

## **Quality Assurance Authority**

Government of Haryana

# Standard Operating Methods and Procedures & Checklists For Roads & Buildings



**Rajeev Arora** 

#### FOREWORD

On behalf of the Quality Assurance Authority (QAA), I extend my heartfelt gratitude to the Honourable Chief Minister Sh. Nayab Singh for inspiring and guiding us with his vision and invaluable insights. Under his leadership, Haryana continues to advance toward greater transparency, accountability, and excellence in infrastructure development.

It is with immense pride that I present this comprehensive compilation of Standard Operating Methods and Procedures (SOMPs) to elevate the standards of infrastructure projects across Haryana. These SOMPs represent our unwavering commitment to achieving excellence in infrastructure development, encompassing Roads, Buildings, Water Supply Systems, Sewerage and STP, Irrigation and Canal Systems, Power Transmission, and Power Distribution.

The establishment of the QAA signifies a transformative step in Haryana's journey toward infrastructure excellence. The QAA gratefully acknowledges the vision and leadership of Hon'ble Sh. Manohar Lal, Union Minister, Housing, Urban Affairs, and Power, and the then Chief Minister, Haryana, whose foresight led to the conceptualization of this Authority for institutionalizing process-driven improvements in quality of Engineering Works in the State.

These SOMPs serve as a cornerstone for implementing a robust quality assurance framework, fostering a culture of accountability and continuous improvement in engineering projects. Our focus extends beyond compliance; we are dedicated to driving innovation, sustainability, and long-term reliability across the entire lifecycle of the projects.

These SOMPs are a testament to the collaborative efforts and credible inputs by various State Government departments implementing engineering works and organizations owned and controlled by the State Government. Together, we are committed to building a future where every infrastructure project reflects the values of quality, safety, and sustainability, contributing to Haryana's growth and serving as a model for others.

> Rajeev Arora, IAS (Retd.) Chairperson Quality Assurance Authority Government of Haryana

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### **Quality Assurance Authority**

Government of Haryana

Standard Operating Methods and Procedures For **Technical Quality Assurance** In

**Road Projects** 

# PREFACE

The QAA has already framed Technical Quality Assurance Parameters outlining indicators and sub-indicators required for Quality Assurance of the projects throughout their lifecycle.

Now the QAA has further developed the Standard Operating Methods and Procedures (SOMPs) for Quality Assurance/Control in the construction and maintenance of Roads, Highways, and Bridges for the purpose of having a ready reckoner to ensure that all quality parameters are adhered to during and after the construction of any project.

The Quality Control process focuses on detecting and correcting defects in a product or service. It involves identifying quality issues and taking corrective actions to resolve them. This is carried out by quality control monitors who would conduct inspections, perform tests, and implement necessary corrective measures. Through this systematic approach, the department would be able to identify shortcomings and defects on a real-time basis and shall ensure the delivery of a high-quality product or service.

Whereas the Quality Assurance process ensures the delivery of a high-quality product or service throughout its entire life cycle by preventing quality problems from the outset. This comprehensive approach involves the entire organization, from top management to front-line employees, working in tandem to meet quality standards within the timeline and financial outlay. Key aspects of this process include planning, design, execution, delivery, training, documentation, and audits. By focusing on defect prevention, Quality Assurance ensures that the product or service meets the desired standards throughout the deliverable period.

A Standard Operating Methods and Procedures (SOMP) for Roads, Highways and Bridges offers a numerous advantage in the construction industry.

- 1) Quality Control it ensures consistent construction standards leading to high-quality infrastructure projects that meet regulatory requirements and industry standards.
- 2) Efficiency Standardized procedures streamline project management, resource allocation and construction processes resulting in cost-effective and timely completion
- 3) Compliance It assists in adhering to the environmental regulations, safety standards and legal requirements, mitigating potential legal and environmental issues.
- 4) Safety It emphasizes safety procedures and guidelines for workers, reducing the risk of accidents and injuries on the construction sites
- 5) Risk Management It helps in identifying and mitigating potential risks associated with construction projects from design and planning to execution, promoting proactive problem-solving and strategic decision-making.
- 6) Documentation and Reporting It aids in maintaining accurate project records and facilitates reporting for stakeholders, regulators and quality assurance purposes.

The construction of roads and highways is conducted in accordance with the standards and specifications established by various IRC guidelines. These standards detail the quality of materials required for constructing high-quality roads and bridges. The IRC/MORTH outlines the necessary quality control tests for various materials and mixes, including their frequency. It is crucial for all stakeholders to ensure that all quality tests are performed at the specified

intervals. Comprehensive quality control and assurance protocols are detailed in various IRC publications which serve as a guideline for quality control in road and bridge construction.

In this respect, a Quality framework relating to all Technical Quality Assurance parameters, indicators, and sub-indicators required in the various stages of road construction has been prepared.

It has been prepared in detailed consultation with the concerned user department responsible for the quality assurance and control for the construction projects. QAA is further hopeful that State Government departments implementing engineering works and organizations owned and controlled by the State Government would evolve suitable mechanisms to implement the required Quality Assurance plans with the objective of achieving economic and social development of the State and improving the quality of life of the people.

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# CHAPTER 1 Part A: Executive Summary

This report outlines the comprehensive approach to the construction of a road, encompassing all phases from initial planning to post-construction maintenance. The project is designed to deliver a high-quality, durable, and safe roadway that meets user needs while minimizing environmental impact.

#### 1. Planning and Design

The planning and design phase forms the foundation of the road construction project. It begins with a thorough assessment of the project's objectives, including the selection of an optimal route that balances community needs, environmental considerations, and cost-effectiveness. Detailed surveys are conducted to determine the best route, factoring in topography, existing infrastructure, and environmental sensitivity. The design phase involves creating detailed plans for road alignment, drainage systems, pavement structures, and intersections, focusing on maximizing traffic flow efficiency, safety, and future expandability. Stakeholder engagement is a crucial part of this phase, ensuring that the design meets regulatory and community requirements. Finally, all necessary approvals and permits are secured from relevant authorities to ensure compliance with local, state, and federal regulations. Major tasks for Planning and design are listed below:

- Define the goals of the project, including selecting an optimal route that balances community, environmental, and cost factors.
- Conduct topographical and environmental surveys to determine the best possible route.
- Create detailed plans for road alignment, drainage systems, pavement structures, and intersections.
- Ensure designs maximize efficiency, safety, and scalability for future expansion.
- Consult with the community, regulatory agencies, and other stakeholders to incorporate feedback and meet regulatory standards.
- Obtain necessary permits and approvals i.e. Land Acquisition, Forest clearances etc. from relevant local, state, and federal authorities.
- Ensure that the project meets all environmental and legal requirements before proceeding.

#### 2. Execution, Inspection, and Testing

The execution phase marks the beginning of physical construction, translating plans into reality with strict adherence to timelines, budgets, and quality standards. Initial activities include site preparation, such as land clearing, grading, and subgrade preparation to ensure a solid foundation for the road. The construction process involves laying base layers, installing drainage systems, paving, and marking, with advanced techniques and materials used to enhance the road's durability. Throughout construction, regular inspections are conducted to ensure adherence to design specifications, with any deviations promptly addressed. Rigorous testing of materials and workmanship is carried out to verify quality, including testing pavement layers for compaction, strength, and thickness, as well as checking road alignment and surface smoothness. Major tasks for execution, inspection and testing are listed below:

- Clear land and prepare the site by cutting and filling, including grading and subgrade preparation for a stable foundation.
- Lay base layers to ensure road durability and strength.
- Install drainage systems to manage water and prevent damage.
- Pave the road surface and apply markings using advanced materials and techniques for longevity.
- Perform regular inspections during construction to ensure adherence to design specifications.
- Address any deviations or issues identified during inspections promptly.
- Conduct rigorous testing of pavement layers for compaction, strength, and thickness.
- Verify road geometrics and surface smoothness to ensure quality and safety standards.

#### 3. Commissioning and Hand Over

Upon completion, the road undergoes a final inspection and testing process to ensure it meets all specified requirements. A comprehensive final inspection is conducted to ensure the road complies with all design, safety, and quality standards, with any deficiencies rectified before approval for use. The road is then officially commissioned, with all necessary documentation, including as-built drawings, material test reports, and maintenance guidelines, handed over to the relevant authorities for public use. Major task for commissioning and handover is listed below:

- Conduct a comprehensive final inspection to ensure the road complies with design, safety, and quality standards.
- Identify and rectify any deficiencies before approval for public use.
- Finalize and submit all necessary documentation, including as-built drawings, material test reports, and maintenance guidelines.
- Officially commission the road for public use after successful inspection.
- Handover the completed project to relevant authorities, ensuring all legal and regulatory requirements are fulfilled.

#### Safety Measures

Safety is a critical consideration throughout the road construction project, from planning to post-construction. During construction, stringent safety protocols are implemented to protect workers, including the use of personal protective equipment (PPE) and secure work zones. The road design incorporates safety features such as guardrails, road signs, traffic signals, and pedestrian crossings to minimize accident risks and ensure user safety. Emergency response plans are in place to address any incidents during construction swiftly and effectively. Major tasks for safety measures are listed below:

- Implement stringent safety protocols for workers throughout construction.
- Ensure the use of personal protective equipment (PPE) by all workers.
- Establish secure and clearly marked work zones to prevent accidents.
- Incorporate safety features in road design, such as guardrails, road signs, traffic signals, and pedestrian crossings.

- Develop and enforce emergency response plans to swiftly address any incidents during construction.
- Regularly monitor and update safety measures to ensure compliance with standards.

#### 4. Project Management

Effective project management is essential for the successful completion of the road construction project. This involves meticulous planning, coordination, and oversight of all activities, ensuring resources are utilized efficiently and the project progresses smoothly. A detailed project timeline with clear milestones and deadlines is established, with regular monitoring and adjustments as needed to keep the project on track. Budget management is closely monitored, with cost-control measures in place to prevent overruns and regular financial reporting to ensure transparency and accountability. Regular communication with all stakeholders is maintained to keep them informed of progress, address concerns, and ensure alignment with project objectives. Major tasks for project management are listed below:

- Plan and coordinate all construction activities meticulously to ensure efficient resource utilization.
- Establish a detailed project timeline with clear milestones and deadlines.
- Regularly monitor project progress and adjust as necessary to stay on track.
- Implement cost-control measures to prevent budget overruns.
- Conduct regular financial reporting to ensure transparency and accountability.
- Maintain regular communication with all stakeholders to keep them informed and aligned with project objectives.
- Address any concerns or issues raised by stakeholders promptly to avoid delays.

#### 5. Environmental Measures

Environmental sustainability is a key consideration throughout the road construction project. An environmental impact assessment (EIA) is conducted during the planning phase to identify potential risks and develop mitigation strategies. Sustainable construction practices are integrated into the project, such as using recycled materials, reducing emissions, and effective waste management, while efforts are made to protect local wildlife and ecosystems. Erosion control measures are implemented to prevent soil erosion during and after construction, and the project team ensures full compliance with environmental regulations through regular audits and assessments. Major tasks for environmental measures are as follows:

- Conduct an environmental impact assessment (EIA) to identify potential risks and develop mitigation strategies.
- Integrate sustainable construction practices, including the use of recycled materials and emissions reduction.
- Implement effective waste management procedures throughout the construction process.
- Protect local wildlife and ecosystems by minimizing environmental disruption.
- Apply erosion control measures to prevent soil erosion during and after construction.
- Ensure full compliance with environmental regulations through regular audits and assessments.
- Continuously monitor environmental impact and adjust practices to minimize harm.

#### 6. User Feedback

User feedback is vital to the project's success, providing valuable insights into the road's design and construction effectiveness. Feedback is collected through surveys, feedback forms, social media, and community meetings to gather users' opinions on the road's functionality and safety. This feedback is analysed to identify any issues or areas for improvement, such as traffic congestion points, signage visibility, or road surface conditions. Based on this analysis, the project team may implement changes or adjustments to ensure the road meets user needs. Major tasks for user feedback are as follows:

- Gather insights on the road's functionality, safety, and overall user experience.
- Analyse feedback to identify issues or areas for improvement, such as traffic congestion, signage visibility, or road surface conditions.
- Use the analysis to make necessary adjustments or improvements to the road design and construction.
- Implement changes to ensure the road meets user needs and enhances overall satisfaction.
- Maintain open communication with users to continuously gather feedback and address concerns.

#### 7. Operation & Maintenance

The long-term operation and maintenance of the road are critical to ensuring its continued performance and safety. A detailed maintenance plan is developed, including routine activities such as road surface repairs, drainage system cleaning, and vegetation control, scheduled to minimize traffic disruption. Periodic inspections are conducted to assess the road's condition and identify maintenance needs, helping to prevent major issues and extend the road's lifespan. In the event of unexpected damage, such as from severe weather or accidents, emergency repairs are promptly carried out to restore the road to a safe condition. The road's performance is continuously monitored to ensure it meets all safety and operational standards, with data from these activities used to plan future maintenance and upgrades. Major tasks for operation and maintenance are as follows:

- Develop a detailed maintenance plan covering routine activities such as road surface repairs, drainage system cleaning, and vegetation control.
- Schedule maintenance activities to minimize traffic disruption.
- Conduct periodic inspections to assess road condition and identify maintenance needs.
- Perform emergency repairs promptly in response to unexpected damage from severe weather or accidents.
- Continuously monitor road performance to ensure it meets safety and operational standards.
- Use performance data to plan and prioritize future maintenance and upgrades.

### Part B: Responsibilities of stakeholders

#### **1.** Employer Department

Project Planning and Initiation

- Scope Definition: Clearly define the project's objectives, scope, and deliverables. This includes determining the project's location, size, design specifications, costing and functional requirements.
- Funding and Approvals: Secure necessary funding from budgetary sources. Obtain all required approvals and permits from relevant authorities to proceed with the project.

**Contractual Agreements** 

- Contract Drafting: Prepare and finalize contracts with the contractor and any other involved parties. This includes detailing the scope of work, deliverables, timelines, payment terms, and penalties for non-compliance.
- Regulatory Compliance: Ensure that contracts comply with local, regional, and national regulations and standards.

Oversight and Monitoring

- Project Monitoring: Regularly check on the project's progress to ensure it aligns with the schedule and budget. This includes tracking milestones and expenditures.
- Quality Assurance: Verify that the work meets the specified quality standards and requirements.

Communication

- Stakeholder Liaison: Act as the primary point of contact for communication between the contractor, TPIA, and other stakeholders.
- Issue Resolution: Address and resolve any issues, conflicts, or changes that arise during the project.

Approval and Acceptance

- Milestone Approval: Review and approve work completed at various stages before moving to the next phase.
- Final Acceptance: Conduct a final review and accept the completed project, ensuring it meets all contractual requirements and standards.

#### 2. Contractor

Execution of Work

- Construction Activities: Perform construction tasks as per the project plans, including excavation, grading, paving, and other road-building activities.
- Resource Management: Manage construction resources, including labour, materials, and equipment, to ensure efficient execution of the project.

**Quality Control** 

• Adherence to Standards: Implement quality control procedures by establishing a quality control laboratory at site to ensure that work meets the required standards and specifications.

• Safety: Maintain a safe working environment and adhere to safety regulations to protect workers and the public.

#### Documentation

- Record-Keeping: Keep detailed records of work performed, including changes, delays, and any issues encountered. Document material usage and construction methods.
- Submittals: Provide necessary documentation such as progress reports, change orders, and compliance certificates.

#### Reporting

- Progress Updates: Regularly report on project progress, including any delays, issues, or deviations from the plan.
- Problem Reporting: Notify the Employer department of any significant problems or challenges that could impact the project.

Compliance

• Legal and Regulatory Adherence: Ensure that all construction activities comply with legal requirements, environmental regulations, and safety standards.

#### 3. Third-Party Inspection Agency (TPIA)

Inspection and Testing

- Material Inspection: Inspect materials used in construction to ensure they meet required specifications and standards.
- Workmanship Evaluation: Assess the quality of workmanship by conducting various tests at site and ensure construction practices conform to the project specifications.

Reporting

- Inspection Reports: Provide detailed reports on inspection and testing results, including any non-compliance or issues found.
- Non-Conformity Reporting: Document and report any deviations from specifications or standards and recommend corrective actions.

Certification

- Quality Certification: Certify that the completed work meets the quality standards required for project acceptance.
- Final Approval: Provide certification that the project is ready for final acceptance by the Employer department.
- Impact Mitigation: Monitor and mitigate any adverse environmental impacts resulting from construction activities.

Each stakeholder plays a critical role in the successful completion of a road construction project, ensuring that it is delivered on time, within budget, and to the required quality and safety standards.

# Activities to be performed by the Departmental Officers/Officials and Executing Agency

S.no	Activity	CE	SE	EE	AE	JE	Executing Agency
Planning and design							
1	Topographic Survey and alignment			$\checkmark$	$\checkmark$	$\checkmark$	
2	Land Acquisition, Forest clearance etc.		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
3	NOC from Railways, Electricity Board, water Resources, PHED etc.			~	~	~	
4	Identification & shifting of utilities			$\checkmark$	$\checkmark$	$\checkmark$	
5	Conducting Traffic survey			$\checkmark$	$\checkmark$	$\checkmark$	
6	Selection of latest software in design	$\checkmark$	$\checkmark$				
7	Selection of modern mechanized/digital equipment		~	~			
8	Identification of material for construction of road			~	~	~	
9	conducting mandatory tests for design			$\checkmark$	$\checkmark$	$\checkmark$	
10	Framing specifications and appropriate design		~	~	~		
11	Preparation of detailed project report along with design, drawing and cost estimate and approval and its timeline.	~	~	~	~	~	
12	Identification of funding agency with annual budget allocation	~	~	~			
13	Call of tenders and award of work after completing all formalities.	~	~	~			
Execution, inspection and testing.							
14	Selection of Materials such as aggregates, sand, good earth etc. from approved source.			~	~	~	~
15	Submission of design mix and its approval as per specifications.			~	~	~	~
16	Procurement of items like cement, steel, Bitumen, RCC Pipes etc. Of approved make and manufacturer		~	~	~	~	~
17	Carrying out tests at manufacture's premises before dispatch/inhouse facilities			~	~	~	~
18	Qualified manpower deployment as per requirement.			~	~	~	~
19	Use of Sensor pavers, Automated batching, hot mix plants and other equipment.			~	~	~	~
20	Work execution as per approved bid document			~	~	~	~

21	Setting up Testing laboratory having all testing equipment relevant to the project specifications		~	~	~	~
22	Preparation of site inspection and quality control registers		~	~	~	~
23	Ensuring relevant mandatory tests with required frequency during execution at every stage of construction		~	~	~	~
24	Checking of test results by Engineer in Charge		~	~	~	
25	Submission of non-conforming reports and rectification of defects.		~	~	~	~
Comm	issioning and Handing over					
26	Installation of road signages, marking of lanes, installation of toll barriers etc.		~	~	~	~
27	Submission of Assets completion Plan & inbuilt drawings.					~
28	Submission of completion report as per approved format and its approval.		~	~	~	~
Safety measures						
29	Providing safety measures such as firefighting equipment, and explosive magazine and it's handling etc.					~
30	Monitoring and Surveillance		~	$\checkmark$	$\checkmark$	$\checkmark$
31	Proving first aid equipment, safety uniforms and housing for workers etc.					~
32	Physical Security measure					$\checkmark$
33	Incident response and reporting				$\checkmark$	$\checkmark$
Operations and maintenance						
34	Ensuring the periodical repairs as per bidding document		$\checkmark$	~	~	~
35	Traffic management					$\checkmark$
36	Reporting and rectification of defects within the specified time during maintenance period.		$\checkmark$	~	~	~
37	Documentation of the maintenance record			$\checkmark$	$\checkmark$	$\checkmark$

Note1: Responsibilities for carrying out above activities by the departmental officers shall be governed by the Technical Sanction Powers vested in them by the Government of Haryana.

