	1	1.001						

Sub Criteria : Age of Last Maintenance

	< 2	2-4	> 4
< 2	1	0.375	0.169
2-4	2.667	1	0.286
> 4	5.917	3.497	1
Sum	9.584	4.872	1.455

n= 3

	< 2	2-4	> 4	Average	λ	λ_{max}	CI	RI	CR	
< 2	0.104	0.077	0.116	**0.099**	3.01	3.047	0.024	0.58	0.041	Ok
2-4	0.278	0.205	0.197	**0.227**	3.012					
> 4	0.617	0.718	0.687	**0.674**	3.047					
Sum	0.999	1	1	1						

Sub Criteria : Social and Political Factor

	SP1	SP2	SP3	SP4
SP1	1	0.543	1.008	2.601
SP2	1.842	1	1.479	4.215
SP3	0.992	0.676	1	3.351
SP4	0.384	0.237	0.298	1
Sum	4.218	2.456	3.785	11.167

n= 4

	SP1	SP2	SP3	SP4	Average	λ	λ_{max}	CI	RI	CR	
SP1	0.237	0.221	0.266	0.233	**0.239**	4.019	4.019	0.006	0.9	0.007	Ok
SP2	0.437	0.407	0.391	0.377	**0.403**	4.01					
SP3	0.235	0.275	0.264	0.3	**0.269**	4.003					
SP4	0.091	0.096	0.079	0.09	**0.089**	4.005					
Sum	1.00	1.00	1.00	1.00	1						

APPENDIX F : SUMMARY OF DATA

Road Width

S.N	Name of the Road	Road Length (m)	Average Road Width (m)
1	Rani Devi Marga	761.22	6.03
2	Tilingtar Marga	891.61	6.86
3	Jaldhara Marga	805.54	5.09
4	Aanandamaya Marga	898.47	5.14
5	Lamtangin Marga	2147.40	5.77
6	Shital Marga	747.13	5.66
7	Bijay Marga	503.37	3.7
8	Bidhyalaya Marga	506.79	3.76
9	Bagaicha Marga	583.97	3.77
10	Kichandwo Marga	639.78	5.2
11	Gyanodaya Marga	1526.16	5.95
12	Tahachal Marga	2137.58	6.36
13	Link Marga	1837.07	5.32
14	Sidhhi Ganesh Marga	1228.85	6.27
15	Sunar Gaun Marga	917.51	4.47
16	Gauri Shankar Marga	986.36	5.35
17	Kuleshwor Aawas Marga	1658.72	6.16
18	Godhar Gaun Marga	784.54	3.82
19	Bishnumati Corridor (Shobha Bhagwati -Balaju)	1456.20	8.26
20	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	1080.65	9.75
21	Alka Basti Marga	498.60	3.68
22	Chetanshil Marga	696.20	5.24
23	Dakshinkali Marga	566.30	4.05
24	Tribeni Marga	341.20	4.63
25	Radhe Marga	511.98	5.38
26	Devi Marga	360.68	5.24
27	Gyaneshwor Marga	511.93	5.32
28	Shahid Marga	503.17	5.08

Traffic Volume

S.N.	Name of Road	Daily Traffic Volume				Daily Traffic Volume (PCU)
		Motorcycle , Bicycle	Car , SUV , Light Van	Light Truck , Tractor	Truck , Bus , Mini Bus	
		0.5	1	1.5	3	
1	Rani Devi Marga	13671	3236	28	6	10131.50
2	Tilingtar Marga	10072	1179	37	24	6342.50
3	Jaldhara Marga	3113	935	16	2	2521.50
4	Aanandamaya Marga	3475	982	17	4	2757.00
5	Lamtangin Marga	3831	1044	28	7	3022.50
6	Shital Marga	2069	556	20	4	1632.50
7	Bijay Marga	2379	307	2	0	1499.50
8	Bidhyalaya Marga	2458	284	3	0	1517.50
9	Bagaicha Marga	2765	427	5	0	1817.00
10	Kichandwo Marga	2722	438	38	3	1865.00
11	Gyanodaya Marga	11376	2012	51	45	7911.50
12	Tahachal Marga	13930	2994	54	37	10151.00
13	Link Marga	4337	944	57	8	3222.00
14	Sidhhi Ganesh Marga	2247	355	32	6	1544.50
15	Sunar Gaun Marga	2774	568	24	5	2006.00
16	Gauri Shankar Marga	2954	472	28	9	2018.00
17	Kuleshwor Aawas Marga	3983	1138	39	8	3212.00
18	Godhar Gaun Marga	1506	378	2	0	1134.00
19	Bishnumati Corridor (Shobha Bhagwati - Balaju)	19886	3885	324	98	14608.00

