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INVESTIGATING THE CAUSES OF FREQUENT FAILURES IN FLEXIBLE PAVEMENTS ON HIGHWAYS IN BANGLADESH: A CASE STUDY OF THE DHAKA–SYLHET CORRIDOR

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Abstract—**Bangladesh's highway network is predominantly composed of flexible pavements, yet their durability is frequently undermined by premature failures driven by heavy axle loading and harsh climatic conditions. This research focuses on recurrent pavement distress along the Dhaka–Sylhet Highway (N2), a critical corridor for both domestic transportation and international trade. A mixed-methods approach was employed, combining field surveys, photographic evidence, and stakeholder consultations. Visual assessments of a 40 km segment identified widespread surface and structural defects, including rutting, alligator cracking, potholes, corrugation, bleeding, raveling, and localized depressions. Feedback from engineers, contractors, consultants, and road users highlighted dissatisfaction with existing maintenance practices, particularly deficiencies in drainage management and patch repairs. Analytical findings suggest that the principal causes of deterioration are axle overloading, inadequate drainage infrastructure, poor-quality construction materials, insufficient site supervision, and reliance on reactive rather than preventive maintenance. To address these challenges, the study recommends enforcing axle load regulations, modernizing drainage systems, implementing proactive maintenance programs, strengthening construction quality assurance, and adopting digital asset monitoring tools. Overall, the results emphasize the necessity of shifting toward a sustainable and data-driven pavement management system to enhance highway performance, safety, and long-term cost efficiency in Bangladesh.**

Keywords—**Watermarking, Haar Wavelet, DWT, PSNR**

I. INTRODUCTION

Road transport is the dominant mode of mobility in Bangladesh, carrying more than 90% of the nation's passenger and freight traffic. This makes the highway system critical not only for domestic connectivity but also for regional trade and economic growth. Among the different pavement types, flexible pavements are the most widely adopted in Bangladesh because of their relatively low initial construction costs and ease of repair. However, their actual performance often falls short of design expectations. Premature failures such as cracking, rutting, potholes, and surface bleeding are common, leading to higher vehicle operating costs, traffic delays, increased accident risks, and diminished transport efficiency.

The Dhaka–Sylhet Highway (N2), a 250 km strategic corridor, exemplifies these challenges. It connects the capital with Sylhet Division and plays a vital role in cross-border trade with India. Despite repeated rehabilitation and resurfacing projects, this highway continues to experience rapid deterioration. Sections frequently display distresses such as alligator cracking, corrugation, bleeding, and water-induced failures, which significantly reduce serviceability.

Flexible pavements are multilayered systems—comprising surface, base, and sub-base layers—that distribute vehicular loads to the subgrade (Singh, 1996). When stresses exceed the structural capacity of these layers, different forms of distress emerge, including cracking, rutting, raveling, bleeding, potholes, and depressions. Moisture intrusion is particularly

damaging, as it destabilizes the base and subgrade layers, accelerating structural breakdown (Woods & Adcox, 2004).
Global studies have consistently shown that deferred or inadequate maintenance leads to exponential increases in rehabilitation costs (Harral & Faiz, 1979). In many developing countries across Asia and Africa, pavement deterioration has been attributed to axle overloading, insufficient drainage, poor construction supervision, and reliance on reactive maintenance practices (Sikdar et al., 1999; Ayuba & Ojo, 2015). Preventive maintenance, by contrast, has been proven to extend service life and reduce long-term costs when applied at early stages of deterioration (Abdulkareem & Adeoti, 2010; Teravaninthorn et al., 2014).
In Bangladesh, premature pavement failures are strongly influenced by climatic conditions and construction-related shortcomings. Seasonal monsoon rainfall and waterlogging frequently damage pavement layers, while weak contractor supervision and substandard materials further reduce durability (Hasan & Sobhan, 2020). Maintenance practices remain largely reactive, focusing on pothole patching or emergency resurfacing rather than systematic preventive approaches (Hasan, 2020).

Against this backdrop, the present study seeks to:

- Identify and classify the types of pavement failures observed along the Dhaka–Sylhet Highway.
- Analyse the underlying causes of these recurrent failures.
- Assess stakeholder perspectives on current maintenance practices.
- Propose sustainable strategies for improving pavement design, construction quality, and maintenance management in the context of Bangladesh.

II. METHODOLOGY

This research employed a mixed-methods design integrating field inspections with stakeholder surveys, followed by comparative and statistical analysis. The combination of technical assessment and perceptual feedback was intended to provide a holistic understanding of pavement failures and the adequacy of maintenance practices along the Dhaka–Sylhet Highway (N2).