Note 2: To comply with the specified requirements, the contract bidding document should be amended to include the provisions delineated in the Standard Operating Procedure

# **CHAPTER 2**

## Standard Operating Methods and Procedures (SOMP) for Road Projects in Haryana

### 1. PLANNING AND DESIGN

1.1) Survey, investigation and regulatory compliances

#### 1.1.1 Topographic Survey and Alignment

I. Initial Preparation

- Appoint a qualified survey team
- Ensure the team is equipped with modern surveying tools (Total Station, GPS, Abney level, tangent clinometer, etc.)
- Review relevant government guidelines and standards for topographic surveys.

II. Survey Execution

- Conduct a detailed topographic survey of the proposed road alignment area using a map of Survey of India where we can propose different alternatives for the road alignment.
- Reconnaissance/Preliminary Survey A rough survey is done along the various alternatives proposed in the map study to arrive at a final alignment.
- Mark all physical features, natural and man-made, including existing infrastructure, vegetation, water bodies, etc.
- Record elevation data, slopes, and other topographic elements critical for road design.
- Use GIS tools for accurate mapping and data collection.

III. Alignment Design

- Prepare the road alignment design based on survey data, ensuring it adheres to Indian Road Congress (IRC) standards.
- Optimise the alignment to minimise environmental impact, land acquisition, and construction costs.
- Engage with local stakeholders, including Panchayats and Municipalities, to address concerns and incorporate feedback.
- Submit the alignment plan to the competent authority of the department for approval.
- Compile all survey data, alignment plans, and design documents after approval and maintain proper records.

1.1.2 Land Acquisition, Forest Clearance, etc.

I. Land Requirement

- Demarcation of land to establish ROW / status of land
- Identify land parcels required for the road project based on the finalized alignment.
- Conduct consultations with landowners, local authorities, and community representatives.

II. Legal Process for Acquisition

- Approach the local Land Revenue Department to identify ownership.
- Submit a proposal to the appropriate government authority with details of the land required and the purpose.

 Obtain consent from landowners or initiate the compulsory acquisition process as per the Land Acquisition Act. (LARR, 2013)

III. Compensation and Settlement

- Calculate compensation as per government guidelines based on land value and any resettlement requirements.
- Negotiate with landowners and provide compensation on time.

IV. Transfer of Ownership

- After compensation, complete the formal transfer of land ownership.
- Obtain all necessary legal documents and records

V. Forest Clearance

- Identify forest land within the project area that requires clearance.
- Prepare and submit a proposal on prescribed format to the State/Central Forest Department (as per requirement), including an Environmental Impact Assessment (EIA).
- Obtain a No Objection Certificate (NOC) from the Forest Department.
- Ensure compliance with the Forest (Conservation) Act, 1980, Forest Conservation Amendment Act, 2023, and other relevant regulations.
- Address compensatory afforestation requirements as mandated by the State Government.

VI. Environmental and Social Clearances

- Conduct an Environmental Impact Assessment (EIA) as per Ministry of Environment, Forest and Climate Change (MOEFCC) guidelines.
- Prepare a Social Impact Assessment (SIA) to address the impact on local communities.
- Obtain necessary clearances from the State Environmental Impact Assessment Authority (SEIAA).

1.1.3 NOC from Railways, Electricity Board, Water Resources, PHED, etc.

I. Identification of Affected Utilities and Authorities

- Identify all existing utilities and infrastructure (railway crossings, power lines, water pipelines, etc) within the project area.
- Determine the need for NOCs from respective departments like Indian Railways, Haryana Power Departments, Water Resources Department, and Public Health Engineering Department (PHED).

II. NOC Application Process

- Prepare and submit detailed applications for NOCs to each concerned department.
- Include necessary technical details, alignment plans, and safety measures in the applications.
- Follow up with departments to ensure timely processing of NOCs.

III. Compliance with Departmental Requirements

- Address any queries or concerns raised by the departments during the NOC approval process.
- Make necessary modifications to the project plans as per the feedback from departments.
- Ensure that all NOC conditions are integrated into the project execution plan.

IV. Documentation and Record-Keeping

- Maintain a record of all NOCs obtained, including dates of issuance and validity.
- Ensure that all NOCs are available for inspection by the government authorities.

#### 1.1.4 Identification & Shifting of Utilities

#### I. Utility Identification

- Conduct a detailed survey to identify all utilities within the project's right-of-way (ROW).
- Engage with utility providers (electricity, water, gas, telecommunications) to confirm the presence and ownership of utilities.
- Mark all utilities on the project's alignment plan.

#### II. Coordination with Utility Providers

- Notify all utility providers about the road project and the need for utility shifting.
- Prepare a coordinated utility shifting plan in consultation with providers.
- Ensure that the plan minimizes disruption to services and adheres to safety standards.
- Get the estimate of utility shifting from the concerned department

#### **III. Shifting Execution**

- Appoint specialized contractors for utility shifting as per state procurement guidelines.
- Monitor the shifting process to ensure it is completed within the project timeline and budget.
- Verify that all shifted utilities are functioning properly and meet regulatory standards.

#### IV. Post-Shifting Verification

- Conduct a final inspection of the shifted utilities in coordination with utility providers.
- Obtain completion certificates from utility providers to confirm successful shifting.
- Document the process and submit a report to the relevant government authorities.

#### 1.1.5 Traffic Survey

I. Survey Planning

- Determine the scope of the traffic survey based on project requirements.
- Identify key locations for data collection (intersections, road segments, urban/rural areas).
- Use both manual counts and automated tools (traffic counters, cameras) for accurate data collection.

II. Data Collection

- Conduct a comprehensive traffic survey to assess current traffic volumes, vehicle types, and peak hours.
- Record additional data on road conditions, accident hotspots, and traffic flow patterns.
- Ensure that the survey is conducted during both weekdays and weekends, as well as during the times of any seasonal events, to capture variations.

III. Traffic Analysis

- Analize the collected data to forecast future traffic growth based on population and economic trends.
- Use traffic modelling software to simulate different scenarios and their impact on road design.
- Identify potential challenges such as congestion points and propose mitigation measures.

IV. Integration into Project Design

- Incorporate traffic survey findings into the road design to ensure adequate capacity and safety.
- Propose traffic management solutions, including signage, signals, and pedestrian crossings.

 Submit the traffic survey report and design recommendations to the competent authority for approval.

V. Stakeholder Consultation

- Share traffic survey findings with local authorities and communities.
- Address concerns related to traffic management during and after construction.
- Integrate stakeholder feedback into the final project plan.

#### 1.2) Long term planning

#### 1.2.1 Future Projections for Traffic Load

I. Data Collection and Baseline Analysis

- Gather current traffic data from existing surveys and traffic counts.
- Analyse historical traffic growth trends in the region, including variations in different seasons and times of the day.
- Collect demographic data, vehicle registration data, and economic indicators to establish a baseline for future projections.

II. Projection Methodology

- Use established traffic forecasting models that consider population growth, economic development, and vehicle ownership trends.
- Incorporate government planning documents, such as the Haryana State Transport Policy and urban development plans, into the projection model.
- Account for planned infrastructure projects (new roads, public transportation systems) that could impact future traffic patterns.

III. Integration with Project Design

- Use the traffic load projections to determine necessary road capacities, lane configurations, and safety features.
- Plan for future expansion options, such as additional lanes, flyovers, or bypasses, based on high-growth scenarios.
- Ensure that road designs comply with IRC standards for future traffic volumes and include provisions for scaling up infrastructure.

IV. Review and Approval

- Submit traffic load projection reports to competent authority.
- Revise projections and designs based on feedback from the department and other stakeholders, including local government bodies and urban planning authorities.
- Ensure all documentation is maintained according to state regulations for future reference and audits.

1.2.2 Future Development of the Area (Industrial Growth, Education Hub, etc.)

I. Assessment of Current Land Use and Zoning Plans

- Review existing land use plans and zoning regulations from local and state urban planning departments.
- Identify areas designated for future industrial, educational, commercial, or residential development.
- Engage with local government agencies, such as the Haryana Urban Development Authority (HUDA) and Haryana State Industrial and Infrastructure Development Corporation (HSIIDC), to understand planned developments.

II. Forecasting Future Development

- Analyse demographic trends, including population growth, migration patterns, and economic activity, to forecast future development.
- Consider state and central government initiatives that may influence development, such as the Smart Cities Mission, industrial corridor projects, and educational initiatives.
- Use GIS tools to map potential growth areas and overlay them with the road project alignment.

III. Impact Analysis on Road Infrastructure

- Assess the impact of projected industrial growth, educational hubs, and other developments on traffic load, road wear and tear, and safety.
- Estimate the increase in heavy vehicle traffic due to industrial growth and the influx of people related to educational institutions.
- Plan for increased access points, service roads, and pedestrian facilities to accommodate future development.
- IV. Coordination with Stakeholders
  - Engage with key stakeholders, including local government authorities, industrial bodies, educational institutions, and community leaders.
  - Incorporate feedback from these stakeholders into the road design and planning process.
  - Ensure that road infrastructure development aligns with broader regional development goals.

V. Design and Infrastructure Planning

- Incorporate future development considerations into road alignment, design, and capacity planning.
- Plan for scalable infrastructure that can be expanded or upgraded as the area develops.
- Ensure that the road design supports economic growth by providing efficient transportation links to industrial zones, educational hubs, and commercial areas.

VI. Approval and Documentation

- Prepare a comprehensive report detailing the future development projections and their integration into the road project.
- Submit the report to the concerned state government departments for review and approval.
- Maintain all records and documentation for future reference, updates, and compliance audits.
- 1.3) Selection of appropriate technology/methodology

#### 1.3.1 Selection of Latest Software in Design

I. Needs Assessment

- Conduct a thorough assessment of the project's design requirements, including road alignment, structural analysis, traffic modelling, and environmental impact.
- Identify the specific functionalities needed in the software, such as 3D modelling, simulation, BIM (Building Information Modelling), and integration with GIS data.

II. Software Evaluation

• Research the latest design software available in the market, focusing on those widely used in road infrastructure projects in India and globally.

- Evaluate software options based on criteria like ease of use, compatibility with existing systems, user support, and compliance with IRC and MORTH (Ministry of Road Transport and Highways) guidelines.
- Consider software that offers advanced features such as AI-driven design recommendations, real-time collaboration tools, and cloud-based data management.

1.3.2 Selection of Modern Mechanized/Digital Equipment

I. Project Requirement Analysis

- Identify the specific mechanized and digital equipment required for different phases of road construction, including earthworks, paving, and quality testing.
- Consider equipment that improves efficiency, reduces labour requirements, and enhances safety.

II. Market Research and Evaluation

- Research the latest mechanized and digital equipment available in the market, focusing on innovations that have proven successful in similar projects in India and abroad.
- Evaluate equipment based on factors such as operational efficiency, precision, ease of operation, maintenance needs, and cost-effectiveness.
- Ensure that equipment options meet Indian standards (BIS) and are compatible with the local operating environment.

#### 1.3.3 Use of Solar Energy for Lighting the Road Infrastructures

I. Feasibility Study

- Conduct a feasibility study to assess the potential for solar energy use across the project, including geographical, climatic, and economic considerations.
- Identify specific road infrastructure components that can benefit from solar lighting, such as streetlights, traffic signals, and signboards.
- Evaluate the availability of solar energy resources in the region, considering factors like sunlight hours, intensity, and seasonal variations.

II. Technology Selection

- Research the latest solar lighting technologies, focusing on options that are efficient, durable, and cost-effective.
- Consider solar panels, batteries, LED lighting, and smart controllers that are designed for Indian conditions and comply with BIS standards.
- Select systems that offer remote monitoring capabilities and can be integrated with IoT (Internet of Things) platforms for efficient management.

III. Design and Planning

- Integrate solar lighting into the overall road design, ensuring optimal placement of solar panels and lighting fixtures.
- Design the system to accommodate future expansions or upgrades, such as adding more panels or connecting to a grid-tied system.
- Coordinate with local electricity boards and regulatory authorities to ensure compliance with renewable energy policies and incentives.

IV. Procurement and Installation

 Procure solar lighting equipment through state-approved vendors, following government procurement guidelines.

- Ensure that the installation process is supervised by qualified engineers and adheres to all safety and quality standards.
- Implement a quality assurance process to verify the proper installation and functioning of the solar lighting system.

V. Operation and Maintenance

- Develop an SOMP for the operation and maintenance of the solar lighting system, including regular inspections, cleaning, and performance monitoring.
- Train local maintenance teams or contractors in the upkeep of solar systems, focusing on battery maintenance, panel cleaning, and troubleshooting.
- Set up a monitoring system to track energy generation and consumption, ensuring the system's long-term sustainability.

VI. Review and Reporting

- Regularly review the performance of the solar lighting system, adjusting settings or upgrading components as needed.
- Report system performance to the competent authority, highlighting energy savings and environmental benefits.
- Document lessons learned and best practices to inform future projects and contribute to state-level sustainable development goals.

#### 1.4) Design and specifications

#### 1.4.1 Identification of Material for Construction of Road

I. Initial Material Survey

- Conduct a thorough survey of available construction materials, such as aggregates, bitumen, cement, and soil, within and around the project area.
- Engage with local suppliers to identify sources of high-quality materials that meet Indian standards (BIS) and IRC guidelines.
- Evaluate the environmental impact of material extraction and transportation, prioritizing eco-friendly and sustainable options.

II. Material Selection Criteria

- Select materials based on key factors like durability, cost, availability, and suitability for the specific road type and traffic conditions.
- Prioritize materials that have a proven track record in similar climatic and geological conditions as those found in Haryana.
- Consider innovative materials, such as waste-derived aggregates or modified bitumen, that offer enhanced performance or sustainability benefits.

III. Compliance with Standards

- Ensure all selected materials comply with relevant IRC codes, BIS standards, and MORTH specifications.
- Verify the quality of materials through laboratory testing before approval for use in construction.
- Obtain material samples and maintain a detailed record of their properties, including test certificates from suppliers.

IV. Approval and Documentation

• Submit a detailed report on the identified materials, including source details, test results, and compliance certificates, to the competent authority for approval.

- Maintain a comprehensive database of approved materials for future reference and audit purposes.
- Ensure that material selection decisions are documented in the project's material management plan.
- 1.4.2 Conducting Mandatory Tests for Design

I. Test Planning and Setup

- Identify all mandatory tests required for road design, including soil tests, aggregate tests, bitumen tests, and concrete tests, as per IRC and MORTH guidelines.
- Engage accredited laboratories, either state-owned or private, that are approved by the concerned department to conduct these tests.
- Develop a testing schedule aligned with the project timeline, ensuring tests are conducted at appropriate stages of the design process.

II. Soil and Subgrade Testing

- Conduct tests to determine the soil's bearing capacity, moisture content, Atterberg limits, and compaction characteristics.
- Perform California Bearing Ratio (CBR) tests to assess the subgrade strength and suitability for road construction.
- Document the results and use them to inform the pavement design and selection of suitable subgrade treatment methods.

III. Aggregate Testing

- Test aggregates for properties such as gradation, specific gravity, water absorption, flakiness, elongation, and Los Angeles abrasion.
- Ensure that aggregates meet the required standards for use in different layers of the pavement, including the base, sub-base, and surface courses.
- Maintain detailed records of test results and ensure they are incorporated into the material quality control plan.

IV. Bitumen and Concrete Testing

- Conduct penetration, ductility, softening point, and viscosity tests on bitumen to ensure it meets the required specifications.
- Test concrete for compressive strength, workability, and durability, ensuring it is suitable for road construction under Haryana's environmental conditions.
- Use test results to refine mix designs for bituminous layers and concrete structures within the road project.

V. Review and Quality Assurance

- Review all test results in consultation with the concerned department and design engineers to ensure compliance with specifications.
- Address any discrepancies or non-conformities by re-evaluating materials, adjusting mix designs, or retesting as necessary.
- Document all testing procedures and results in the project's quality control plan, ensuring transparency and traceability.

1.4.3 Framing Specifications and Appropriate Design

I. Specification Development

 Begin by reviewing existing IRC, MORTH, and BIS standards relevant to the road project, ensuring that all specifications align with national guidelines.

- Collaborate with design engineers, material specialists to develop project-specific specifications that address unique challenges, such as soil conditions, traffic loads, and environmental factors.
- Include specifications for all key components, including subgrade preparation, pavement layers, drainage systems, and road furniture.

II. Customization for Local Conditions

- Adapt standard specifications to account for the specific climatic, geological, and traffic conditions in Haryana.
- Consider local construction practices, material availability, and potential environmental impacts when framing specifications.
- Ensure that specifications are robust enough to accommodate future traffic growth and maintenance needs.

III. Design Development

- Use the results from mandatory tests and material selection processes to inform the road design, ensuring it meets the framed specifications.
- Develop detailed design plans, including alignment, cross-section, drainage, and pavement layer details, that adhere to the approved specifications.
- Incorporate modern design tools and software to optimize the road design for safety, durability, and cost-effectiveness.

IV. Review and Approval Process

- Submit the framed specifications and detailed design plans to the competent authority for review and approval.
- Engage with the concerned department to address any feedback or required modifications, ensuring all design elements meet the highest quality standards.
- Document the final approved specifications and designs, ensuring they are included in the project's master plan and available for future reference.

Implementation and Monitoring

- Ensure that the construction team has a clear understanding of the specifications and design requirements, conducting training if necessary.
- Monitor the implementation of the specifications during construction, ensuring adherence through regular inspections and quality audits.
- Adjust the specifications and design as needed during the project's lifecycle to address any unforeseen challenges or changes in project scope.

1.5) Cost Analysis, Budget planning and timeline estimates

1.5.1 Financial Implication with Cost Index Up to Implementation Period

- Conduct a detailed cost estimation based on the schedule of rates of the Haryana State PWD considering current prices for materials, labour, equipment, and other inputs required for the project.
- Apply the latest cost indices to the project's financial plan, adjusting for inflation and market fluctuations over the implementation period.
- Factor in location-specific costs, such as transportation, logistics, and site preparation, as well as potential contingencies.
- Consider the cost of aesthetic improvements, finishing, horticulture development, etc.
- Submit the updated financial plan, including cost index adjustments, to the competent authority of the concerned department for review and approval.

#### 1.5.2 Identification of Funding Agency with Annual Budget Allocation

I. Identification of Funding Sources

- Identify potential funding agencies, including state and central government bodies, multilateral institutions, and public-private partnerships (PPP).
- Review the eligibility criteria, application procedures, and funding cycles of these agencies to align with the project's financial needs and timeline.
- Engage with the state finance department to explore the possibility of budget allocations from the Haryana state budget or other government schemes like the Pradhan Mantri Gram Sadak Yojana (PMGSY) or other Central Government Schemes, etc

#### II. Funding Proposal Preparation

- Prepare a comprehensive funding proposal, including detailed project reports (DPRs), financial plans, and justifications for the required funding.
- Include an annual budget allocation plan, specifying the phased release of funds in alignment with the project milestones and implementation schedule.
- Ensure that the proposal complies with the funding agency's requirements and is aligned with state government priorities.

III. Negotiation and Finalization

- Engage in discussions with identified funding agencies to negotiate the terms and conditions of the funding, including interest rates, repayment schedules, and any required guarantees.
- Finalize agreements with the selected funding agency, ensuring that all legal and financial obligations are clearly understood and documented.
- Coordinate with the state finance department to ensure that the funding arrangement is approved and integrated into the state's financial planning processes.

IV. Monitoring and Reporting

- Set up a monitoring system to track the disbursement and utilization of funds, ensuring they are used in accordance with the agreed terms.
- Prepare periodic financial reports for the funding agency, highlighting the progress of the project, fund utilization, and any deviations from the planned budget.
- Maintain a transparent and auditable record of all financial transactions, ensuring compliance with state and funding agency regulations.