S.N.	Name of Road	Daily Traffic Volume				Daily Traffic Volume (PCU)
		Motorcycle , Bicycle	Car , SUV , Light Van	Light Truck , Tractor	Truck , Bus , Mini Bus	
		0.5	1	1.5	3	
20	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	12414	2906	303	73	9786.50
21	Alka Basti Marga	4426	239	3	7	2477.50
22	Chetanshil Marga	2284	373	34	12	1602.00
23	Dakshinkali Marga	2348	214	18	7	1436.00
24	Tribeni Marga	2173	198	9	4	1310.00
25	Radhe Marga	2514	764	14	2	2048.00
26	Devi Marga	2857	878	32	2	2360.50
27	Gyaneshwor Marga	3057	772	11	4	2329.00
28	Shahid Marga	2708	804	19	7	2207.50

Age of Last Maintenance

S.N	Name of the Road	Age of last maintenance (Years)
1	Rani Devi Marga	2-4
2	Tilingtar Marga	< 2
3	Jaldhara Marga	< 2
4	Aanandamaya Marga	< 2
5	Lamtangin Marga	< 2
6	Shital Marga	< 2
7	Bijay Marga	2-4
8	Bidhyalaya Marga	2-4
9	Bagaicha Marga	< 2
10	Kichandwo Marga	2-4
11	Gyanodaya Marga	2-4
12	Tahachal Marga	2-4
13	Link Marga	> 4
14	Sidhhi Ganesh Marga	< 2

S.N	Name of the Road	Age of last maintenance (Years)
15	Sunar Gaun Marga	2-4
16	Gauri Shankar Marga	< 2
17	Kuleshwor Aawas Marga	2-4
18	Godhar Gaun Marga	2-4
19	Bishnumati Corridor (Shobha Bhagwati -Balaju)	< 2
20	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	< 2
21	Alka Basti Marga	2-4
22	Chetanshil Marga	< 2
23	Dakshinkali Marga	2-4
24	Tribeni Marga	< 2
25	Radhe Marga	< 2
26	Devi Marga	< 2
27	Gyaneshwor Marga	< 2
28	Shahid Marga	< 2

Social and Political Factor

S.N	Name of the Road	Population Served by the Road	Accessibility to Essential Services	Public Sensitivity	Availability of Alternative Routes
1	Rani Devi Marga	4.6	4.4	3.6	4
2	Tilingtar Marga	4.4	3.8	4.4	3.4
3	Jaldhara Marga	3.6	3.4	3	2
4	Aanandamaya Marga	3.8	3.4	2.6	4.4
5	Lamtangin Marga	4.2	3.8	4.4	2.4
6	Shital Marga	3.4	3.6	3.6	1.6
7	Bijay Marga	3	2.4	2.4	3.6

S.N	Name of the Road	Population Served by the Road	Accessibility to Essential Services	Public Sensitivity	Availability of Alternative Routes
8	Bidhyalaya Marga	3	2.4	2.4	3.6
9	Bagaicha Marga	3	3	2.6	4
10	Kichandwo Marga	3	2.4	2.6	4
11	Gyanodaya Marga	4.6	4.6	3.6	4.6
12	Tahachal Marga	4.6	4.6	3.6	4.6
13	Link Marga	4.6	4.6	3.6	3
14	Sidhhi Ganesh Marga	3	2.6	2.6	3
15	Sunar Gaun Marga	3.6	2.6	2.6	3.2
16	Gauri Shankar Marga	3.6	3	3.2	3
17	Kuleshwor Aawas Marga	3.6	3	3.2	3
18	Godhar Gaun Marga	3	2.6	2.6	3
19	Bishnumati Corridor (Shobha Bhagwati - Balaju)	3.6	4	3.6	2.4
20	Lekhnath Sadak (Balaju Chowk - Bypass Chowk)	4.6	4	4.2	2.2
21	Alka Basti Marga	4	3.6	3	4.6
22	Chetanshil Marga	3.2	3	2.4	4.2
23	Dakshinkali Marga	3.6	3	2.4	4
24	Tribeni Marga	3.2	3	2.2	4
25	Radhe Marga	3	2.4	3	4
26	Devi Marga	3	2.6	3	4
27	Gyaneshwor Marga	3	3.4	3.4	4.2
28	Shahid Marga	3	2.6	2.4	4