Field Survey

A 40 km stretch of the Dhaka–Sylhet Highway (Fig. 1) was selected for investigation, representing one of the most trafficked sections with recurrent maintenance interventions. The survey was carried out over a two-week period under dry-weather conditions to ensure visibility of surface distresses. The inspection process followed guidelines from the Pavement Distress Identification Manual (FHWA, 2012) and the Asphalt Institute (2007) standards, which are widely adopted in pavement performance studies. The observed distresses were classified based on their type, severity, and extent, with the primary categories being:

- Cracking: alligator, longitudinal, transverse, and slippage cracking
- Deformation: rutting, corrugation, depressions, and shoving
- Surface defects: potholes, bleeding, ravelling, and polished aggregate
- Moisture-related failures: stripping and water-induced weakening of subgrade

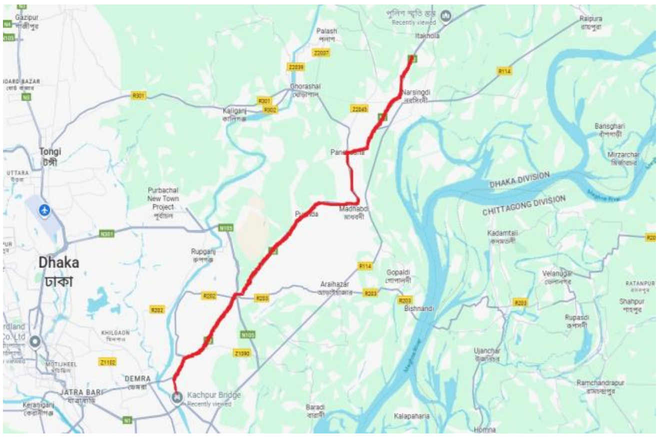

Fig. 1. Study location (40 km stretch) in the Dhaka–Sylhet Highway

Each distress was geo-tagged using GPS-enabled devices and documented with high-resolution photographs for later verification. The severity rating (low, medium, or high) and areal extent (in square meters or percentage of lane coverage) were recorded for quantitative assessment.

Questionnaire Survey

To complement the technical survey, a structured questionnaire was designed to capture the perspectives of stakeholders directly involved in pavement usage and management. The sampling targeted four groups: engineers from the Roads and Highways Department (RHD), contractors, consulting engineers, and frequent road users including commercial drivers and passengers.
A total of 117 questionnaires were distributed, and 100 valid responses were collected, yielding an effective response rate of 85.47 percent. The questionnaire consisted of both closed-ended and Likert-scale items, focusing on the following themes: respondents' duration of residence in the area to establish the credibility of their assessments; frequency and adequacy of roadside drainage maintenance; perceptions of general road maintenance activities such as cleaning, repair, and resurfacing; adequacy of line marking renewal and roadside guide posts; frequency of road signage maintenance; and overall satisfaction with the effectiveness of road maintenance practices. The design of the questionnaire was validated through expert review by three senior pavement engineers to ensure relevance and clarity. Pilot testing with 10

respondents allowed refinement of wording before full deployment.

Data Analysis and Ethical Considerations

Survey responses were systematically coded and analysed using SPSS (Version 26). Descriptive statistical techniques—including measures of central tendency, dispersion, and frequency distributions—were applied to identify overarching patterns in stakeholder perceptions. To further explore heterogeneity within the dataset, cross-tabulation analyses were conducted, enabling comparisons of perspectives between professional engineers and general road users. Findings from the field inspections were then integrated with the survey outcomes to examine the extent of alignment or divergence between objectively observed pavement conditions and subjective evaluations of maintenance performance. This triangulated strategy provided a comprehensive lens through which both technical deficiencies and institutional limitations could be assessed, thereby illuminating the complex and interdependent factors that constrain the sustainability of pavement infrastructure. All participants in the survey were informed of the study objectives, and responses were collected anonymously to ensure confidentiality. Participation was voluntary, and data were used solely for academic and research purposes.

III. RESULTS AND DISCUSSION

Observed Pavement Failures

The field survey documented a wide range of pavement distresses along the inspected 40 km section of the Dhaka–Sylhet Highway (Fig. 2). The defects observed were both structural and surface-related, reflecting weaknesses in design, construction, and maintenance practices.

The field survey identified a range of pavement distresses(Fig. 2), encompassing both structural and surface defects in the study sites. These failures largely stemmed from design limitations, construction flaws, poor drainage, and reliance on reactive rather than preventive maintenance. The main types of distress observed are summarized below:

- **Alligator cracking (8 sites):**These cracks typically develop from asphalt fatigue caused by repeated axle loading. Their occurrence indicates insufficient pavement thickness or degradation of the asphalt binder and aggregates, pointing to fatigue-related structural inadequacy.
- **Slippage cracking (7 sites):** Characterized by crescent-shaped cracks, these are generally associated with poor bonding between successive pavement layers. Such failures reflect deficiencies in construction quality control, particularly inadequate tack coat application.
- **Transverse cracking (10 sites):** These cracks are primarily linked to temperature variations and thermal stresses. Their presence indicates insufficient flexibility of the asphalt mixture or inadequate accommodation of thermal expansion and contraction.
- **Potholes (7 sites):** These originated from untreated cracks that allowed water infiltration, which progressively weakened the underlying layers. The process was exacerbated by ineffective drainage and delayed maintenance responses.