1.5.3 Period for DPR Approval, Call of Tenders, Award of Work & Its

#### Implementation

I. Timeline Establishment

- Develop a detailed project timeline, starting from the preparation of the Detailed Project Report (DPR) to the final implementation of the project.
- Establish a timeline for each phase, including DPR preparation, approval, tendering, contract award, and construction, ensuring alignment with the project's overall schedule.
- Include buffer periods to accommodate potential delays in approvals, tendering processes, or unforeseen challenges during implementation.

II. DPR Preparation and Approval

 Allocate sufficient time for the preparation of a comprehensive DPR, including all necessary studies, designs, and financial estimates.

- Submit the DPR to the competent authority of the concerned department for review and approval, ensuring it meets all regulatory and technical requirements.
- Monitor the approval process closely, addressing any queries or revisions promptly to minimize delays.

III. Tendering Process

- Plan the tendering process in accordance with state government procurement guidelines, ensuring transparency and competitiveness.
- Publish the tender notice in line with the approved DPR, allowing sufficient time for potential bidders to prepare their proposals.
- Set a clear timeline for all procedures, including pre-bid meetings, submission of bids, evaluation, and final selection of contractors, and any other procedural requirements.

IV. Award of Work

- Conduct a thorough evaluation of bids, focusing on technical capabilities, financial strength, and past performance of the bidders.
- Finalize the contract award based on the best value for the project, ensuring compliance with all state procurement regulations.
- Obtain the necessary approvals from relevant authorities before formalizing the contract with the selected bidder.

V. Implementation and Monitoring

- Establish a detailed implementation schedule, aligned with the project timeline, to guide the construction phase.
- Set up a monitoring and reporting mechanism to track the progress of work, ensuring adherence to the schedule and quality standards.
- Regularly review the implementation progress, addressing any delays or issues proactively to keep the project on track.

VI. Documentation and Review

- Document all key decisions, approvals, and timelines related to DPR preparation, tendering, contract award, and implementation.
- Conduct periodic reviews of the timeline to identify potential delays and take corrective actions as necessary.
- Maintain an up-to-date project management dashboard that provides a real-time overview of the project's progress and any deviations from the planned schedule.

1.6) Provision of utility corridor and Horticulture Planning

1.6.1 Provision of Space for Conduits/Channels/Cables/Wires

I. Planning and Design

- Identify the requirements for utility conduits, channels, and cables during the initial planning phase.
- Integrate designated spaces for these utilities into the road design, ensuring they do not interfere with road structures.

II. Coordination with Utility Agencies

- Engage with relevant utility providers (e.g., electricity, telecom, water supply) to determine their specific needs for space and access.
- Ensure proper alignment of utility conduits with existing and planned road infrastructure.

III. Implementation

- Allocate specific sections along the road for laying conduits and cables, considering future expansion needs.
- Ensure that the placement of these utilities is marked clearly on the construction plans and communicated to the construction team.

IV. Compliance and Safety

- Follow IS codes and other relevant guidelines for the safe installation of utilities within roadways.
- Conduct inspections to ensure that the provisions for utilities are implemented as per the approved design and safety standards.

#### 1.6.2 Provision for Horticulture Planning

I. Survey and Assessment

- Assess soil type, terrain, and land availability along highways, state roads, and urban roads to determine suitable plantation areas.
- Conduct climate analysis to select plant species that can thrive in local weather conditions.
- Identify accident-prone zones where plantation can act as a protective barrier to prevent vehicle skidding and mitigate glare.
- Examine underground utilities and drainage systems to ensure trees do not interfere with infrastructure

II. Selection of Plantation Area

- Highways & Expressways: Wide medians, shoulders, and service lanes should be utilized for tree planting.
- State & District Roads: Green belts should be developed along road edges to prevent soil erosion and dust pollution.
- Urban Roads: Roundabouts, footpaths, and central verges should be landscaped with aesthetic plants and shade-giving trees.
- Flyovers & Bridges: Vertical gardens and potted plants should be installed where space is limited.

III. Plant Species Selection

- Trees should be planted on the edge of the ROW and selected depending upon their shade and pollution control abilities.
- Shrubs such as Bougainvillea, Hibiscus, etc may be planted on the medians and embankments
- Use low-height shrubs and flowering plants in medians for visibility and aesthetics

### 2. EXECUTION, INSPECTION, AND TESTING

#### 2.1) Use of construction materials as per relevant codes & manuals

#### 2.1.1 Use of Materials from Approved Sources

#### I. Source Verification

- Ensure that all materials such as aggregates, sand, and earth are sourced from the authorized/approved suppliers/quarries by the concerned department.
- Ensure testing of material at site before execution to confirm that the material is in accordance with the IS codes and project specifications.

#### II. Documentation and Inspection

- Maintain records of material sources and quality certificates.
- Conduct random inspections and testing of materials upon delivery to confirm compliance with approved standards.

#### III. Compliance and Reporting

- Ensure materials used in construction meet the quality and specification standards set by the project.
- Report any discrepancies or deviations to the concerned department and take corrective actions as necessary.

#### 2.1.2 Use of Design Mix as Per Specifications

I. Mix Design Preparation

- Develop and verify the design mix for concrete and bituminous materials based on project specifications and IS codes.
- Ensure the mix design is approved by the project engineer or relevant authority before use.

II. Mix Implementation

- Use the approved design mix during construction, ensuring all batches are consistent with the specified proportions and quality.
- Document the mix design details and maintain records for quality control and audits.

#### III. Quality Control

- Conduct regular checks to ensure the mix used aligns with the approved design and project requirements.
- Address any deviations or quality issues promptly and report them to the concerned authorities.

#### 2.1.3 Procurement of Items from Approved Make and Manufacturer

I. Vendor Selection

- Procure items such as cement, steel, bitumen, and RCC pipes, etc from manufacturers and suppliers approved by the concerned department and specified in the project's procurement plan.
- Verify the credentials and certifications of manufacturers to ensure compliance with quality standards.

II. Quality Assurance

- Obtain and review quality certificates and compliance documents for all procured items.
- Conduct random inspections upon delivery to confirm that items meet the required specifications and standards.

III. Documentation and Compliance

- Maintain detailed records of procurement, including supplier information, quality certificates, and inspection reports.
- Report any issues with procured items to the concerned authorities and take necessary actions to address non-compliance.

2.1.4 Carrying Out Tests at Manufacturer's Premises Before Dispatch/In-House Facilities

#### I. Testing Procedures

- Arrange for pre-dispatch testing of materials at the manufacturer's premises or in-house facilities as specified in the project requirements.
- Ensure that tests are conducted according to relevant IS codes and project specifications.

#### II. Quality Assurance

- Obtain test reports and certification from the manufacturer, confirming that the materials meet quality and specification standards before dispatch.
- Review test results to ensure compliance with project requirements.

#### III. Documentation and Follow-Up

- Maintain records of all test reports and certification documents.
- Follow up with the manufacturer or supplier to address any issues identified during testing and ensure that corrective measures are implemented before dispatch.

#### 2.2) supervision by skilled manpower/TPIA

#### 2.2.1 Deployment of Appropriately Qualified Personnel

#### I. Qualifications and Selection

- Ensure that all personnel deployed on the project, including engineers, supervisors, and skilled workers, possess the necessary qualifications and certifications as per project requirements and IS codes.
- Verify credentials and professional experience of key personnel before deployment.

II. Roles and Responsibilities

- Clearly define and communicate the roles and responsibilities of each personnel to ensure effective project execution.
- Regularly review and assess the performance of qualified personnel to ensure they meet the project's standards and requirements.

#### III. Compliance and Reporting

- Ensure that all personnel adhere to project specifications, safety regulations, and quality standards.
- Report any issues related to personnel qualifications or performance to project management and take corrective actions as needed.

#### 2.2.2 Manpower Deployment as Per Requirement

- Develop a detailed manpower plan based on project requirements, including the number of workers, skill sets, and deployment timelines.
- Adjust the manpower plan according to project phases, ensuring adequate staffing levels for each stage of the project.
- Deploy manpower as per the bid document and project plan, ensuring that all teams are equipped with the necessary tools and resources.

- Coordinate with subcontractors and suppliers to align manpower deployment with project needs and schedules.
- Maintain records of manpower deployment, including work schedules, attendance, and performance.
- Provide regular updates to project management on manpower status and any issues impacting project execution.

#### 2.3) Use of modern facilities for construction and treatment

#### 2.3.1, 2.3.2 and 2.3.3 Sensor Paver, Automated Batching and Hot Mix Plants

I. Setup and Calibration

- Set up and calibrate sensor paver, automated batching and hot mix plants according to the manufacturer's instructions and project specifications.
- Perform calibration checks to ensure accurate measurement of materials and consistent batching

#### II. Operation and Quality Control

- Operate the sensor paver according to the project's requirement, ensuring accurate and consistent paving thickness and material distribution, and monitor its performance during operation.
- Operate the batching and hot mix plant to produce concrete or asphalt mixtures as per the approved design mix and quality standards and implement quality control measures to monitor the consistency and accuracy of the batching process.

III. Maintenance and Documentation

- Conduct regular maintenance and inspections of these equipment to prevent breakdowns and ensure smooth operation.
- Maintain records of maintenance activities, calibration checks, and any issues encountered during operation.

#### IV. Compliance

Ensure that the equipment complies with all relevant IS codes and project specifications.

#### 2.3.4 Use of Other Mechanized and Digital Equipment

- Ensure the use of latest mechanized and digital equipment in accordance with the project's requirements, specifications, and safety standards.
- Monitor equipment performance to ensure efficiency and address any operational issues.

#### 2.4) Conformity to relevant standards

#### 2.4.1 Work Executed as Per Approved Bid Document

I. Review and Understanding

- Thoroughly review the approved bid document, including technical specifications, scope of work, and contractual obligations.
- Ensure all project team members understand the requirements and constraints outlined in the bid document.

II. Implementation

- Execute work in strict accordance with the approved bid document, ensuring that all specifications, designs, and standards are adhered to.
- Follow the approved methodologies and practices detailed in the bid document for construction activities.

• Follow proper guidelines for horticulture planning as outlined in the bid document/estimate, keeping in mind the aesthetic appeal, safety, plantation techniques, and maintenance and upkeep.

III. Monitoring and Compliance

- Regularly monitor work progress to ensure compliance with the bid document's requirements.
- Conduct inspections and quality checks to confirm that the work meets the specified standards and project criteria.

IV. Documentation and Reporting

- Maintain comprehensive records of work executed, including any deviations from the bid document and reasons for such deviations.
- Report progress, compliance, and any issues related to the bid document to project management and relevant authorities.

V. Corrective Actions

- Address any deviations or non-compliance issues promptly, taking corrective actions as necessary to align with the approved bid document.
- Document and report corrective actions and their outcomes to ensure transparency and accountability.

#### 2.5) Testing laboratory at site

2.5.1 Setting Up Testing Laboratory Having All Testing Equipment Relevant to the Project Specifications

I. Planning and Requirements

- Identify the testing requirements based on project specifications, including types of tests and relevant equipment.
- Develop a list of required testing equipment and materials needed to meet project specifications and standards.

II. Laboratory Setup

- Establish a testing laboratory in a suitable location, ensuring it meets space, safety, and operational requirements.
- Procure and install all necessary testing equipment, including calibration tools, ensuring they conform to IS codes and project specifications.

III. Equipment Calibration and Maintenance

- Ensure that all testing equipment is calibrated according to manufacturer guidelines and industry standards before use.
- Implement a maintenance schedule to keep equipment in optimal working condition and perform regular calibration checks.

IV. Documentation and Compliance

- Maintain detailed records of equipment installation, calibration, maintenance, and testing procedures.
- Ensure that all testing activities comply with relevant IS codes and project specifications, and document all test results accurately.

V. Quality Assurance

- Regularly review laboratory processes and procedures to ensure compliance with project requirements and industry standards.
- Address any issues or discrepancies identified during testing and implement corrective actions as necessary.

#### 2.6) Pre & Post Inspections of all materials

2.6.1 Selection of Quarry Site for Aggregate, Sand, Good Earth, etc.

I. Site Identification

- Identify potential quarry sites that are geographically suitable and can supply the required quantity of materials (aggregate, sand, good earth) for the project.
- Ensure that selected quarry sites comply with environmental regulations and have necessary approvals from relevant authorities.

II. Evaluation and Approval

- Evaluate the quality of materials from potential quarry sites by conducting preliminary tests as per IS codes and project specifications.
- Obtain necessary approvals from the relevant agencies before finalizing the quarry site.

III. Documentation and Compliance

- Maintain detailed records of the quarry selection process, including test results, approvals, and compliance with environmental and legal requirements.
- Ensure that the selected quarry site continues to meet quality standards throughout the project by conducting regular inspections and tests.

2.6.2 Ensuring Required Frequency of Tests During Implementation

I. Test Planning

- Develop a testing schedule based on project requirements, specifying the frequency of tests for materials, construction processes, and finished work.
- Ensure that the testing frequency aligns with IS codes, project specifications, and the approved quality control plan.

II. Monitoring and Execution

- Conduct tests at the specified intervals during implementation, covering all relevant materials and construction stages.
- Ensure that test results are recorded systematically and compared with project standards to identify any deviations.

III. Documentation and Reporting

- Maintain comprehensive records of all tests conducted, including frequency, results, and any corrective actions taken.
- Report test results regularly to project management and the concerned department, highlighting any issues or non-compliance.

**IV.** Corrective Actions

- If test results indicate non-compliance with project specifications, take immediate corrective actions to address the issues.
- Document corrective actions and re-test to ensure that the required standards are met.

#### 2.6.3 Ensuring Relevant Mandatory Tests During Execution at Every Stage

I. Test Identification

- Identify all mandatory tests required during each stage of execution, such as grading, binder content, density, super elevation, and camber.
- Ensure that the testing requirements are in line with project specifications and IS codes.

#### II. Execution and Compliance

- Conduct mandatory tests at appropriate stages of construction, ensuring that all tests are performed accurately and on time.
- Use standardized procedures and calibrated equipment to guarantee reliable test results.

III. Documentation and Reporting

- Maintain detailed records of each mandatory test conducted, including test conditions, results, and compliance with project standards.
- Report test outcomes to project management and the concerned department, ensuring transparency and accountability.

IV. Quality Assurance

- Review test results to ensure that construction processes and materials comply with the specified quality standards.
- Implement corrective actions if any test results indicate non-compliance, and re-test to confirm that the issues have been resolved.

#### 2.7) Documentation and Reporting

#### 2.7.1 Preparation of Site Inspection and Quality Control Registers

I. Register Setup

- Establish site inspection and quality control registers before the commencement of construction activities.
- Include sections for recording inspection dates, observations, test results, corrective actions, and signoffs.

II. Documentation

- Record all site inspections, test results, and quality control checks in the registers promptly and accurately.
- Ensure that registers are maintained systematically and are accessible to all relevant project personnel.

III. Review and Compliance

- Regularly review the registers to ensure that all required inspections and tests are documented and that any issues are noted.
- Maintain compliance with project specifications and IS codes through diligent recordkeeping.

#### 2.7.2 Checking of Test Results by Engineer in Charge

I. Test Result Review

- The Engineer in Charge (EIC) must review all test results documented in the quality control register.
- Verify that the test results meet the project specifications and IS code requirements.

II. Approval and Documentation

- The EIC should approve test results that conform to the required standards and document their approval in the quality control register.
- For any non-conforming results, the EIC must note the discrepancies and recommend corrective actions.

#### III. Reporting

- Ensure that the EIC's review and approval of test results are documented and communicated to project management and relevant stakeholders.
- Maintain a record of all reviewed test results for future reference and audits.

#### 2.7.3 Submission of Non-Conforming Reports and Keeping the Record

I. Identification and Reporting

- Identify any instances where construction materials, processes, or finished work do not meet the specified standards.
- Prepare a Non-Conformance Report (NCR) detailing the nature of the non-conformance, its impact, and potential corrective actions.

II. Submission and Documentation

- Submit the NCR to the Engineer in Charge, project management, and the concerned department for review and action.
- Keep a detailed record of all NCRs, including the corrective actions taken and their outcomes.

III. Follow-Up and Compliance

- Monitor the implementation of corrective actions and re-assess the work to ensure compliance with project standards.
- Document the resolution of non-conformance issues and update the quality control register accordingly.

#### 2.7.4 Rectification of Defects

I. Defect Identification

- Identify defects in materials, construction processes, or completed work during inspections, tests, or through non-conformance reports.
- Categorize defects based on severity and impact on the overall project quality and safety.

II. Rectification Process

- Implement corrective actions to rectify defects in accordance with project specifications and IS codes.
- Ensure that the rectification work is carried out by qualified personnel and is closely monitored.

III. Re-Testing and Verification

- Conduct re-testing and inspections after defect rectification to confirm that the issues have been resolved.
- The Engineer in Charge should verify and approve the rectified work, ensuring it meets the required standards.

**IV.** Documentation

- Document the defect rectification process, including details of the identified defects, corrective actions taken, and verification results.
- Update the quality control register and other relevant records to reflect the successful rectification of defects.

### **3. COMMISSIONING AND HANDOVER**

#### 3.1) Testing and Commissioning

#### 3.1.1 Installation of Road Signages

#### I. Planning and Specifications

- Review the project specifications to determine the types, sizes, and locations of road signages required.
- Ensure that all signages meet the standards outlined in the Indian Roads Congress (IRC) and IS codes.

#### II. Installation Process

- Install road signages at designated locations as per the approved plans and specifications.
- Verify that signages are installed at the correct height, angle, and position to ensure visibility and compliance with safety standards.

III. Inspection and Compliance

- Conduct a post-installation inspection to verify that all road signages are correctly installed and meet project standards.
- Document the installation and any issues encountered and ensure that any noncompliance is addressed promptly.

#### 3.1.2 Marking of Lanes

I. Preparation and Specifications

- Review the lane marking specifications, including types of markings, paint materials, and layout as per IRC and IS codes.
- Ensure that the surface is properly prepared, clean, and dry before lane marking begins.

II. Execution

- Apply lane markings using appropriate equipment and materials, ensuring precision and adherence to the approved layout.
- Monitor the application process to ensure that the markings are even, visible, and durable.

#### III. Inspection and Approval

- Inspect the lane markings after application to confirm they meet the required specifications and visibility standards.
- Document the inspection process and address any deficiencies or areas requiring touchup.

#### 3.1.3 Installation of Toll Barrier

I. Planning and Setup

- Review the project requirements and layout plans for the installation of toll barriers, ensuring compliance with IRC standards.
- Coordinate with relevant authorities to ensure that all necessary permits and approvals are obtained before installation.

II. Installation Process

- Install toll barriers at the specified locations, ensuring they are correctly aligned and fully functional.
- Test the barriers' mechanical and electronic systems to ensure smooth operation and integration with toll collection systems.
III. Testing and Commissioning

- Conduct operational tests on the toll barriers to verify their functionality, including opening/closing mechanisms and electronic systems.
- Document the installation and testing process, addressing any issues that arise before commissioning the toll plaza.

# 3.1.4 Conducting Certain Tests such as Roughness Index

I. Test Planning

- Identify the tests required during commissioning, including the Roughness Index, skid resistance, and other relevant assessments.
- Develop a testing schedule and ensure all necessary equipment and personnel are available.

II. Execution of Tests

- Conduct the Roughness Index test using standardized equipment to measure the smoothness of the road surface.
- Perform additional tests, such as skid resistance and surface drainage, as required by project specifications.

III. Analysis and Reporting

- Analyze the test results to ensure they meet the standards set out in the project specifications and IS codes.
- Document the test results and submit a detailed report to the Engineer in Charge and the concerned department

**IV.** Corrective Actions

- If test results indicate non-compliance with project standards, take corrective actions such as re-surfacing or re-marking as needed.
- Re-test the affected areas to confirm that the corrective measures have been successful and update all relevant documentation.

# 3.1.5 Road Safety Audit at Completion Stage

I. Planning and Preparation

- Analyse final drawings and safety measures implemented during construction.
- Focus on assessing safety compliance with IRC standards post-construction.