Social and Political Factor Survey

Name of the Road : Alka Basti Marga
Location : KMC 26

S.N	PARAMETER	R1	R2	R3	R4	R5	AVERAGE RATING
1	Population Served by the Road	4	4	4	4	4	4.000
2	Accessibility to Essential Services	4	3	4	4	3	3.600
3	Public Sensitivity	2	4	3	3	3	3.000
4	Availability of Alternative Routes	5*	5	5	4	4	4.500

5* : Reverse Rating : (Max Rating+1)-(Actual Rating)

Name of the Road : Chetanshil Marga
Location : KMC 26

S.N	PARAMETER	R1	R2	R3	R4	R5	AVERAGE RATING
1	Population Served by the Road	4	3	3	3	3	3.200
2	Accessibility to Essential Services	3	3	3	3	3	3.000
3	Public Sensitivity	2	3	2	2	3	2.400
4	Availability of Alternative Routes	5	4	4	4	4	4.200

Name of the Road : Dakshinkali Marga
Location : KMC 26

S.N	PARAMETER	R1	R2	R3	R4	R5	AVERAGE RATING
1	Population Served by the Road	4	4	4	3	3	3.600
2	Accessibility to Essential Services	3	3	3	3	3	3.000
3	Public Sensitivity	2	3	3	2	2	2.400
4	Availability of Alternative Routes	4	4	4	4	4	4.000

Name of the Road : Tribeni Marga
Location : KMC 26

S.N	PARAMETER	R1	R2	R3	R4	R5	AVERAGE RATING
1	Population Served by the Road	4	3	3	3	3	3.200
2	Accessibility to Essential Services	3	3	3	3	3	3.000
3	Public Sensitivity	2	3	2	2	2	2.200
4	Availability of Alternative Routes	4	4	4	4	4	4.000

APPENDIX G : PCI CALCULATION

Name of the Road : Alka Basti Marga KMC 26

Chainage : **0+000 - 0+100 m**

Length of Section = **100** **m** **Average Width of Section =** **3.75** **m** **Area=** **375** **Sq.m**

Distress Type	**Severity Level**	**Quantity**							**Total**	**Density (%)**	**Deduct Value**
Bleeding	Low	0.24							0.24	0.06	0
Potholes	Low	1.00							1.00	0.27	6
Weathering and Ravelling	Low	0.18	0.09	0.04	0.14	0.36			0.81	0.21	0
Weathering and Ravelling	High	0.09	0.04						0.13	0.03	0
Patching and Utility Cuts	Low	0.81							0.81	0.22	0

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV	6.00
PCI	**94.00**
Rating	**Good**

Chainage : **0+100 - 0+200 m**

Length of Section = **100** **m** **Average Width of Section =** **3.60** **m** **Area=** **360.00** **Sq.m**

Distress Type	**Severity Level**	**Quantity**	**Total**	**Density (%)**	**Deduct Value**

Weathering and Ravelling	Low	0.04	0.14	0.20	0.27	0.27	0.12		1.04	0.29	1
Patching and Utility Cuts	Low	0.64	0.64	0.64					1.92	0.53	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV	3.00
PCI	**97.00**
Rating	**Good**

Chainage : **0+200 - 0+300 m**

Length of Section = **100** **m** **Average Width of Section =** **3.60** **m** **Area=** **360.00** **Sq.m**

Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Weathering and Ravelling	Low	0.12	0.16	0.24					0.52	0.14	0
Weathering and Ravelling	Medium	0.14	2.50	1.00					3.64	1.01	9
Alligator Cracking	Low	0.09							0.09	0.03	0
Potholes	Low	1.00							1.00	0.28	5
Patching and Utility Cuts	Low	0.81	0.81	0.64					2.26	0.63	2

Since more than one individual deduct value is greater than 2 , maximum CDV is to be determined

m= 9.36 ≤ 10

#	Deduct Values			Total	q	CDV
1	9.00	5.00	2.00	16.00	2.00	10.00
2	9.00	2.00	2.00	13.00	1.00	12.00

Max CDV 12.00
PCI **88.00**
Rating **Good**

Chainage : **0+300 - 0+400 m**

Length of Section = **100** **m** **Average Width of Section =** **3.73** **m** **Area=** **373.00** **Sq.m**

