LEA Associates South Asia Pvt. Ltd.
Office of the JTFRP-TAQA Consultant
2nd floor, ERA Commercial Complex, Rambagh
Srinagar - 190009

SUB-PROJECT COMPLETION REPORT

COMPONENT – II

RECONSTRUCTION OF ROADS & BRIDGES

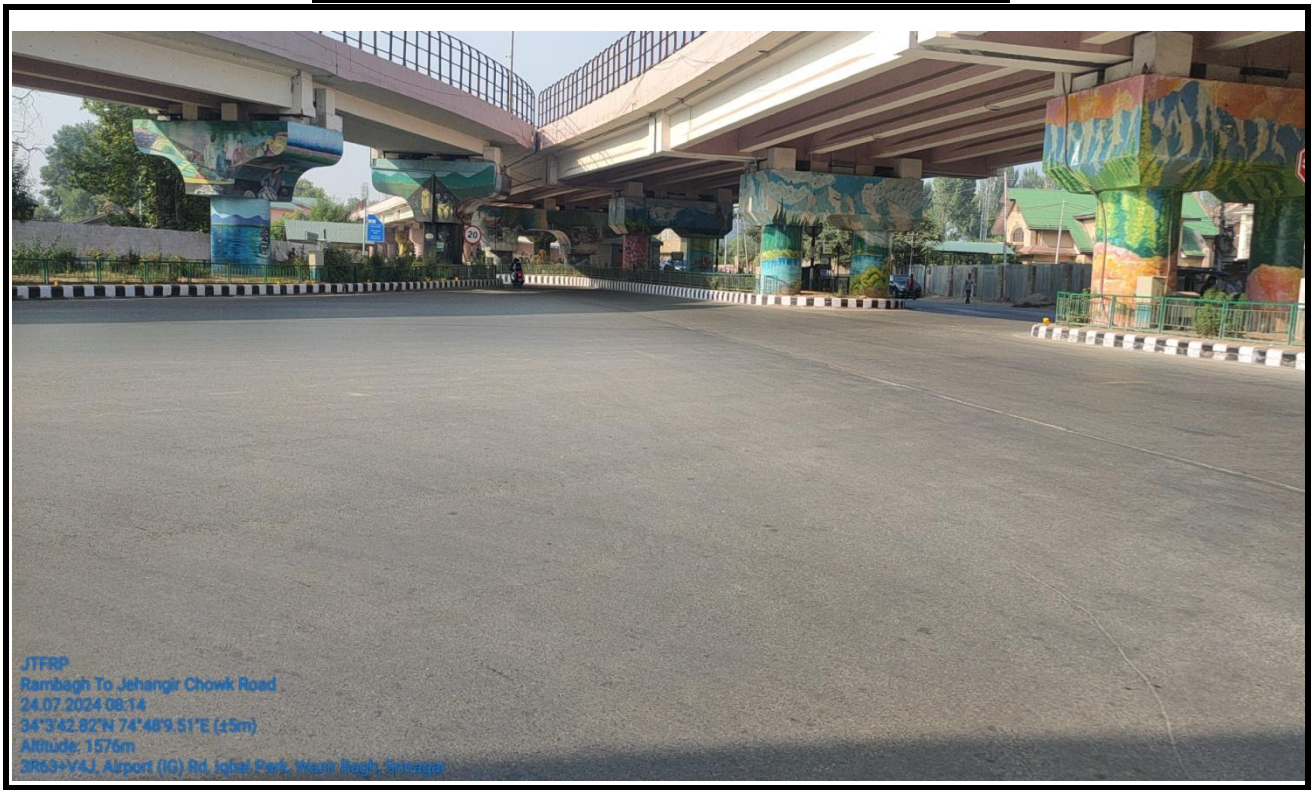
VOLUME – I (ROADS)

Prepared By: Lea Associates South Asia Pvt. Ltd.

Technical Assistance & Quality Audit Consultants

VOLUME-I

Reconstruction of Roads in Kashmir Division.



Contents

SUB-PROJECT COMPLETION REPORT JTFRP KASHMIR DIVISION

PMU JTFRP KASHMIR

1. Introduction

1.1 Project Background

In September 2014, Jammu & Kashmir experienced torrential monsoon rains in the region causing major flooding & landslides. The continuous spell of rains from September 2-6, 2014 caused Jhelum and Chenab Rivers as well as many other streams/tributaries to flow above the danger mark. The Jhelum River also breached its banks flooding many low-lying areas in Kashmir, including the capital. In many districts, the rainfall exceeded the normal by over 600%. The Indian Meteorological Department (IMD) records precipitation above 244.4 mm as extremely heavy rainfall and J&K received 558mm of rain in the June – September period as against the normal 477.4 mm. For example, the district of Qazigund recorded over 550 mm of rainfall in 6 days as against a historic normal of 6.2 mm over the same period.

Due to unprecedented heavy rainfall the catchment areas particularly the low lying areas were flooded for more than two weeks. Some areas in urban Srinagar stayed flooded for 28 days. Water levels were as high as 27 feet in many parts of Srinagar. The areas from the main tributaries of river Jhelum vis-à-vis Brengi nallah, Vishow nallah, Lider nallah and Sandran nallah started overflowing due to the heavy rainfall causing water levels in Jhelum to raise. Subsequently, the discharge of the river Suran was 200 thousand cusecs as against an average of 50 thousand cusecs. With the excessive discharge of water, the river Suran affected the basin areas and also took a different course at various locations causing damages to the surrounding villages in the catchment area. Water levels also increased in the rivers of Chenab and Tawi, both of which were flowing above normal levels. Due to the rivers overflowing nearly 20 districts of the State were impacted.

A Joint team led by the Department of Economic Affairs (DEA), GoI, with representation from the World Bank visited J&K on October 21, 2014. Subsequently, GoI has sent a request to the World Bank on January 5, 2015 to field a joint Rapid Damage and needs Assessment (RDNA) Mission within the State. In response, a mission of the World Bank visited the State during February 1-6, 2015 in order to produce a rapid multi-sectored assessment report of the damages and needs. The RDNA estimates the total damages and loss caused by floods at about INR 211.975 Million, most of it to housing, livelihoods; roads and bridges which combined represented more than 70% of the damages in terms of value. Public service infrastructure and equipment of hospitals and education centers were also severely damaged and were still not fully operational.

The primary focus of the project "Jhelum & Tawi Flood Recovery Project" is on restoring critical infrastructure using international best practice of resilient infrastructure. Given the region's vulnerability to both flood and earthquakes, the infrastructure will be designed with upgraded resilient feature, and will include contingency planning for future disaster events. Therefore, a study followed by detailed reports on flood management aims at both restoring essential services disrupted by the floods and improving the design standards and practices resilience.

The Government of India has received a loan from the World Bank towards the cost of Jhelum &Tawi Flood Recovery Project (JTFRP) for Government of Jammu and Kashmir. The Disaster Management, Relief & Rehabilitation Department, Government of J&K has been appointed as the implementing agency. One Project Management Unit (PMU) has been set up under this implementing agency which is responsible for overall project management, coordination and reporting.

Based on the Rapid Damage Needs Assessment (RDNA): Results, restoration works underway and discussion with the GOJ&K, the project will focus on resorting critical infrastructure using international best practice on resilient infrastructure. Given the state's vulnerability to both floods and earthquakes, the infrastructure will be designed with upgraded resilient features and will include contingency planning for further disaster events. Therefore, the project aims at both restoring essential services disrupted by the floods and improving the design standard and practices in the state to increase resilience.

1.2 Project Development Objective: The Project Development Objective (PDO) is to support the recovery and increase disaster resilience in targeted areas of the state and increase the capacity of the state entities to respond promptly and effectively to an eligible crisis or emergency.

1.3 Project Components:

The project is comprised of the following seven components:

1. Reconstruction and strengthening of critical infrastructure (US$50 million)
2. Reconstruction of roads and bridges (US$55 million)
3. Restoration of urban flood management infrastructure (US$40 million)
4. Restoration and strengthening of livelihoods (US$15 million)
5. Strengthening disaster risk management capacity (US$25 million)
6. Contingent Emergency Response (US$45 million)
7. Implementation Support (US$20 million).

Total Amount is US$ 250 Million.

Component 2 – Reconstruction of Roads and Bridges, US$80million

The objective of this component is to restore and improve the connectivity disrupted due to the disaster through the reconstruction of damaged roads and bridges. The infrastructure has been designed to withstand earthquake and flood forces as per the latest official design guidelines. The affected areas will benefit by the restored access to markets, inter district connectivity thereby increasing the economic growth in these areas and timely access to health and education services. Restoration of roads will also serve as supply/rescue lines in the event of a disaster.

The component will finance the reconstruction of damaged roads, bridges and associated drainage and slope stabilization works, retaining walls, breast walls and other structures to increase resilience.

PART – A: ROADS UNDER EXECUTION BY JKERA

The road subprojects under this component involves the restoration, improvement, and upgrading of several critical road stretches in the Kashmir Valley, with a focus on enhancing connectivity, improving road safety, and addressing infrastructure deficiencies caused by natural disasters. The project addresses a range of issues, including inadequate road surfaces, drainage problems, poor riding quality, accident-prone stretches, and flood vulnerability. Through systematic up gradation and reconstruction, the project aims to ensure all-weather connectivity, bolster economic growth, and enhance accessibility to key services such as health, education, and markets. The roads under this subproject also serve as crucial lifelines for disaster response and recovery, offering improved access for relief and rescue operations.

The roads selected for upgrading are vital arteries for both regional and national transportation, with several roads connecting Srinagar city to other parts of the Kashmir Valley, including important locations like the airport, markets, and residential areas. These roads have been impacted by multiple factors, including floods (particularly the 2014 disaster), submergence, drainage issues, and poor maintenance practices over the years. In many instances, the road infrastructure had deteriorated to the point where the existing pavement quality was inadequate to handle the growing traffic load and adverse weather conditions.

This component encompasses a variety of road stretches that vary in terrain, traffic intensity, and condition, but all of which play a key role in the regional economy and daily life. These roads have faced challenges like potholes, road settlements, and damage from floods, leading to substandard road conditions. Some of the roads were constructed decades ago and have undergone multiple ad hoc maintenance interventions over the years, resulting in inconsistent road structure and materials. In addition to the physical improvements, specific measures such as the installation of longitudinal and cross-drainage systems, as well as embankment raising where necessary, were implemented to mitigate submergence risks and enhance road longevity.

One of the groundbreaking features of this subproject is the introduction of **Rigid Pavement** technology, which has been implemented for the first time in Srinagar and the wider Kashmir Valley. The use of rigid pavements, which consist of jointed plain concrete pavement (JPCP), offers a robust solution to the region's unique challenges, especially the recurring issues of submergence during floods and the need for long-lasting, low-maintenance road surfaces. Unlike traditional flexible bituminous pavements, rigid pavements provide enhanced durability, especially in areas prone to water logging, as they are resistant to deformation caused by heavy traffic loads and fluctuating water tables.

Overall, this subproject represents a comprehensive effort to restore and strengthen vital road infrastructure in the region, ensuring that the roads can withstand future environmental challenges, improve traffic flow, reduce accident rates, and provide uninterrupted connectivity for both daily commuters and emergency services. The upgraded roads are designed with the future in mind, offering sustainable, high-quality infrastructure that will continue to support the local economy and enhance the overall quality of life for residents in the affected areas.

2. Executive Summary:

- **Objective:** The objective of this subproject was to restore and upgrade vital road infrastructure across key stretches in the Kashmir Valley, enhancing connectivity, road safety, and resilience to natural disasters, particularly flooding. This initiative focuses on improving the quality of roads by addressing longstanding issues such as poor riding conditions, inadequate drainage, and safety concerns, while ensuring all-weather connectivity and reducing vulnerability to future disasters. The subproject introduces innovative solutions, such as the use of Rigid Pavement technology, which provides greater durability and resistance to flood-induced damage. Additionally, safety measures like widening narrow stretches, opening blind curves, and strengthening vulnerable areas with RCC retaining walls and parapets aim to improve traffic flow and road safety. The goal is to create a sustainable, reliable road network that supports economic growth, facilitates access to essential services, and ensures better preparedness for disaster response and recovery.

- **Summary of Achievement:** The subproject focused on restoring and upgrading critical road infrastructure in the Kashmir Valley, aiming to improve connectivity, safety, and resilience to natural disasters like flooding. A total of 11 roads were proposed under 7 packages, with one package dropped due to a dispute. The remaining roads were successfully restored, addressing issues such as poor surfaces, drainage, and safety features. All-weather connectivity was established, enhancing access to markets, inter district connectivity, healthcare, and education, which are expected to foster local economic growth. Road safety improvements, such as widening narrow stretches, improving curves, and adding retaining walls, reduced accident risks and improved traffic flow. The introduction of Rigid Pavement technology (JPCP) for the first time in the region provided a durable solution to flood damage, minimizing maintenance costs. Drainage and flood

mitigation measures were also implemented, ensuring road functionality during adverse weather. Overall, the upgraded infrastructure significantly improved access to essential services and provided a reliable network for disaster response and recovery, offering long-term social and economic benefits.

2.1 Introduction & Background

This subproject focuses on upgrading and restoring critical road infrastructure across the Kashmir Valley, an area severely affected by floods and other environmental challenges in recent years. The project is managed by the **Jammu & Kashmir Economic Reconstruction Agency (JKERA)**, acting as the Project Implementation Unit (PIU), with support from various agencies and stakeholders.

The region's road network has faced significant challenges, including deteriorating pavement quality, inadequate drainage systems, and road safety hazards caused by narrow stretches, blind curves, and flood-induced damages. This subproject was designed to address these issues by upgrading key roads, particularly those that connect Srinagar city to essential areas such as the airport, markets, and residential zones.

In the aftermath of the 2014 floods, these roads became even more vulnerable due to submergence, poor drainage, and the deterioration of road surfaces. The subproject was initiated under the Jammu and Kashmir Urban Flood Recovery Project (JTFRP) to provide a sustainable and resilient transportation network for the region.