II. Audit Process

- Inspect completed road safety elements, such as signage, road markings, barriers, and lighting.
- Ensure compliance with road geometry, sight distances, and surface quality. Identify potential hazards like blind spots and missing barriers.
- Confirm the functionality of crash barriers, speed breakers, and reflective road markers.

III. Testing and Analysis

- Test lighting, crash barriers, and signage for operational effectiveness.
- Evaluate surface smoothness (Roughness Index) and drainage systems for compliance.

- IV. Reporting and Recommendations
  - Document observations and suggest corrective actions for identified risks.
  - Share with the Engineer in Charge and authorities for action.
- V. Corrective Actions and Follow-up
  - Address non-compliance with appropriate fixes like re-marking or adding barriers.
  - Verify the effectiveness of corrective actions and update documentation.

3.2) Submission of Assets management Plan and completion certificate and adhering to approved timelines and budget

3.2.1 Submission of Assets Completion Plan & As-Built Drawings by the Agency

I. Preparation of Documentation

- The executing agency should prepare an Assets Completion Plan detailing all constructed assets, including roads, bridges, drainage systems, and other infrastructure.
- Develop As-Built Drawings reflecting the final construction details, modifications, and actual dimensions of the completed work.

II. Review and Verification

- The agency should ensure that the As-Built Drawings accurately represent the completed project, including any deviations from the original design.
- Submit the Assets Completion Plan and As-Built Drawings to the Engineer in Charge for review and verification.

III. Submission and Record Keeping

- Submit the finalized Assets Completion Plan and As-Built Drawings to the project management team and the concerned department.
- Maintain copies of all submitted documents in the project records for future reference and audits.

# 3.2.2 Submission of Completion Report by Agency

I. Report Preparation

- Prepare a Completion Report summarizing the project execution.
- Ensure that the report mentions all important information and milestones pertaining to the project including cost, timelines, etc. and any other important issues related to the project.

II. Submission and Review

- Submit the Completion Report to the Engineer in Charge and concerned department for review and final approval.
- Address any feedback or requests for additional information from the reviewing authorities promptly.

# 3.2.3 Ensuring Adherence to Timelines

I. Timeline Monitoring

- Continuously monitor project progress against the approved timeline, ensuring that each phase is completed on schedule.
- Use project management tools to track deadlines and identify any potential delays early.

II. Coordination and Communication

- Coordinate with all stakeholders, including contractors, suppliers, and regulatory authorities, to ensure smooth execution of the project as per the timeline.
- Communicate any potential delays to the project management team and propose mitigation strategies.

III. Documentation and Reporting

- Document the actual progress of the project against the timeline and include this in regular progress reports.
- Submit reports on adherence to timelines to the concerned department, and project management, highlighting any deviations and corrective actions taken.

# 3.2.4 Ensuring Expenditure Within Approved Awarded Amount

I. Budget Monitoring

- Monitor project expenditures continuously to ensure they remain within the approved awarded amount.
- Use financial management tools to track costs, including material purchases, labor, equipment, and other expenses.

II. Cost Control Measures

- Implement cost control measures, such as optimizing resource usage and minimizing wastage, to prevent budget overruns.
- Regularly review expenditure reports and adjust resource allocation as necessary to stay within budget.

III. Documentation and Reporting

- Document all expenditures and maintain a clear record of financial transactions related to the project.
- Submit regular financial reports to project management and the concerned department, detailing actual costs versus the approved budget, along with explanations for any variances.

# 3.3) Guarantee of works

# 3.3.1 Post Commissioning Monitoring and Support

I. Establishment of Monitoring Plan

- Develop a post-commissioning monitoring plan to track the performance and condition of the road infrastructure after it is opened to traffic.
- Include key performance indicators (KPIs) such as road surface quality, drainage efficiency, and traffic flow in the monitoring plan.

II. Regular Inspections and Maintenance

- Conduct regular inspections of the commissioned road to identify any early signs of wear, damage, or operational issues.
- Schedule periodic maintenance activities based on the findings of the inspections to ensure the longevity of the infrastructure.

III. Reporting and Documentation

 Maintain detailed records of all monitoring activities, including inspection reports, maintenance work, and any issues identified.  Provide regular reports to the project management team and the concerned department, outlining the condition of the road and any support actions taken.

#### IV. Technical Support and Response

- Offer ongoing technical support to address any issues that arise during the postcommissioning phase, ensuring that problems are resolved promptly.
- Implement a mechanism for quick response to any critical issues that could affect the safety or functionality of the road.

# 3.3.2 Withholding of Security Amount

#### I. Security Retention

- Retain a specified security amount from the contractor's payment as per the contract terms, to ensure compliance with post-commissioning obligations.
- The withheld security amount serves as a guarantee for the quality and durability of the work completed.

#### II. Conditions for Release

- Set clear conditions for the release of the security amount, such as successful completion of the post-commissioning monitoring period and rectification of any identified defects.
- Ensure that the contractor has fulfilled all contractual obligations, including providing necessary documentation and support during the post-commissioning phase.

#### III. Review and Approval

- Review the contractor's performance during the post-commissioning period, including adherence to maintenance requirements and responsiveness to issues.
- Upon satisfactory performance and fulfilment of conditions, approve the release of the security amount in accordance with the contract terms.

# IV. Documentation

- Document the conditions under which the security amount is withheld and the criteria for its release.
- Maintain records of all communications, inspections, and approvals related to the withholding and release of the security amount.

# 4. SAFETY AND SECURITY

4.1) Adherence to safety standards & regulations

4.1.1 Providing Safety Measures Such as Firefighting Equipment, Explosive Magazine, and Handling

I. Safety Equipment Provision

- Ensure that appropriate firefighting equipment is provided at all construction sites, including fire extinguishers, fire blankets, and water hoses.
- Install firefighting equipment at accessible and strategic locations, especially near areas with higher fire risks such as fuel storage or welding operations.

II. Explosive Magazine Management

- If the project involves the use of explosives, set up an explosive magazine in accordance with the guidelines from the Petroleum and Explosives Safety Organization (PESO) and other relevant authorities.
- Ensure that the explosive magazine is in a secure, isolated area, away from the main construction zone and is properly labelled and fenced off.

III. Training and Handling

- Provide training to all relevant personnel on the proper handling, storage, and use of explosives and firefighting equipment.
- Assign a qualified safety officer to oversee the handling of explosives and to ensure compliance with all safety regulations.

IV. Inspection and Maintenance

- Conduct regular inspections of firefighting equipment and the explosive magazine to ensure they are in good working condition and meet safety standards.
- Replace or repair any defective safety equipment immediately to maintain a safe working environment.

V. Documentation and Compliance

- Maintain detailed records of all safety equipment inspections, maintenance activities, and training sessions.
- Ensure compliance with all legal and regulatory requirements related to fire safety and explosive handling, including obtaining necessary permits and approvals.

# 4.1.2 Monitoring and Surveillance

I. Monitoring Plan

- Develop a comprehensive monitoring and surveillance plan to ensure the safety and security of the construction site and its workers.
- Include provisions for 24/7 surveillance of critical areas, such as material storage zones, explosive magazines, and access points.

II. Surveillance Equipment

- Install surveillance cameras and other monitoring equipment at strategic locations across the construction site.
- Ensure that the surveillance system is capable of recording and storing footage for a specified period, as per project requirements.

III. Real-Time Monitoring

- Implement real-time monitoring of the construction site through a central control room, staffed by trained personnel who can respond to any security or safety incidents.
- Set up alarms and alerts to notify the control room of any unauthorized access, equipment failure, or other potential risks.

IV. Incident Reporting

- Establish a clear protocol for reporting and responding to safety incidents, security breaches, or any other concerns identified through surveillance.
- Document all incidents, including actions taken and outcomes, in a log that is reviewed regularly by project management and the concerned department.

V. Review and Improvement

- Regularly review the effectiveness of the monitoring and surveillance system, making improvements as necessary based on incident reports and feedback from site personnel.
- Conduct periodic audits of the surveillance system to ensure it remains up to date with the latest technology and best practices.

# 4.2) Safety measures for workers and users

# 4.2.1 Providing First Aid Equipment, Safety Uniforms, and Housing for Workers

I. First Aid Equipment Provision

- Equip all construction sites with fully stocked first aid kits, including supplies for treating common injuries such as cuts, burns, and fractures.
- Place first aid kits in accessible locations throughout the site and ensure they are regularly checked and restocked.

II. Safety Uniforms

- Provide all workers with appropriate safety uniforms, including hard hats, high-visibility vests, gloves, safety boots, and protective eyewear.
- Ensure that workers are trained on the proper use and maintenance of safety gear and always enforce its use on-site.

III. Worker Housing

- Provide safe and hygienic housing facilities for workers who require on-site accommodation.
- Ensure that the housing includes basic amenities such as clean drinking water, sanitation facilities, and proper ventilation.

IV. Health and Safety Training

- Conduct regular health and safety training sessions for all workers, focusing on the use of first aid equipment, personal protective equipment (PPE), and emergency procedures.
- Maintain records of all training sessions and ensure that new workers are trained promptly.

V. Inspection and Compliance

- Perform regular inspections of first aid equipment, safety uniforms, and worker housing to ensure they meet safety standards.
- Address any deficiencies immediately to ensure a safe and compliant working environment.

# 4.3) Security measures

# 4.3.1 Physical Security Measures

I. Security Plan Development

- Develop a comprehensive physical security plan to protect the construction site, equipment, materials, and personnel.
- Identify critical areas that require heightened security, such as material storage zones, offices, and entry/exit points.

II. Access Control

- Implement access control measures, including fencing, gates, and security personnel, to prevent unauthorized access to the construction site.
- Issue identification badges to all workers, contractors, and visitors, and enforce strict check-in/check-out procedures.

III. Surveillance Systems

- Install surveillance cameras at strategic locations to monitor the site continuously.
- Ensure that the surveillance system is always operational and that footage is recorded and stored securely.

IV. Security Personnel Deployment

- Deploy trained security personnel to patrol the site, monitor access points, and respond to security incidents.
- Provide security personnel with communication devices and protocols for reporting and escalating incidents.

V. Regular Audits

- Conduct regular audits of physical security measures to identify vulnerabilities and areas for improvement.
- Update the security plan as needed based on audit findings and changes in project requirements.

# 4.3.2 Incident Response and Reporting

I. Incident Response Plan

- Develop an incident response plan outlining the steps to be taken in case of an emergency, such as accidents, security breaches, or natural disasters.
- Assign roles and responsibilities to specific personnel for responding to different types of incidents.

II. Immediate Action

- In the event of an incident, take immediate action to secure the site, provide first aid to any injured personnel, and prevent further damage or injury.
- Notify the Engineer in Charge, project management, and relevant authorities as required by the incident response plan.

III. Documentation and Reporting

- Document all details of the incident, including time, location, individuals involved, and actions taken, in an incident report.
- Submit the incident report to project management and the concerned department for review and further action.

IV. Post-Incident Review

- Conduct a thorough review of the incident to determine the root cause and identify any lapses in safety or security protocols.
- Implement corrective actions to prevent the recurrence of similar incidents and update the incident response plan accordingly.

V. Communication and Training

- Communicate the findings of the incident review to all relevant personnel and provide additional training if necessary.
- Ensure that lessons learned from the incident are incorporated into future safety and security practices.

# **5. OPERATION AND MAINTENANCE**

# 5.1) Compliance to prescribed deliverable

# 5.1.1 Ensuring Periodical Repairs as Per Bidding Document

# I. Maintenance Planning

- Develop a detailed maintenance schedule based on the requirements outlined in the bidding document, specifying the frequency and type of repairs needed.
- Include activities such as pothole repairs, crack sealing, resurfacing, drainage maintenance, maintenance of horticulture assets, and other necessary road upkeep tasks.

#### II. Execution of Repairs

- Carry out repairs as per the established maintenance schedule, ensuring that all work adheres to the specifications and standards set forth in the bidding document.
- Use approved materials and techniques to ensure the durability and effectiveness of the repairs.

#### III. Monitoring and Quality Control

- Regularly inspect the condition of the road to identify areas requiring repair and ensure that repairs are conducted promptly.
- Implement quality control measures to verify that the repairs meet the required standards, and document all maintenance activities.

IV. Reporting and Documentation

- Maintain detailed records of all periodical repairs, including dates, locations, materials used, and the nature of the work performed.
- Submit periodic maintenance reports to the project management team and the concerned department, ensuring compliance with the bidding document.

# 5.1.2 Traffic Management

#### I. Traffic Management Planning

- Develop a comprehensive traffic management plan to ensure the safe and efficient flow of traffic during maintenance activities and regular operation.
- Include provisions for detours, signage, speed control, and temporary traffic signals as needed to minimize disruptions and ensure road user safety.

II. Implementation

- Implement the traffic management plan during maintenance work, coordinating with local authorities to manage traffic flow and communicate changes to the public.
- Deploy traffic management personnel, such as flaggers and traffic controllers, to guide vehicles and pedestrians safely around the work zones.

#### III. Signage and Communication

- Install appropriate warning signs, barriers, and directional signs well in advance of the maintenance site to inform and guide road users.
- Use electronic message boards or other communication tools to provide real-time updates on traffic conditions and any changes to traffic patterns.

IV. Monitoring and Adjustment

 Continuously monitor traffic flow during maintenance activities to identify any issues or bottlenecks.  Adjust the traffic management plan as needed to address unexpected challenges and ensure the safety and efficiency of road operations.

#### V. Post-Maintenance Review

- After the completion of maintenance work, review the effectiveness of the traffic management measures implemented.
- Document any lessons learned and incorporate them into future traffic management plans to improve operations.

#### 5.2) Timely rectification of defects

# 5.2.1 Rectification of Defects Within the Specified Time Period

I. Defect Identification and Reporting

- Regularly inspect the road infrastructure to identify any defects, such as potholes, cracks, drainage issues, or structural damages.
- Record and report any defects immediately to the maintenance team and Engineer in Charge.

II. Timely Rectification

- Prioritize defects based on severity and impact on road safety and functionality, ensuring critical issues are addressed first.
- Rectify all identified defects within the time specified in the contract or bidding document to prevent further deterioration and maintain road quality.

III. Quality Assurance

- Ensure that all rectification work meets the required quality standards and specifications outlined in the bidding document.
- Conduct follow-up inspections after repairs to confirm that the defects have been properly rectified.

IV. Communication and Coordination

- Coordinate with relevant stakeholders, including contractors, suppliers, and local authorities, to ensure that defect rectification is carried out efficiently and within the specified time frame.
- Keep the concerned department informed of the progress and completion of defect rectification.

V. Penalties for Delays

• If defects are not rectified within the specified time period, implement penalties as per the contract terms to enforce compliance.

#### 5.2.2 Documentation of the Maintenance Record

I. Record Keeping

- Maintain comprehensive records of all maintenance activities, including routine repairs, defect rectification, and any emergency maintenance work.
- Document details such as the nature of the work, materials used, personnel involved, and the dates of maintenance activities.

I. Maintenance Logs

 Create and update maintenance logs that track the condition of the road over time, noting any recurring issues or areas that require frequent attention.  Include before-and-after photos of maintenance work, where applicable, to visually document the improvements made.

II. Compliance and Reporting

- Ensure that all maintenance records follow the requirements set forth in the bidding document and other relevant guidelines.
- Submit regular maintenance reports to the project management team and the concerned department, summarizing the work completed and the status of the road infrastructure.

III. Data Management

- Use digital tools and software to organize and store maintenance records, making them easily accessible for review and audits.
- Implement a system for backing up records to prevent data loss and ensure long-term preservation of maintenance documentation.

IV. Audits and Reviews

- Periodically audit the maintenance records to ensure accuracy and completeness and adjust record-keeping practices as needed.
- Use the documented maintenance records to evaluate the effectiveness of the maintenance program and make informed decisions for future road management strategies.

# **CHAPTER 3**

# List of IS/IRC codes and manuals used for Road Project

Phase	Category	Code/Standard	Description
	Topographical Survey	IRC: SP:19-2001	Manual for Survey, Investigation, and Preparation of Road Projects.
	Controphysical and Sail	IRC: 75-2015	Guidelines for the Design of High Embankments.
	Surveys	IS 2720 (Various Parts)	Methods of Test for Soils.
	Traffic Surveys	IRC: 9-1972	Traffic Census on Non-Urban Roads.
	- Traffic Studies for Planning By-Passes around Towns	IRC:102-1988	Focuses on traffic studies required for planning bypasses, including traffic flow analysis and alignment determination
	Guidelines for Traffic Prediction on Rural Highways	IRC:108-1996	Guidelines for Traffic Prediction on Rural Highways   Guidelines for predicting future traffic volumes on rural highways based on current census data and trends
	Guidelines for Utility Shifting in Road Widening Projects	IRC: SP:91-2010	Guidelines for shifting utilities during road widening projects, including procedures and coordination with utility agencies
	Hydrological Surveys	IRC: SP:13-2004	Guidelines for the Design of Small Bridges and Culverts.
Planning &	Pavement Condition Surveys	IRC: 82-2015	Code of Practice for Maintenance of Bituminous Surfaces of Highways.
Design	Alignment and Levelling Surveys	IRC: SP:48-1998	Hill Road Manual.
	Environmental Impact Surveys	IRC: 104-1988	Guidelines for Environmental Impact Assessment of Highway Projects.
	Utility Surveys	IS 5613 (Various Parts)	Code of Practice for Design, Installation, and Maintenance of Overhead Power Lines.
	Coomotric Design	IRC: 73-1980	Geometric Design Standards for Rural (Non-Urban) Highways.
	Geometric Design	IRC: 86-1983	Geometric Design Standards for Urban Roads in Plains.
	Flexible Pavement Design	IRC: 37-2018	Guidelines for the Design of Flexible Pavements.
	General Construction in Steel	IS 800	Specifies the design, fabrication, and erection of steel structures, relevant to bridges and overhead structures.
	Code of Practice for Plain and Reinforced Concrete	IS 456	Covers the general structural design and construction aspects of concrete structures, applicable to road pavements and bridges.
	Vertical Curves for Highways	IRC: SP:23	Guidelines for designing vertical curves to ensure safety and comfort, covering aspects like curve length and gradient changes

	Rigid Pavement Design	IRC: 58-2015	Guidelines for the Design of Plain Jointed Rigid Pavements for Highways
	Pavement Drainage Design	IRC: SP:42-2014	Guidelines on Road Drainage.
	High Embankment and Slope Design	IRC: 75-2015	Guidelines for the Design of High Embankments.
	Dridge and Culturat Design	IRC: 6-2017	Standard Specifications and Code of Practice for Road Bridges, Section II: Loads and Stresses.
	Bridge and Culvert Design	IRC: SP:13-2004	Guidelines for the Design of Small Bridges and Culverts.
	Troffic Design and Control	IRC: 35-2015	Code of Practice for Road Markings.
	Trainic Design and Control	IRC: 67-2012	Code of Practice for Road Signs.
	Environmental Considerations	IRC: 104-1988	Guidelines for Environmental Impact Assessment of Highway Projects.
	Earthwork and	IRC: 36-2010	Recommended Practice for the Construction of Earth Embankments for Roadworks.
	Embankment Construction	IS 2720 (Various Parts)	Methods of Test for Soils.
	Standard Specifications and Code of Practice for Water Bound Macadam	IRC:19	Specifies the materials, preparation, and construction methods for Water Bound Macadam (WBM) roads.
		IRC: 37-2018	Guidelines for the Design of Flexible Pavements.
	Pavement Construction	IRC: 58-2015	Guidelines for the Design of Plain Jointed Rigid Pavements for Highways.
	Bituminous Work	IRC: 111-2009	Specification for Dense Graded Bituminous Mixes.
	Concrete Work	IS 456:2000	Code of Practice for Plain and Reinforced Concrete.
Execution &	Subgrade and Sub-base Construction	IRC: 63-1976	Tentative Guidelines for the Use of Low-Grade Aggregates and Soil Aggregate Mixtures in Road Construction.
lesting	Quality Control and Assurance	IRC: SP:47-1998	Guidelines on Quality Systems for Road Construction.
	Road Markings and Signage	IRC: 35-2015	Code of Practice for Road Markings.
	Drainage and Stormwater Management	IRC: SP:42-2014	Guidelines on Road Drainage.
	Earthwork, Erosion Control, and Drainage	MORTH Specifications Section 300	Covers specifications for excavation, embankment construction, and drainage
	Sub-base, Base Courses (Granular and Non- granular)	MORTH Specifications Section 400	Specifications for the construction of granular and stabilized layers beneath the pavement
	Bituminous Layers and Surface Courses	MORTH Specifications Section 500	Includes standards for bituminous paving layers, mix design, and quality control.