Distress Type	**Severity Level**	**Quantity**							**Total**	**Density (%)**	**Deduct Value**
Weathering and Ravelling	Low	0.60	0.36						0.96	0.26	0
Weathering and Ravelling	Medium	0.90							0.90	0.24	5
Patching and Utility Cuts	Low	0.81	0.81	0.64	0.64	0.64	0.64	0.64	4.82	1.29	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV 7.00
PCI **93.00**
Rating **Good**

Chainage : **0+400 - 0+498.6 m**

Length of Section = **98.6** **m** **Average Width of Section =** **3.73** **m** **Area=** **367.78** **Sq.m**

Distress Type	**Severity Level**	**Quantity**							**Total**	**Density (%)**	**Deduct Value**
Weathering and Ravelling	Low	0.68							0.68	0.18	0
Weathering and Ravelling	Medium	1.35	1.80						3.15	0.86	8
Bleeding	Low	0.10							0.10	0.03	0
Patching and Utility Cuts	Low	0.64	0.81	0.64	0.81	0.64	0.81	0.64	4.99	1.36	3

Since more than one individual deduct value is greater than 2 , maximum CDV is to be determined

m= 9.45 ≤ 10

#	Deduct Values		Total	q	CDV
1	8.00	3.00	11.00	2.00	9.00
2	8.00	2.00	10.00	1.00	10.00

Max CDV 10.00
PCI **90.00**
Rating **Good**

Name of the Road : Tribeni Marga KMC 26

Chainage : **0+000 - 0+100 m**

Length of Section = 100 m **Average Width of Section = 4.65 m** **Area= 465 Sq.m**

Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Patching and Utility Cuts	Low	0.64	0.64	0.64					1.92	0.41	0
Patching and Utility Cuts	High	3.85	3.36	0.18	0.56				7.95	1.71	25

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV	25.00
PCI	**75.00**
Rating	**Satisfactory**

Chainage : **0+100 - 0+200 m**

Length of Section = 100 m **Average Width of Section = 4.70 m** **Area= 470.00 Sq.m**

Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Patching and Utility Cuts	Low	0.64	0.64	0.36	0.64	0.64			2.92	0.62	2
Patching and Utility Cuts	High	0.36	0.09						0.45	0.10	8

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV	10.00
PCI	**90.00**
Rating	**Good**

Chainage : **0+200 - 0+300 m**

Length of Section = **100** **m** **Average Width of Section =** **4.70** **m** **Area=** **470.00** **Sq.m**

Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Alligator Cracking	High	0.80	0.96						1.76	0.37	19
Alligator Cracking	Low	0.80							0.80	0.17	3
Patching and Utility Cuts	Low	0.64	0.64	0.64	0.64	0.64			3.20	0.68	2
Patching and Utility Cuts	High	0.81	0.72	0.64					2.17	0.46	12

Since more than one individual deduct value is greater than 2 , maximum CDV is to be determined

m= 8.44 ≤ 10

#	Deduct Values				Total	q	CDV
1	19.00	12.00	3.00	2.00	36.00	3.00	22.00
2	19.00	12.00	2.00	2.00	35.00	2.00	28.00
3	19.00	2.00	2.00	2.00	25.00	1.00	26.00

Max CDV 28.00
PCI **72.00**
Rating **Satisfactory**

Chainage : **0+300 - 0+341.2 m**

Length of Section = **41.2** **m** **Average Width of Section =** **4.47** **m** **Area=** **184.16** **Sq.m**

Distress Type	**Severity Level**	**Quantity**							**Total**	**Density (%)**	**Deduct Value**
Alligator Cracking	Medium	0.11							0.11	0.06	8
Alligator Cracking	Low	0.60							0.60	0.33	5
Patching and Utility Cuts	Low	0.64	0.64						1.28	0.70	2
Patching and Utility Cuts	High	0.64	0.64	0.64	0.48	0.40			2.80	1.52	22

Since more than one individual deduct value is greater than 2 , maximum CDV is to be determined

m= 8.16 ≤ 10

#	Deduct Values				Total	q	CDV
1	22.00	8.00	5.00	2.00	37.00	3.00	22.00
2	22.00	8.00	2.00	2.00	34.00	2.00	24.00
3	22.00	2.00	2.00	2.00	28.00	1.00	28.00