The roads selected for upgrading include some of the most vital stretches in the region, with high traffic volumes and strategic importance. These include the Rambagh to Civil Secretariat road, Eastern Foreshore Road (Bari Nambal), and Peerbagh to Humhama Chowk. All three roads were upgraded using Rigid Pavement technology for the first time in the region, marking a major step forward in road construction practices.

In addition to the introduction of rigid pavements, the project also includes comprehensive drainage improvements, the widening of narrow stretches, the opening of blind curves, and the construction of protective works such as RCC retaining walls and parapets. The upgraded roads also feature improved drainage systems, including the installation of longitudinal drains and culverts, to ensure the effective management of storm water and prevent flooding that could damage the road infrastructure.

The subproject's goal is to provide durable, safe, and flood-resistant road infrastructure that supports economic development, enhances public safety, and improves access to critical services, while ensuring long-term sustainability and resilience to future environmental challenges.

2.2 Sub-Project Detail

The Jammu & Kashmir Economic Reconstruction Agency (JKERA) has finalized nine road development projects under the Jhelum Tawi Flood Recovery Project (JTFRP), financed by the World Bank, to repair infrastructure affected by the 2014 floods in Kashmir. These initiatives were designed to enhance connectivity, build climate resilience, and support socio-economic recovery in the Kashmir region. The subprojects were organized into six contract packages and covered various districts such as Srinagar, Budgam, Baramulla, Bandipora, and Anantnag. They consisted of three rigid pavement roads and six flexible pavement roads, tailored to meet specific site requirements and traffic loads. Significant locations included three roads within Srinagar, one connecting Srinagar and Budgam, two that link Baramulla and Bandipora, one in Bandipora, and two in Anantnag.

The comprehensive project report, along with the design and construction-ready drawings, was developed by EPTISA Roads, while LEA Associates South Asia Pvt. Ltd. (TAQAC) offered technical support and quality audit during the construction period. All contracts were awarded to experienced and qualified contractors through a competitive bidding process. The work scope encompassed the upgrading, widening, and rehabilitation of existing roads to meet all-weather standards, which includes enhancements to drainage and safety measures.

The table below outlines the essential details of each finished subproject, such as pavement type, road length, contractor name, financials (allocated, revised, and final completion costs), and timelines from the start to actual completion.

S. No	Name of Road Subproject	Type of Pavement	Name of Contractor	Length of Road Package *(in Km)*	Allotted cost *(in Crores)*	Revised cost *(in Crores)*	Completion cost *(in Crores)*	Date of Start *(as per Allotment)*	Date of Completion *(Actual)*
1	Up-gradation of Hamray Sultanpora Nowgam to Sumbul Bridge, Shadipura Khanpeth Sumbal road & Hajin Ajas Road Via Saidnara	Flexible Pavement	M/s ASMCC-JSP Projects (JV)	25.566	31.89	27.977	23.44	02-09-2020	31-10-2023
2	Up-gradation of Rambagh to Civil Secretariat (Lot1).	Rigid Pavement	M/s HRCC Pvt Ltd	1.907	9.67	8.33	8.33	27-07-2020	15-06-2022
3	Up-gradation of Eastern Foreshore Road (Lot2).	Rigid Pavement		3.6	17.26	16.52	Final Bill under process	20-07-2020	30-06-2023
4	Up-gradation of Peerbagh to Humhama IG Road (Lot3).	Rigid Pavement		1.491	7.09	6.39	6.39	27-07-2020	31-03-2022
5	Up-gradation of Parimpora to Soibugh road (Lot-4).	Flexible Pavement	M/s MM Shawl - VRCC (JV).	7.927	8.47	6.62	6.35	26-08-2020	15-05-2022
6	Up-gradation of Sangam - Khudwani Road and Bijbehara - waghama via Katriteng Road).	Flexible Pavement	M/s Mirz Infrastructure	11.253	16.50	16.92	Final Bill under process	25-08-2020	15-06-2024

DETAILS OF THE STAKEHOLDERS		
1	Project Implementation Unit (PIU).	JAMMU & KASHMIR ECONOMIC RECONSTRUCTION AGENCY (JKERA)
2	Project Management Unit (PMU)	JHELUM TAWI FLOOD RECOVERY PROJECT (JTFRP)
3	Design Consultant	EPTISA ROADS
3	Quality Audit Consultants	LEA ASSOCIATES SOUTH ASIA PVT LTD. (TAQAC)
4	Funding Agency	The World Bank
5	Total Contract Price of Road subprojects under execution by JKERA	****

3. Contract Details:

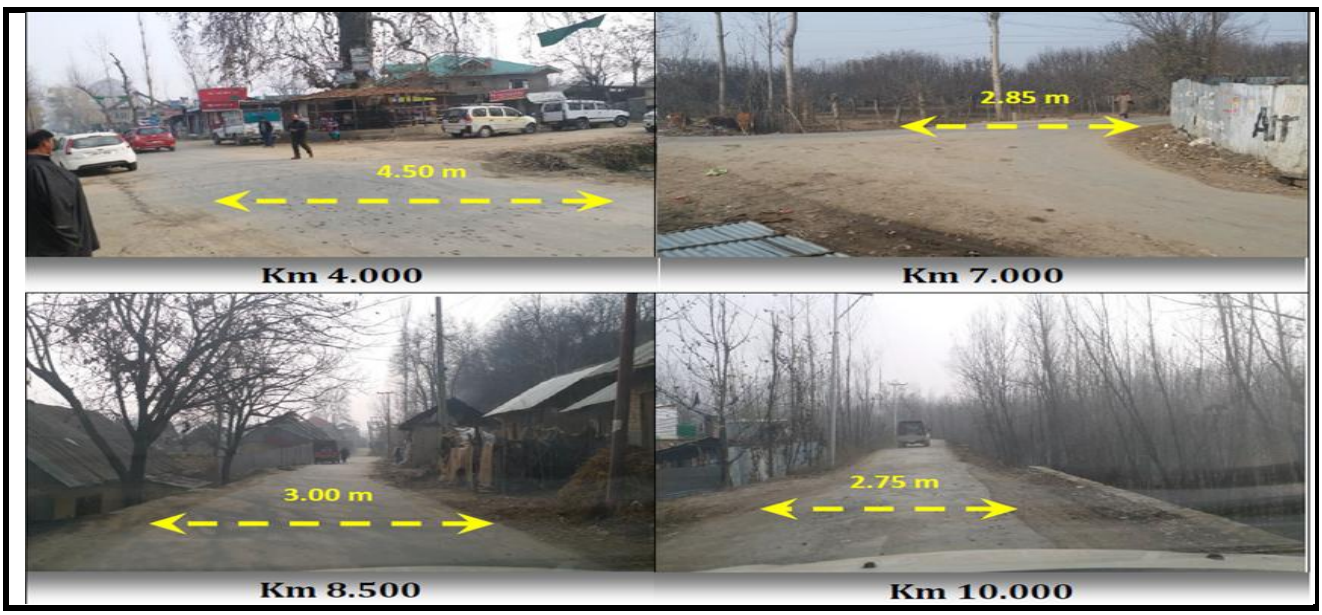
3.1 Up-gradation of Hamray-Sultanpora Nowgam to Sumbal Bridge, Shadipora-Kanipeth Sumbal road and Hajin Ajas road via Saidnara.

3.1.1 INTRODUCTION & PRE-EXISTING FEATURES:

Hamray-Sultanpora-Sumbal Road:

Hamray-Sultanpora-Sumbal road is an essential single-lane road that connects several villages within Baramulla and Bandipora districts in the Kashmir Province. Spanning over 12 kilometers, it serves as a critical link for local commuters, as well as for transporting goods between rural settlements. Serving a population of 72,946, the route traverses through several key habitations, including Hamray, Tramba Gund, Rakh Haigam, Wussan, Gundi Jahangir, Sadat Pora, Sumbal, Tanga Pora, and Bulagam. Originally constructed to provide rural connectivity to hillside villages, the road has become increasingly important due to its role in local economic activities. Despite its importance, the road has not kept up with the growing demands of the region's traffic.

Originally constructed as a narrow, single-lane road, it primarily served local traffic and had a minimal capacity to accommodate the growing transportation needs of the region. The **narrow carriageway**, less than the standard 3 meters for a single-lane road, combined with **poor pavement conditions**, prone to accidents and slow-moving traffic. Sections of the road had fallen into disrepair, with severe **erosion**, **potholes**, and **water logging** issues that made travel hazardous, especially during the rainy season. Furthermore, existing **cross-drainage structures** were either inadequate or blocked due to siltation, exacerbating water logging problems.



➢ PRE-EXISTING CONDITIONS:

- **Pavement Condition:** The existing pavement was flexible and was in fair to poor condition throughout the stretch. Several areas were severely damaged, with visible cracks, rutting, potholes, and edge failure. The road's condition worsened after the 2014 floods, which caused substantial structural damage, resulting in weeks of disrupted connectivity to nearby villages.
- **Carriageway & Shoulders:** The average carriageway width ranged from 2.5 meters to 2.75 meters, which was significantly below the standard for a single-lane road (3.75 meters). The shoulder width was around 1 meter on average, contributing to a formation width ranging from 4.75 meters to 5 meters.
- **Cross Drainage Structures:** The road contained 15 cross-drainage (CD) structures, including 5 HP culverts, 7 slab culverts, and 3 bridges. Out of these, the 5 Hume pipe culverts were in poor condition and required desiltation. Additionally, pipe culverts were required to improve drainage.
- **Protection Walls (Retaining Walls):** There were a total of 684.49 meters of retaining walls made of stone masonry or PCC, which were in poor condition and required substantial repairs to prevent soil erosion and further degradation of the road.

Shadipora-Kanipeth Sumbal Road:

The **Shadipora-Kanipeth road** is another important single-lane road running through the plains of Kashmir. Serving a population of 15,791, this road connects several villages, including **Shadipora**, **Rakh Shilvat**, **Tirgam**, **Najin**, **Parihaspora**, **Gund Khalil**, and **Turgam**. It has a moderate to low intensity of commercial traffic, but the existing infrastructure, such as the narrow **carriageway** and the **poor pavement condition**, fails to meet modern traffic needs. Like the Hamray-Sultanpora-Sumbal road, the Shadipora-Kanipeth road was originally constructed for **rural connectivity**, but its role has evolved with the growing population and traffic. Over the years, this road has experienced various **maintenance works** of varying specifications, but these efforts have been inconsistent and inadequate. The road was severely damaged by **heavy rains in 2014**, with several stretches left impassable for weeks. Given its growing importance, an upgrade is urgently required to handle future traffic demands and ensure safe travel.

➢ PRE-EXISTING CONDITIONS:

- **Pavement Condition:** The flexible pavement of the Shadipora-Kanipeth road was in fair to poor condition, with significant damage visible in several stretches. Rutting, cracking, and potholes are common, particularly in areas where maintenance had been inconsistent or poorly executed.
- **Carriageway & Shoulders:** The carriageway width varied from 2.5 meters to 3 meters, which was substandard for a single-lane road. The shoulder width was

approximately 1 meter, resulting in a formation width ranging from 4.75 meters to 5 meters.

- **Cross Drainage Structures:** The road had 11 cross-drainage structures, including 10 Hume Pipe (HP) culverts and 1 slab culvert. These structures were outdated, and many had become choked due to siltation, leading to inadequate drainage. As a result, the existing HP culverts were proposed to be replaced.
- **Protection Walls (Retaining Walls):** Due to the road's poor condition, erosion control measures were highly likely required, particularly in flood-prone or waterlogged areas. Therefore, protection work such as retaining wall and toe wall was required at certain stretches of the road.

Hajin-Ajas Road via Saidnara:

The **Hajin-Ajas road** is a Major District Road (MDR) that provides an essential transportation route for the region, connecting the Bandipora-Sumbal road to villages along the **Jhelum River**; the road serves a population of 49,524 mainly the villages of Koshum bagh, Rakhi Hajin, Sadurkote, Gund Prang & Ajas. The road passes through several **low-lying areas** that are vulnerable to **water logging**, especially during the monsoon season, which impacts the road's condition. The road is crucial for **moderate-intensity commercial traffic**, but its narrow width (2.75 meters to 2.95 meters) and **dilapidated bituminous surface** do not meet current transportation standards. Initially constructed for rural access, the road now serves a wider range of vehicles, necessitating

widening and upgrades. Like the other two roads, the **2014 floods** exacerbated the road's existing issues, damaging several sections and making it difficult to travel. The existing infrastructure, such as the cross-drainage structures, has been overwhelmed by siltation and flooding, requiring urgent attention.

➢ PRE-EXISTING CONDITIONS:

- **Pavement Condition:** The existing pavement was a flexible type and was in very poor condition. There were signs of extensive longitudinal cracks, crocodile cracks, rutting, edge failure, and potholes throughout the stretch. Sections of the road had been patched with bituminous material, but the overall condition was still unsuitable for modern traffic.
- **Carriageway & Shoulders:** The carriageway width ranged from 2.75 meters to 2.95 meters, which was below the standard for an intermediate lane. The shoulder

width was around 0.85 meters, resulting in an overall roadway width of 6.5 meters to 8 meters.

- **Cross Drainage Structures:** The road had 13 cross-drainage structures, including 9 Hume Pipe (HP) culverts and 4 slab culverts. These structures were in poor condition and require demolition and reconstruction to prevent water logging and maintain the road's structural integrity.
- **Protection Walls (Retaining Walls):** The road had 701 meters of retaining walls, constructed from stone masonry or PCC, which were in poor condition. These walls required significant repairs to prevent soil erosion and protect the road from further damage.

3.1.2 ROAD UPGRADES & IMPROVEMENT

The **Hamray-Sultanpora Nowgam to Sumbal Bridge**, **Shadipora-Kanipeth Sumbal Road**, and **Hajin-Ajas Road via Saidnara** underwent a series of extensive upgrades as part of a large-scale infrastructure project aimed at improving the safety, functionality, and resilience of these roads. The project focused on addressing the key issues identified in the background section, including road widening, pavement upgrades, drainage improvement, and structural protection. Below are the key components of the improvements implemented:

- **Hamray-Sultanpora Nowgam to Sumbal Bridge:**
  - **IMPROVEMENT OF GEOMETRICS:**

- **Carriageway Width:**
  - The cross-section consists of a 3.75 m wide carriageway with a 1.000 m wide granular hard shoulder on either side.
  - The camber for the carriageway and shoulder is **2.5%** and **3.0%** respectively, promoting proper drainage.