	Cement Concrete Pavement	MORTH Specifications Section 600	Guidelines for constructing concrete pavements, including joint details and curing practices.
	Structures (Bridges, Culverts, and Underpasses)	MORTH Specifications Section 700	Specifications for the construction of various structures, including reinforcement and concrete quality.
	Traffic Signs, Road	MORTH Specifications Section 800	Standards for installing traffic signs, road markings, and other safety features.
	Furniture	MORTH Quality Assurance Handbook	Guidelines for ensuring quality control during road construction, including material testing, workmanship standards, and inspection protocols
	Methods of Test for Aggregates for Concrete	IS 2386	Covers testing methods for aggregates used in concrete, relevant to ensuring material quality during construction
	Methods for Testing Tar and Bituminous Materials	IS 1201 to 1220	A series of standards for testing bituminous materials, essential for quality control in asphalt paving.
		Haryana PWD Code	Governs administrative procedures, tendering processes, and contract management for road construction projects in Haryana.
		PMGSY Quality Assurance Handbook for Rural Roads (Vol. I and II)	For all QA related Requirements for Rural Roads
	Code of Practice for Maintenance of Bituminous Surfaces of Highways	IRC: 82-2015	Provides guidelines for the maintenance of bituminous pavements, including patching, surface dressing, and preventive measures
	Recommended Practice for Surface Dressing with Bitumen Emulsion for Roads	IRC: 10-1961	Offers procedures for surface dressing using bitumen emulsions to maintain road surfaces.
	Code of Practice for Road Markings	IRC: 35-2015	Specifies maintenance procedures for road markings to ensure visibility and effectiveness.
Operation, Maintenance & Road Safety	Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique.	IRC: 81-1997	Focuses on the maintenance and strengthening of flexible pavements using deflection data to determine the extent of deterioration.
	Guidelines for Structural Evaluation and Strengthening of Flexible Road Pavements.	IRC: 115-2014	Provides guidelines for the structural evaluation and strengthening of flexible pavements based on traffic and material considerations
	Tentative Guidelines for the Use of Low-Grade Aggregates and Soil Aggregate Mixtures in Road Construction	IRC: 63-1976	Offers maintenance strategies using low-grade aggregates and soil aggregate mixtures

	Recommended Practice for Sealing of Cracks in Concrete Pavements	IRC: 57-2006	Details procedures for sealing cracks in concrete pavements to prevent further deterioration.
	Guidelines for Maintenance, Repair, and Rehabilitation of Cement Concrete Pavements.	IRC: SP:83-2008	Provides comprehensive guidelines for the maintenance, repair, and rehabilitation of cement concrete pavements.
	Guidelines on Road Drainage	IRC: SP:42-2014	Covers the maintenance of road drainage systems, including surface and subsurface drainage, to prevent water accumulation and pavement damage
	Manual for Highway Bridge Maintenance Inspection	IRC: SP:18-1978	Provides guidelines for the inspection and maintenance of highway bridges, including routine and periodic inspections.
	Guidelines for Inspection and Maintenance of Bridges	IRC: SP:35-1990	Focuses on the inspection and maintenance of bridges, addressing common issues like structural deterioration and load-bearing capacity
	Code of Practice for Road Signs	IRC: 67-2012	Offers guidelines for the maintenance of road signs to ensure they remain visible and effective
	Guidelines on Traffic Management in Work Zones.	IRC: SP:55-2014	Provides guidelines for managing traffic during maintenance activities to ensure safety and minimize disruption
	Manual for Maintenance of Roads in India	IRC: SP:16-1977	A comprehensive manual covering routine maintenance activities, including pothole repairs, crack sealing, shoulder maintenance, and vegetation control

# CHAPTER 4

# **Classification and Components of Roads**

In India, the roads are classified into several categories listed below:

- 1- National highway (NH).
- 2- State Highways (SH).
- 3- Major District Roads (MDR).
- 4- Minor or other District Roads (ODR)
- 5- Village Roads (VR).
- 6- Urban Roads
- 7- Expressway

# TYPES OF ROADS IN INDIA

1. National Highways (NH):

Description: National Highways are the primary roadways that connect major cities, ports, state capitals, and other significant locations across India. They form the backbone of India's road network.

Responsibility: Managed and maintained by the National Highways Authority of India (NHAI)/ respective state government.

2. State Highways (SH):

Description: State Highways are roads that connect important cities, towns, and districts within a state. They serve as vital links between National Highways and rural roads.

Responsibility: Managed by the respective state governments.

3. District Roads:

Description: District Roads connect district headquarters with other important towns within the district and to State Highways and National Highways.

Categories:

- Major District Roads (MDR): These roads handle moderate traffic and link areas of significant importance within a district.
- Minor District Roads: These are lower-order roads that connect smaller towns and villages to the major district roads.

Responsibility: Managed by respective state government.

# 4. Rural Roads:

Description: Rural Roads, also known as Village Roads, connect villages and rural areas to nearby towns or other roads. These roads are crucial for local transportation and access to markets, healthcare, and education.

Responsibility: Managed by respective state government and local bodies controlled by the state government.

# 5. Urban Roads:

Description: Urban Roads are roads within the boundaries of urban areas, including cities and towns. They facilitate local traffic within urban centres.

Responsibility: Managed by municipal corporations or urban local bodies.

6. Expressways:

Description: Expressways are high-speed, controlled-access highways designed for fastmoving traffic, with limited entry and exit points. These roads are usually six lanes or more and have grade-separated junctions.

Responsibility: Managed by the National Highways Authority of India (NHAI) or state governments.

# COMPONENTS OF ROADS

I. Pavement Structure:

- Subgrade: The natural soil or embankment that forms the foundation of the road. It needs to be well-compacted and stable.
- Sub-base Course: A layer of material placed above the subgrade, providing additional support and drainage. It often consists of granular materials like crushed stone.
- Base Course: A load-bearing layer above the sub-base, made of strong materials like crushed aggregate or bituminous material, designed to distribute the loads from the pavement above.
- Surface Course (Wearing Course): The top layer of the road, designed to resist wear from traffic and provide a smooth driving surface. It is typically made of asphalt (bituminous) or concrete.

II. Roadway:

- Carriageway: The portion of the road used by vehicular traffic, typically consisting of lanes for vehicles to travel in.
- Shoulder: The edge of the road beside the carriageway, providing space for emergency stops and sometimes used for non-motorized traffic.
- Median: The dividing strip between opposing lanes of traffic on a divided highway, which may include barriers, vegetation, or open space.

III. Drainage System:

- Side Drains: Channels along the sides of the road to collect and direct surface water away from the road structure.
- Culverts: Structures that allow water to pass underneath the road, preventing waterlogging and erosion.
- Storm Drains: Part of urban road systems, designed to collect and dispose of rainwater to avoid flooding.

IV. Intersections and Junctions:

- At-Grade Intersections: Points where roads cross at the same level, controlled by signals, signs, or roundabouts.
- Grade-Separated Intersections: Intersections where roads cross at different levels using flyovers, underpasses, or bridges, eliminating conflicts between crossing traffic streams.

V. Traffic Control Devices:

- Signs and Signals: Regulatory, warning, and informational signs and traffic signals to manage traffic flow and ensure safety.
- Road Markings: Painted lines and symbols on the road surface to guide and regulate traffic, including lane markings, crosswalks, and stop lines.

VI. Auxiliary Features:

- Footpaths/Sidewalks: Pathways alongside the road for pedestrians.
- Cycle Tracks: Separate lanes or paths for cyclists, often running parallel to the main road.
- Crash Barriers: Safety barriers placed along the edges of roads or medians to prevent vehicles from veering off the road.
- Street Lighting: Lights installed along the road to ensure visibility at night and in poor weather conditions.

The construction of a road involves various layers and components, each contributing to the road's durability, strength, and ability to handle traffic loads. Here's a detailed breakdown of the components of a road in India:

1. Subgrade

- Definition: The subgrade is the natural soil prepared to support the layers of the road above it.
- Function: It provides the foundational support for the road structure. The subgrade must be strong and stable to withstand the loads transmitted from the upper layers.
- Preparation:
  - Compaction: The soil is compacted to achieve the required density and strength. Compaction reduces voids and increases soil strength, ensuring the subgrade can support the loads from the road.
  - Stabilization: If the soil is weak, it might be stabilized using lime, cement, or other additives. This process improves the load-bearing capacity of the subgrade.

2. Sub-base Course

- Definition: The sub-base is the layer of material placed on the subgrade.
- Function: It provides additional support to the road by distributing loads evenly to the subgrade and acts as a working platform during construction.
- Materials Used: Common materials include granular materials like crushed stone, gravel, or recycled concrete. Sometimes a cement-treated base or soil-cement is used.
- Construction: The sub-base is laid and compacted in layers, ensuring proper gradation and compaction to avoid settlement and provide a strong base for the upper layers.

3. Base Course

• Definition: The base course lies directly above the sub-base and is a crucial loadbearing layer.

- Function: It provides structural strength and distributes traffic loads to the subbase. It also helps in reducing stress on the subgrade.
- Materials Used: Typically made from high-quality crushed stone, gravel, or a combination of materials like bituminous macadam (BM) or water-bound macadam (WBM).
- Construction: The base course is compacted and graded to ensure even distribution of loads. In flexible pavements, the base course is critical in preventing surface deformation.

4. Surface Course (Pavement)

- Definition: The surface course, or pavement, is the topmost layer of the road, exposed to traffic.
- Types:
  - Flexible Pavement: Consists of multiple layers of bituminous materials. The top layer is usually an asphalt concrete or bituminous concrete layer.
  - Rigid Pavement: Made of concrete (Plain Cement Concrete or Reinforced Cement Concrete).
- Function: It provides a smooth and durable surface for vehicles, offers skid resistance, and protects the underlying layers from weather and traffic wear.
- Construction:
  - Flexible Pavement: Involves multiple layers, including a base and a binder course made from bituminous materials, topped with a wearing course.
  - Rigid Pavement: Constructed with concrete slabs, which may include joints to allow for expansion and contraction due to temperature changes.

#### 5. Shoulders

- Definition: Shoulders are the strips of land adjacent to the carriageway (roadway).
- Function: They provide lateral support to the pavement, accommodate stopped vehicles, and assist in drainage.
- Materials Used: Typically composed of compacted earth, gravel, or paved with asphalt or concrete.
- Construction: Shoulders are constructed with proper grading to prevent water accumulation and ensure stability. In some cases, paved shoulders are used to improve road safety.

6. Drainage System

- Definition: The drainage system is designed to remove surface and subsurface water from the road structure.
- Function: Proper drainage prevents water from weakening the subgrade and pavement layers, which can lead to road failure.
- Components:
  - Surface Drainage: Includes side drains, cross drains, and culverts that collect and channel surface water away from the road.
  - Subsurface Drainage: Involves underdrains, filter layers, and drainage blankets to remove water from beneath the road.

• Construction: Drainage channels are carefully graded to ensure effective water flow, and structures like culverts are designed to handle expected water loads.

7. Kerbs

- Definition: Kerbs are raised edges along the sides of the pavement, commonly found in urban areas.
- Function: They define the boundaries of the roadway, prevent vehicles from leaving the carriageway, assist in directing stormwater to drainage inlets, and provide aesthetic delineation.
- Materials Used: Commonly made from concrete, stone, or precast units.
- Construction: Installed along the edges of the road, kerbs are usually integrated with the pavement structure to ensure durability and effective water management.

8. Medians (Dividers)

- Definition: Medians are raised or marked areas separating opposing lanes of traffic.
- Function: Medians improve road safety by preventing head-on collisions, guiding traffic, and providing space for street lighting or greenery.
- Materials Used: Constructed using concrete, metal barriers, or landscaped with grass, shrubs, or trees.
- Construction: Medians are designed based on the type of road (urban or highway) and are often combined with crash barriers to enhance safety.

9. Road Markings and Signage

- Definition: Road markings include lines, symbols, and words painted on the road surface. Signage includes various traffic signs installed along the road.
- Function: They guide, regulate, and inform road users, enhancing safety and ensuring smooth traffic flow.
- Materials Used: Markings are usually done with thermoplastic paint, reflective paint, or non-reflective paint. Signboards are made from metal or plastic with reflective surfaces.
- Construction: Markings and signs are placed according to traffic regulations, with consideration for visibility, legibility, and durability.

10. Footpaths and Cycle Tracks

- Definition: Footpaths are pedestrian pathways, while cycle tracks are dedicated lanes for cyclists, usually found alongside roads in urban areas.
- Function: They provide safe spaces for non-motorized users, reducing conflicts with vehicular traffic.
- Materials Used: Typically made of concrete, asphalt, or paving blocks.
- Construction: Footpaths and cycle tracks are constructed with proper grading and width to accommodate pedestrian and cyclist traffic, ensuring safety and comfort.

11. Traffic Barriers and Guardrails

• Definition: These are protective structures installed along the edges of roads, particularly on curves, bridges, and steep embankments.

- Function: They prevent vehicles from leaving the roadway, protect against collisions, and safeguard pedestrians and property.
- Materials Used: Usually made of metal (steel or aluminium), concrete, or a combination of materials.
- Construction: Barriers and guardrails are anchored firmly to withstand impacts, with designs tailored to absorb energy and minimize injury in the event of a collision.
- 12. Expansion Joints (in Rigid Pavements)
  - Definition: Expansion joints are gaps left in concrete pavements to accommodate the expansion and contraction of concrete due to temperature changes.
  - Function: They prevent cracking and damage by allowing the concrete slabs to expand and contract freely.
  - Materials Used: Filled with compressible materials like rubber, bitumen, or synthetic compounds.
  - Construction: Joints are carefully spaced and filled with flexible material to ensure longevity and prevent water infiltration.

13. Bridges, Culverts, and Flyovers

- Definition: These are structures that allow roads to cross over obstacles like rivers, valleys, other roads, and railways.
- Function: They provide continuity in the road network, ensuring that the road can maintain its course over physical obstructions.
- Materials Used: Typically made of reinforced concrete, steel, and sometimes prestressed concrete.
- Construction: These structures are engineered for strength, durability, and resistance to environmental factors. The design considers factors like load-bearing capacity, seismic activity, and hydraulic capacity.

14. Utilities and Lighting

- Definition: Utilities include electrical lines, water pipes, and communication cables, often installed beneath or alongside roads. Lighting includes streetlights and other illumination structures.
- Function: Utilities provide essential services to adjacent areas, while lighting improves safety and visibility for road users, especially at night.
- Materials Used: Utility lines are made from materials suitable for their specific use (e.g., PVC for water pipes, copper for electrical wires, hume pipes etc.), while lighting poles are typically made from steel or aluminium.
- Construction: Utility installations are planned to minimize interference with the road structure, and lighting is installed to ensure even illumination without glare or shadow zones.

15. Pavement Markers

• Definition: Pavement markers are reflective or non-reflective devices installed on the road surface to provide visual guidance.

- Function: They enhance road visibility during nighttime and in adverse weather conditions, assisting in lane demarcation and providing warnings at critical points.
- Materials Used: Typically made from plastic, ceramic, or metal, with reflective surfaces made from glass beads or reflective tape.
- Construction: Markers are embedded or glued to the road surface in a pattern that aligns with traffic lanes

# **ANNEXURE I**

# Technical Quality Audit Parameters: Roads

Sr.	Parameter	Benchmark	Reference	Indicator	Sub indicators	Max.	Marks	Weightage
no.						marks	optained	(%)
1		Technical	DPR	1.1) Survey, investigation	1.11) Topographic Survey and alignment	10		20 %
	Planning &	Framework and		and regulatory	1.12) Land Acquisition, Forest clearance etc.	5		
	Design	comprehensive		compliances	1.13) NOC from Railways, Electricity Board,	5		
		Planning			water Resources, PHED etc.			
					1.14) Identification & shifting of utilities	5		
					1.15) Traffic survey	10		
				1.2) Long term planning	1.21) Future projections for traffic load	5		
					1.22) Future development of the area such	5		
					as industrial growth, education hub etc.			
				1.3) Selection of	1.31) Selection of latest software in design	5		
				appropriate				
				technology/methodology	1.32) Selection of modern	5		
					mechanized/digital equipment	-		
					1.33) Use of solar energy for Lighting the road	5		
					infrastructures	5		
					แแลงแนงเนเซง.			

# **Pre-implementation Stage**

1.4) Design and specifications	1.41) Identification of material for construction of road	5	
	1.41) conducting mandatory tests for design	5	
	1.42) Framing specifications and appropriate design	10	
1.5) Cost Analysis, Budget planning and	1.51) Financial implication with cost index up to implementation period.	5	
timeline estimates	1.52) Identification of funding agency with annual budget allocation	5	
	1.53) Period for DPR approval, call of tenders, award of work & its implementation etc.	5	
1.6) Provision of utility corridor/Horticulture	1.61) Provision of space for conduits /channels /cable /wires etc.	3	
Planning	1.62) Provision for Horticulture Planning	2	
	Total	100	<b>20</b> %

Sr.	Parameter	Benchmark	Reference	Indicator	Sub Indicators	Max.	Marks	Weightage
no.						marks	obtained	
2	Execution,	Technical	contract	2.1) Use of	2.11) use of Materials such as aggregates, sand, good	5		40%
	Inspection	methodology	Agreement,	construction	earth etc. from approved source			
	and testing	for	test reports	materials as per	2.12) Use of design mix as per specifications	5		
		implementation	and quality	relevant codes	2.13) Procurement of items like cement, steel,	5		
		and inspection & testing	control register	& manuals	Bitumen, RCC Pipes etc. Of approved make and manufacturer			
					2.14) Carrying out tests at manufacture's premises before dispatch/inhouse facilities	5		
				2.2) supervision	2.21) Deployment of appropriate qualified personal	2		
				by skilled manpower/ TPIA	2.22) Manpower deployment as per requirement	4		
				2.3) Use of	2.31) Sensor pavers	3		
				modern	2.32) Automated batching plants	3		
				facilities for	2.33) Automated hot mix plants	3		
				construction and treatment	2.34) Use of other mechanized and digital equipment etc.	5		
				2.4) Conformity to relevant standards	2.41) Work executed as per approved bid document	10		
				2.5) Testing laboratory at site	2.51) Setting up Testing laboratory having all testing equipment, relevant to the project specifications	10		
					2.61) Selection of quarry site for aggregate, sand, good earth etc.	5		

#### IMPLEMENTATION STAGE

		<ul> <li>2.6) Pre &amp; Post Inspections of all materials</li> <li>2.7) Documentation and Reporting</li> </ul>	<ul> <li>2.62) Ensuring required frequency of tests during implementation</li> <li>2.63) Ensuring relevant mandatory tests during execution at every stage such as grading, binder contents, density, super elevation, camber etc.</li> <li>2.71) Preparation of site inspection and quality control registers</li> <li>2.72) Checking of test results by Engineer in Charge</li> <li>2.73) Submission of non-conforming reports and keeping the record</li> <li>2.74) Rectification of defects</li> </ul>	5 5 5 5 5 5 5 5	
			2.74) Rectification of defects	5	
Tota	l			100	<b>40</b> %

Sr.	Parameter	Benchmark	Reference	Indicators	Sub Indicator	Max.	Marks	Weightage
no.						marks	obtained	
3	Commissioning	Guidelines for	Completion	3.1) Testing and	3.11) Installation of road signages	10		10%
	and Hand over	commissioning	report	commissioning	3.12) Marking of lanes	10		
		and handover			3.13) Installation of toll barriers	10		
					3.14) conducting certain test such as roughness	10		
					index etc.			
				3.2)	3.21) Submission of Assets completion Plan &	10		
				Submission of	inbuilt drawings by the agency			
				Assets	3.22) submission of completion report as per	10		
				management	approved format by Agency			
				Plan and	3.23) Ensuring to the timelines	10		
				completion	3.24) Ensuring expenditure within approved	10		
				certificate and	awarded amount			
				adhering to				
				approved				
				timelines and				
				budget				
				3.3) Guarantee	3.31) Post commissioning Monitoring and	10		
				ofworks	support			
					3.32) Withhold of security amount	10		
Tota	l					100		10%

#### COMMISSIONING

Sr.	Parameter	Benchmark	Reference	Indicator	Sub Indicator	Max.	Marks	Weightage
no.						marks	obtained	
4	Safety and	Guidelines	Safety	4.1)	4.11) Providing safety measures such as firefighting	5		5%
	Security	for Safety	plan	Adherence	equipment, explosive magazine and it's handling etc.			
		and		to safety	4.12) Monitoring and Surveillance	1		
		Security		standards				
				&				
				regulations				
				4.2) Safety	4.21) Proving first aid equipment, safety uniforms and housing	2		
				measures	for workers etc.			
				for workers				
				and users				
				4.3)	4.31) Physical Security measure	1		
				Security	4.32) Incident response and reporting	1		
				measures				
Tota	l					10		5%

#### SAFETY AND SECURITY

Sr.	Parameter	Benchmark	Reference	Indicator	Sub Indicator	Max.	Marks	Weightage
no.			document			marks	obtained	
5	Operation	Procedure	Assets	5.1)	5.11) Ensuring the periodical repairs as per bidding	3		10 %
	and	for effective	management	Compliance	document			
	maintenance	maintenance	plan	to prescribed	5.12) Traffic management	2		
				deliverable				
				5.2) Timely	5.21) Rectification of defects within the specified	3		
				rectification	time period			
				of defects	5.22) Documentation of the maintenance record	2		
					Total	10		10%

#### **OPERATION & MAINTENACE**

Sr. No.	Parameter	Marking Criteria	Weightage (%)	Marks obtained
1	Planning and Design		20*	
2	Execution, Inspection and Testing		40*	
3	Commissioning and Handing over		10*	
4	Safety Measures		5*	
5	Project Management	Adherence to project timelines and Cost Projections	10	
6	Environmental Measures	Consideration of environmental factors like sustainability, eco- friendly construction practices	3	
7	User Feedback	Feedback from beneficiaries, stakeholders to assess their satisfaction levels	2	
8	Operation & Maintenance		10*	
TOTAL	•		100	

\*The breakup of the weightage is given in the detailed framework for these parameters

\*Parameters that are not applicable to a specific project will not be considered in the audit scoring. The weightage will be adjusted accordingly.

