

Addressing Road-Level Planning Challenges in Pakistan for a Sustainable Future

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HIGHLIGHTS

Pakistan's infrastructure suffers from uneven road elevations, poor coordination, and unplanned construction, causing drainage failures, urban flooding, and health risks across cities and rural areas.

Consistent road levels are vital for safety and resilience. Irregular elevations disrupt drainage, leading to stagnant water, disease, and environmental damage.

These brief outlines road-level challenges, their impact on infrastructure and health, and proposes centralized, practical solutions to enhance urban resilience and improve public well-being in Pakistan.



Introduction

The nation of Pakistan continues to experience enduring problems regarding uniform road surface heights both within metropolitan zones as well as throughout its rural territories. The combination of inadequate planning and missing authority coordination as well as repeated road constructions without proper benchmarking has resulted in significant infrastructure disruptions. Myriad problems stem from poor drainage management and haphazard road elevation methods that create adverse effects on community infrastructure and local populations.

Importance:

Road levels must stay consistent to achieve effective urban infrastructure delivery. Public safety remains directly affected while urban flooding risks decrease and roads with connected facilities last longer (Zhang, et, al., 2021).

Poor road-level planning causes drainage system problems that lead to water stagnation and respiratory illnesses and air pollution. Resolving this challenge is fundamental to stop additional economic and societal harm while boosting Pakistan's citizen quality of life.

Objective:

- To Highlight the challenges caused by inconsistent road-level planning and maintenance in Pakistan.
- To Analyse the impact of poor coordination, improper practices, and lack of benchmarks on infrastructure, public health, and urban flooding.
- To Provide actionable recommendations for implementing centralized road-level policies and adopting systematic practices to resolve these persistent challenges.

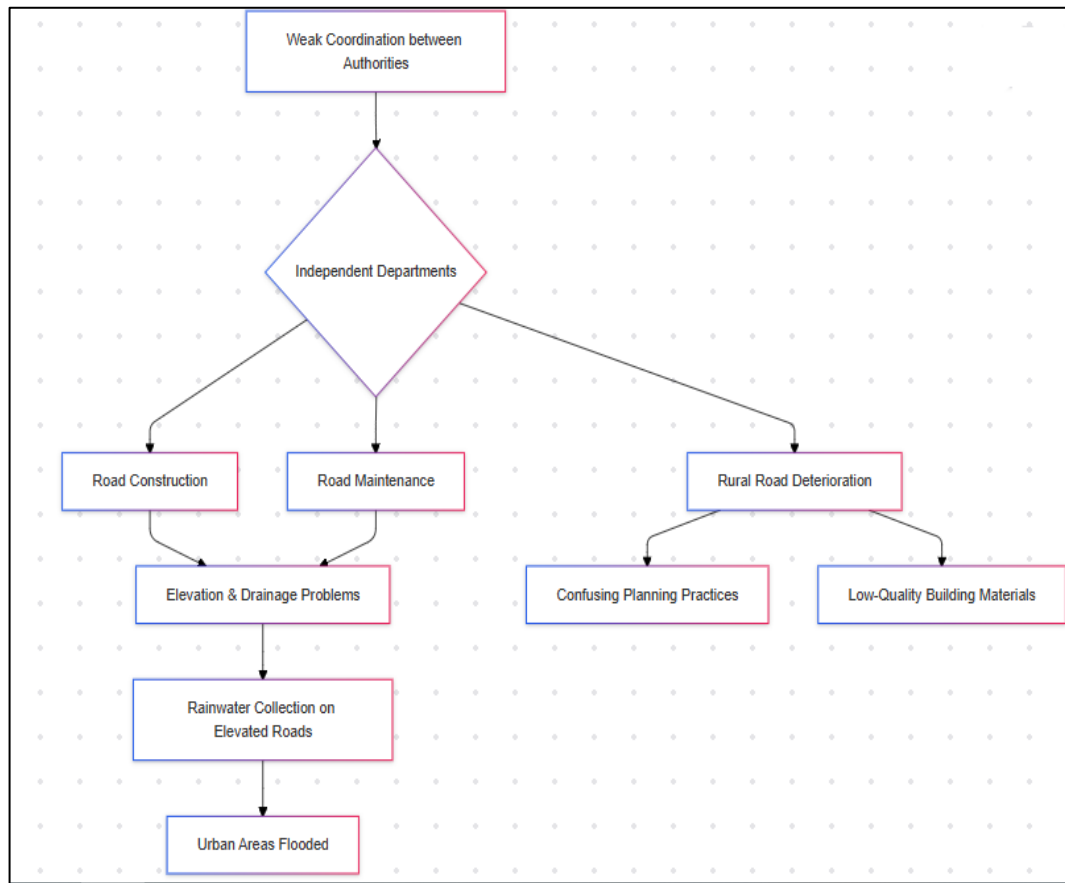
The policy brief delivers essential information for policymakers to create enduring and successful road-level management approaches.