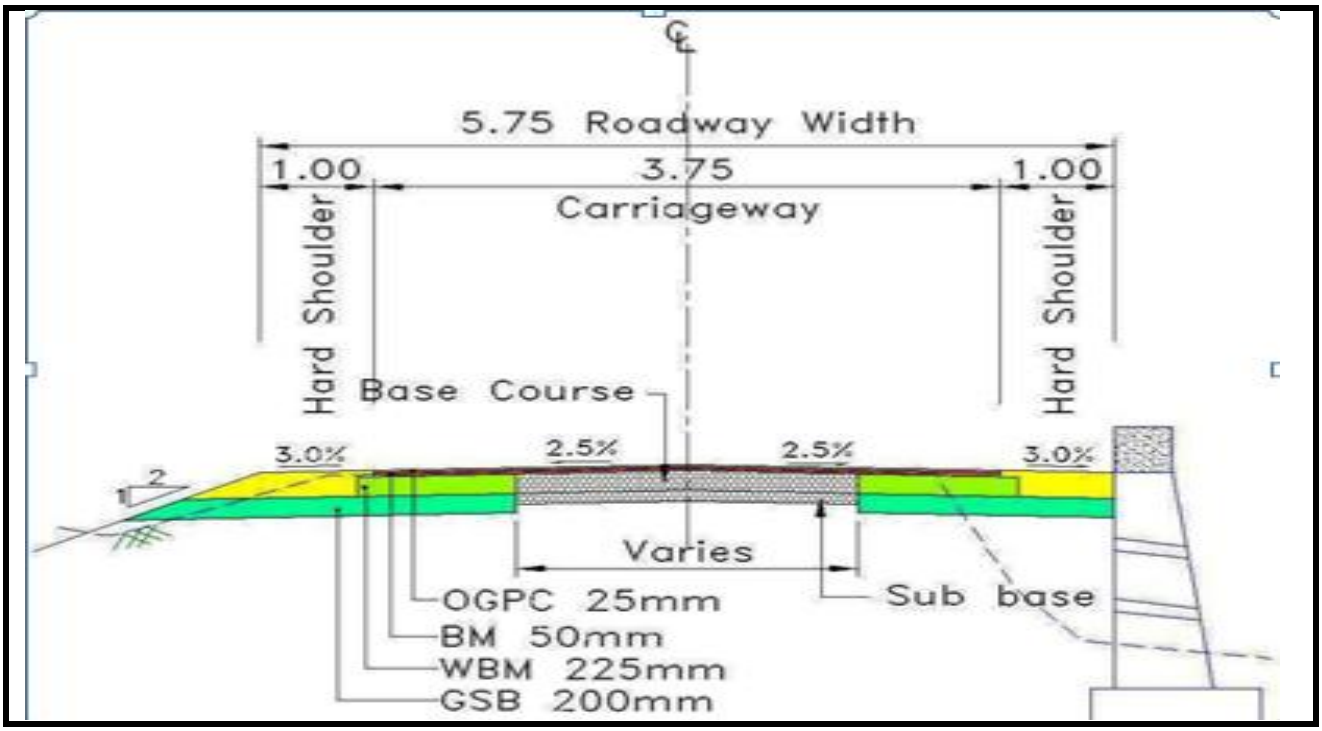
- **Horizontal & Vertical Alignment:**
  - Widening of the road provided more room for vehicles to pass safely, reducing the risk of head-on collisions and improving maneuverability.
  - Realigning the road and opening blind curves helped in enhancing the overall visibility for drivers, which in turn, reduced the likelihood of accidents caused by sudden curves or poorly lit sections of the road however, due to land constraints in some stretches passing bays totaling 507.8 meters between Km 9.327 to Km 10.393 were constructed for smooth flow of traffic in both directions.
  - Profile corrective courses in few stretches were applied to improve the road's grade and enhance water drainage.

➢ PAVEMENT UPGRADES:

- **Hamray-Sultanpora-Sumbal Road:**
  - The road surface was upgraded with **50mm thick Bituminous Macadam (BM)** and **25mm Open Graded Premix Carpet (OGP**). This upgrade provides high-quality smoothness and durability, making it resilient to traffic and harsh weather.

➢ IMPROVEMENT OF CROSS DRAINAGE STRUCTURES:

- **Cross Drainage Works:**
  - Two NP4 Hume pipe culverts (300mm diameter) were installed at RD 7+185 and RD 7+300, with lengths of 10m and 7.5m, to enhance water runoff management, smooth passage of water across the road catering paddy fields.



➢ PROTECTIVE WORKS:

- **Retaining Walls:**
  - In total 1132 meter long RCC retaining wall was constructed in stretches between Km 8.006 to Km 10.741 to safeguard the road from soil erosion and sliding.

➢ ROAD MARKING & ROAD SIGNS:

- **Markings:**
  - **Thermoplastic road markings** were applied with reflective glass beads, following IRC: 35-2015 standards for improved visibility on the both sides of road marking the carriage way throughout the entire length of the project road.
- **Signs:**
  - **129 road signs** were strategically placed, including mandatory, cautionary, and informative signs, complying with IRC: 67-2012.
  - Precast kilometer stones were installed along the road as per IRC: 8-1980.

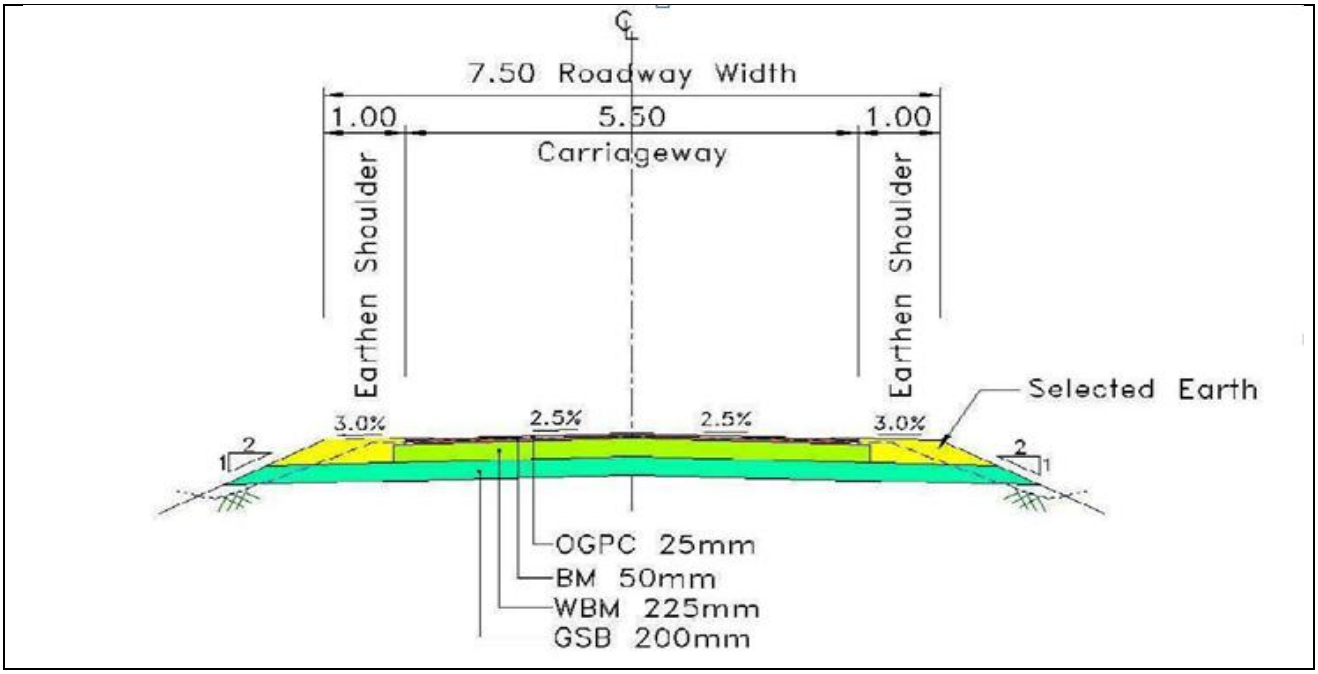
➢ Shadipora-Kanipeth Sumbal Road:

➢ IMPROVEMENT OF GEOMETRICS:

- **Carriageway Width:**
  - The cross-section now includes a 5.5 m wide carriageway with 1.000 m wide granular hard shoulders on both sides, maintaining 2.5% camber on the carriageway and 3.0% on the shoulders.
- **Horizontal & Vertical Alignment:**
  - The alignment followed the existing path while upgrading the road from a single lane to an intermediate carriageway of 5.5 meters.
  - Widening of the road provided more room for vehicles to pass safely, reducing the risk of head-on collisions and improving maneuverability.
  - Realigning the road and opening blind curves helped in enhancing the overall visibility for drivers, which in turn, reduced the likelihood of accidents caused by sudden curves or poorly lit sections of the road alignment of the road.

➢ PAVEMENT UPGRADES:

- **Shadipora-Kanipeth Sumbal Road:**
  - The road was resurfaced with **50mm Bituminous Macadam (BM)** and **25mm Open Graded Premix Carpet (OGP)**, along with additional layers of **Granular Sub-base (GSB)** and **Water Bound Macadam (WBM) for widening portion** to improve its structural strength and durability.



➢ IMPROVEMENT OF CROSS DRAINAGE STRUCTURES:

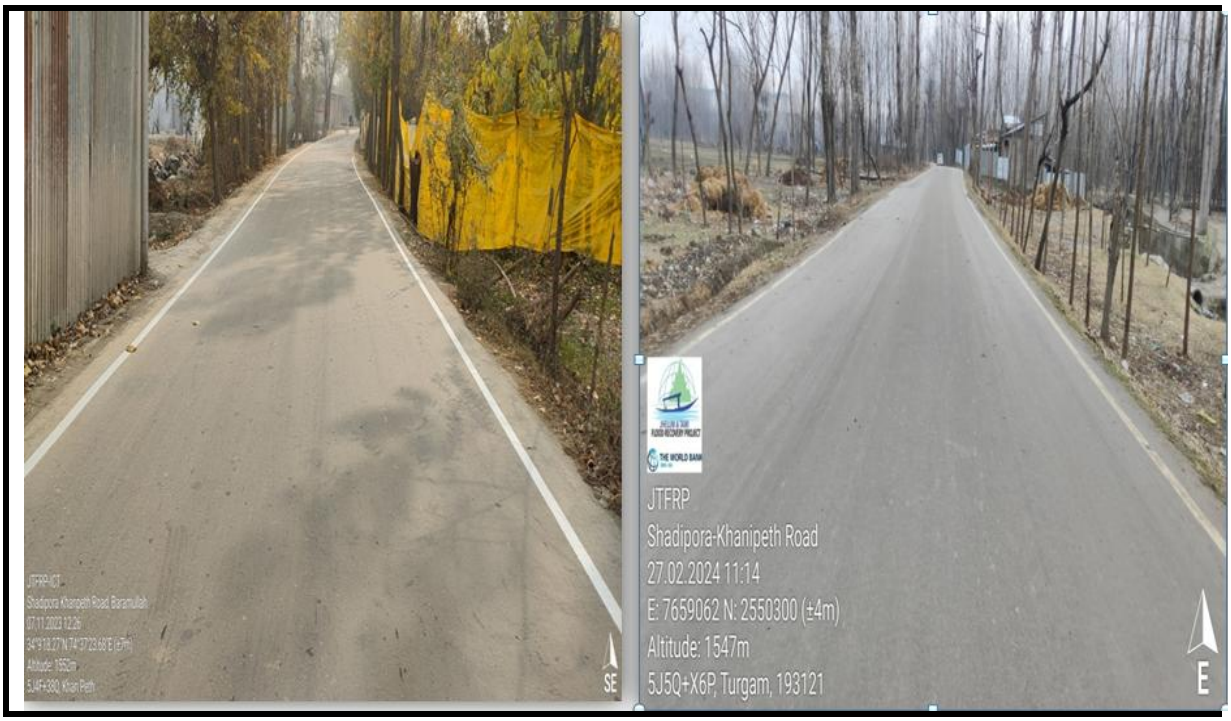
- **Cross Drainage Works:**
  - Two 1200mm diameter NP4 Hume pipe culverts were constructed at RD 0+025 and RD 2+240, measuring 15m and 7.5m respectively.
  - Additionally, 12 cross drainage Hume pipe culverts (300mm diameter) were installed between RD 2+080 and RD 4+520.

➢ PROTECTIVE WORKS:

- **Retaining Walls:**
  - In total 681.25-meter retaining wall was constructed from Km 3.452 to Km 5.283 to prevent soil erosion and ensure the road's stability.