# **ANNEXURE II**

# Part A: Checklist for Approval of DPR for Road Projects

Name of Division: \_\_\_\_\_

Name of Project: \_\_\_\_\_

Sr.	Questienneire	Vaa	No		Domorko
No.	Questionnaire	res	INO	IN/A	Remarks
1.	Project title appropriately defined as per the scope of the work				
2.	Preliminary survey / site investigation conducted				
3.	Feasibility study conducted				
4.	Topographic survey conducted				
5.	Alignment planned and finalized				
6.	Status of land as per revenue record				
7.	Traffic survey conducted				
8.	Future projections for traffic load made				
0	Future development in the area (industrial, educational)				
5.	analyzed				
10.	Land acquisition completed				
11.	Forest clearance obtained				
12.	Identification of utilities and its proposal for relocation				
13.	NOC obtained from railway department				
14.	NOC obtained from UHBVN/DHBVN				
15.	NOC obtained from I&WRD				
16.	NOC obtained from PHED				
17.	NOC obtained from MC/PRI				

-				
18.	Environmental Impact Assessment (EIA) completed			
19.	Social Impact Assessment (SIA) completed			
20.	Road safety provisions taken as per IRC guidelines			
	i)Hydrological study conducted to understand the flood risk of			
	the area			
	ii)Road level in embankment construction fixed as per highest			
21.	flood level in the adjoining area		 	
	iii) Provision of roadside culverts/ drains taken as per			
	requirement			
	iv) Disposal point of drain/ rainwater identified			
22.	Provision for utilization of solar energy taken			
23.	Provision for rainwater harvesting incorporated			
24.	Provision of utility ducts taken			
25.	Provision for Horticulture Planning			
26.	Geo-technical investigation conducted			
27.	Public consultations and stakeholder engagements conducted			
28.	Specifications and appropriate designs framed			
29.	Pavement design and structural analysis completed			
30.	Detailed design and drawings prepared			
21	Financial analysis and cost estimation prepared with provision			
51.	for price escalation			
32.	Bill of Quantities (BOQ) and technical specifications prepared			
22	DPR draft submitted for internal review and checking by the			
<u> </u>	competent authority			
34.	Identification of Funding agency and provision of annual budget			
	allocation made			
35.	Final DPR approval by the competent authority			
36.	Approval from financial and administrative departments			
	received			

Note: This checklist is required to be appended with the DPR at the time of approval and duly signed by the concerned officers/officials. **Part B: Checklist for Execution, Inspection and Testing Commissioning & Handover of Road Projects** 

Name of Division: \_\_\_\_\_

Name of Project: \_\_\_\_\_

Estimated Cost of Project: \_\_\_\_\_

Date of Sanction of Project: \_\_\_\_\_

Name of Agency: \_\_\_\_\_

Date of Award of Contract: \_\_\_\_\_

Contract Value of the Work: \_\_\_\_\_

Sr.	Questionnaire	Vas	No	N/A	Remarks
No.		165			
1	Required clearances (environmental, land acquisition, etc.)				
	obtained before execution				
2.	Site properly prepared (clearing, grubbing, leveling)				
3.	Safety measures in place (fencing, signages etc)				
4.	Materials like aggregates, sand, and good earth being procured from				
	approved/authorized sources				
5.	Items like cement, steel, bitumen, RCC pipes, etc. procured from				
	approved/authorized manufacturers				
6.	Test conducted at the manufacturer's premises or in-house				
	facilities				
7.	Qualified personnel appropriately deployed at the site				
8.	Manpower deployed as per the project requirements				
9.	Sensor paver used for paving operations				
10.	Automated batching plant available for concrete production				
11.	Automated hot mix plant used for bituminous work				
12.	Mechanized and digital equipment used as per specification				

13.	Work executed as per the approved bid documents		
14.	Testing laboratory with all necessary equipment set up on-site		
15.	Test carried out at the required frequency during implementation		
16.	Material testing for aggregates like gradation, water absorption etc. conducted		
17.	Verification of the bitumen content for the various bituminous layers of the road pavement conducted		
18.	Checking of temperature of the bituminous material within the specified range during paving		
19.	Compaction of the various layers of road pavement conducted and result of the density tests satisfactory		
20.	Super elevation and camber checked at various stages during execution		
21.	Thickness and width of the road as per approved design		
22.	Road slopes and drainage provisions as per the design		
23.	Inspection and quality control registers being properly maintained		
24.	Test results checked by the Engineer in Charge		
25.	Non-conforming reports submitted and recorded properly		
26.	Defects rectified promptly upon identification		
27.	Final inspection of the road completed		
28.	Road surface free of defects (cracks, potholes, etc.)		
29.	Road markings properly applied as per specification		
30.	Traffic signs and signals installed as per the design		
31.	Road signage for speed limits, directions, and other information installed		
32.	Drainage infrastructure inspected and verified for proper functioning		
33.	Utilities (electricity, water, telecom, etc.) fully installed and functional		

24	Final as-built documentation such as asset completion plant and		
34.	in-built drawings submitted		
35.	Completion report submitted in the approved format		
36.	Contractor provided all necessary warranties and guarantees		
37.	Punch-list items resolved to satisfaction		
38.	Required performance standards for the road tested and verified		
39.	Toll barriers installed as per the project requirements		
40.	Post-commissioning monitoring and support arranged		
41.	Site inspection conducted, and hazards identified		
42.	Risk assessment report prepared		
42	Consultations with relevant authorities (police, local authorities)		
43.	carried out and traffic management plan implemented		
44.	Safety signs and road markings installed as per standards		
45.	Adequate street lighting installed for night operations		
46.	Workers training on safety protocols		
47	Personal protective equipment (PPE) provided to workers during		
47.	execution		
48.	Safety barriers and guardrails installed where necessary		
49.	Machinery inspected for operational safety		
50.	Safety measures for handling explosive provided		
51.	Emergency evacuation plan and response system in place		
52	Communication system set up for quick response during		
52.	emergencies		
53.	Regular safety audits and reviews being conducted		
E 4	Implementation of physical security measures such as deployment		
54.	of security personnel in the project area		
55.	First aid and medical facilities available on-site		
56.	Fire prevention and control measures in place		

Note: This checklist is required to be signed by the Executive Engineer in charge of the work and other officers during their visit.

# Part C: Checklist for Operation and Maintenance of Road Projects

Name of Division: \_\_\_\_\_

Cost of Project at Completion:

Name of Project: \_\_\_\_\_

Date of Completion: \_\_\_\_\_

Name of Agency: \_\_\_\_\_

Sr. No.	Questionnaire	Yes	No	N/A	Remarks
1.	Road condition survey conducted				
2.	Required material and equipment for maintenance procured				
3.	Skilled personnel assigned to perform the O&M activities				
4.	Proper procedures in place for the maintenance of drainage system				
5.	Traffic safety measures installed and operational				
6.	Inspection of road signage and markings been conducted				
7.	Vegetation along the roadway trimmed or cleared as required				
8.	Emergency response procedures established and tested				
9.	Defined pothole repair schedule in place				
10.	Routine inspections of road surfaces conducted regularly				
11.	Agreements with third-party contractors for O&M services finalized				
12.	O&M budget finalized and approved				
13.	Periodical repairs planned and carried out as per the bidding document requirements				
14.	Effective traffic management plan in place and operational				
15.	Defects rectified within the specified timeframes				
16.	Maintenance record properly documented and up to date				

Note: This checklist is required to be signed by the Executive Engineer in charge of the work and other officers during their visit.
# **ANNEXURE III\***

## Checklists already in use by the PWD (Roads) for various works

\*The checklists annexed as Annexure II (Part A) is comprehensive and shall be followed for the preparation of DPR for any Road Project. However, if required, checklists already in use by the department (Annexed as Annexure III) may be referred to depending upon the nature and scope of work.

#### Part 1: Checklist for Preparation of rough cost estimates for improvement of road by Pdg. Wdg. Stg. Works etc

Name of Division: \_\_\_\_\_

Sr. No.	Questionnaire/Description	Remarks/Comments
1.	Category of road NH/SH/MDR/ODR	
2.	Existing PWD road or transferred from other Department.	
2	Whether proposed under head	
5.	5054/3054/SCSP/NABARD/PMGSY/CRIF/NH/NCRPB/Deposit?	
4.	Existing carriageway width of road?	
5.	Proposed carriageway width of Road if widening is proposed	
6.	Existing Right of way (EROW) in meters.	
7.	Proposed Right of way (PROW).	
8.	Whether improvement of geometrics required?	
9.	Whether any land acquisition involved?	
10.	Whether encumbrance free land is available.	
11.	Whether ownership of land pertains to Government?	

10	Whether as per Revenue record land rest in the name of	
12.	Government?	
13.	Whether road ID of the existing road has been created?	
1/	Whether the provision of the repair/improvement are as per	
	State Road Maintenance Policy?	
15.	Whether the provisions are taken as per IRC?	
16	Whether the provision of road safety are taken in compliance of	
10.	IRC?	
17.	Whether black spots have been identified or not?	
18.	Provisions of improvement of black spots if any included or not?	
10	Whether District Road Safety Committee has proposed some	
13.	improvement on this stretch, if yes?	
20.	The details of existing crust of the road.	
21	Whether the proposed crust of road is in conformity with design	
21.	requirements?	
22	Whether any pond exists adjoining the road if yes, provisions of	
22.	retaining wall/toe wall taken?	
23.	What is level difference (above/below) from adjoining land?	
24.	What is level difference (above/below) from nearby road?	
25	Whether inspection of existing bridge/culvert done or not and	
25.	does any improvement required?	
26	Whether road passes through flood prone area, if yes, details of	
20.	such stretch?	
27	Whether road passes through built-up area, if yes, details	
27.	thereof?	
20	Whether road passes through reserve forest, hilly area, wild life	
20.	area, if yes, details thereof?	
20	Whether provision of improvement of junctions and curves	
29.	taken?	

30	Whether provision of balancing culverts as per the requirement	
50.	of Drainage/Sajra Plan?	
31.	Whether provision for roadside drains taken in built-up area?	
32.	Whether disposal point of drains/rainwater available?	
22	Whether provision for retaining wall/toe wall/breast wall/stone	
<u> </u>	pitching required?	
24	Whether the provision of footpath/divider has been taken in case	
54.	of four-laning?	
25	Whether the NOC has been obtained from concerned	
35.	department, if land belongs to other Department?	
20	Whether any utility shifting like HT Line/LT Line is involved,	
36.	including raising for clearance?	
27	Whether forest clearance is involved? If yes, provision included	
57.	or not?	
20	Whether any utility shifting of sewerage/water pipeline is	
50.	involved? If yes, provision included?	
20	Whether provision of horticulture works incorporated, if	
	required?	
40	Whether provision for Road lighting/street light works	
40.	incorporated?	
41.	Whether provision for cost escalation has been incorporated?	
40	Whether provision for road furniture/road safety items like	
42.	marking, signages, and crash barriers?	
43.	Whether provision for rainwater harvesting incorporated?	
4.4	Whether any litigation/court case pending in any court? If yes,	
44.	provide details.	
4 -	Whether the availability of budget in case of deposit work is as	
45.	per PWD Code?	
40	Whether the RD wise detail Performa along with LDOT/Status of	
46.	DLP along with justification?	

#### Part 2: Checklist for Preparation of rough cost estimates for construction of new road

Name of Division: \_\_\_\_\_

Sr. No.	Questionnaire	Remarks
1.	Whether proposed under head 5054/SCSP/Deposit Head?	
2.	Name of constituency/District?	
3.	Existing Right of way (EROW) in meters.	
4.	Proposed Right of way (PROW).	
5.	Whether any land acquisition involved?	
6.	Whether encumbrance free land is available.	
7.	Whether ownership of land pertains to Government?	
8.	Whether ownership of land transfer to PWD B&R Branch?	
9.	Whether the link is Multiple or Single?	
10	Whether there is any proposal for construction of proposed road	
10.	by HSAMB or any other Department?	
11.	Whether the demarcation of katcha path is got done?	
12.	Whether the Sajra plan/Index plan attached?	
12	Whether as per Revenue record land rest in the name of	
13.	Government?	
14.	Whether the provisions are taken as per IRC?	
15	Whether the provision of road safety are taken in compliance of	
15.	IRC?	
16.	Whether the sub grade of proposed road is 0.9 mtr. above OGL?	

17.	Whether the proposed crust of road is in conformity with design requirements?	
18.	Whether any pond exists adjoining the road if yes, provisions of	
10	What is level difference (above/below) from adjoining land?	
20	What is level difference (above/below) from poarby road?	
20.	What is level unrelence (above/below) nonnearby road?	
21.	such stretch?	
22	Whether road passes through built-up area, if yes, details	
22.	thereof?	
22	Whether road passes through reserve forest, hilly area, wild life	
23.	area, if yes, details thereof?	
24.	Whether provision of junctions and curves taken?	
25	Whether provision of culverts as per the requirement of	
25.	Drainage/Sajra Plan of Revenue Department?	
26.	Whether provision for roadside drains taken in built-up area?	
27.	Whether disposal point of drains/rainwater available?	
20	Whether provision for retaining wall/toe wall/breast wall/stone	
20.	pitching required?	
20	Whether the NOC has been obtained from concerned	
29.	department, if land belongs to other Department?	
20	Whether any utility shifting like HT Line/LT Line is involved,	
30.	including raising for clearance?	
01	Whether forest/environment clearance is required? If yes,	
31.	provision included or not?	
20	Whether any utility shifting of sewerage/water pipeline is	
32.	involved? If yes, provision included?	
33.	Whether provision for cost escalation has been incorporated?	
24	Whether provision for road furniture/road safety items like	
34.	marking, signages, and crash barriers?	

35.	5. Whether provision for rainwater harvesting incorporated?	
26	Whether any litigation/court case pending in any court? If yes,	
30.	provide details.	
27	Whether the availability of budget in case of deposit work is as	
37.	/ per PWD Code?	
38.	8. Special benefit if any?	

## Part 3: Preparation of Detailed Estimate for construction of new road

Name of Division: \_\_\_\_\_

Sr. No.	Questionnaire	Remarks
1.	Whether proposed under head 5054/SCSP/Deposit Head?	
2.	Name of constituency/District?	
3.	Existing Right of way (EROW) in meters.	
4.	Proposed Right of way (PROW).	
5.	Whether any land acquisition involved?	
6.	Whether encumbrance free land is available.	
7.	Whether ownership of land pertains to Government?	
8.	Whether ownership of land transfer to PWD B&R Branch?	
9.	Whether the link is Multiple or Single?	
10	Whether there is any proposal for construction of proposed road	
10.	by HSAMB or any other Department?	
11.	Whether the demarcation of katcha path is got done?	
12.	Whether the Sajra plan/Index plan attached?	
12	Whether as per Revenue record land rest in the name of	
15.	Government?	
14.	Whether the provisions are taken as per IRC?	
15	Whether the provision of road safety are taken in compliance of	
15.	IRC?	
16.	Whether the sub grade of proposed road is 0.9 mtr. Above OGL?	
17.	Whether the proposed crust of road is in conformity with design requirements?	

18.	Whether any pond exists adjoining the road if yes, provisions of	
	retaining wall/toe wall taken?	
19.	What is level difference (above/below) from adjoining land?	
20.	What is level difference (above/below) from nearby road?	
21	Whether road passes through flood prone area, if yes, details of	
21.	such stretch?	
22	Whether road passes through built-up area, if yes, details	
۲۲.	thereof?	
0.0	Whether road passes through reserve forest, hilly area, wild life	
23.	area, if yes, details thereof?	
24.	Whether provision of junctions and curves taken?	
25	Whether provision of culverts as per the requirement of	
25.	Drainage/Sajra Plan of Revenue Department?	
26.	Whether provision for roadside drains taken in built-up area?	
27.	Whether disposal point of drains/rainwater available?	
20	Whether provision for retaining wall/toe wall/breast wall/stone	
20.	pitching required?	
20	Whether the NOC has been obtained from concerned	
29.	department, if land belongs to other Department?	
20	Whether any utility shifting like HT Line/LT Line is involved,	
50.	including raising for clearance?	
21	Whether forest/environment clearance is required? If yes,	
51.	provision included or not?	
20	Whether any utility shifting of sewerage/water pipeline is	
52.	involved? If yes, provision included?	
33.	Whether provision for cost escalation has been incorporated?	
24	Whether provision for road furniture/road safety items like	
54.	marking, signages, and crash barriers?	
35.	Whether provision for rainwater harvesting incorporated?	

36	Whether any litigation/court case pending in any court? If yes,	
00.	provide details.	
27	Whether the availability of budget in case of deposit work is as	
57.	per PWD Code?	
20	Certificate recorded by Executive Engineer in the body of	
50.	estimate should be signed by SE.	
20	SE will check all the design, hydraulic data, structure drawings	
	of culverts/bridges in the estimate.	
40	Drawing of bridges/minor bridges should be proof checked and	
40.	BBS should also be attached.	
11	Where provision of earth work taken after dismantling or	
41.	otherwise L-section X-section must be approved by SE.	
40	EE should record a certificate of 100% x-section of earth work	
42.	checked personally in the estimate.	