(a)

(b)

(c) (d)

(e) (f)

(g) (h)

Fig. 2. Photographs Presenting: (a) Alligator Cracking (Location: Ruposhi); (b) Slippage Cracking (Location: Madhubdi); (c) Transverse Cracking (Location: Ruporshi); (d) Pathholes (Location: Madhubdi); (e) Raveling (Location: Bhulta); (f) Bleeding (Location: Madhubdi); (g) Corrugation and Shoving (Location: Bhulta); & (h) Depression (Location: Ruposhi).

- **Raveling (10 locations):** Raveling, characterized by the gradual detachment of aggregate particles, occurs due to binder hardening and poor bonding between asphalt and aggregates. This progressive deterioration eventually causes surface disintegration and exposes the underlying base layer.
- **Bleeding (12 locations):** Bleeding results from excessive binder content combined with inadequate surface drainage, leading to binder migration upward. This forms a shiny, sticky film on the pavement surface, which significantly decreases skid resistance.
- **Corrugation and shoving (19 locations):** The most prevalent distress type, corrugation and shoving, arises from unstable asphalt layers subjected to shear deformation under repeated traffic loads. This not only compromises ride quality but also highlights severe deficiencies in mix stability.

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- **Depressions (6 sites):** These localized settlements were caused by weak or saturated subgrade soils, often aggravated by water accumulation and inadequate compaction during construction.

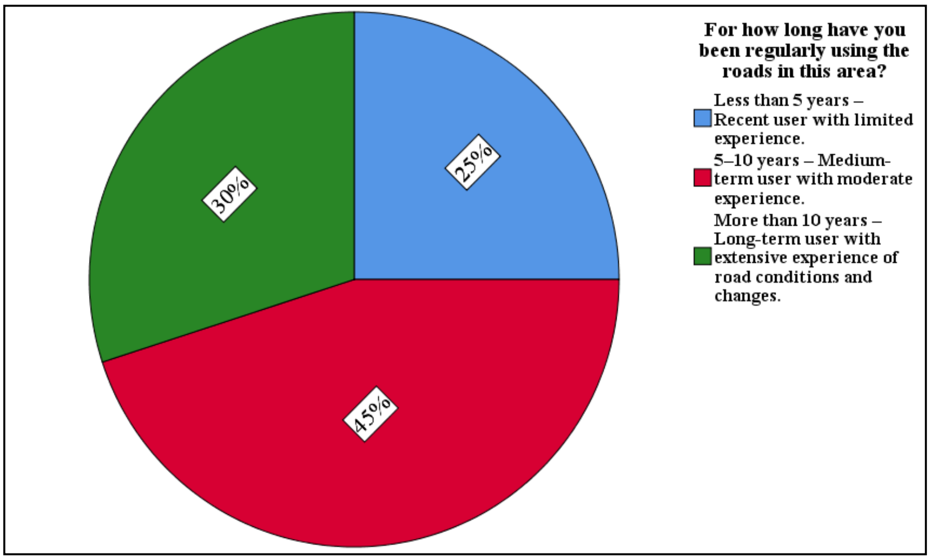
The dominance of corrugation, bleeding, and raveling suggests that pavement failures stem from deeper structural deficiencies rather than surface wear alone. These distresses point to poor material quality, weak construction practices, inadequate traffic regulation, and ineffective drainage. Similar studies in tropical, high-traffic regions also identify poor water management and axle overloading as key drivers of premature pavement deterioration (Ayuba and Ojo, 2015; Hasan and Sobhan, 2020).

Survey Findings

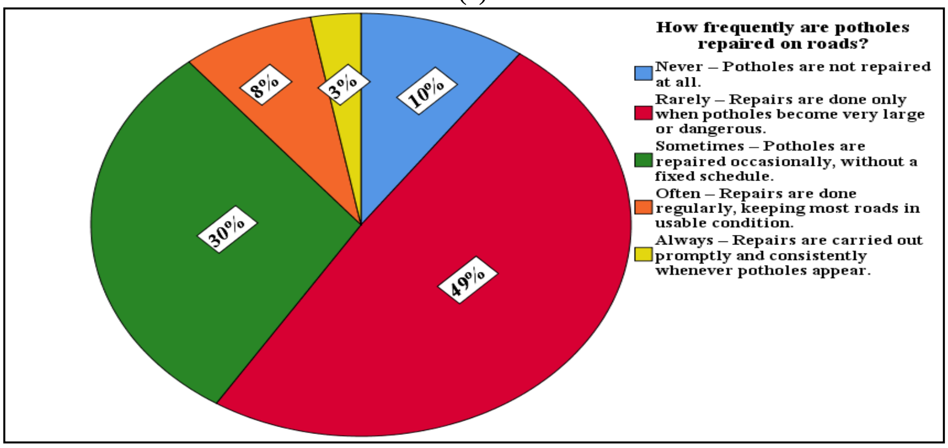
A structured questionnaire survey was administered to 100 stakeholders comprising engineers (15), contractors (17), consultants (19), and road users (49). The use of a five-point Likert scale allowed quantitative assessment of satisfaction with road maintenance practices and outcomes. The results reveal consistently low levels of satisfaction across critical indicators: Sealed roads: 2.27, Pothole repair: 2.25, Unsealed roads: 1.98 and Drainage: 1.95. These mean scores underscore a widespread perception of poor maintenance performance, with drainage and unsealed roads emerging as the weakest aspects. Equally concerning is the finding that only 51% of respondents were aware of official road management plans. This indicates not only deficiencies in implementation but also a lack of communication and transparency on the part of responsible agencies.