➢ ROAD MARKING & ROAD SIGNS:

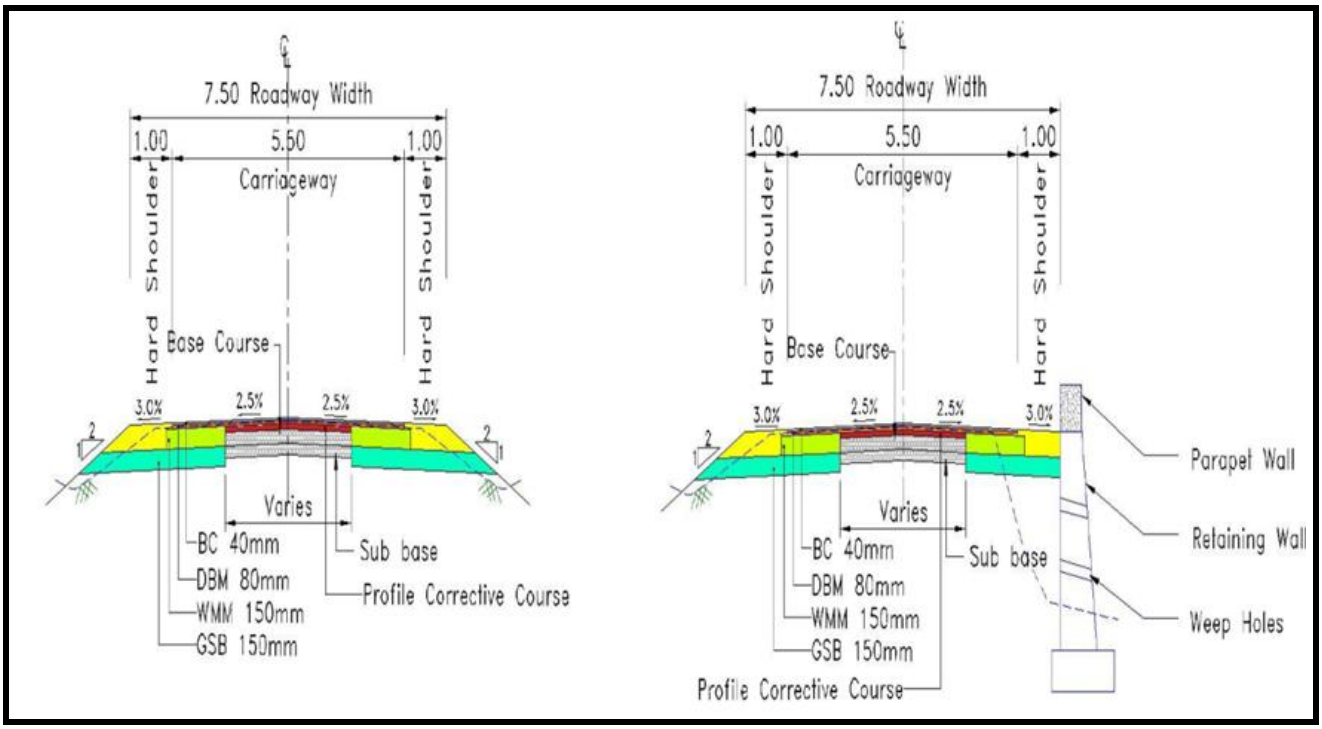
- **Markings:**
  - Thermoplastic road markings were applied with reflective glass beads, following IRC: 35-2015 standards for improved visibility on the both sides of road marking the carriage way throughout the entire length of the project road.
- **Signs:**
  - 72 road signs were placed along the road, including mandatory, cautionary, and informative types, following the IRC: 67-2012 guidelines.
  - Precast kilometer stones were installed along the road as per IRC: 8-1980.



➢ Hajin-Ajas Road:

➢ IMPROVEMENT OF GEOMETRICS:

- **Carriageway Width:**
  - The road now features a 5.5 m wide carriageway with 1.0 m earthen shoulders on both sides. The camber on the carriageway is 2.5%, and the earthen shoulders are sloped at 3.5%.
- **Horizontal & Vertical Alignment:**
  - Widening of the road provided more room for vehicles to pass safely, reducing the risk of head-on collisions and improving maneuverability.
  - Realigning the road and opening blind curves helped in enhancing the overall visibility for drivers, which in turn, reduced the likelihood of accidents caused by sudden curves or poorly lit sections of the road alignment of the road.
  - **Profile corrective courses** in few stretches were applied to improve the road's grade and enhance water drainage.



➢ PAVEMENT UPGRADES:

- **Hajin - Ajas Road:**
  - The surface was upgraded with **80mm Dense Bituminous Macadam (DBM)** and **40mm Bituminous Concrete (BC)** to improve its structural integrity.
  - The application of Granular Sub-base (GSB) and Wet Mix Macadam (WMM) further enhanced the road's strength, especially in key sections.

➢ IMPROVEMENT OF CROSS DRAINAGE STRUCTURES:

- **Cross Drainage Works:**
  - 1200mm diameter NP4 Hume pipe culvert was installed at RD 6+950 (15m long in a double row). Additionally, three 300mm diameter Hume pipe culverts were placed at RD 3+450, RD 3+600, and RD 3+900 to manage water runoff efficiently and provide smooth flow of water across the road to cater the paddy fields along the road.

➢ PROTECTIVE WORKS:

- **Retaining Walls:**
  - In total 901-meter retaining wall was constructed along stretches from Km 0.00 to Km 5.228 to prevent soil erosion and road instability.

➢ ROAD MARKING & ROAD SIGNS:

- **Markings:**
  - As per IRC: 35-2015, thermoplastic markings with reflective glass beads were applied along the entire length of the road.
- **Signs:**
  - 98 road signs were installed, including mandatory, cautionary, and informative signs as per IRC: 67-2012. Precast kilometer stones marked each kilometer of the road following IRC: 8-1980.
  - Precast kilometer stones were installed along the road as per IRC: 8-1980.

3.2 CONSTRUCTION OF RIGID PAVEMENTS

I. Up-gradation of Rambagh to Civil Secretariat (Lot1).

II. Up-gradation of Eastern Foreshore Road (Lot2).

III. Up-gradation of Peerbagh to Humhama IG Road (Lot3).

3.2.1 INTRODUCTION & PRE-EXISTING FEATURES:

The project roads upgraded—Rambagh to Civil Secretariat (Lot 1), Eastern Foreshore Road (Lot 2), and Peerbagh to Humhama IG Road (Lot 3)—are vital to the infrastructure of Srinagar and the Kashmir Valley. These roads connect large urban centers and facilitate the movement of people and products. Over time, these roadways have experienced major challenges in terms of maintenance and flood-related submergence, necessitating a comprehensive upgrade project to increase their resilience and usefulness.

Up-gradation of Rambagh to Civil Secretariat (Lot 1)

This sub-project focused on enhancing the Rambagh to Civil Secretariat road, an essential 4-lane arterial route that links to Srinagar Airport. The road serves a population of around 64,286 catering the localities such as Magarmal bagh, Alochi bagh, Maraharaji Bazaar, Bakshi Stadium, Ghogji bagh, Barzulla & Natipora. This road segment handles moderate commercial traffic and faces frequent flooding challenges due to poor drainage, especially after the floods in 2014. The current cross-drainage systems do not effectively manage water flow, and the surface/ subsurface drain has reduced its capacity because of debris build-up.

➢ **PRE-EXISTING CONDITIONS:**

- **Embankment, Carriageway, and Shoulder:** The average carriageway width was 7.5 meters with a raised footpath of 1.8 meters, resulting in a total formation width of 17.6 meters. The road experiences regular submergence from Km 0.000 to Km 1.9.
- **Pavement Condition:** The existing flexible pavement was in good condition but with inconsistent thickness across the stretch, ranging from 640 mm to 800 mm for the hard crust.
- **Cross Drainage Structures:** The road features a single bridge on the flood channel and three slab culverts. These structures only manage cross drainage and do not prevent submergence.
- **Drainage Issues:** The absence of longitudinal drainage exacerbates the submergence problem, heavily filled with debris, and cannot handle the water flow efficiently

Up-gradation of Eastern Foreshore Road (Lot 2)

The Eastern Foreshore Road connects several key areas in downtown Srinagar, including Munawar abad, Khayam, Sathu, Khaniyar, Bahri Kadal, Shamswari fateh kadal, and others serving a population of 82,299 people. The road runs through flat terrain, experiences heavy commercial traffic and used to face significant submergence due to inadequate drainage infrastructure. The project area includes "Babdemb," which is a small freshwater lake surrounded by a marshy land that serves as a buffer zone for excess water but has lost its capacity due to siltation and debris deposition.

➢ PRE-EXISTING CONDITIONS:

- **Embankment, Carriageway, and Shoulder:** The average carriageway width was 7 meters with footpaths ranging from 1.2 meters to 2.4 meters, resulting in a formation width between 17 meters and 19 meters.
- **Pavement Condition:** The existing flexible pavement varied in thickness from 300 mm to 420 mm, with significant wear, especially in sections that have experienced flooding.
- **Cross Drainage Structures:** The road has one bridge on the flood channel and two parallel Hume Pipe sewerage systems, which are insufficient to handle rainwater runoff.
- **Drainage Issues:** The existing drainage system, including the Hume Pipe sewerage system, is inadequate for managing heavy rainfall. The siltation of "Babdemb" further exacerbates drainage challenges.

Peerbagh – Humhama Road:

The I.G. Road, stretching from Peerbagh Bridge to Humhama Chowk, is a key arterial road in Srinagar that connects Srinagar city to Srinagar Airport. The road serves a population of around 1,16,348 catering the localities such as Peerbagh, Jeelan abad, Cooperative colony, Noorani colony, Milat abad, Toiba colony & humaham chowk .This road plays a crucial role in both local and commercial transportation, particularly catering to moderate traffic, including significant commercial vehicle movement. The road runs through a flat terrain and is lined with built-up sections on both sides.

➢ Pre-Existing Conditions

- **Pavement Condition**:
  - The existing pavement was flexible and had varying thickness across the stretch, with sections in good condition but many parts showing signs of wear such as cracks, rutting, and potholes. The pavement was not homogeneous throughout, and sections that experienced flood damage, particularly after the 2014 floods, have significantly deteriorated.
- **Carriageway & Shoulders**:

- The average width of the existing carriageway was 7.5 meters on either side, with a raised footpath of 1.8 meters, leading to a total formation width of 18.6 meters. However, the embankment height was minimal in several areas, especially in built-up stretches, and submergence has been a persistent issue due to inadequate drainage.

- **Cross Drainage Structures**:
  - There is one bridge on the flood channel and three slab culverts along the stretch. These structures only cater to cross-drainage and do not effectively manage water that accumulates on the road during rainfall, contributing to frequent submergence.
- **Drainage Issues**:
  - The existing surface drain had lost its capacity due to debris accumulation, and there is a lack of longitudinal deep drainage along the major portion of the road. The existing cross-drainage structures fail to handle the water flow, leading to regular submergence and water logging on the road.

3.2.2 ROAD UPGRADES & IMPROVEMENT

The project entails a number of significant improvements targeted at enhancing the road's drainage, functionality, and flood resistance in order to address the problems mentioned above. The key upgrades for each subproject have been mentioned below.

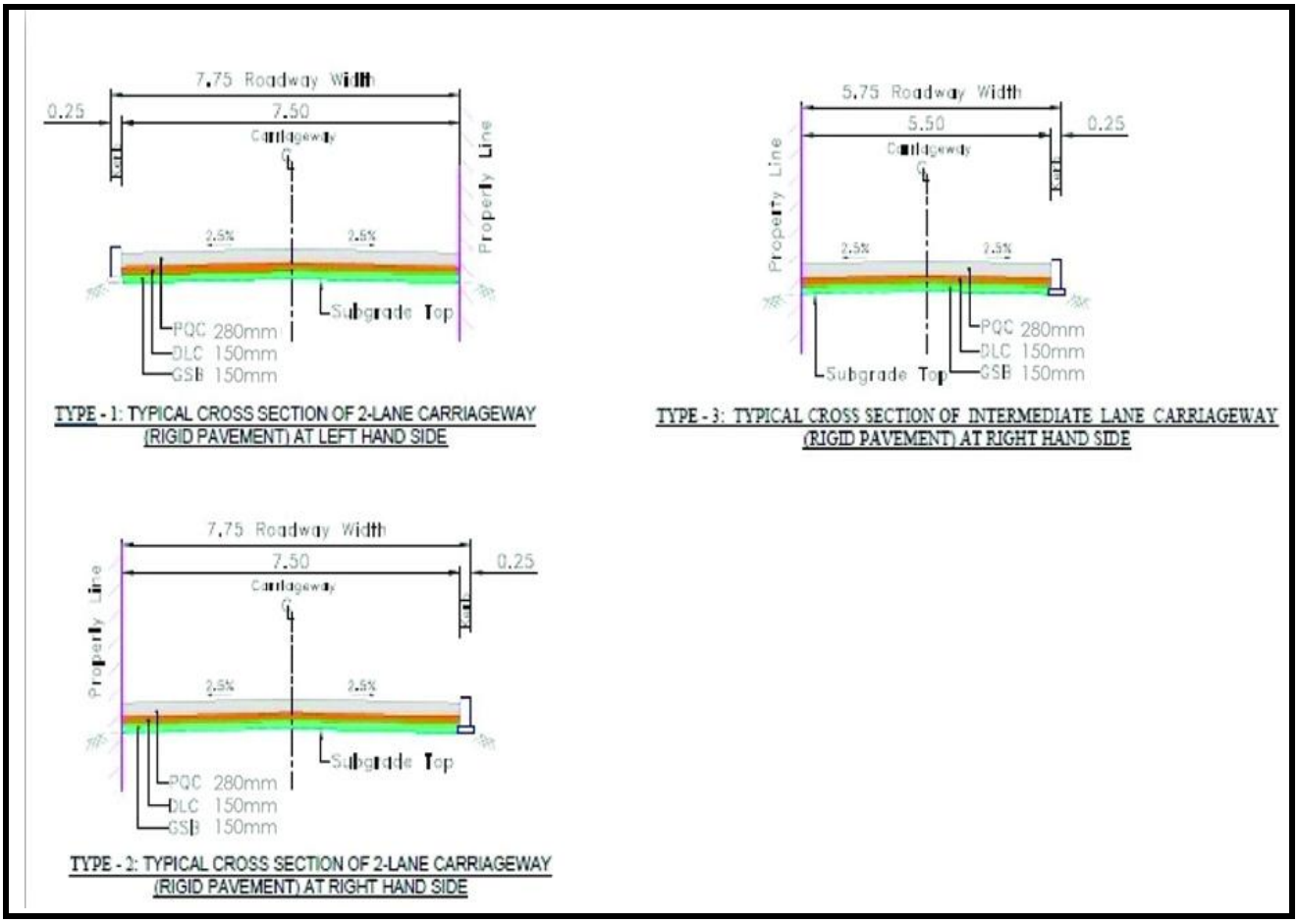
Up-gradation of Rambagh to Civil Secretariat (Lot 1)

➢ **IMPROVEMENT OF GEOMETRICS:**

- **Carriageway Width**:
  - The road has been upgraded to a 2-Lane Dual carriageway, rigid pavement cross-section. The carriageway upgraded is between 7.5-8.0 meter, surface drains provided on both sides of the road to facilitate water drainage. The camber on both sides of the carriageway is set at 2.0%, promoting proper water runoff.
- **Horizontal & Vertical Alignment**:
  - The existing alignment has been maintained, with necessary profile correction, in some stretches for better grade and water drainage. The road has been designed to support an average design speed of 60 km/h.