## Part 4: Preparation of Detailed Estimate for improvement of road by Pdg. Wdg. Stg. Works etc

Name of Division: \_\_\_\_\_

Name of Project: \_\_\_\_\_

Sr. No.	Questionnaire	Remarks
1.	Category of road NH/SH/MDR/ODR	
2.	Existing PWD road or transferred from other Department.	
3.	Whether proposed under head 5054/3054/SCSP/NABARD/PMGSY/CRIF/NH/NCRPB/Deposit?	
4.	Existing carriageway width of road?	
5.	Proposed carriageway width of Road if widening is proposed	
6.	Existing Right of way (EROW) in meters.	
7.	Proposed Right of way (PROW).	
8.	Whether improvement of geometrics required?	
9.	Whether any land acquisition involved?	
10.	Whether encumbrance free land is available.	
11.	Whether ownership of land pertains to Government?	
12.	Whether as per Revenue record land rest in the name of Government?	
13.	Whether road ID of the existing road has been created?	
11	Whether the provision of the repair/improvement are as per State	
14.	Road Maintenance Policy?	
15.	Whether the provisions are taken as per IRC?	
16.	Whether the provision of road safety are taken in compliance of IRC?	
17.	Whether black spots have been identified or not?	
18.	Provisions of improvement of black spots if any included or not?	

10	Whether District Road Safety Committee has proposed some	
19.	improvement on this stretch?	
20.	The details of existing crust of the road.	
21	Whether the proposed crust of road is in conformity with design	
21.	requirements?	
22.	Whether any pond exists adjoining the road?	
23.	What is level difference (above/below) from adjoining land?	
24.	What is level difference (above/below) from nearby road?	
25.	Whether inspection of existing bridge/culvert done or not?	
26.	Whether road passes through flood prone area?	
27.	Whether road passes through built-up area?	
20	Whether road passes through reserve forest, hilly area, or wildlife	
20.	area?	
29.	Whether provision of improvement of junctions and curves taken?	
30.	Whether provision of balancing culverts as per Drainage/Sajra Plan?	
31.	Whether provision for roadside drains taken in built-up area?	
32.	Whether disposal point of drains/rainwater available?	
33	Whether provision for retaining wall/toe wall/breast wall/stone	
55.	pitching required?	
34.	Whether provision of footpath/divider taken in case of four-laning?	
25	Whether the NOC has been obtained from the concerned	
35.	department?	
36.	Whether any utility shifting like HT Line/LT Line is involved?	
37.	Whether forest clearance is involved? If yes, provisions included?	
38.	Whether any utility shifting of sewerage/water pipeline is involved?	
39.	Whether provision of horticulture works incorporated, if required?	
40.	Whether provision for Road lighting/street light works incorporated?	
41.	Whether provision for cost escalation has been incorporated?	

40	Whether provision for road furniture/road safety items like marking	
42.	and crash barriers?	
43.	Whether provision for rainwater harvesting incorporated?	
44.	Whether any litigation/court case pending in any court?	
45.	Whether the availability of budget is as per PWD Code?	
46	Whether the RD wise detail Performa along with justification	
46.	attached?	
47	Certificate recorded by Executive Engineer in the body of estimate	
47.	should be signed by SE.	
10	SE will check all the design, hydraulic data, and structure drawings of	
40.	culverts/bridges.	
49.	Drawing of bridges/minor bridges should be proof-checked.	
50	Where provision of earthwork taken after dismantling must be	
50.	approved by SE.	
51	EE should record a certificate of 100% x-section of earthwork checked	
51.	personally.	

#### Part 5: Checklist for Preparation of Rough cost estimates of Bridge/RoB/RuB works

Name of Division: \_\_\_\_\_

Sr. No.	Questionnaire	Remarks
1.	Whether the feasibility has been carried out or not?	
2.	Head of Account	
3.	Whether the encroachment free Right of Way (ROW) is available?	
4.	Proposed carriageway width of Bridge/ROB/RUB (including future planning if any).	
5.	Existing Right of way (EROW) in meters.	
6.	Proposed Right of way (PROW).	
7.	Whether any land acquisition involved?	
8.	Suitability of land:	
9.	Whether site is original soil or land fill?	
10.	If yes, whether site is of old pond filled with suitable good earth or solid waste?	
11.	Level difference (above/below) from adjoining land.	
12.	Level difference (above/below) from nearby road.	
13.	Whether hydrological investigation has been carried out?	
14.	Approximate depth of ground water table.	
15.	Mention the HFL level.	
16.	Mention the maximum observed scouring depth on upstream/downstream under nearest existing bridge.	
17.	Whether the bore hole data has been carried out?	
18.	Whether the soil investigation has been carried out?	

10	Mention the bearing capacity of soil	
13.	Prendom the bearing capacity of solt.	
	Span arrangement of existing bridge on (D/S and U/S) in case of	
20.	HL bridges. Also mention the distance in between existing and	
	proposed bridge.	
21	Whether the detailed plans/GAD/NOC has been prepared by the	
21.	competent authority/Railway?	
22	Whether the detailed plans/GAD/NOC has been approved by the	
۲۲.	competent authority/Railway?	
00	Whether provision of R.E. Wall or Retaining Wall taken in case of	
23.	ROB/RUB?	
24.	Whether provision of RUB/LHS has been taken in case of ROB?	
	Whether the arrangement for disposal of rainwater has been	
25.	taken, specifically in case of RUB/LHS?	
	Whether the provision for covering of approach road with sheet	
26.	roofing in case RUB/LHS has been taken?	
07	Whether provision for protection work/guide bund taken	
27.	specifically in case of H.L. Bridge?	
28.	Whether provision for roadside drains taken?	
29.	Whether disposal point of drains/rainwater available?	
30.	Whether provision for approaches to H.L. Bridge taken?	
01	Whether provision for retaining wall/toe wall/stone pitching on	
31.	approaches in case of H.L. Bridge taken?	
32.	Whether the provision of footpath/divider has been taken?	
00	Whether the provision of stair case has been taken in case of	
33.	ROB?	
	Whether any utility shifting like HT Line/LT Line is involved	
34.	including raising for maintenance of requisite clearance? If yes,	
	provision thereof.	
05	Whether any forest clearance is involved? If yes, provision	
35.	thereof.	

26	Whether any utility shifting of sewerage/water pipeline is	
30.	involved? If yes, provision thereof.	
27	Whether the provision for alternate route/diversion road has	
57.	been taken?	
38.	Whether provision of horticulture works incorporated?	
39.	Whether the provision of lift/escalator has been taken?	
40.	Whether provision for Road/Street light works incorporated?	
41.	Whether the provision of generator has been taken?	
42.	Any special provisions like CCTV taken?	
43.	Whether provision for cost escalation has been incorporated?	
11	Whether provision for road furniture/road safety items including	
44.	marking, signages, and crash barrier are incorporated?	

#### Part 6: Checklist for Preparation of Detailed estimates of Bridge/ROB/RUB Works

Name of Division: \_\_\_\_\_

Name of Project: \_\_\_\_\_

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Sr. No.	Questionnaire	Remarks
1.	Whether the encroachment free land is available?	
0	Proposed carriageway width of Bridge/ROB/RUB (including	
Ζ.	future planning if any).	
3.	Proposed carriageway width of Railway portion in case of	
	ROB/RUB.	
4.	Existing Right of way (EROW) in meters.	
5.	Proposed Right of way (PROW) in meters.	
6.	Whether any land acquisition involved?	
	Suitability of land:	
7	Whether site is original soil or land fill?	
7.	If yes, whether site is of old pond filled with suitable good earth	
	or solid waste?	
8.	Level difference (above/below) from adjoining land.	
9.	Level difference (above/below) from nearby road.	
10.	Whether hydrological investigation has been carried out?	
11.	Approximate depth of ground water table.	
12.	Mention the HFL level.	
	Mention the maximum observed scouring depth level on	
13.	upstream/downstream under nearest existing bridge in case of	
	H.L. bridge.	
14.	Whether the bore hole data has been carried out?	
15.	Mention the bearing capacity of soil.	

16.	Whether the detailed plans/GAD/NOC has been approved by the	
	competent authority/Railway?	
17.	Whether provision of R.E. Wall or Retaining Wall taken in case of	
	ROB?	
	Whether the Natural Surface Level (NSL) has been recorded and	
18.	signed by JE, SDE & EE and supplied to the office of SE, design	
	consultant & head office?	
10	Whether the angle of skew, if any, at site, is as per approved	
19.	GAD?	
	Whether the design consultant has certified that the design is	
20.	economical and a certificate has been incorporated on	
	drawings?	
01	Whether all the detailed structural drawings duly proof checked	
21.	and structural safety certificate received from IIT/NIT/PEC?	
	Whether proof checked drawings have been signed by the	
22.	consultant certifying for economy in the design?	
00	Whether detailed Bar Binding Schedule (BBS) has been	
23.	prepared?	
24.	Whether steel has been calculated as per BBS or factor basis?	
25.	Whether provision of RUB/LHS has been taken in case of ROB?	
00	Whether the arrangement for disposal of rainwater has been	
26.	taken, specifically in case of RUB/LHS?	
07	Whether the provision for covering of approach road with sheet	
27.	roofing in case RUB/LHS has been taken?	
	Whether provision for protection work/guide bund taken	
28.	specifically in case of H.L. Bridge?	
29.	Whether provision for roadside drains taken?	
30.	Whether disposal point of drains/rainwater available?	
31.	Whether provision for approaches to H.L. Bridge taken?	

22	Whether provision for retaining wall/toe wall/stone pitching in	
32.	case of H.L. Bridge taken?	
33.	Whether the provision of footpath/divider has been taken?	
34	Whether the provision of stair case has been taken in case of	
04.	ROB?	
	Whether any utility shifting like HT Line/LT Line is involved,	
35.	including raising for maintenance of requisite clearance? If yes,	
	provision thereof.	
36	Whether any forest clearance is involved? If yes, provision	
	thereof.	
37	Whether any utility shifting of sewerage/water pipeline is	
57.	involved? If yes, provision thereof.	
38	Whether the provision for alternate route/diversion road has	
	been taken?	
39.	Whether provision of horticulture works incorporated?	
40.	Whether provision for Road/Street light works incorporated?	
41.	Whether the provision of lift/escalator has been taken?	
42.	Whether the provision of generator has been taken?	
43.	Any special provisions like CCTV taken?	
11	Whether provision for road furniture/road safety items	
44.	incorporated?	
45	Whether any litigation is ongoing w.r.t. the proposed	
45.	structure/road?	
16	Whether the availability of budget in case of deposit work is as	
46.	per PWD Code with assurance to the Client Department?	

## Part 7: Checklist for Performa for Rehabilitation/Repair of bridges/ROB

Name of Division: \_\_\_\_\_

Sr. No.	Questionnaire	Remarks
1.	Name of Road.	
2.	Name of Bridge.	
3.	Exact road RD.	
4.	Name of Drain/ Canal/ River.	
5.	Carriageway width of existing bridge in meters.	
6.	Existing ROW in meters.	
7.	Proposed ROW in meters.	
8.	Year of construction of bridge.	
9.	Last date of treatment and type of treatment done.	
10.	Condition of the existing bridge.	
11.	Type of bridge.	
12.	Span arrangement of the existing bridge.	
13.	Plan for the diversion of traffic during execution whether taken	
	into account in the proposal or not.	
14.	Any utility shifting required or not.	
15	Whether the proposed bridge can be constructed in the existing	
	ROW or LA required or not.	
16.	Type of foundation of existing bridge.	
17.	Condition of bearing/ expansion joint.	
18.	Type of bearings.	
19.	Condition of crash barrier/hand rail.	

20.	Whether there is any requirement of soil nailing in RE wall	
	panels.	
01	Whether there is any requirement of External prestressing in the	
21.	PSC Girders.	
22	Whether there is any requirement of Improvement/strengthening	
22.	in approaches of Bridge.	
22	Photographs / VCD of the existing bridge superstructure,	
23.	substructure and foundation including bottom view of bridge.	
24	Whether any litigation is ongoing w.r.t. the proposed	
24.	structure/road?	



## **Quality Assurance Authority**

Government of Haryana

Standard Operating Methods and Procedures For **Technical Quality Assurance** In **Building Construction** 

# PREFACE

The QAA has already framed Technical Quality Assurance Parameters outlining indicators and sub-indicators required for Quality Assurance of the building construction throughout their lifecycle. Now the QAA has further developed the Standard Operating Methods and Procedures (SOMPs) for Quality Assurance/Quality Control in the planning & design, construction, operation and maintenance of the building for the purpose of having a ready reckoner to ensure that all quality parameters are adhered to during and after the construction of any project.

The Quality Control process focuses on detecting and correcting defects in a product or service. It involves identifying quality issues and taking corrective actions to resolve them. This is carried out by quality control monitors who would conduct inspections, perform tests, and implement necessary corrective measures. Through this systematic approach, the department would be able to identify shortcomings and defects on a real-time basis and shall ensure the delivery of a high-quality product or service.

The Quality Assurance process ensures the delivery of a high-quality product or service throughout its entire life cycle by preventing quality problems from the outset. This comprehensive approach involves the entire organization, from top management to front-line employees, working together to meet quality standards within the timeline and financial outlay. Key aspects of this process include planning, design, execution, delivery, training, documentation, and audits. By focusing on defect prevention, Quality Assurance ensures that the product or service meets the desired standards throughout the delivery period.

Standard Operating Methods and Procedures (SOMPs) for building construction offer numerous advantages such as:

- 1. Quality Control: It ensures consistent construction standards leading to a high quality in building construction that meet regulatory requirements and industry standards.
- 2. Improves Efficiency: Standardised Procedure streamlines project management, resource allocation, and construction processes resulting in cost effective and timely completion.
- 3. Compliance with Regulations: It assists in adhering to the environmental regulations, safety standards and legal requirements, mitigating potential legal and environmental issues.
- 4. Safety: It emphasises safety procedures and guidelines for workers, reducing the risk of accidents and injuries on the construction site.
- 5. Risk Management: It helps in identifying and mitigating potential risks associated with construction projects from design and planning to execution, promoting proactive problem solving and strategic decision making.
- 6. Documentation and Reporting: It aids in maintaining accurate project records, and facilitates reporting for stakeholders, regulator and quality assurance purposes.
- 7. Accountability: With documented processes, it's easier to identify who is responsible for different tasks, improving accountability within the organization.

In this respect, the Quality framework relating to all Quality Assurance parameters, indicators, and sub-indicators required in the various stages of building construction have been prepared in detailed consultation with the user department responsible for the quality assurance and quality control for the building construction. QAA is further hopeful that State Government departments implementing engineering works and organizations owned and controlled by the State Government would evolve suitable mechanisms to implement the required Quality Assurance plans with objective of achieving economic and social development of the State and improving the standard of life of the people.

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# **CHAPTER 1** PART A: Executive Summary

This executive summary provides a comprehensive overview of key phases in building construction, focusing on planning and design, execution, inspection and testing, commissioning and handover, safety and security, operation and maintenance, environmental measures, and user feedback.

#### 1. Planning and Design

The planning and design phase is crucial for ensuring the project's long-term success and functionality. Detailed site surveys and geo technical investigations are conducted to assess terrain, soil, and environmental factors. Based on these surveys, contour site plans of the project site is prepared. Compliance with local building codes, zoning laws, and environmental regulations is kept in mind while preparing the architectural drawings. After the comprehensive architectural designs are developed that align with both aesthetic and functional requirements while optimizing the use of space and natural resources. Structural and mechanical systems are designed according to project specifications, adhering to industry standards for safety, efficiency, and sustainability. A detailed cost analysis is performed, followed by budget planning and a realistic timeline estimation to ensure resource allocation is efficient and the project remains financially viable. The major tasks for Planning and Design in building construction are as follows:

- Conduct site surveys, geotechnical investigations, and obtain regulatory compliances
- Develop architectural designs and finalize space utilization plans
- Perform structural and mechanical design, specifying materials and systems
- Prepare detailed cost analysis, budget allocation, and timeline estimations
- Ensure designs comply with local building codes and environmental regulations

#### 2. Execution, Inspection, and Testing

This phase focuses on translating the design into reality while maintaining high standards of quality and safety. The construction should start strictly as per the approved architectural drawings and structural design approved by the competent authority. All materials used are in strict compliance with relevant building codes and construction manuals to ensure safety and durability. Skilled manpower and Third Party Inspection Agencies (TPIA) supervise the construction activities to maintain quality control and adherence to approved plans. Advanced construction methods and tools are utilized to improve efficiency, precision, and project timelines. Construction processes conform to national and international standards, including ISO and local building codes, ensuring the highest quality. On-site laboratories conduct tests on construction materials like concrete, steel, soil, etc. to validate strength and quality. All materials undergo thorough inspection both before and after use to ensure they meet required specifications. Regular documentation of construction progress, material usage, and inspection results is maintained to ensure transparency and track project milestones. The major tasks for Execution, Inspection, and Testing as follows:

- Use materials according to relevant codes and construction manuals
- Supervise construction with skilled manpower and Third-Party Inspection Agencies (TPIA)

- Utilize modern construction techniques and equipment for enhanced efficiency
- Adhere to national and international construction standards
- Establish an on-site testing laboratory for materials and quality checks
- Conduct pre- and post-inspections of all construction materials/works
- Maintain regular documentation and progress reporting throughout the project

#### 3. Commissioning and Handover

At the completion of construction, the building is prepared for handover to the Employer Department through a well-structured commissioning process. All systems such as electrical, water supply and sanitary installation, and HVAC, lift, etc. are tested to ensure they operate as intended and meet performance criteria. A completion certificate is issued once the project meets all specifications within the approved timelines and budget, ensuring satisfaction of the Employer Department. The contractor provides a guarantee for the quality of work completed, covering aspects like structural integrity, system performance, and defect liability for a specified period. Major tasks for Commissioning and Handover are as follows:

- Test all building systems, including electrical, WS and SI, and HVAC, lift, etc.
- Issue completion certificates and ensure adherence to timelines and budget
- Provide guarantees for completed works and rectify any identified defects

#### 4. Safety and Security

Ensuring the safety and security of both workers and the building site is paramount throughout the project. Construction follows Occupational Safety and Health (OSH) guidelines and other relevant safety standards to minimize risks on-site. Proper safety gear, emergency response systems, and regular safety drills are conducted to protect workers from potential hazards. On-site security protocols, including surveillance and restricted access areas, are enforced to safeguard the construction site and equipment. The major tasks for Safety and Security are as follows:

- Implement safety protocols according to Occupational Safety and Health (OSH) standards
- Equip workers with personal protective equipment (PPE) and conduct regular safety drills
- Set up on-site security measures, including surveillance and access control

#### 5. Operation and Maintenance

Post-handover, the operation and maintenance of the building ensure its long-term functionality and safety. Maintenance teams follow established protocols to ensure all systems, from HVAC to fire safety, function according to prescribed standards. Any defects or operational issues that arise post-handover are promptly addressed within the stipulated defect liability period, ensuring user satisfaction and longevity of the building. The major tasks for Operation and Maintenance are as follows:

- Ensure compliance with prescribed maintenance protocols for all systems
- Promptly rectify defects during the defect liability period
- Schedule regular inspections and preventive maintenance for building systems

#### 6. Environmental Measures

Environmental considerations are integrated throughout the project lifecycle, with a focus on minimizing ecological impact. Sustainable building materials, energy-efficient systems, and waste management strategies are employed to reduce the project's carbon footprint and

promote environmental responsibility. The major tasks for Environmental Measures are as follows:

- Use sustainable materials and energy-efficient systems throughout the construction
- Minimize construction waste and implement waste management practices
- Incorporate water conservation measures (rainwater harvesting) and energy-saving designs

#### 7. User Feedback

Post-occupation, feedback from building occupants is collected to evaluate the overall satisfaction, functionality, and performance of the building. This data is critical for addressing any deficiencies and for implementing improvements in future projects.