Background and Context

Historical Context:

Since 1947 when Pakistan gained its independence the process of urban planning and infrastructure development has encountered multiple serious problems. Post-Partition rapid urban development happened without suitable planning causing cities to remain short of proper drainage systems and to experience uncontrolled construction (Ansari, 2023). Road elevations were adjusted without method at random which interrupted the natural water runoff patterns. These haphazard planning practices from the past have caused roads to become uneven and blocked sewers and urban flooding to occur. Without systematic infrastructure development Pakistan's roads suffer from poor quality and unsustainable infrastructure which creates additional health risks and environmental hazards (Mukesh & Katpatal, 2021).

Current Scenario:



The current road-level planning situation in Pakistan shows evidence of weak coordination between different authorities as well as the lack of measurable performance standards. The independent nature of departments responsible for road construction and maintenance creates elevation and drainage problems because they work separately from each other. Rainy season water collects primarily on elevated roads that transform into waterways within urban areas. Rural road infrastructure suffers from deterioration because of confusing planning practices and inexpensive building materials. Painting Lahore DHA's infrastructure benchmarks stands as a contrast to typical municipal systems since most cities operate without performance standards that would address their deficient infrastructure.

Key Data:

- Since proper drainage planning is absent Pakistan faces elevated urban flooding incidents throughout the monsoon period in its major cities such as Karachi and Lahore.
- Research findings show that inadequate road building methods lead to 30-40% of major urban flood events.
- Recent respiratory illnesses have gone up due to poor road maintenance directly linked to stagnant water accumulation which leads to very bad air quality across urban areas.
- Road construction that frequently adds layers of gravel and asphalt has resulted in road surfaces reaching 5-6 feet above their initial elevation which disrupts proper stormwater drainage.

Stakeholders:

Addressing road-level maintenance challenges requires a collaborative effort from:

- **Government Bodies:** Municipal and provincial authorities bear responsibility for developing urban plans and constructing roads while maintaining the infrastructure throughout their jurisdictions (Lu et al., 2022).
- **Contractors:** The implementation practices of contractors produce direct effects on road quality and longevity.
- **Local Authorities:** The entities perform regulatory enforcement activities to verify that benchmarks are met.
- **Urban Planners:** Urban planners contribute essential functions by developing systematic drainage and road-level policies which integrate into broader urban development plans.
- **Public:** Sustainable improvements require public awareness as well as citizen involvement to both experience and create changes in infrastructure since people simultaneously face its consequences and help fashion it.

The combination of stakeholder cooperation will enable Pakistan to defeat past deficiencies and establish a path toward long-lasting road-level planning and maintenance systems.

Problem Statement

Define the Problem:

Multiple issues plague Pakistan because its roads operate at different elevation levels that create urban flooding and harm public infrastructure and endanger health. Without benchmark standards in road elevation procedures the drainage patterns become disrupted which results in water accumulation on roads specifically during rainy periods.