Questionnaire Results Illustrated through Pie Charts

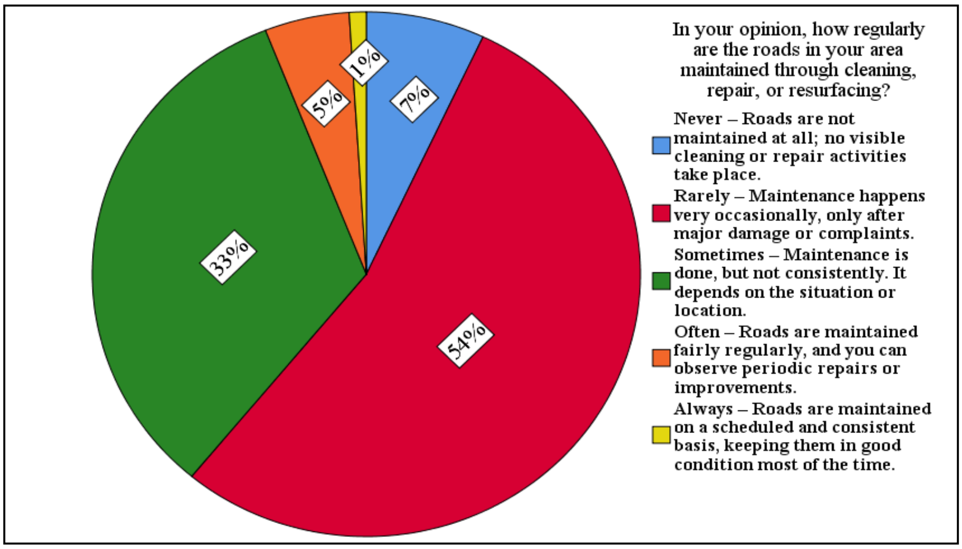
The distribution of stakeholder responses is further illustrated in the pie charts (Fig. 3), which provide granular insights into perceptions of maintenance effectiveness across several dimensions.



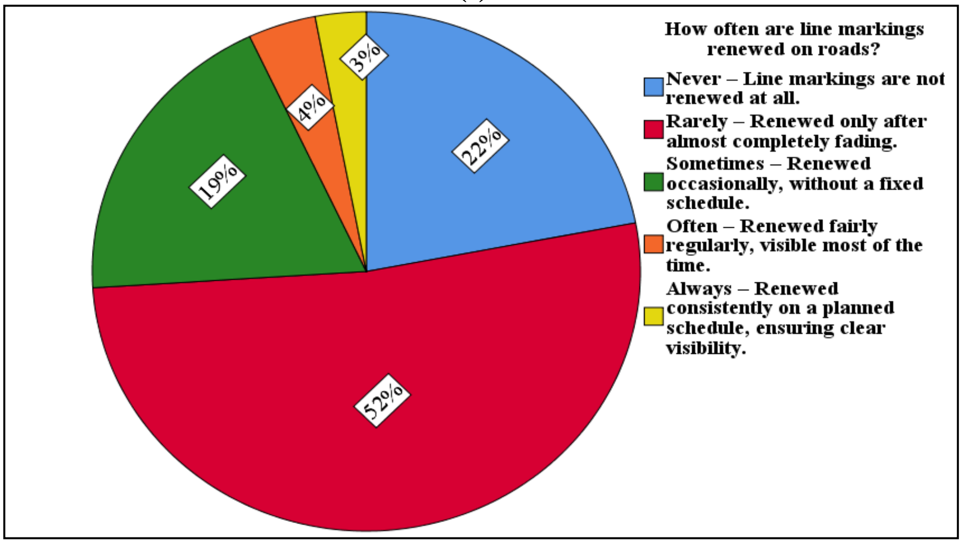
(a)