Max CDV 28.00
PCI **72.00**

Rating **Good**

Name of the Road : Chetanshil Marga KMC 26

Chainage : **0+000 - 0+100 m**

Length of Section = **100** **m** **Average Width of Section =** **5.30** **m** **Area=** **530** **Sq.m**

Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Weathering and Ravelling	Low	3.00	2.40	3.20	6.00				14.60	2.75	3
Patching and Utility Cuts	Low	0.81	0.81	0.81	0.81	0.64			3.88	0.73	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV 5.00
PCI **95.00**
Rating **Good**

Chainage : **0+100 - 0+200 m**

Length of Section = **100** **m** **Average Width of Section =** **5.15** **m** **Area=** **515.00** **Sq.m**

Distress Type	Severity Level	Quantity	Total	Density (%)	Deduct Value

Weathering and Ravelling	Low	4.00	3.00						7.00	1.32	2
Longitudinal and Transverse Cracking	Low	5.00	4.00						9.00	1.70	4
Bleeding	Low	0.81							0.81	0.16	2
Patching and Utility Cuts	Low	0.81	0.64	0.81	0.64	0.81	0.81	0.81	5.33	1.03	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV	10.00
PCI	**90.00**
Rating	**Good**

Chainage : 0+200 - 0+300 m

Length of Section = 100 m Average Width of Section = 5.45 m Area= 545.00 Sq.m

Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Patching and Utility Cuts	Low	0.81	0.64	0.81	0.64	0.64			3.54	0.65	2
Patching and Utility Cuts	Medium	12.00	7.20						19.20	3.52	18
Patching and Utility Cuts	High	0.96							0.96	0.18	8
Weathering and Ravelling	Low	7.20	1.44						8.64	1.59	2

Since more than one individual deduct value is greater than 2 , maximum CDV is to be determined

m= 8.53 ≤ 10

#	Deduct Values				Total	q	CDV
1	18.00	8.00	2.00	2.00	30.00	2.00	22.00
2	18.00	2.00	2.00	2.00	24.00	1.00	24.00

Max CDV 24.00
PCI **76.00**
Rating **Satisfactory**

Chainage : **0+300 - 0+400 m**

Length of Section = **100** **m** **Average Width of Section =** **5.20** **m** **Area=** **520.00** **Sq.m**

Distress Type	**Severity Level**	**Quantity**							**Total**	**Density (%)**	**Deduct Value**
Weathering and Ravelling	Low	2.25	2.88	2.52					7.65	1.47	3
Patching and Utility Cuts	Low	0.64	0.64	0.81	0.64	0.64	0.81		4.18	0.80	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV 5.00
PCI **95.00**
Rating **Good**

Chainage : **0+400 - 0+500 m**

Length of Section = 100 m **Average Width of Section = 5.00 m** **Area= 500.00 Sq.m**

Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Weathering and Ravelling	Low	0.80	0.60	0.48	0.90				2.78	0.56	2
Weathering and Ravelling	Medium	3.36	0.88						4.24	0.85	8
Patching and Utility Cuts	Low	0.81	0.81	0.64	0.81	0.64			3.71	0.74	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV	12.00
PCI	**88.00**
Rating	**Good**

Chainage : **0+500 - 0+600 m**

Length of Section = 66.3 m **Average Width of Section = 5.00 m** **Area= 331.50 Sq.m**

Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Weathering and Ravelling	Low	0.64	1.20	1.80					3.64	1.10	3
Longitudinal and Transverse Cracking	Low	2.20							2.20	0.66	2

Patching and Utility Cuts	Low	0.64	0.81	0.64	0.81				2.90	0.87	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV	7.00
PCI	**93.00**
Rating	**Good**

Chainage : **0+600 - 0+696.2 m**

Length of Section = 96.2 m **Average Width of Section = 5.60 m** **Area= 538.72 Sq.m**

Distress Type	**Severity Level**	**Quantity**							**Total**	**Density (%)**	**Deduct Value**
Weathering and Ravelling	Low	0.75	1.20	0.24					2.19	0.41	2
Weathering and Ravelling	High	22.96	0.90						23.86	4.43	28
Alligator Cracking	Low	0.27	0.12						0.39	0.07	4
Longitudinal and Transverse Cracking	Low	1.80							1.80	0.33	0
Patching and Utility Cuts	Low	0.64	0.81	0.64					2.09	0.39	0