The failure to use proper road materials together with insufficient long-term planning causes roads to break down and exposes them to water damage. Housing and shop infrastructure that rises above normal height levels creates "canal-like" water conditions due to the failure to account for planned road elevations. The substandard construction methods result in drainage system collapses along with unstable short-lived surfaces that create major problems for settlements in urban as well as rural areas.

Why It's Problematic:

Unstable road levels create multiple significant problems that affect diverse areas. The issues stemming from urban flooding interrupt both daily operations and damage structures and restrict essential transportation routes. The infrastructure facilities create economic damage and disrupt living conditions for residents by restricting local goods and service distribution. The transmission of respiratory illnesses along with malaria follows from poorly maintained drainage systems allowing water to stagnate thus increasing public health expenses. Road planning authorities demonstrate poor departmental coordination and lack operational accountability which further worsens the situation. Departments that operate without centralized control work independently from each other leading to increased complexity. Cost-reduction strategies adopted by constructors create road defects alongside failures to implement established road requirements. A combination of these issues generates disruptions that obstruct both urban development and infrastructure efficiency and delays economic growth. Practical methods should unite efforts to preserve regular road height standards and build efficient drainage systems as well as enhance urban development practices.

Analysis and Evidence

Root Causes:

Several root causes contribute to Pakistan's persistent challenges with road-level planning:

- 1. Ad Hoc Repairs:** Road maintenance procedures consist of laying additional asphalt and gravel layers above damaged surfaces without performing initial surface removal. Road level elevation through this practice develops drainage problems and blocks natural water courses (Chu, et, al., 2023).
- 2. Lack of Coordination:** Several authorities including municipal governments along with contractors work in isolation with no shared operational framework. Multiple governing bodies operating separately without a unified framework create road level inconsistencies as well as standard implementation discrepancies (Montanino & Punzo, 2021).
- 3. Absence of Fixed Benchmarks:** The national infrastructure of Pakistan does not include standardized benchmarks to measure road heights as other developed countries do. The lack of proper planning produces substandard infrastructure that presents misalignments between roads and drainage systems and buildings (Mazele & Amoah, 2022).

Consequences:

- 1. Urban Flooding:** Drainage systems become blocked when roads occupy elevated positions or when alignment between pipes is improper thus interrupting natural rainwater flow to sewers. Karachi together with Lahore suffer major waterlogging events during monsoon periods that result in transportation delays while causing property destruction (Roy, et, al., 2021).
- 2. Infrastructure Deterioration:** Roads show faster deterioration when planning at the road level is done improperly. The presence of standing water in road surfaces leads to their degradation and creates both potholes and cracks. Road lifetime decreases while maintenance expenses rise due to improper road-level planning.
- 3. Public Health Issues:** The combination of poor road construction dust with urban water stagnation leads to respiratory conditions and the transmission of diseases such as malaria and dengue. The healthcare system bears a big cost because of these health issues.

Existing Policies:

The Pakistani Road maintenance system operates without strategic planning and performs only reactive procedures at present. Current policies choose temporary fixes instead of dealing directly with fundamental problems. The practice of road maintenance occurs without proper consultation of drainage plans and fails to meet standardized benchmarks. The planned residential community DHA in Lahore follows exacting standards about road elevation but typical urban districts across Pakistan lack such systematic supervision. The lack of centralized authority which oversees road construction along with maintenance creates additional issues throughout the system. Contractors lack effective accountability systems which enable them to choose cheaper methods over high-quality performance.

International Comparisons:

Developed nations like Paris and London provide valuable lessons in systematic road-level planning:

- 1. Integrated Drainage Systems:** Paris applies a drainage system that supports both water drainage and sewage disposal functions effectively even in close proximity to the River Seine. Road durability and urban flooding prevention are achieved through this system (Henry, 2023).
- 2. Fixed Benchmarks:** The road elevation standards which London and other UK cities preserve today trace back to centuries ago. All construction operations follow these benchmarks which helps maintain consistent alignment between roadways and drainage networks.