➢ **PAVEMENT UPGRADES:**

- **Rigid Pavement**:
  - The existing flexible pavement has been replaced with rigid pavement along the stretches that are most prone to submergence. Excavation was carried out to a depth of 580 mm to accommodate the new rigid pavement structure, providing improved durability and resilience against flooding.



- **Bituminous concrete**:
    - For areas where rigid pavement could not be applied, particularly on important utility corridor, and slopes of the existing Rambagh bridge, the surface was upgraded with **50mm Dense Bituminous Macadam (DBM)** and **40mm Bituminous Concrete (BC)**. Additionally, few stretches of utility corridor was covered with Plain Cement concrete (M15).

➢ Improvement of Drainage Structures:

- **Box Culverts & Pipe Culverts**:
- There were no cross drainage structures on the project stretch.
- **Longitudinal Drains**:
    - Longitudinal surface drains were installed on both sides of the road to efficiently channel water. In certain sections between RD 0+017 and RD 1+835, trash guards were also added over the drains to prevent blockages. This was particularly necessary as the surface drains run parallel to a busy commercial market, where debris accumulation could hinder drainage flow.

➢ ROAD MARKING AND SIGNS:

- **Road Markings**:
  - Thermoplastic road markings **were applied with** reflective glass beads**, following** IRC: 35-2015 **standards for improved visibility on the both sides of road marking the carriage way throughout the entire length of the project road.**
- **Road Signs**:
  - **41 No road signs** were placed along the road, including mandatory, cautionary, and informative types, following the **IRC: 67-2012** guidelines.

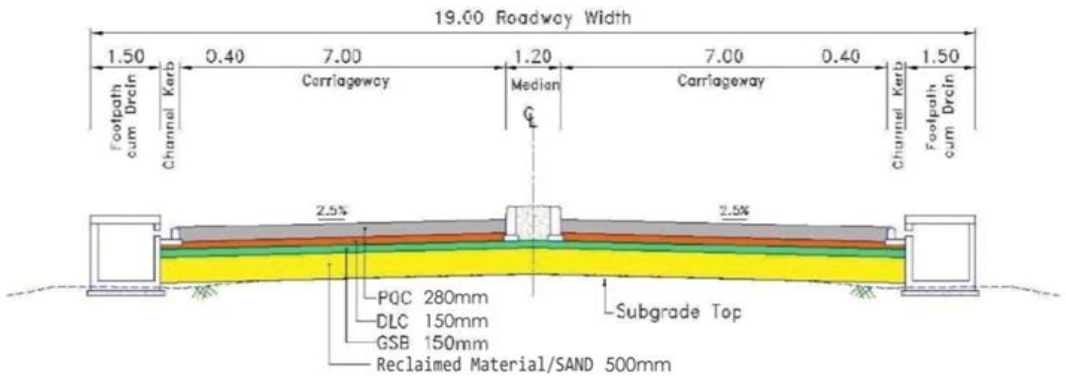
Up-gradation of Eastern Foreshore Road (Lot 2)

➢ IMPROVEMENT OF GEOMETRICS:

- **Carriageway Width**:
  - The road has been upgraded to a rigid pavement with a 2-lane dual carriageway for the main stretch of 2.890 km and a 2-lane intermediate carriageway for a 0.71 km link road. The carriageway width varies between 7.5 and 8.0 meters. The camber on each side of the carriageway is set at 2.0%, ensuring optimal water runoff.
- **Horizontal & Vertical Alignment**:
  - The existing alignment has been retained for the rehabilitation and strengthening of the road, ensuring that the required average design speed of 40 km/h is maintained. The finished level of the carriageway was adjusted to the necessary grade, with a profile corrective course implemented, along with appropriate two-directional cambers on the surface. Furthermore, the profile correction for the approaches to the Baba Dawood Khaki Bridge has been successfully completed.

➢ PAVEMENT UPGRADES:

- **Rigid Pavement**:
  - The existing flexible pavement has been replaced with rigid pavement. Excavation was carried out to a depth of 1080 mm to accommodate the new rigid pavement structure, which also included sub grade stabilization by way of replacing the existing sub grade up to a depth of 500 mm providing improved durability.



TYPE - 1: TYPICAL CROSS SECTION OF 2-LANE DUAL CARRIAGEWAY (RIGID PAVEMENT) WITH MEDIAN & BOTH SIDE COVERED RCC DRAIN

- **Bituminous concrete**:
  - For areas where rigid pavement could not be provided, particularly on important utility corridor, and slopes of the existing Rambagh bridge, the surface was upgraded with **50mm Dense Bituminous Macadam (DBM)** and **40mm Bituminous Concrete (BC)**.

➢ Improvement of Drainage Structures:

- **Box Culverts & Pipe Culverts**:
- There were no cross drainage structures on the project stretch.
- **Longitudinal Drains**:
  - Longitudinal drains for around 600 meter were only executed at site.

➢ ROAD MARKING AND SIGNS:

- **Road Markings**:
  - ➢ Thermoplastic road markings **were applied with** reflective glass beads**, following** IRC: 35-2015 **standards for improved visibility on the both sides of road marking the carriage way throughout the entire length of the project road.**
- **Road Signs**:
  - ➢ The installation of road signs was not carried out at the site by the contracting agency.

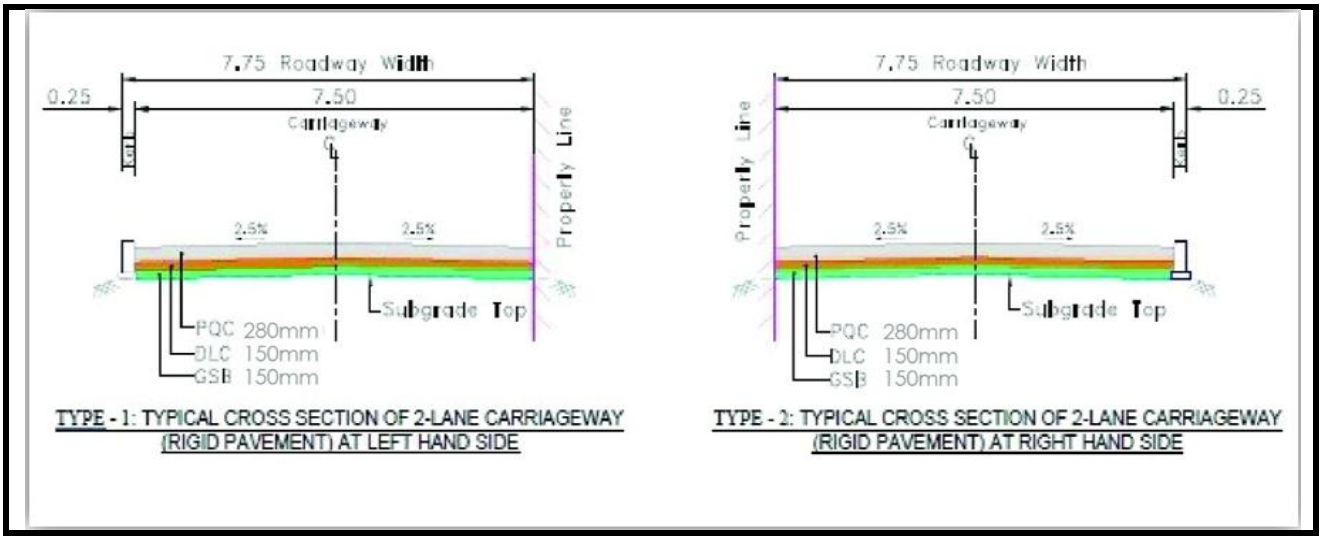
Up-gradation of Peerbagh to Humhama IG Road (Lot3).

➢ IMPROVEMENT OF GEOMETRICS:

- **Carriageway Width**:
  - ➢ The road is upgraded to a dual-lane, rigid pavement cross-section. The carriageway upgraded is between 7.5-8.0 meter, surface drains provided on both sides of the road to facilitate water drainage. The camber on both sides of the carriageway is set at 2.0%, promoting proper water runoff.
- **Horizontal & Vertical Alignment**:
  - ➢ The existing alignment is maintained, with necessary profile correction for better grade and water drainage. The road has been designed to support an average design speed of 60 km/h.

➢ PAVEMENT UPGRADES:

- **Rigid Pavement**:
  - ➢ The existing flexible pavement has been replaced with rigid pavement along the stretch that is most prone to submergence. Excavation was carried out to a depth of 580 mm to accommodate the new rigid pavement structure, providing improved durability and resilience against flooding.



TYPE - 1: TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY (RIGID PAVEMENT) AT LEFT HAND SIDE

TYPE - 2: TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY (RIGID PAVEMENT) AT RIGHT HAND SIDE

- **Bituminous concrete**:
  - ➢ For areas where rigid pavement could not be applied, such as existing bridges, its approaches and locations where the pavement level transitions to existing flexible pavement, Bituminous Macadam 50mm and Semi dense bituminous concrete 25mm was used to improve surface quality and prevent water infiltration.

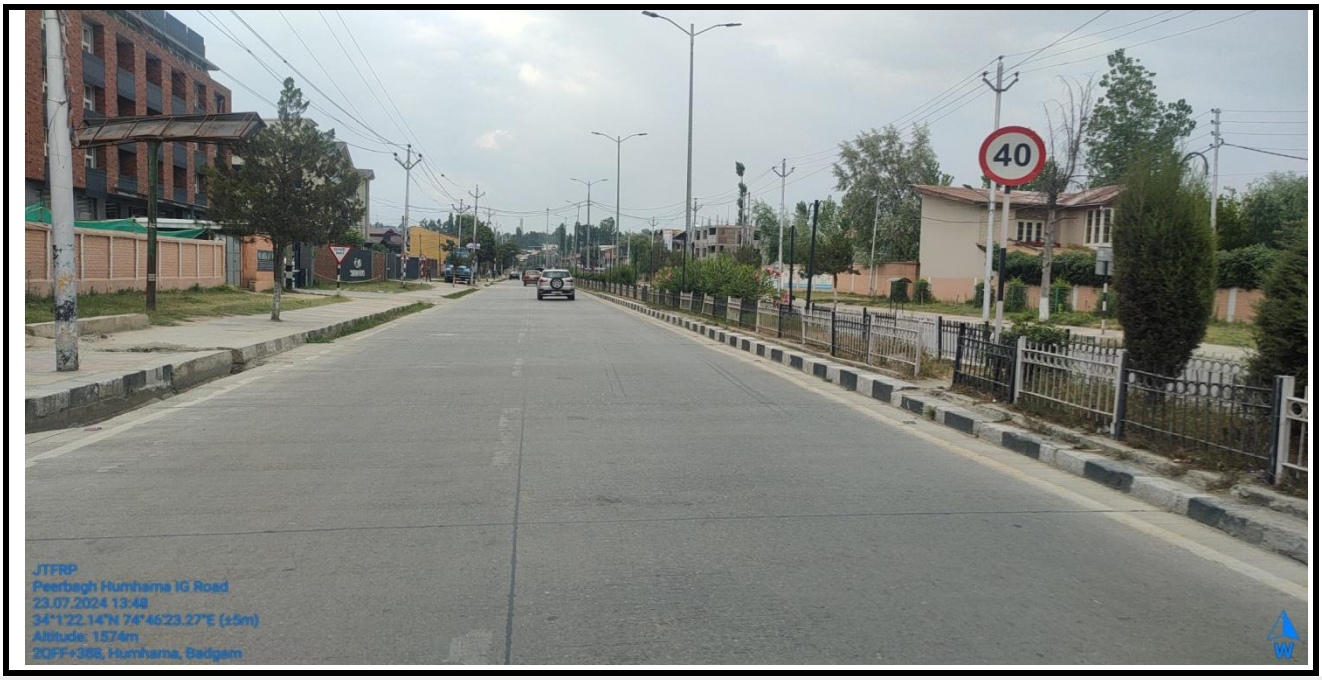
➢ IMPROVEMENT OF DRAINAGE STRUCTURES:

- **Box Culverts & Pipe Culverts**:
  - ➢ The existing slab culverts were replaced with larger Box culverts at RD 1+210, RD 1+290 & RD 1+475 to improve water flow and prevent the build-up of water on the road. In addition to these box culverts, Hume pipe culverts at RD 0+875 & RD 1+035 were provided to handle the runoff during heavy rains and avoid submergence.

- **Longitudinal Drains**:
  - Longitudinal surface drains were constructed on both sides of the road to direct water toward the cross-drainage systems. In specific sections, trash guards were installed over the drains to allow access to the sub-lanes and homes located on both sides of the road.

➢ ROAD MARKING AND SIGNS:

- **Road Markings**:
  - ➢ Thermoplastic road markings were applied with reflective glass beads, following IRC: 35-2015 standards for improved visibility on the both sides of road marking the carriage way throughout the entire length of the project road.
- **Road Signs**:
  - ➢ 38 No road signs were placed along the road, including mandatory, cautionary, and informative types, following the IRC: 67-2012 guidelines. In addition, 01 No digital board was also placed at RD 1+490.



3.3 Up-gradation of Parimpora to Soibugh Road (Lot 4).

3.3.1 INTRODUCTION & PRE-EXISTING FEATURES:

The **Parimpora to Soibugh Road** is a vital road segment in the Kashmir Valley that connects **Parimpora Bypass (NH 1A)** at 558 km to **Soibugh**, stretching approximately 7.932 kilometers. The road runs through agricultural land, residential areas, and commercial zones, serving as a crucial link for several villages, including Parimpora, **Bemina**, Shareif abad, Abanshah, **Hajibagh**, and **Soibugh** serving a population of 63,662. The road, originally constructed for rural connectivity, now plays an important role in local commerce and transportation, with increased traffic demanding an upgrade. The pre-existing infrastructure was insufficient to meet current needs, particularly due to narrow sections, sharp curves, and the limited capacity of drainage systems and bridges.