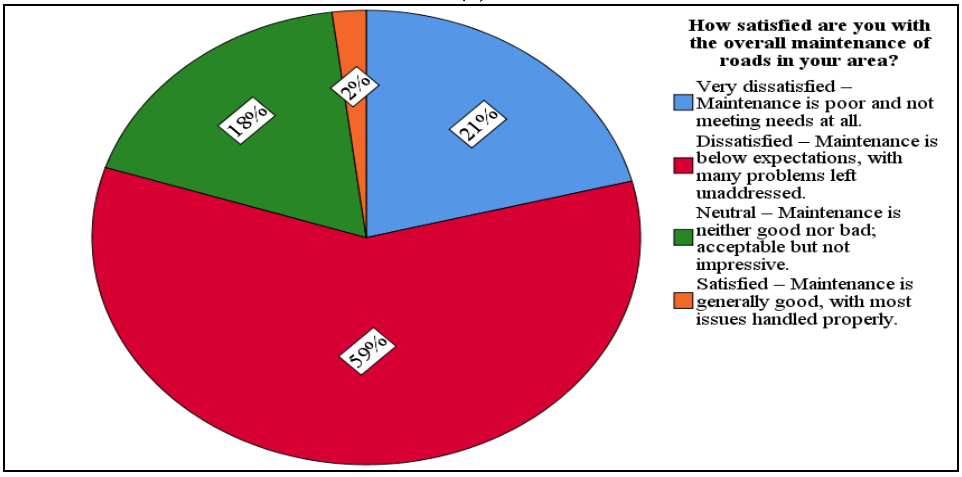
(b)


In your opinion, how regularly are the roads in your area maintained through cleaning, repair, or resurfacing?
Never – Roads are not maintained at all; no visible cleaning or repair activities take place.
Rarely – Maintenance happens very occasionally, only after major damage or complaints.
Sometimes – Maintenance is done, but not consistently. It depends on the situation or location.
Often – Roads are maintained fairly regularly, and you can observe periodic repairs or improvements.
Always – Roads are maintained on a scheduled and consistent basis, keeping them in good condition most of the time.
7%
54%
33%
5%
1%

(c)


How often are line markings renewed on roads?
Never – Line markings are not renewed at all.
Rarely – Renewed only after almost completely fading.
Sometimes – Renewed occasionally, without a fixed schedule.
Often – Renewed fairly regularly, visible most of the time.
Always – Renewed consistently on a planned schedule, ensuring clear visibility.
22%
52%
19%
4%
3%

(d)


How satisfied are you with the overall maintenance of roads in your area?
Very dissatisfied – Maintenance is poor and not meeting needs at all.
Dissatisfied – Maintenance is below expectations, with many problems left unaddressed.
Neutral – Maintenance is neither good nor bad; acceptable but not impressive.
Satisfied – Maintenance is generally good, with most issues handled properly.
21%
59%
18%
2%

(e)