3. Advanced Technology: Developed countries use modern equipment to remove road damage instead of building additional layers. The selected method preserves natural road elevation while stopping the development of long-term infrastructure dilemmas (Belyaev, et, al.,2020).

Pakistan should implement these best practices through standardized benchmarks together with synchronized drainage and road infrastructure followed by modern road maintenance equipment. The implementation of these methods produces substantial enhancements to urban infrastructure while simultaneously minimizing floods and creating better public health conditions. A strong unified policy framework serves as a critical requirement for reaching these targets.

Result:

Theme 1: Inconsistent Road Design and its Impact on Urban Flooding

This theme was common throughout all interviews, with varied participants indicating poor maintenance in terms of the management of consistent road heights as a major contributor to flooding urban areas. Candidates indicated that maintaining consistency in road levels across urban and rural areas is not a straightforward task, as urban development can, at times, lead to roads becoming suddenly elevated or depressed. This unevenness inhibits appropriate water drainage, as rain seepages causes gathering that leads to urban flooding.

Key Findings:

Due to improper collusion and low-grade material in road construction, the road levels are not even and drainage is a pain point in rural areas.

Urban flooding is aggravated by uncontrolled development in urban areas and encroachments on natural drainage channels.

The lack of proper grading and elevation control while constructing roads leads to standing water.

Example Quote:

“Inconsistent Road elevation is a major issue, especially when roads are constructed without proper grading.” (Person 4)

Theme 2: Lack of Coordination Among Authorities in Road-Level Planning

Interviewees also mentioned that there's no coordination between the various government authorities responsible for road construction and maintenance. Another problem is that road planning is broken up in a way that leads to haphazard projects, where roads are changed without consideration for what that might mean for things such as drainage systems. Since there is no single authority, in many areas' roads are raised or lowered without any coordination, which interferes with the normal flow of water, contributing to flooding.

Key Findings:

There is no cohesive planning strategy and different departments work in silos.

Road construction is not often consulted with drainage systems or urban planning.

Road planning will have to be overseen by a centralized authority and standardized.

Example Quote:

“To solve this, authorities need a unified umbrella policy to collaborate effectively and ensure cohesive planning.” (Person 2)

Theme 3: Impact of Post-Partition Planning on Infrastructure Deterioration

The historical context of Pakistan's partition in 1947 and road-level planning has played a major role in deteriorating the structure of roads. Badly built roads and primitive drainage systems have led to perennial flooding, degradation of roads, and adverse public health consequences because of stagnant

water and waterborne disease. The lack of planning as it relates to future growth, climate change and water management has exacerbated these problems over the course of time.

Key Findings:

Lack of proper drainage system results in waterlogging and subsequently damage to the infrastructure due to construction of these roads.

Systematic failure in road level planning ever since 1947 has led to severe water stagnation which results in public health issues like respiratory and water-borne diseases.

The post-Partition urban expansion did not forecast climate events leading to scenario of unfriendly roads and vulnerable cities.

Example Quote:

“Improper drainage systems and misaligned roads caused flooding, leading to the rapid destruction of infrastructure.” (Person 1)

Theme 4: Lessons from Developed Nations on Sustainable Road Planning

Some of those interviewed made the point that developed countries had implemented systems that aligned road-level planning with sustainable water management. For example, Western cities like Paris and London use dual-purpose drainage systems which do a great job at managing both stormwater and sewage, preventing waterlogging, solving durability problems of the road. Interviewees stressed that Pakistan also needed to embrace such systems that combine climate resilience with drainage management and future-proofing their infrastructure.

Key Findings:

Developed countries have long-term urban planning systems that integrate stormwater and sewerage systems.