This road faced several challenges, such as narrow stretches with single-lane capacity, especially between **Km 2.550** and **Km 4.100**, where sharp turns and waterlogged areas exist. Additionally, a **26-meter bridge** over the flood spill channel is inadequate for handling water flow, prompting the construction of a larger bridge nearby. The project involved widening the road, improving alignment, regarding slopes, and upgrading cross drainage systems to address water logging. Protection works, including **RCC retaining walls** and **parapets**, has been installed in areas vulnerable to erosion, while **milling and resurfacing** in certain stretches improved the riding surface. The goal was to restore and improve connectivity, reduce travel time, and support economic growth by enhancing road safety and infrastructure.

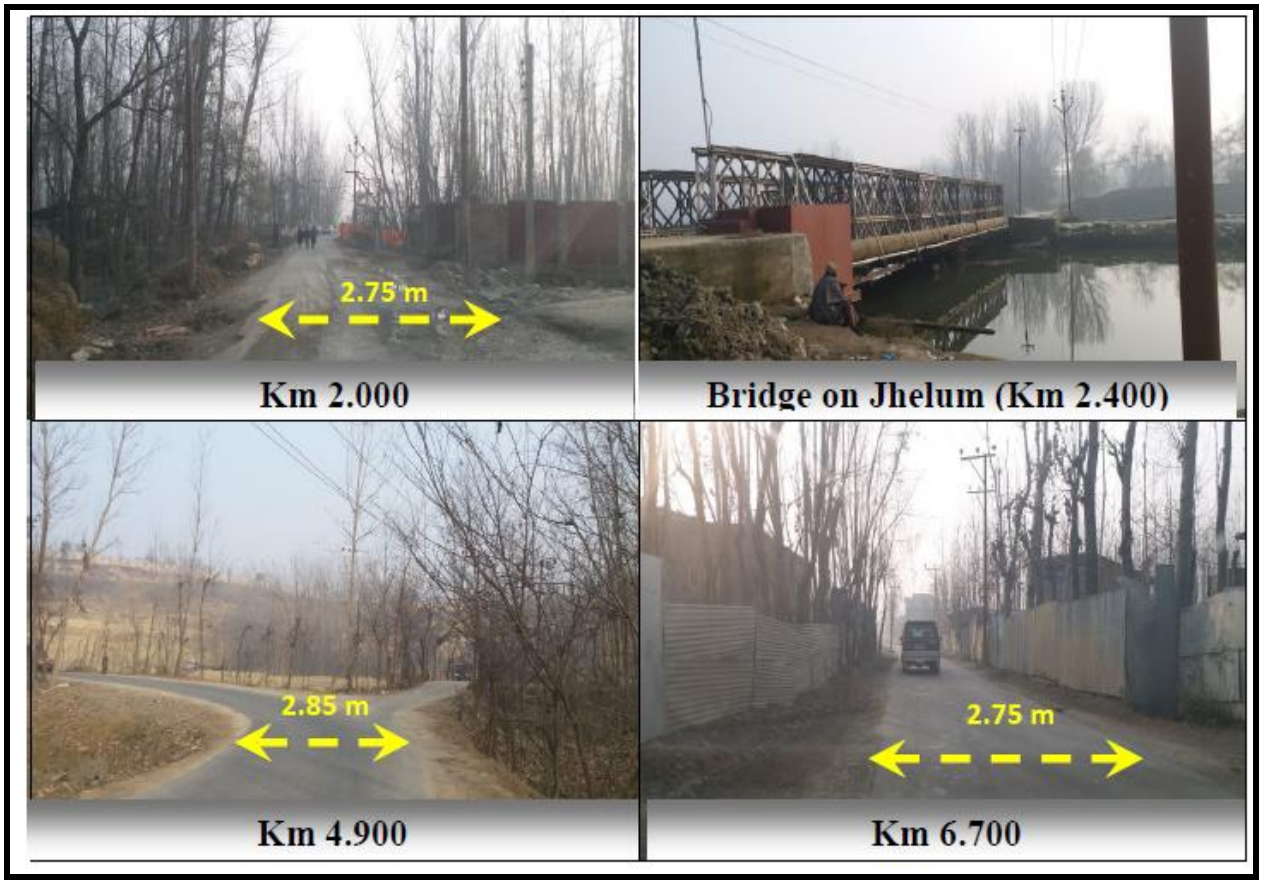
➢ PRE-EXISTING CONDITIONS:

- **Embankment, Carriageway, and Shoulder:**

  - The existing carriageway varied from 2.75 m to 2.85 m in width, with an average shoulder width of 0.85 m. This results in an overall average roadway width of 4.55 m to 5.0 m.
  - The road passes through both agricultural and residential areas, with **several narrow stretches**, especially between **Km 2.550 and Km 3.900**.
  - The road faced **frequent flooding** issues in low-lying areas such as **Ch 4.940 km to Ch 5.475 km**.

- **Pavement Condition:**

  - The pavement was **flexible** and in **poor condition**, showing signs of **longitudinal cracks, crocodile cracks, edge failure**, and **potholes**. The top layer of bituminous pavement is significantly damaged along the stretch.
  - **Milling/ dismantling** of the top 50 mm layer in some stretches was necessary before laying a new base course and bituminous layers.



• CROSS DRAINAGE STRUCTURES:

- The road has **15 culverts**, with **8 Slab culverts** and **7 Hume Pipe culverts**. Several of these structures were in poor condition and needed to be **demolished and reconstructed**.
- The road also has **two Bailey bridges** at **Ch 2+412 km** and **Ch 5+079 km**, but their span was insufficient to handle current floodwater flow.

• DRAINAGE ISSUES:

- The existing cross drainage structures were not efficient in managing the floodwater, leading to submergence during the rainy season. The absence of longitudinal drainage exacerbates these issues, especially in residential and commercial areas.

3.3.2 ROAD UPGRADES & IMPROVEMENT:

- **IMPROVEMENT OF GEOMETRICS:**

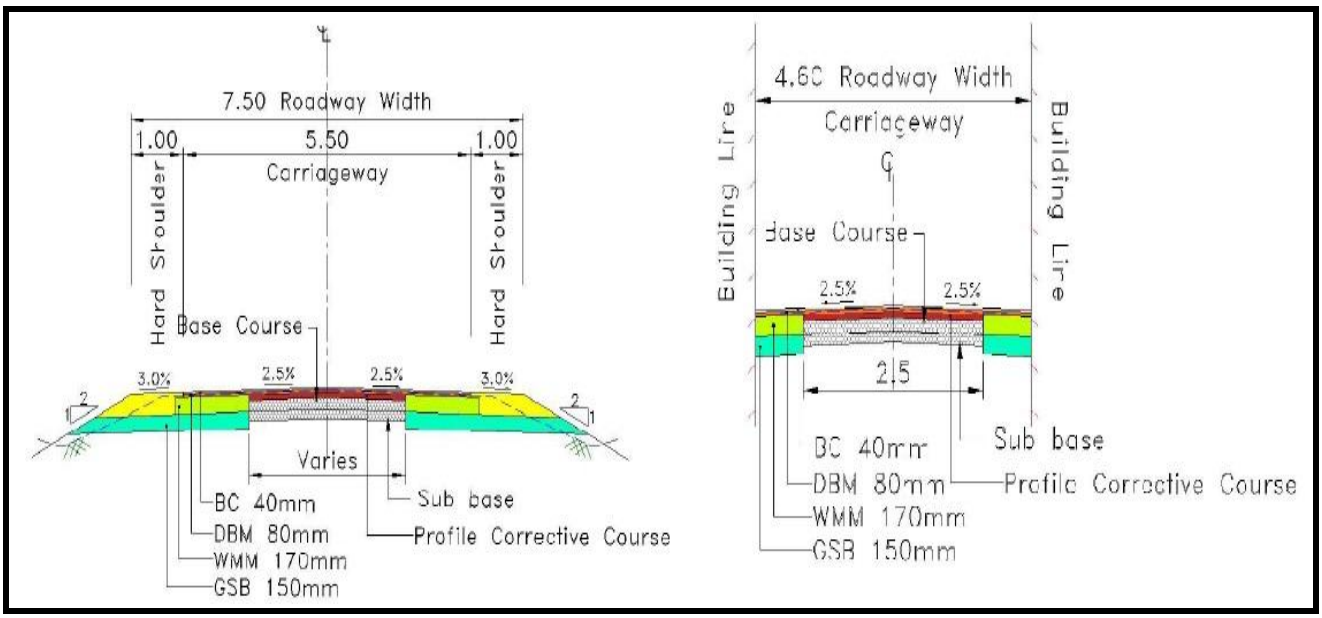
• CARRIAGEWAY WIDTH:

- The road has been upgraded to a **5.5-meter wide carriageway** with **0.5-meter wide earthen shoulders** on both sides, improving its capacity and traffic flow.

- The **camber** on both sides of the carriageway and the shoulder has been set at **2.5%**, with **3.5%** on the earthen shoulder, to ensure proper water drainage and runoff.

• HORIZONTAL & VERTICAL ALIGNMENT:

- The **existing alignment** has been maintained, with necessary **profile corrections** to enhance the **road grade** and facilitate better **water drainage**.
- The road has been designed for an **average design speed of 40 km/h**, considering the residential and commercial nature of the area.



➢ PAVEMENT UPGRADES:

- The surface was upgraded with **60mm Dense Bituminous Macadam (DBM)** and **30mm Bituminous Concrete (BC)** to improve its structural integrity.
- Granular Sub-base (GSB) 200mm Thick and Wet Mix Macadam (WMM) 170mm Thick was applied to further enhance the road's strength, especially in widened sections.

➢ IMPROVEMENT OF DRAINAGE STRUCTURES:

• CROSS DRAINAGE STRUCTURES:

- **03 new Box culverts at RD 5+200, RD 5+400 & RD 6+020 has been constructed** to improve the carrying capacity/ water flow of existing insufficient cross drainage infrastructure.

- In addition to these box culverts, **Hume pipe culverts of 900mm diameter NP4 pipes at RD 2+200, RD 2+800 & RD 4+600.** Further, **Hume pipe culverts of 1200mm diameter & 600mm diameter NP4 pipes at RD 4+150 & RD 5+700** respectively were provided to handle the runoff during heavy rains and avoid submergence.

- **LONGITUDINAL DRAINS:**
  - **Longitudinal surface drains** of total 281 meters was constructed on both sides of the road between **RD 1+780 to RD 1+940** & **RD 4+143 to RD 4+264** to efficiently channel water and reduce the risk of submergence.

PROTECTION WORK:

- Plain Cement Concrete retaining wall was constructed in the different stretches of the road. In total 523 meters of retaining wall was constructed on both sides of road.

ROAD MARKING AND SIGNS:

- **ROAD MARKINGS:**
  - **Thermoplastic road markings** with **reflective glass beads** have been be applied along the entire length of the project road to improve **visibility** and **safety**, following **IRC: 35-2015** standards.

- **ROAD SIGNS:**
  - 63 road signs have been placed along the road, including mandatory, cautionary, and informative signs to ensure proper traffic management and driver awareness, following IRC: 67-2012 guidelines.

3.4 Up-gradation of Sangam –Khudwani and Bijbehara – Waghama via Katreteng Road.

3.4.1 INTRODUCTION & PRE-EXISTING FEATURES:

Bijbehara – Waghama via Katreteng Road

Bijbehara-Waghama via Katreteng road is a single-lane rural road connecting Bijbehara to Karihama NH, passing through plain and rolling terrains. The road serves moderate commercial traffic and provides connectivity to several villages such as Zirpara, Hayar, Waghama, Sirhama, Sirighupwara, Shalbhug, serving a population exceeding 31,529 people. The road has an average carriageway width of 2.5 meters, which is substandard for a single-lane road, requiring widening. Due to Right of Way (ROW) constraints, concentric widening is proposed. The existing pavement is in poor condition, and a complete reconstruction is proposed for the entire stretch. Cross-drainage improvements and retaining wall repairs are also necessary at various stretches.