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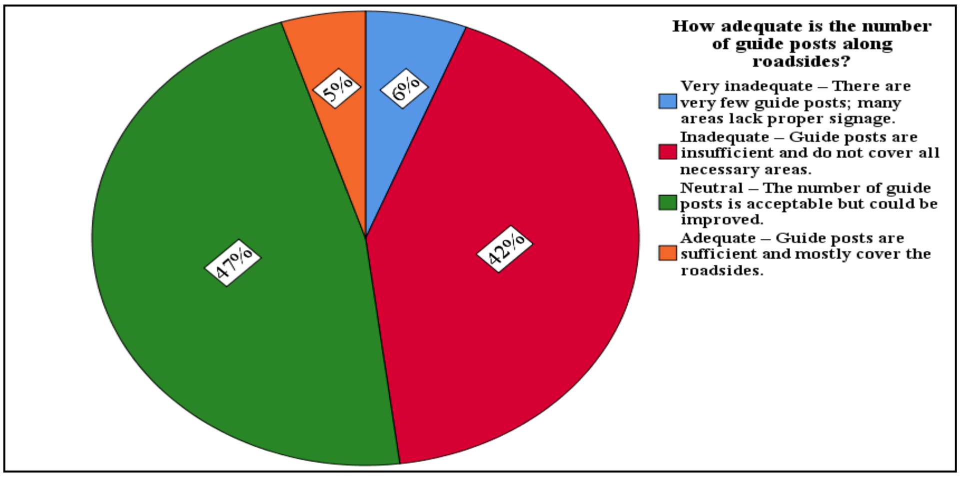
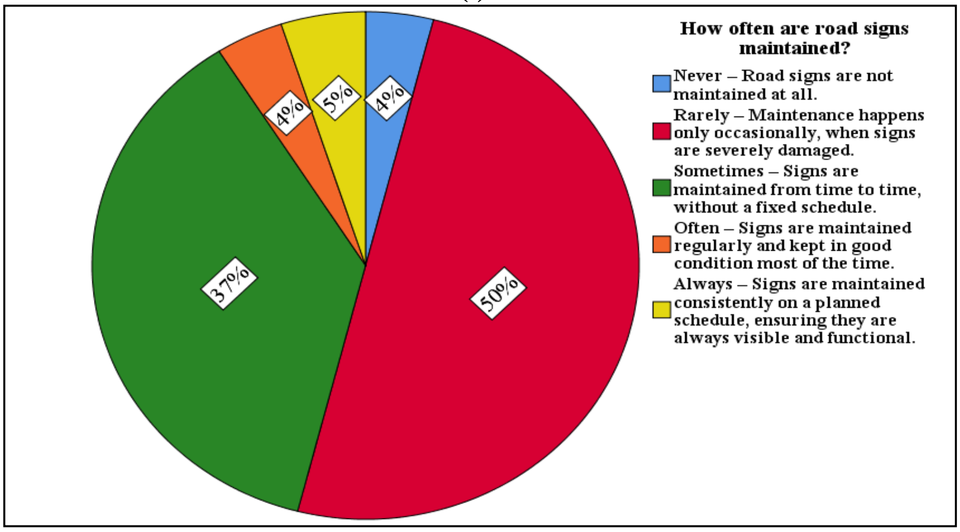
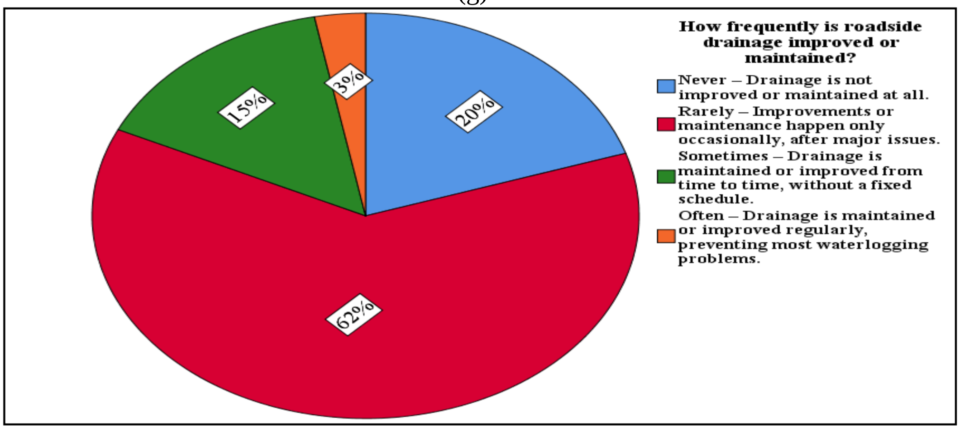


(f)



(g)



(h)

Fig. 3. Pie charts Presenting: (a) Duration of Residence in the Area; (b) Frequency of Roadside Drainage Improvement; (c) Frequency of General Road Maintenance; (d) Frequency of Line Marking Renewal; (e) Overall Satisfaction with Road Maintenance; (f) Adequacy of Roadside Guide Posts; (g) Frequency of Road Sign Maintenance; (h) Frequency of Roadside Drainage Maintenance.

Duration of Residence in the Area: More than half of the respondents (52%) reported living in their locality for over ten years, while 31% had resided for 5–10 years and only 17% for less than five years. Such prolonged exposure strengthens the reliability of their evaluations, as their views are shaped by sustained interaction with road conditions rather than short-term or incidental experiences.

Frequency of Roadside Drainage Improvement: Nearly half (48%) reported that roadside drainage is never maintained, with a further 22% indicating it is rarely addressed. Only 18% observed occasional maintenance, and just 12% believed drainage improvements occur regularly. These results confirm drainage as one of the most neglected components of maintenance.

Frequency of General Road Maintenance (Cleaning, Repair, Resurfacing): The majority (46%) described maintenance as irregular and inadequate, while 29% found it moderately adequate. Only 15% considered it regular and 10% very regular. Dissatisfaction with routine activities therefore dominates.

Frequency of Line Marking Renewal: About 43% reported that line markings are never renewed, 25% rarely, 20% occasionally, and only 12% regularly. This neglect directly undermines road safety by reducing visibility and guidance.

Overall Satisfaction with Road Maintenance: More than half of respondents (55%) expressed dissatisfaction, with 21% being highly dissatisfied. Only 16% were satisfied and 8% very satisfied, highlighting systemic discontent.

Adequacy of Roadside Guide Posts: Nearly half (49%) judged guide posts inadequate, 26% poor, 18% moderately adequate, and only 7% very adequate. This inadequacy compromises safe navigation, particularly in low-visibility conditions.

Frequency of Road Sign Maintenance: A majority (57%) reported that road signs are rarely maintained, 19% never, 17% occasionally, and only 7% regularly. Given the central role of signage in road safety, this neglect has serious implications.

Frequency of Roadside Drainage Maintenance: Consistent with earlier observations, 46% reported drainage is never maintained, 27% rarely, 19% occasionally, and only 8% regularly. This reiterates drainage as a critical point of failure.