To do this, you can use technologies like GIS and automated hydrological models to keep the road level constant and drain properly.

Pakistan can adopt these strategies with an emphasis on urban sustainability, the provision of water management in urban planning.

Example Quote:

“Western countries plan roads with strict benchmarks and integrated systems to manage rainwater and sewage effectively.” (Person 2)

Theme 5: Need for a Centralized Policy with Fixed Benchmarks for Road Levels

The overarching response from interviews indicated a need for a policy with a centralized approach to road levels with benchmarks set from a fixed point. Interviewees proposed one authority to oversee road construction to ensure compliance with fixed reference points and standards. Such a policy would standardize road construction nationwide, helping to alleviate problems like urban inundation and infrastructure decay.

Key Findings:

A single jurisdiction should oversee planning at the road level and enforce consistent standards.

In the survey, respondents were asked whether the standardization of road levels would bridge differences between locals and become a fixed benchmark.

Road level standards should be enforced by regular audits, inspections and penalty.

Example Quote:

“Every city should have a fixed benchmark level for roads. All roads should be constructed and maintained according to this fixed point.” (Person 1)

Conclusion:

Challenges in road level planning in Pakistan were found to be multi-dimensional, ranging from lack of design consistency in roads to coordination issues among the responsible authorities and historical planning flaws. Among these solutions, key recommendations include the establishment of a centralized authority to administer road planning, adoption of best practices in sustainable water management from developed countries, and implementation of fixed standard for the levels of roads for consistency and durability of infrastructure. These conclusions underscore the necessity for multidimensional and integrated urban development policies to mitigate the persistent challenges of flood risks, infrastructural decay, and health hazards.

Policy Options and Recommendations

Policy Options:

1. Establishing a Centralized Authority to Oversee Road-Level Benchmarks and Maintenance:

A central organization should manage planning activities at the road level throughout all cities and provinces. Such an authority would maintain uniform standards by which construction teams must operate alongside maintenance requirements. Such oversight can solve the coordination problems which exist between different departments and their contractors (Doan, 2023).

2. Implementing Fixed Benchmarks for Road Levels Nationwide:

National road level requirements provide a standard framework that stops construction entities from making arbitrary elevation or alignment choices. The guidelines will integrate benchmarks into urban and rural planning standards for establishing uniform standards across all infrastructure projects.

3. Enforcing Accountability and Collaboration Among Contractors and Authorities:

Government departments along with contractors must follow road-level benchmarks through rigorous accountability systems. The implementation of collaborative frameworks would lead to enhanced communication and coordination for all operations between repairs and construction work as well as drainage planning.

4. Adoption of Advanced Machinery for Maintaining Original Road Levels:

Developed nation road-lifting and recycling systems could remove road debris by stripping damaged surfaces and reprocessing materials to achieve uniform levels. The method would lower unnecessary elevation while providing lasting durability to the infrastructure.

Evaluation:

1. Centralized Authority:

Advantages: A standardized road-level planning emerges while officials combine their efforts more effectively to reduce repeated work and enhance departmental coordination.

Disadvantages: The combined costs of establishing and maintaining this new body together with possible bureaucratic hold-ups create major operational issues.

Scalability: This solution operates across all cities and provinces with adjustable parameters for various urban and rural development requirements.

2. Fixed Benchmarks:

Advantages: A clear reference point serves all construction projects which simplifies planning activities and maintenance procedures.

Disadvantages: The implementation process requires extensive survey work and mapping across rural areas because unmonitored areas present difficulties for enforcement activities.

Scalability: Upon establishing benchmark standards, the system will showcase enduring sustainability and worldwide applicability.

3. Accountability and Collaboration:

Advantages: Through this system construction becomes more transparent and road quality standards rise along with permanent standards maintenance.

Disadvantages: Effective execution of major policy changes combined with thorough tracking systems requires construction companies to overcome their resistance to new reforms.