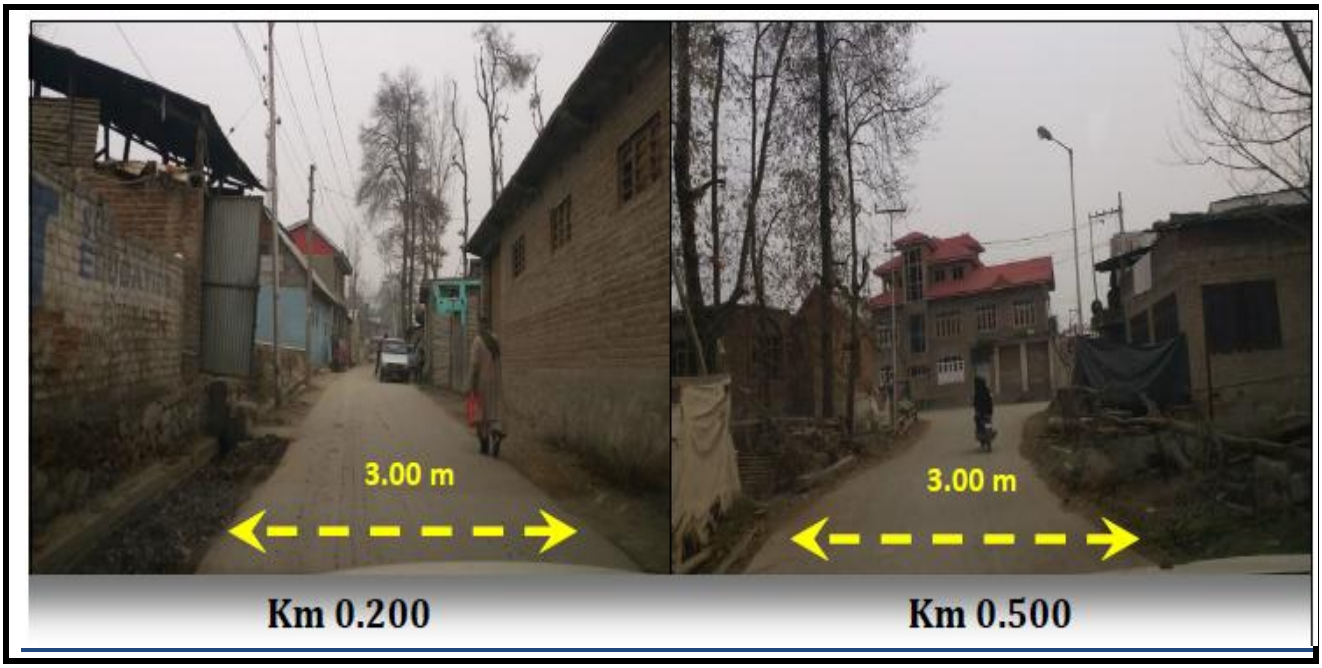
- **PRE-EXISTING CONDITIONS:**

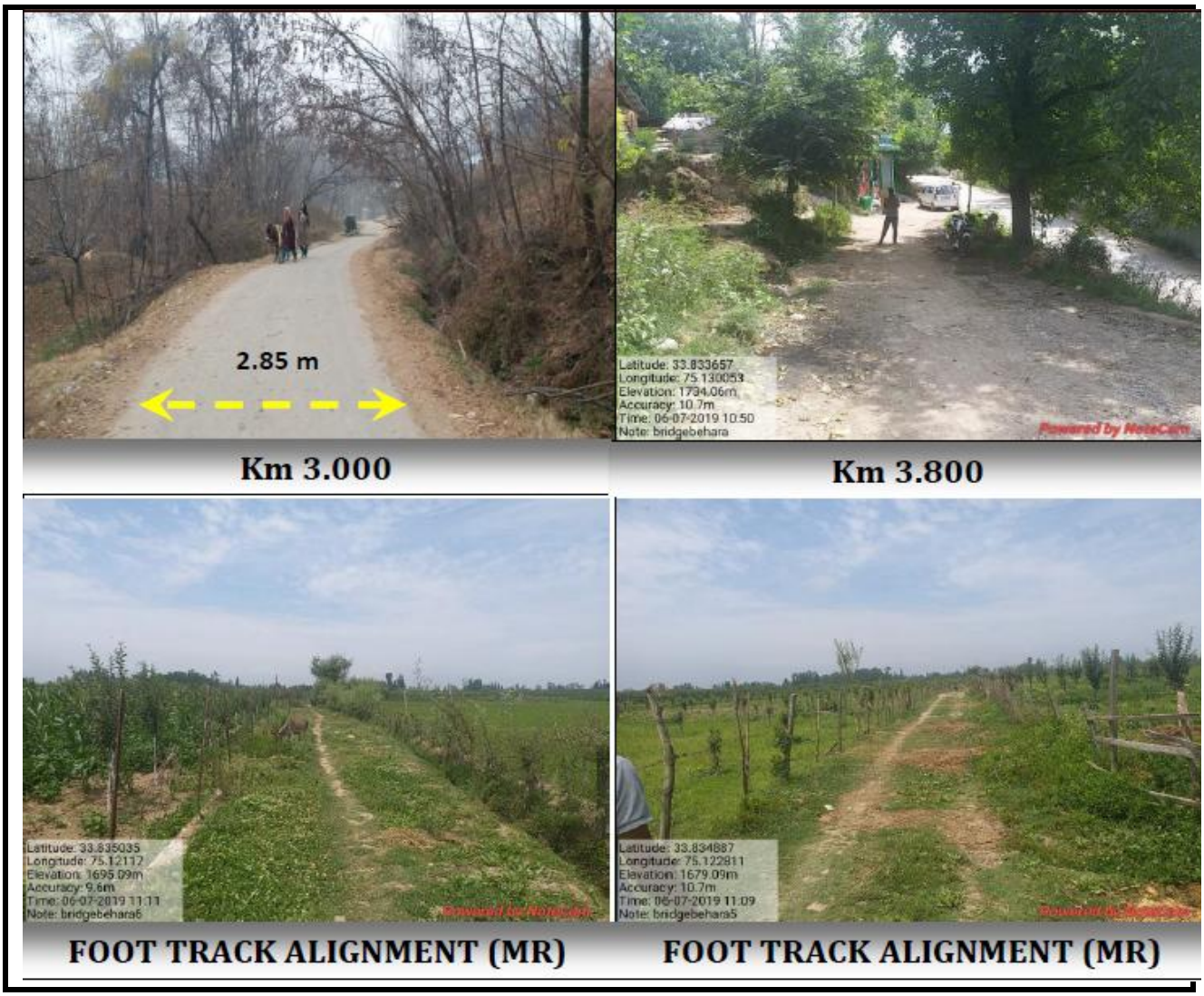
- **Pavement Condition:**
  - The flexible pavement was in poor condition for the entire stretch, with a composition not uniform throughout due to inconsistent maintenance over time. A significant portion of the road, especially from Km 0.000 to Km 4.000, is covered with broken BT (Bituminous) surface, while other stretches were either gravel or earthen. Furthermore, the portion of road between Km 6.040 to Km 6.773 required complete reconstruction.

- **Carriageway & Shoulders:**
  - The average width of the existing carriageway was between 2.5 meters to 3.0 meters, with a shoulder width of approximately 0.5 meters, leading to a formation width of 3.5 meters to 4.0 meters, below the standard for a single-lane road.

- **Cross Drainage Structures:**
  - The road had 6 cross-drainage structures, including 4 slab culverts and 2 bridges. One of the slab culverts needs to be reconstructed into a box culvert of suitable size to improve drainage.

- **Protection Walls (Retaining Walls):**
  - There were 121.20 meters of stone walls and 116.65 meters of retaining walls constructed with stone masonry, which were in poor condition and require substantial repairs.


3.00 m
3.00 m
Km 0.200
Km 0.500


2.85 m
Km 3.000
Latitude: 33.833657
Longitude: 75.130053
Elevation: 1734.06m
Accuracy: 10.7m
Time: 06-07-2019 10:50
Note: bridgebehara
Km 3.800
Latitude: 33.835035
Longitude: 75.12117
Elevation: 1695.09m
Accuracy: 9.6m
Time: 06-07-2019 11:11
Note: bridgebehara6
Latitude: 33.834887
Longitude: 75.122811
Elevation: 1679.09m
Accuracy: 10.7m
Time: 06-07-2019 11:09
Note: bridgebehara5
FOOT TRACK ALIGNMENT (MR)
FOOT TRACK ALIGNMENT (MR)

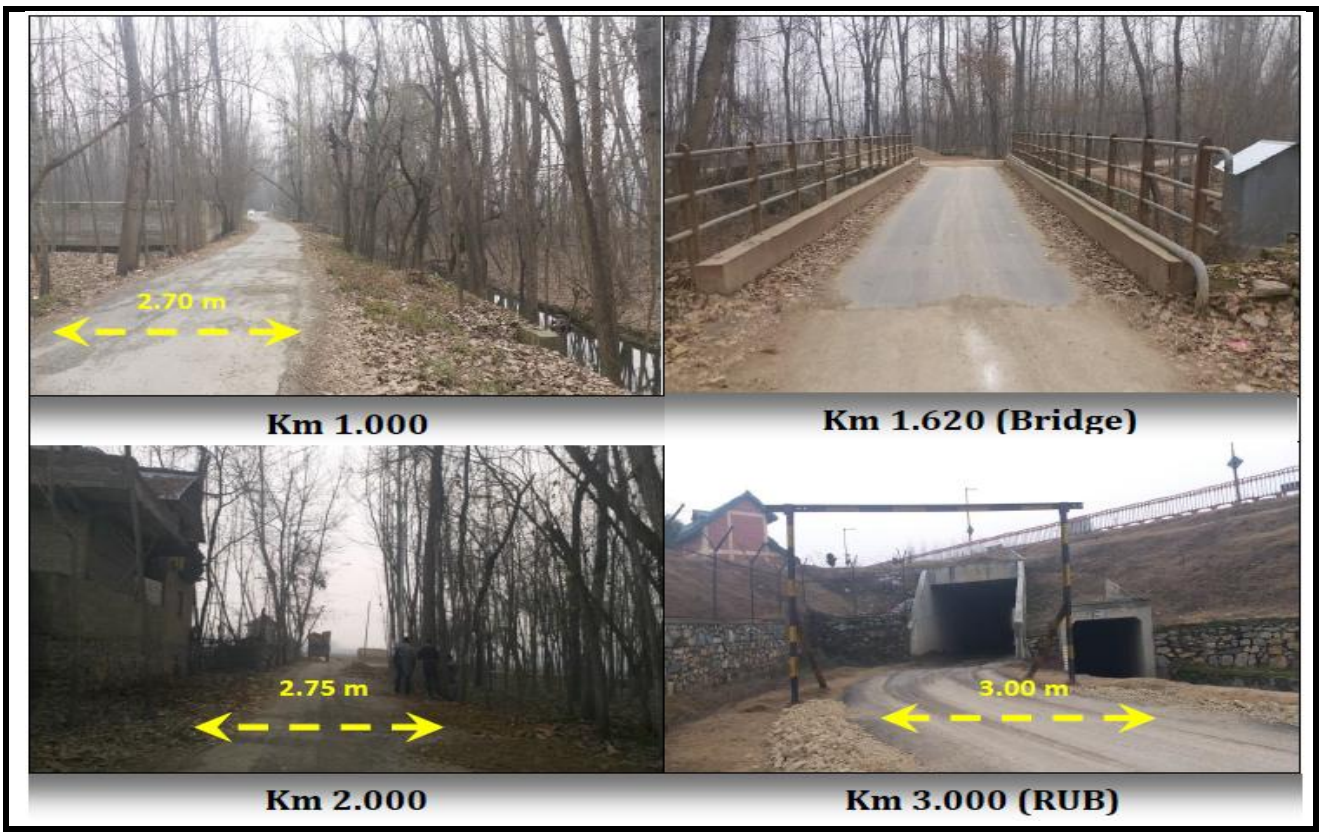
Sangam - Khudwani Road

Sangam Khudwani road is a single-lane village road running through plain terrain with low-intensity commercial traffic. The project stretch starts from NH-44 the total length of the road is 11.481 km, with the project stretch focusing on the first 3.830 km. The road provides connectivity to several villages such as Sangam, Hassanpora, Tawella, Arwani, Tulkhun serving a population exceeding 54,848 people. The average carriageway width is 2.7 meters, which is below the standard for a single-lane road, requiring reconstruction. Embankment height is minimal, and while no history of regular submergence has been found, protection work is necessary along stretches passing by the Vishow Nallah. The existing BT surface is dilapidated, and complete reconstruction is proposed for 1st Km while as widening throughout the road is recommended along with the replacement of poor culverts.

➢ PRE-EXISTING CONDITIONS:

- **Pavement Condition:**

  - The flexible pavement was in poor condition throughout the stretch. The surface is severely damaged at several points, with a composition that varies significantly due to inconsistent maintenance. From Km 0.0 to Km 3.830, the existing BT surface was in poor condition.



- **Carriageway & Shoulders:**

  - The carriageway width ranges from 2.7 meters to 3.0 meters, and the shoulder width averages 0.9 meters. The formation width ranges from 4.5 meters to 4.8 meters, which was below the standard for an intermediate road.

- **Cross Drainage Structures:**

  - There are 12 cross-drainage structures, including 8 Hume pipe culverts, 2 slab culverts, and 1 bridge. The 8 Hume pipe culverts were choked due to siltation and required replacement.

- **Protection Walls (Retaining Walls):**

  - There were existing PCC retaining walls in few stretches along the road. In km 2nd only. However, the road runs along the Vishow Nallah, and necessary protection work was needed at various locations to prevent erosion.

3.4.2 ROAD UPGRADES & IMPROVEMENT

This subproject involved a series of significant upgrades focused on enhancing the road's drainage system, functionality, and flood resistance. These improvements were specifically designed to address the existing challenges impacting the road. The key upgrades implemented for each subproject are outlined below:

- **Bijbehara – Waghama via Katreteng Road:**
  - **IMPROVEMENT OF GEOMETRICS:**

- **Carriageway Width:**

  - The completed road now features a 3.75 m wide carriageway with 1.000 m wide earthen/ granular hard shoulders on either side.
  - The camber for the carriageway is 2.5%, while the shoulder camber is 3.0%, promoting efficient water drainage.

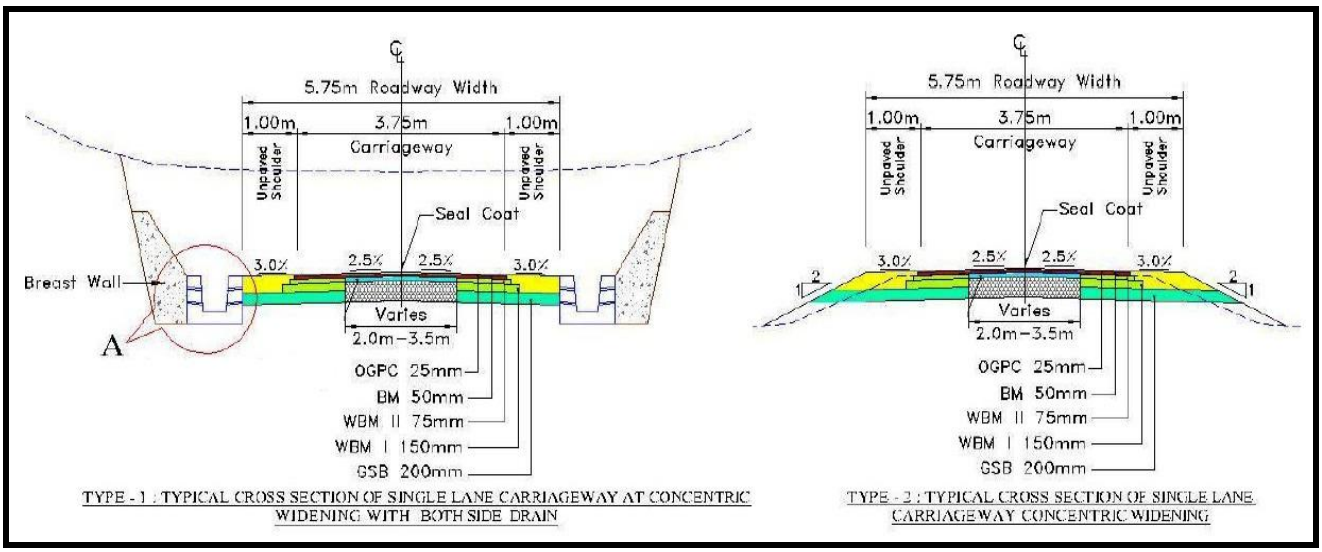
- **Horizontal & Vertical Alignment:**

  - The road widening and strengthening were carried out along the existing alignment.
  - The required ruling design speed of 40 km/h has been maintained along the entire stretch.