Interpretation of Findings

The overall distribution of responses across the assessed categories reinforces the findings of the quantitative survey. Widespread dissatisfaction is evident across all aspects of pavement maintenance, with drainage systems, road signage, and line markings emerging as the most neglected components. The predominance of long-term residents in the sample further enhances the reliability of these insights, as their evaluations are informed by extensive and cumulative experience with roadway conditions rather than short-term observations.

Regression Analysis of Predictors of Satisfaction

To examine the factors influencing overall satisfaction, a regression model was developed incorporating specific maintenance activities as predictors.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.239[a]	.057	-.004	.690

a. Predictors: (Constant), How frequently is roadside drainage improved or maintained?, How often are road signs maintained?, How frequently are potholes repaired on roads?, How often are line markings renewed on roads?, In your opinion, how regularly are the roads in your area maintained through cleaning, repair, or resurfacing?, How adequate is the number of guide posts along roadsides?

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.687	6	.448	.940	.470[b]
	Residual	44.303	93	.476		
	Total	46.990	99			

a. Dependent Variable: How satisfied are you with the overall maintenance of roads in your area?

b. Predictors: (Constant), How frequently is roadside drainage improved or maintained?, How often are road signs maintained?, How frequently are potholes repaired on roads?, How often are line markings renewed on roads?, In your opinion, how regularly are the roads in your area maintained through cleaning, repair, or resurfacing?, How adequate is the number of guide posts along roadsides?

The model yielded an R^2 of 0.057, indicating that only 5.7% of the variance in satisfaction could be explained by the selected predictors. The adjusted R^2 was slightly negative (–0.004), and the ANOVA results (F = 0.940, p = 0.470) confirmed that the model lacked statistical significance.
At the individual predictor level:

- Line marking (β = 0.133, p = 0.237) and pothole repair (β = 0.105, p = 0.328) showed weak positive but insignificant effects.
- Guide posts (β = –0.120, p = 0.291) and drainage (β = –0.044, p = 0.667) exhibited weak negative associations, also insignificant.
- Road sign maintenance (β = –0.017, p = 0.870) and general road maintenance (β = 0.044, p = 0.677) demonstrated negligible influence.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1.921	.580		3.314	.001
	In your opinion, how regularly are the roads in your area maintained through cleaning, repair, or resurfacing?	.041	.099	.044	.417	.677
	How often are line markings renewed on roads?	.101	.085	.133	1.190	.237
	How frequently are potholes repaired on roads?	.081	.083	.105	.983	.328
	How adequate is the number of guide posts along roadsides?	-.120	.113	-.120	-1.063	.291
	How often are road signs maintained?	-.014	.084	-.017	-.164	.870
	How frequently is roadside drainage improved or maintained?	-.044	.101	-.044	-.431	.667

a. Dependent Variable: How satisfied are you with the overall maintenance of roads in your area?

The absence of statistically significant predictors indicates that satisfaction cannot be explained by routine maintenance activities considered in isolation. Instead, broader and more tangible outcomes—such as improved ride comfort, structural durability, drainage effectiveness, and safety performance—likely play a more decisive role in shaping stakeholder perceptions.

Discussion

The combined analysis of field inspections, stakeholder perceptions, and regression modeling provides a nuanced understanding of systemic weaknesses in pavement management along the Dhaka–Sylhet Highway. Field surveys identified extensive structural and surface-level failures, including corrugation, bleeding, raveling, alligator cracking, transverse and slippage cracks, potholes, and depressions. These failures indicate underlying issues in material quality, subgrade stability, asphalt mix design, and drainage provision.
Stakeholder survey responses mirror these technical deficiencies. Drainage systems, line markings, and road signage were consistently highlighted as the most neglected aspects of maintenance. Dissatisfaction levels were highest for pothole repairs, unsealed roads, and drainage, corroborating the field observations. Long-term residents, comprising the majority of respondents, reinforced the reliability of these perceptions, as their assessments are based on cumulative experience rather than isolated incidents.
Regression analysis further clarifies the relationship between maintenance activities and overall satisfaction. The model (R^2 = 0.057, p = 0.470) indicates that routine maintenance tasks—such as pothole repair, line marking renewal, and drainage improvement—explain only a small fraction of variance in satisfaction. Individual predictors showed weak or statistically insignificant associations, suggesting that overall perceptions of road quality are influenced more by tangible outcomes, such as ride comfort, structural integrity, safety performance, and effective drainage, rather than the frequency of isolated maintenance activities.
This integration of technical data and stakeholder perceptions highlights a critical insight: reactive maintenance alone is insufficient to meet user expectations or ensure pavement longevity. Structural failures persist despite routine interventions, underscoring the need for preventive, data-driven, and holistic pavement management.