Scalability: Effective at both provincial and national levels with proper legislation.

4. Advanced Machinery:

Advantages: Applying this technique leads to reduced infrastructure need along with lower construction heights and longer lasting roads.

Disadvantages: A combination of specialized equipment with operator expertise requires startup funding while professional industry knowledge is needed to operate the equipment.

Scalability: Constructing advanced road systems within big metropolitan areas works well but establishing enough technology assets becomes challenging when building in rural settings.

Recommendations:

To address the persistent challenges of inconsistent road levels, a hybrid approach is recommended:

1. Establish a Centralized Authority:

A national body must take responsibility for establishing road-level benchmarks as well as drainage systems and road maintenance operations. A central authority would establish guidelines that would supervise implementation and maintain coordination with departments throughout the nation.

The law should enforce benchmark standards as a requirement which ensures provinces meet the same standards.

2. Adopt Advanced Technology:

The government should provide modern road-lifting and recycling machinery to contractors and themselves for maintaining original road levels.

The government should sponsor training courses for road maintenance operators and contractors about the efficient operation of these technologies.

3. Implement Fixed Benchmarks:

A unified road-level benchmark system needs to be established through a national survey. Road designers must use contour maps to find optimal positioning which matches effective natural drainage systems operating during monsoon seasons. Future construction projects need to integrate benchmark standards into urban planning policies as part of standardized implementation.

4. Enhance Accountability and Collaboration:

- Contractual work requires companies to follow mandatory integrity procedures which control quality parameters and established benchmarks.
- The government should develop shared digital platforms which unite urban planners with contractors and government departments to work on joint projects.
- Organizations will receive financial incentives in addition to facing penalties when their projects achieve set quality targets.

Cost-Effectiveness, Sustainability, and Scalability:

- The hybrid method requires significant upfront capital to deploy cutting-edge technology and centralized administrative core but generates enduring financial benefits through reduced maintenance requirements and diminished frequency of maintenance.
- Sustainable infrastructure develops when modern infrastructure techniques unite with natural drainage patterns and adopt environmentally friendly reuse approaches.
- Modern machinery and fixed benchmark implementation enable scalable operations capable of serving both urban and rural environments.

The implementation of national planning policies alongside modern technology along with collaborative methods presents Pakistan with a comprehensive solution to solve road-level development issues. Improved infrastructure and reduced urban flooding and enhanced public health together with economic growth result from this approach. The proposed recommendations require immediate implementation by policymakers to develop sustainable economic growth.

Implementation Strategy

Steps for Implementation:

1. Develop Legislation for Centralized Road-Level Benchmarks:

- The national government needs to develop legislation that grants control over road-level benchmarks to a central entity.
- The national organization requires enforcement power to maintain consistent road-level policies across all provinces and municipalities.
- The authors suggest that benchmarking should appear throughout urban planning guidelines and infrastructure development standards to ensure drainage systems align with permanent infrastructure needs.

2. Train Contractors and Officials:

- Training should deliver complete education about fixed road-level benchmarks to both contractors and engineers as well as urban planners.
- A solution includes providing teams with the capability to work with advanced road maintenance equipment which includes road-lifting and recycling machinery.
- The organization will organize periodic certification classes together with educational sessions to verify that members stick to benchmarks and quality expectations.

3. Create a Monitoring and Evaluation Framework:

- A real-time monitoring system must be established to check that road repair and construction work meets benchmark parameters.
- Geographic Information Systems together with contour mapping provide organizations an opportunity to maintain precise road-level data.

- The organization must establish independent inspection teams which will evaluate finished projects, perform compliance audits and track areas for continued improvement.

The organization must prepare yearly reports to sustain open transparency and maintain accountability standards.

Challenges:

1. Resistance from Local Contractors and Authorities:

- Many contractors and local authorities may resist changes due to lack of awareness, perceived increases in operational complexity, or fear of reduced profits.
- Contractors may also lack the technical expertise or resources to adopt advanced machinery and comply with strict standards.