- Profile corrective courses were applied to the existing carriageway surface at few stretches, ensuring the required grade and proper cambers.
- Due to land constraints, curves with radii less than 60 meters were widened by 0.6 m to 0.9 m in accordance with IRC norms, improving safety and maneuverability.

➢ PAVEMENT UPGRADES:

- The surface was upgraded with **50mm Bituminous Macadam (BM)** and **25mm Open Graded Premix Carpet (OGP)** to improve its structural integrity.
- The road stretch from Km 6.040 to Km 6.773 was constructed anew, including the formation of a sub-grade with an average thickness of 300 mm, followed by a 200 mm thick Granular Sub-base (GSB), and a 225 mm thick layer of Water Bound Macadam (WBM).



TYPE - 1 : TYPICAL CROSS SECTION OF SINGLE LANE CARRIAGEWAY AT CONCENTRIC WIDENING WITH BOTH SIDE DRAIN

TYPE - 2 : TYPICAL CROSS SECTION OF SINGLE LANE CARRIAGEWAY CONCENTRIC WIDENING

➢ IMPROVEMENT OF CROSS DRAINAGE STRUCTURES:

- **Cross Drainage Works:**
  - **01 new RCC Slab culverts at RD 2+490 of Span 4.5 meter has been constructed** to improve the carrying capacity/ water flow of existing insufficient cross drainage infrastructure.
  - In addition to the slab culvert, Hume pipe culverts using NP4 class pipes of 1200mm, 450mm, and 300mm diameters have been provided at 15 locations between RD 0+820 and RD 6+650. These culverts are designed to facilitate irrigation for horticultural land and paddy fields located on both sides of the project road.

➢ DRAINAGE WORKS:

- RCC covered drain has been constructed over a 45-meter stretch between RD 0+180 and RD 0+225. Furthermore, an irrigation channel that required reconstruction due to the collapse of the existing channel within the acquired area was rebuilt in two stretches totaling 425 meters, between RD 6+050 and RD 6+505, to ensure uninterrupted irrigation supply and proper water management for the surrounding horticultural land

➢ PROTECTIVE WORKS:

- ➢ Plain Cement Concrete retaining wall was constructed in the different stretches of the road. In total 3991 meters of retaining/ toe wall was constructed on both sides of road.

➢ ROAD MARKING & ROAD SIGNS:

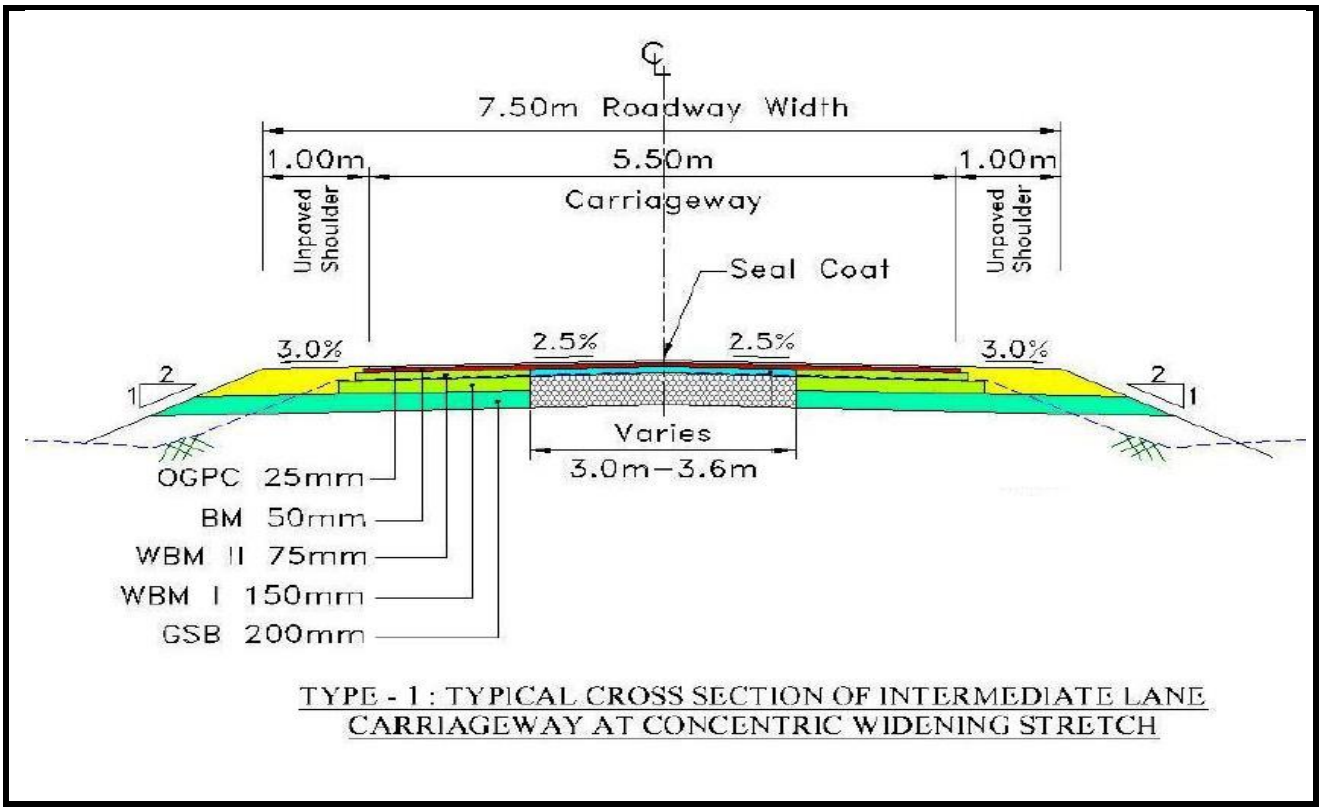
- **Markings:**
  - Thermoplastic road markings, complying with IRC: 35-2015 standards have been applied along the carriageway, intersections, and bridge locations. These markings enhance road safety and visibility.
- **Signs:**
  - A total of 44 road signs have been installed along the road, including mandatory, cautionary, and informative signs, in accordance with IRC: 67-2012 standards.

➢ Sangam Khudwani Road:

➢ IMPROVEMENT OF GEOMETRICS:

- **Carriageway Width:**
  - The completed road features a 5.5 m wide carriageway with 1.000 m wide granular hard shoulders on either side.
  - The camber for the carriageway is 2.5%, and for the shoulder, it is 3.0%, facilitating proper drainage.

- **Horizontal & Vertical Alignment:**
  - The existing alignment was followed for the widening and strengthening of the road.
  - The required ruling design speed of 40 km/h has been maintained along the entire stretch.
  - Profile corrective courses were applied to the existing carriageway surface from RD 0+000 to RD 0+550 to ensure proper camber and achieve the required grade alignment for seamless integration with NH-44.
  - Due to land constraints, curves with radii less than 60 meters were widened by 0.6 m to 0.9 m, following IRC norms, enhancing vehicle maneuverability and safety.



TYPE - 1 : TYPICAL CROSS SECTION OF INTERMEDIATE LANE CARRIAGEWAY AT CONCENTRIC WIDENING STRETCH

➢ PAVEMENT UPGRADES:

- ➢ The surface was upgraded with **50mm Bituminous Macadam (BM)** and **25mm Open Graded Premix Carpet (OGP)** to improve its structural integrity.
- ➢ Granular Sub-base (GSB) 200mm Thick and a 225 mm thick layer of Water Bound Macadam (WBM) were applied to further enhance the road's strength, especially in widened sections.

➢ IMPROVEMENT OF CROSS DRAINAGE STRUCTURES:

- **Cross Drainage Works:**
  - **01 new Box culverts at RD 0+530 of Span 4.2 meter has been constructed** to replace the existing insufficient cross drainage infrastructure.
  - In addition to the box culvert, Hume pipe culverts using NP4 class pipes of 1200mm, 1000mm, 450mm, and 300mm diameters have been provided at 16 locations between RD 0+020 and RD 3+730. These culverts are designed to facilitate irrigation for paddy fields located on both sides of the project road.

➢ PROTECTIVE WORKS:

- ➢ Plain Cement Concrete retaining wall was constructed in the different stretches of the road. In total 3243 meters of retaining/ toe wall was constructed on both sides of road.

➢ ROAD MARKING & ROAD SIGNS:

- **Markings:**
  - Thermoplastic road markings, following IRC: 35-2015 standards have been applied to the carriageway, intersections, and bridge locations. These markings ensure the smooth flow of traffic and promote road safety.
- **Signs:**
  - A total of 14 road signs have been installed along the road, including mandatory, cautionary, and informative signs, as per IRC: 67-2012 standards.


JHELUM & TAWI
FLOOD RECOVERY PROJECT
THE WORLD BANK
JTFRP
Sangam Khudwani Road
28.02.2024 14:39
E: 7762468 N: 2600598 (±11m)
Altitude: 1569m
R37H+MFW, Bijbehara, 192124
S

IMPACT

The transportation system in the Kashmir Valley has undergone major transformation as a result of the successful completion of Road Packages under Component 2 of the Jhelum Tawi Flood Recovery Project (JTFRP). The subproject has restored significant connectivity that was severely disrupted by the 2014 floods and ongoing environmental challenges by rebuilding and repairing over 50 kilometers of vital roads and bridges, spanning important urban routes and vital rural linkages. More than 500,000 people now have better mobility thanks to the upgraded road infrastructure, which has also generated significant socioeconomic benefits, increased climate and disaster resilience, and laid the foundation for inclusive, sustainable development in one of India's most vulnerable regions.

- **Better Roads, Better Access**

  - Over 500,000 people now benefit from upgraded road infrastructure in both cities and villages.
  - Improved access to key destinations like the Srinagar Civil Secretariat and airport.
  - Faster travel and easier access to schools, hospitals, markets, and offices.
  - Smoother travel between districts through routes like Hamray – Sultanpora (Package), Parimpora–Soibugh, and Sangam–Khudwani.

- **Boost to Local Economy**

  - Stronger roads support more commercial traffic and smoother movement of goods.
  - Farmers and traders in areas like Hajin–Ajas and Bijbehara–Waghama now reach markets faster.
  - Durable construction and drainage systems reduce delays and keep roads open all year.
  - Roads connecting orchid horticulture lands now allow direct loading and supply of fruits from the fields, reducing additional labor and carriage to distant accessible points

- **Stronger, Safer Roads**

  - Srinagar saw the first use of flood-resistant Rigid Pavement Technology (Jointed Plain Concrete Pavement).
  - Rural roads upgraded with high-quality bitumen to handle tough weather and heavy vehicles.
  - Roads widened (e.g., Shadipora–Kanipeth from 2.5m to 5.5m), curves realigned, and over 7,000 meters of retaining walls built.
  - New drainage systems (box culverts, Hume pipes, and side drains) help prevent water logging.

- **Ready for Emergencies**

  - Roads now act as reliable routes for emergency response and rescue during disasters.
  - Embankments raised and protective structures added in flood-prone areas like Peerbagh–Humhama.
  - Better road conditions ensure mobility even during extreme weather, keeping communities connected and safe.

- **Built to Last**

  - Roads are designed to handle future floods using the latest construction standards.
  - Lower repair and maintenance costs thanks to high-quality materials.
  - Eco-friendly features like proper drainage and erosion control reduce environmental impact.

- **Smart Spending and Timely Delivery**

  - Projects like Hamray–Sultanpora were finished under budget (₹23.44 crore vs. ₹31.89 crore).
  - Despite challenges like land availability and one canceled package, the rest were completed efficiently.
  - Subprojects were wrapped up between March 2022 and June 2024, showing strong management and adaptability.

Lessons Learnt

The experience from this project offers valuable insights that must inform the planning and execution of future projects. Key lessons derived from the project are as below:

- **Comprehensive Detailing in DPRs is Essential**

  - DPRs must go beyond basic specifications and include detailed descriptions of special treatment areas.
  - Pavement designs exceeding standard lane widths should have clearly defined treatment methods.
  - Ambiguity in design leads to execution delays, cost overruns, and potential rework.
  - Project planning should incorporate practical field inputs to ensure relevance and feasibility.

- **Drainage system must be properly planned and integrated**

  - Surface drain disposal methods must be clearly shown in drawings and reports.

- Drainage paths, outfalls, and connections to existing networks must be specified.
- Poorly planned drainage can lead to water stagnation, flooding, and long-term maintenance issues.
- Integration with municipal drainage systems should be verified during planning.

➢ **Defined Utility Corridors to Avoid Future Conflicts**

- Utility corridors should be marked clearly in all design drawings.
- Dedicated corridors help prevent damage to essential services during construction.
- Avoids rework and delays due to conflicts with existing underground or overhead utilities.
- Facilitates easier integration of future service lines without disrupting existing infrastructure.

➢ **Early Involvement of Line Departments for Holistic Planning**

- Departments such as JKPDD, Jal Shakti, UEED, R&B, etc., must be consulted at the planning stage.
- Their inputs can help identify local challenges and infrastructure overlaps early on.
- Joint site inspections and coordination meetings should be conducted during DPR preparation.
- Helps align project goals with the ongoing and upcoming works of other departments.

➢ **Institutional Strengthening of PMU and PIUs is Critical**

- A clearly defined mandate and authority for the PMU is essential for decision-making.
- Adequate staffing in PMU and PIUs must be ensured, with roles and responsibilities clearly assigned.
- Retaining trained staff for a minimum of 3 years helps maintain continuity and institutional memory.
- Establishing a core technical team with both permanent staff and expert consultants improves capacity.
- Capacity-building programs should be ongoing to adapt to technical and administrative complexities.

END OF REPORT

ANNEXURE

COMPLETION CERTIFICATES