Since more than one individual deduct value is greater than 2 , maximum CDV is to be determined

m= 7.61 ≤ 10

#	Deduct Values	Total	q	CDV

M

1	28.00	4.00	2.00		34.00	2.00	26.00
2	28.00	2.00	2.00		32.00	1.00	30.00

Max CDV 30.00

PCI **70.00**

Rating **Fair**

Name of the Road : Dakshinkali Marga KMC 26

Chainage : **0+000 - 0+100 m**

Length of Section = **100** **m** **Average Width of Section =** **4.10** **m** **Area=** **410** **Sq.m**

Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Weathering and Ravelling	Medium	1.20	0.04						1.24	0.30	2
Weathering and Ravelling	Low	0.48							0.48	0.12	0
Patching and Utility Cuts	Low	2.79	0.81	0.64	0.64				4.88	1.19	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV 4.00

PCI **96.00**

Rating **Good**

Chainage : **0+100 - 0+200 m**

Length of Section = **100** **m** **Average Width of Section =** **4.10** **m** **Area=** **410.00** **Sq.m**

Distress Type	**Severity Level**	**Quantity**							**Total**	**Density (%)**	**Deduct Value**
Weathering and Ravelling	Medium	0.80							0.80	0.20	6
Weathering and Ravelling	Low	0.32	0.50						0.82	0.20	0
Patching and Utility Cuts	High	0.50							0.50	0.12	8
Patching and Utility Cuts	Low	0.81	0.81	0.81	0.81				3.24	0.79	2

Since more than one individual deduct value is greater than 2 , maximum CDV is to be determined

m= 9.45 ≤ 10

#	Deduct Values			Total	q	CDV
1	8.00	6.00	2.00	16.00	2.00	10.00
2	8.00	2.00	2.00	12.00	1.00	12.00

Max CDV 12.00
PCI **88.00**
Rating **Good**

Chainage : **0+200 - 0+300 m**

Length of Section = **100** **m** **Average Width of Section =** **3.96** **m** **Area=** **396.00** **Sq.m**

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Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Patching and Utility Cuts	Low	1.44	0.64	0.64	0.64	0.64	1.44	2.40	7.84	1.98	6
Weathering and Ravelling	Low	0.80	0.60	0.48					1.88	0.47	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV	8.00
PCI	**92.00**
Rating	**Good**

Chainage : **0+300 - 0+400 m**

Length of Section = **100** **m** **Average Width of Section =** **3.95** **m** **Area=** **395.00** **Sq.m**

Distress Type	Severity Level	Quantity							Total	Density (%)	Deduct Value
Weathering and Ravelling	Low	0.36	0.12	0.24					0.72	0.18	0
Patching and Utility Cuts	Low	0.64	0.64	0.64	0.64	0.64			3.20	0.81	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV	2.00
PCI	**98.00**
Rating	**Good**

Chainage : **0+400 - 0+500 m**

Length of Section = 100 m Average Width of Section = 3.90 m Area= 390.00 Sq.m

Distress Type	**Severity Level**	**Quantity**							**Total**	**Density (%)**	**Deduct Value**
Weathering and Ravelling	Low	0.80	0.60	0.48	0.90				2.78	0.71	2
Weathering and Ravelling	Medium	0.90	0.80						1.70	0.44	6
Patching and Utility Cuts	Low	0.81	0.81	0.64	0.81	0.64			3.71	0.95	2

Since only one individual deduct value is greater than 2 , total value is placed in place of maximum CDV

Max CDV 10.00

PCI 90.00

Rating Good

Chainage : 0+500 - 0+566.3 m

Length of Section = 66.3 m Average Width of Section = 4.34 m Area= 287.74 Sq.m

Distress Type	**Severity Level**	**Quantity**							**Total**	**Density (%)**	**Deduct Value**
Weathering and Ravelling	Low	0.48	1.20	0.30					1.98	0.69	2
Potholes	Low	1.00							1.00	0.35	8
Patching and Utility Cuts	High	0.48	2.00						2.48	0.86	18
Patching and Utility Cuts	Low	0.64	0.81	0.64	0.81	2.25			5.15	1.79	4

Since more than one individual deduct value is greater than 2 , maximum CDV is to be determined

m= 8.53 ≤ 10

#	Deduct Values				Total	q	CDV
1	18.00	8.00	4.00	2.00	32.00	3.00	18.00
2	18.00	8.00	2.00	2.00	30.00	2.00	22.00
3	18.00	2.00	2.00	2.00	24.00	1.00	26.00

Max CDV	26.00
PCI	**74.00**
Rating	**Satisfactory**

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