2. High Initial Costs of Equipment and Training:

- Acquiring advanced road-recycling machinery and implementing a nationwide training program will require significant financial investment.
- Municipalities, especially in rural areas, may struggle to allocate funds for these initiatives.

Solutions:

1. Phased Implementation:

- Roll out the policy in phases, starting with pilot projects in major urban centres such as Karachi, Lahore, and Islamabad.
- Use these pilots to refine processes, evaluate challenges, and demonstrate the benefits of the new system to stakeholders.
- Gradually expand implementation to smaller cities and rural areas over time.

2. Incentivizing Compliance:

- Offer financial incentives, such as tax breaks or subsidies, to contractors and municipalities that adopt advanced machinery and comply with benchmarks.
- Recognize and reward compliant contractors through certifications or public acknowledgment, enhancing their reputation and competitiveness.

3. Public Awareness Campaigns:

- Launch awareness campaigns to educate the public, contractors, and local authorities about the long-term benefits of maintaining consistent road levels.
- Highlight how improved infrastructure will reduce urban flooding, improve public health, and save costs over time.

4. Government Support for Financing:

- Secure government and donor funding to offset the initial costs of acquiring advanced machinery and setting up training programs.
- Establish public-private partnerships (PPPs) to share the financial burden and encourage private sector involvement.

Cost-Benefit Analysis

Costs:

1. Initial Investment in Advanced Machinery and Training Programs:

A substantial initial investment must be made for modern road-recycling equipment acquisition and across-the-nation training of contractors together with officials. All expenses stem from the purchase of machinery alongside operational training expenses and maintenance costs (Mindell & Reynolds, 2023).

2. Costs of Creating and Enforcing Centralized Policies:

The establishment of a centralized benchmarking authority demands legislative work together with personnel management and evaluation system construction. The ongoing costs of compliance inspection together with periodic audits generate added operational expenses (Yang, et, al., 2021).

Benefits:

1. Long-Term Savings:

The integration of standard road-level benchmarks alongside innovative technologies will decrease roadway maintenance needs leading to substantial cost reductions throughout multiple decades. Drainage system improvements will protect urban areas from flooding while saving the nation millions of rupees in annual property damage costs. Every year during monsoon season the poor planning of Karachi leads to urban flooding which generates billions of rupees in costs for the city.

2. Improved Public Health and Economic Activity:

Obtaining appropriate road elevations paired with proper drainage structures prevents water accumulation and this reduction helps prevent pest disease illnesses together with respiratory issues stemming from dust and air pollution. Economies experience higher productivity levels in communities where people maintain better health so they contribute to national development. Normative transportation systems shorten wait times which supports economic expansion across trade and commercial sectors.

Evidence-Based Support:

The systematic planning of roads leads to more economical road infrastructure systems according to France and the UK approaches. Through its connected drainage and road network system Paris reduces flood risks while saving on present and future expenses for maintenance work and healthcare services. Pakistan can generate enduring value while making its initial budget investments through proper implementation.

Conclusion

Summary:

The improper road-level planning in Pakistan's cities and rural areas creates flood damage to infrastructure systems and public health problems. Standardized policies and technical benchmarks together with insufficient advanced technology systems amplified these issues. The achievement of sustainable urban development coupled with enhanced public health outcomes requires instant solutions to address these weaknesses.

Call to Action:

Policyholders and stakeholders need to make decisions that will bring the suggested recommendations to life. The implementation of sustainable engineering depends on both set evaluation standards and official authority with modern road maintenance equipment. The sustained challenges of Pakistan will be overcome through collective efforts between contractors and urban planners and local authorities. A priority system for organized road-level planning should become our immediate focus to craft an

upcoming framework which delivers health advantages and prosperity alongside safety for Pakistan's population. Immediate action is required to secure permanent forward progress.

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