Key Implications:

1. Corrugation, bleeding, and raveling reflect both material and structural inadequacies, necessitating improvements in mix design, layer stability, and subgrade preparation.
2. Neglect of drainage, signage, and line markings not only accelerates pavement deterioration but also compromises road safety.
3. Maintenance strategies must shift from ad hoc repairs to proactive, asset-based management, integrating real-time monitoring, predictive modeling, and preventive interventions.

Adopting such reforms—including improved design standards, enforcement of axle load regulations, enhanced drainage systems, quality control during construction, and digital monitoring frameworks—can significantly enhance pavement performance, optimize safety outcomes, reduce life-cycle costs, and align maintenance activities with stakeholder expectations.

IV. CONCLUSION AND RECOMMENDATIONS

Conclusions

The comprehensive analysis of the Dhaka–Sylhet Highway (N2) reveals that pavement distress is extensive and multifaceted, dominated by corrugation, bleeding, raveling, alligator cracking, transverse and slippage cracks, potholes, and localized depressions. These defects are symptomatic of both superficial and deep-seated structural weaknesses. Field observations indicate that corrugation, bleeding, and raveling are the most prevalent failures, pointing to instability in asphalt layers, inadequate binder-aggregate cohesion, and insufficient drainage management. Such technical shortcomings reflect a combination of design inadequacies, substandard construction practices, weak quality control during construction, and insufficient supervision during maintenance activities.

Survey findings corroborate these technical observations. Stakeholder responses consistently highlight low satisfaction levels across critical aspects of maintenance, with drainage systems, line markings, and road signage identified as the most neglected areas. The predominance of long-term residents in the sample strengthens the credibility of these perceptions, as they are informed by extended exposure to roadway conditions rather than temporary experiences. Regression analysis further suggests that routine maintenance activities, when considered in isolation, are insufficient predictors of overall satisfaction, implying that broader outcomes—such as ride quality, structural durability, safety, and drainage performance—play a more decisive role in shaping stakeholder evaluations.

Collectively, the evidence indicates systemic deficiencies in both technical and institutional dimensions of pavement management. The persistence of these problems underscores the need for a paradigm shift from reactive, emergency-focused maintenance toward proactive, data-driven, and preventive strategies. Without such reforms, pavement performance will continue to deteriorate under high traffic loads and adverse climatic conditions, compromising safety and increasing life-cycle costs.

Recommendations

Based on the outcomes of the field survey, stakeholder consultations, and statistical regression analysis, the following strategies are proposed to improve pavement durability, road safety, and overall sustainability:

1. **Improve Drainage Provisions:** Construct adequately deep side drains, stabilize erosion-prone embankments, and institute scheduled inspections and cleaning operations. Well-functioning drainage is essential to safeguard the subgrade from moisture damage, thereby reducing the occurrence of potholes and surface deformation.
2. **Adopt Proactive Maintenance Practices:** Implement scheduled interventions such as sealing of cracks, application of surface overlays, and periodic resurfacing. Addressing pavement distress at its early stages extends service life, lowers long-term repair costs, and minimizes the risk of structural deterioration.
3. **Control Axle Overloading:** Set up weigh-in-motion stations or permanent weighing facilities, supported by strict enforcement measures and penalties for non-compliance. Regulating axle loads reduces fatigue damage and helps prevent accelerated rutting and deformation of asphalt layers.
4. **Enhance Quality Assurance During Construction:** Ensure strict supervision of contractors through performance-based contracts, adherence to material specifications, and systematic monitoring. Proper quality control is vital to avoid premature failures such as cracking, slippage, and other early-life defects.
5. **Revise Pavement Design Standards:** Update design specifications to better reflect the realities of tropical climates, growing traffic demand, and heavy axle loading. More resilient design approaches will increase structural reliability and reduce susceptibility to both load- and temperature-induced cracking.
6. **Integrate Digital Monitoring and Asset Management Systems:** Utilize GIS-based and mobile-enabled platforms to record pavement defects, track performance trends, and manage maintenance in real time. Data-driven planning ensures timely responses and more efficient use of resources.
7. **Strengthen Institutional Capacity:** Establish continuous professional development programs for engineers, contractors, and maintenance personnel, emphasizing advanced pavement technologies, proactive maintenance methods, and modern asset management practices. Building technical expertise and organizational capacity is

fundamental to achieving sustainable pavement management.

8. **Foster Stakeholder Participation:** Increase transparency by making road management and maintenance schedules publicly available. Encouraging local community involvement supports early identification of defects and reinforces accountability in the management process.

Future Research Directions

Subsequent studies should evaluate the cost-effectiveness of alternative maintenance strategies, monitor the long-term performance of rehabilitated pavements under heavy traffic and monsoon conditions, and explore innovative financing mechanisms to sustain maintenance programs. Investigating predictive maintenance models using climatic, traffic, and material data could further support evidence-based decision-making and advance sustainable pavement management practices in Bangladesh.

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