This structured and detailed approach ensures the building construction project meets the highest standards of quality, safety, sustainability, and user satisfaction. The major tasks for User Feedback are as follows:

- Collect feedback from building occupants post-handover
- Address any performance or functionality issues reported by users
- Use feedback data to improve future building projects

# PART B: Responsibilities of Stakeholders

In the context of ensuring quality assurance for Building Construction, the roles and responsibilities of the key stakeholders—such as the Employer Department, Contractor, and TPIA—are critical in maintaining the project's success and longevity. Here's a detailed breakdown of each stakeholder's responsibilities:

#### 1. Employer Department

The Employer Department plays a crucial role in ensuring the overall success of the building project by maintaining oversight and providing guidance on quality standards. Their key responsibilities include:

Defining Quality Standards:

- The Employer Department must set clear and detailed quality benchmarks for construction materials, workmanship, and processes. These standards should comply with national and international building codes, safety regulations, and environmental guidelines.
- They must ensure that the quality assurance framework is comprehensive and includes all aspects of the project, from the design phase through construction to the final handover.
- Specifications should include not only materials but also methodologies, performance criteria, and durability standards, ensuring the building will function as intended under expected loads and environmental conditions.

Approval of Plans and Designs:

- All architectural, structural, mechanical, and electrical designs must be rigorously reviewed and approved by the Employer Department to ensure they meet the required standards.
- Any deviations from the approved designs during construction must be documented, reviewed, and re-approved to avoid compromising the integrity and quality of the project.

Tendering and Selection of Contractor:

- Draft comprehensive tender documents with clear quality standards, performance indicators, payment terms, and timelines.
- Evaluate and select contractors based on their expertise, technical competency, past performance, and ability to meet the required quality standards.

Monitoring Contractor's Performance:

- The Employer Department should establish mechanisms to continuously monitor the contractor's work against the project plan and quality standards. This includes attending regular site meetings, reviewing progress reports, and conducting quality audits.
- They are responsible for ensuring that the contractor meets the agreed timelines and budget while delivering high-quality workmanship.

Inspection and Verification:

• Periodic site visits should be conducted by the Employer Department to ensure that the construction work is aligned with approved designs and quality standards.

• The department should verify that quality control tests are being conducted at the various stages of construction at required frequency.

Engaging Third-Party Inspection Agencies (TPIA):

To ensure an unbiased verification process, the Employer Department must engage a qualified TPIA to oversee the quality control activities independently.

• The selection of the TPIA should be based on their qualifications, experience, and understanding of the project requirements.

**Review of Reports:** 

- Regular review of reports submitted by the contractor and TPIA is essential to stay updated on the project's quality status. This includes reviewing inspection records, test results, and any non-conformance reports.
- The Employer Department should ensure timely communication of any concerns raised in these reports and initiate corrective actions.

Approvals and Certifications:

- The department must provide official approvals at each stage of construction after verifying that the quality standards have been met.
- Final certification of the completed project is critical before the handover to ensure that all quality and safety requirements have been fully met.

Audit of Construction Process:

• The Employer Department should also perform regular audits to assess whether the construction process is aligned with the QA/QC plan. This may involve reviewing the contractor's adherence to safety protocols, material procurement procedures, and site supervision.

#### 2. Contractor/Executing Agency

The contractor is responsible for executing the construction project while adhering strictly to the quality assurance and control framework established by the Employer Department. Their responsibilities include:

Implementation of Quality Assurance Plan (QAP):

- The contractor must prepare a detailed QAP that outlines how they will achieve the quality objectives of the project, including work procedures, material specifications, quality control tests, and timelines.
- The contractor must ensure that their QAP is reviewed and approved by the Employer Department before construction begins.

Material Testing and Certification:

- All materials used in the construction process must meet the specified quality standards. The contractor must procure materials from approved suppliers and submit relevant certificates and test reports to the Employer Department.
- Material testing should be performed by accredited laboratories, and test results must be documented and reviewed before materials are approved for use.

Workmanship:

• The contractor must employ skilled workers and qualified supervisors to ensure that the construction work meets the required standards. Proper training and oversight are crucial to maintaining high workmanship quality throughout the project.

• Special attention should be given to critical areas such as concrete pouring and its compaction using vibrators, formwork, reinforcement, waterproofing, curing, and finishing to prevent defects that could compromise the structural integrity or aesthetics of the building.

Adherence to Standards:

- The contractor is responsible for strictly following the construction methodologies and procedures outlined in the approved plans. This includes ensuring that the materials, tools, and equipment used are suitable for the project's specifications.
- Any deviation from the standards must be communicated immediately to the Employer Department for review and approval before proceeding.

Site Supervision and Quality Control:

- The contractor should establish a quality control lab on site so as to perform various quality control tests at site.
- The contractor should maintain qualified on-site supervisors to oversee daily operations and ensure that construction work is performed according to the QAP.
- Regular quality control tests, such as concrete slump tests, steel reinforcement inspections, and structural integrity checks, must be conducted. These tests ensure that the materials and workmanship meet the required specifications.

Documentation and Reporting:

- The contractor must document all quality control activities, including test results, inspections, daily work logs, and any issues encountered. This documentation should be submitted regularly to the Employer and TPIA (as applicable) for review.
- In case of any non-conformance, the contractor should document the issue, implement corrective actions, and ensure the matter is resolved before proceeding.

**Corrective Actions:** 

• The contractor must address any issues or non-conformances identified by the TPIA or Employer Department. This includes reworking defective sections, replacing faulty materials, or improving workmanship to meet the required standards.

Handover Process:

- Upon completion of the project, the contractor is responsible for ensuring that all work is completed to the Employer Department's satisfaction and that all quality documentation is finalized.
- The contractor must ensure that all punch list items are resolved before final handover and that the building is ready for occupation.

#### 3. Third-Party Inspection Agency (TPIA)

The TPIA provides an independent and impartial assessment of the construction quality. Their role is critical in ensuring transparency and objectivity in quality control.

Independent Verification of Quality:

• The TPIA must carry out inspections and quality control checks independently of both the contractor and the Employer Department. This helps ensure that any issues related to materials or workmanship are identified without bias.

Material and Workmanship Inspection:

- The TPIA should review the quality of materials delivered to the site, ensuring they comply with the approved specifications. This includes reviewing test certificates and conducting random sampling tests.
- Inspections should also be carried out at critical stages of construction (e.g., foundation laying, formwork, steel reinforcement, column casting, concreting) to ensure that workmanship is up to standard.

**Testing and Reporting:** 

• The TPIA is responsible for conducting independent tests, such as compressive strength tests for concrete, tension tests for steel, and soil compaction tests, tests on aggregates, etc. Test results must be reported promptly to the Employer Department.

Review of Contractor's QA/QC Plans:

• The TPIA should thoroughly review the contractor's QA/QC plan to ensure it aligns with the project's objectives. Any gaps or deficiencies in the plan should be reported, and corrective actions should be recommended.

Site Audits and Inspections:

• Regular site audits must be conducted to verify that the contractor is adhering to the approved QA/QC plan. The TPIA should also conduct surprise inspections to ensure quality standards are being maintained at all times.

Non-Conformance Reports (NCRs):

- The TPIA must issue NCRs whenever they identify deviations from approved plans, specifications, or quality standards.
- These reports should include recommendations for corrective actions, and follow-up inspections must be conducted to verify that the non-conformance has been rectified.

**Recommendations for Corrective Actions:** 

• The TPIA is responsible for providing practical recommendations to address quality issues. They should also monitor the implementation of these corrective actions to ensure the desired quality is achieved.

Final Quality Certification:

• Before the project is handed over, the TPIA must certify that the construction meets all the quality standards outlined in the project specifications. This final certification is crucial for the completion and handover of the project to the Employer Department.

# Activities to be performed by the Departmental Officers/Officials and Executing Agency

S No.	Activity	CE	SE	EE	AE	JE	Executing Agency	Architect
Planning and Design								
1.	Site selection and feasibility			$\checkmark$	$\checkmark$	$\checkmark$		
2.	Land survey/preparation of contour site plan			~	$\checkmark$	>		
3.	NOC from country and town planning/local municipal authority/another department			~	~	>		
4.	Land acquisition and forest/other environmental clearances if required		~	~	~	>		
5.	Gather detailed Scope of Work from the user department.			~	~	~		
6.	Preparation of preliminary architectural drawings as per scope of work and its approval from user department			~	~	~		~
7.	Preparation of working architectural drawings showing all the details along with specifications of each item			~	~	~		~
8.	Conducting Geo technical/soil testing investigation to know the soil composition and its characteristics			~	~	~		
9.	Framing structural design with detailed specification	~	~	~	~			
10.	Selection of latest software in design	$\checkmark$	$\checkmark$					
11.	Preparation of detail cost estimates (DPR)			~	$\checkmark$	>		
12.	Approval of Detailed Project Report	$\checkmark$	$\checkmark$					
13.	Identification of funding agency with annual budget allocation	~	~					
14.	Call of tenders and award of work after completing all formalities	~	~	~				
Execution	on, Inspection, and Testing							
15.	Procurement of items like steel, cement, CGI sheets, WS&SI, electric fittings etc. from approved make and manufacturers			~	$\checkmark$	$\checkmark$	~	

16.	Selection of materials such as aggregate sand, stones, bricks etc. from approved source only		~	~	~	~	
17.	Approval and use of design mix of concrete as per specification		~	$\checkmark$	~	~	
18.	Carrying out tests at manufacture's premises before dispatch/inhouse facilities		~	~	$\checkmark$	~	
19.	Deployment of appropriate qualified personnel		~	~	~	$\checkmark$	
20.	Manpower deployment as per requirement					~	
21.	Use of automated batching plants					$\checkmark$	
22.	Use of cranes, Hoist, Transit mixer trucks etc.					$\checkmark$	
23.	Use of other mechanized and digital equipment etc.					~	
24.	Ensuring the execution as per design and specifications, and as per the bid document		~	$\checkmark$	$\checkmark$		
25.	Setting up Testing laboratory having all testing equipment, relevant to the project specifications				~	~	
26.	Selection of quarry site for aggregate, stone, sand etc.		~	~	$\checkmark$	$\checkmark$	
27.	Ensuring relevant mandatory tests during execution at every stage of the construction such as cube test of concrete, gradation of aggregates, fineness modulus of sand etc.		~	~	~	~	
28.	Preparation of site inspection and quality control registers		~	~	~	$\checkmark$	
29.	Checking of test results by Engineer in Charge		~	~	~		
30.	Submission of non-conforming reports and Rectification of defects		$\checkmark$	$\checkmark$	~	~	
Commi	ssioning and Handover	•	 	•	•		
31.	Inspection and testing of all water supply and sanitary works		$\checkmark$	$\checkmark$	~	$\checkmark$	
32.	Inspection and testing of Electric installation work (EI), lifts/elevators, fire safety works by the certified authorized personnel		$\checkmark$	~	~	~	

33.	Inspection of drainage outlets		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
34.	Submission of completion certificate as per approved drawing & its approval		$\checkmark$	~	$\checkmark$	~	
35.	Post commissioning Monitoring and support from the contractor in the defect liability period					~	
36.	Submission of all safety related clearances such as evacuation plan etc. in case of emergencies.		$\checkmark$	~	~	~	
37.	Providing first aid equipment, safety uniforms and housing for workers etc.					>	
38.	Physical Security measure		$\checkmark$	~	$\checkmark$	>	
39.	Incident response and reporting		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Operati	on and Maintenance				•		
40.	Ensuring proper maintenance as per the bidding document		$\checkmark$	~	~	$\checkmark$	
41.	Rectification of defects within the specified time period during defect liability period					~	
42.	Documentation of the maintenance record		$\checkmark$	~	$\checkmark$	$\checkmark$	

Note 1: Responsibilities for carrying out above activities by the departmental officers shall be governed by the Technical Sanction Powers vested in them by the Government of Haryana

Note 2: To comply with the specified requirements, the contract bidding document should be amended to include the provisions delineated in the Standard Operating Methods and Procedure.

# **Chapter 2**

# SOMPs for Building Construction

## 1. PLANNING AND DESIGN

#### 1.1 Survey, investigation and regulatory compliances

1.1.1 Site Selection and Feasibility

#### I. Initial Assessment

- Conduct a preliminary site assessment considering factors such as topography, access to infrastructure (roads, water, electricity), soil stability, and environmental impact.
- Evaluate the site's suitability for the proposed building in terms of zoning regulations, master plans, and land use categories.

II. Feasibility Study

- Perform a feasibility study that includes analysis of the environmental, and technical aspects of the project.
- Ensure the site meets the requirements for building dimensions, floor space index (FSI), and permissible building height as per local regulations.
- Identify potential challenges related to site accessibility, utilities, and environmental constraints.

1.1.2 Land Survey / Preparation of Contour Site Plan

I. Topographic and Geodetic Survey

- Conduct a detailed land survey using modern equipment such as Total Station or GPS to capture the site's topography, including contours, elevation points, and natural features.
- Ensure that the survey complies with IS 1498 (Classification and Identification of Soils) and other relevant survey codes for precision.

II. Preparation of Contour Site Plan

- Create a contour map indicating the elevations, slopes, and other topographical details of the land.
- Incorporate existing structures, vegetation, roads, and utilities into the plan.
- The contour site plan should meet the standards outlined by the Town and Country Planning Department or local municipality.

III. Survey Report and Documentation

- Prepare a detailed survey report including measurements, boundaries, existing structures, and utilities.
- Submit the contour plan and survey report to the project management team and relevant authorities for approval.

#### 1.1.3 NOC from various departments

I. Identification of Required NOCs

 Identify all necessary NOCs (No Objection Certificates) required from various departments such as Town and Country Planning, Municipal Corporation, Pollution Control Board, Fire Department, Water and Sewerage Boards, and Electricity Departments II. Application Process

 Submit formal applications for NOCs to the relevant authorities, providing all required documents.

III. Follow-up and Compliance

- Regularly follow up with the authorities to track the status of NOC approvals.
- Ensure that the site plans and proposed building designs conform to the guidelines set by each department to avoid delays in approval.

IV. Record-Keeping

- Maintain a detailed record of all applications, correspondence, and approvals related to NOCs.
- Ensure that all NOCs are obtained and documented before proceeding to the next phase of the project.

1.1.4 Land Acquisition and Forest / Other Environmental Clearances by the Client Department (in whom ownership is vested)

I. Land Acquisition Process

- Identify the legal owner(s) of the land and initiate the acquisition process in compliance with the Right to Fair Compensation and Transparency in Land Acquisition, latest Rehabilitation and Resettlement Act.
- Engage with the local revenue department for land title verification and mutation records.
- Negotiate terms with landowners and prepare legal documentation for land transfer.

II. Forest Clearance

- If the project site includes forest land or is adjacent to forest areas, apply for forest clearance under the latest Forest Conservation Act.
- Submit a detailed report including the impact on forest resources, compensatory afforestation plans, and biodiversity management strategies.

III. Environmental Clearances

- Conduct an Environmental Impact Assessment (EIA) in compliance with the latest Environmental Protection Act, if required for the project.
- Prepare the EIA report and submit it to the State Environment Impact Assessment Authority (SEIAA) or Ministry of Environment, Forest, and Climate Change (MOEFCC) for clearance.
- Implement recommendations made during the EIA process to minimize environmental impact.

IV. Documentation and Submission

- Ensure all land acquisition and clearance-related documents are properly filed with the relevant authorities and project team.
- Track the progress of land acquisition and environmental clearances to ensure timely approvals.
#### 1.2 Architectural Planning

1.2.1 Requirement Details from the Concerned Department

I. Initial Consultation

- Conduct meetings with the concerned department for the relevant nature of the building (e.g., Health/Education Department) to gather project-specific requirements, including building use, capacity, and functional needs.
- Clarify the project's objectives, timeline, budget, and any special requirements such as sustainability, accessibility, or safety standards.
- Special consideration must be given for horticultural planning as per the need of the building/project type emphasizing on the importance of aesthetic appeal, utility, and finishing of the building

II. Scope of Work Definition

- Collect detailed information regarding space requirements, building features, aesthetic preferences, and other department-specific needs.
- Ensure compliance with relevant building codes, zoning laws, and regulations as per local authorities, including the Haryana Building Code.
- Ensure proper planning for horticulture development of the area specific to the need of the building project. For example, provisions for pathways, walkways, water features, pergolas, gardens, selection of trees, landscaping, etc.

III. Documentation

- Prepare a detailed project brief summarizing the department's requirements, including functional areas, room sizes, number of floors, and any other essential details.
- Obtain written confirmation from the concerned department to ensure alignment with expectations.

1.2.2 Preparation of Preliminary Architectural Drawings and Its Approval from Concerned Department

I. Conceptual Design and Drawings

- Based on the requirements provided, prepare preliminary architectural drawings, which include site layout, floor plans, building elevations, and sections.
- The design should comply with Haryana's building regulations, environmental guidelines, and urban planning standards.

II. Review and Refinement

- Present the preliminary architectural drawings to the concerned department for review. Incorporate any feedback or required changes.
- Ensure that the design accommodates key requirements such as fire safety, structural stability, and energy efficiency as per the relevant IS codes.

III. Approval Process

- Submit the refined preliminary drawings along with necessary documents (e.g., site plans, elevations, 3D views) to the department for formal approval.
- Track and follow up on the approval process, addressing any queries or revisions requested by the approving authorities.

IV. Record-Keeping

 Maintain copies of all submitted drawings and approval documents for future reference. Ensure that approved plans are well-documented and accessible for future project phases.

1.2.3 Preparation of Working Architectural Drawings Showing All the Details Along with Specifications of Each Item

I. Detailed Working Drawings

- Prepare comprehensive working drawings that include all construction details such as foundation plans, floor layouts, wall sections, roof designs, and elevation drawings.
- Ensure these drawings detail structural components (e.g., beams, columns), utility layouts (e.g., plumbing, electrical, HVAC), and materials to be used.
- Ensure that all working drawings are developed in compliance with relevant IS Codes.

II. Material Specifications

- Provide detailed specifications for each construction item, including materials (cement, steel, glass, etc.), finishes (paint, plaster), and fixtures (doors, windows, fittings), flooring, water supply and sanitary installation details, etc.
- Follow the Haryana PWD specifications for guidelines on material quality and installation.

III. Approval of Working Drawings

- Submit the working drawings along with specifications to the concerned department for approval.
- Obtain approval for the working drawings before proceeding to the construction phase, ensuring compliance with all design standards and regulatory requirements.

IV. Documentation and Circulation

- Maintain an official record of the approved working drawings and distribute them to all relevant stakeholders, including contractors, engineers, and site supervisors.
- Update drawings as necessary throughout the project's lifecycle, and ensure any revisions are communicated to the department and project team.

#### 1.3 Design and Specification

1.3.1 Conducting Geotechnical/Soil Testing Investigation to Know the Soil Composition and Its Characteristics

I. Site Sampling and Testing

- Conduct a detailed soil investigation, including borehole drilling, sampling, and in-situ tests such as the Standard Penetration Test (SPT) and Cone Penetration Test (CPT).
- Collect samples for laboratory testing to determine soil properties like bearing capacity, moisture content, density, shear strength, and permeability.
- Conduct laboratory tests as per relevant IS code (various parts) to assess soil classification, compaction, and consolidation characteristics.

II. Analysis of Soil Characteristics

- Analyse the data from the soil tests (CBR) to determine the soil's ability to support the proposed building structure.
- Ensure that the soil's load-bearing capacity meets the project's structural requirements and identify potential risks like liquefaction, settlement, or erosion.

III. Soil Report and Recommendations

- Prepare a comprehensive geotechnical report detailing soil composition, site stratigraphy, groundwater levels, and recommendations for foundation type (shallow or deep).
- Submit the report to the project design team for approval and further integration into the project's design phase.

IV. Documentation and Compliance

- Ensure that the investigation report is compliant with relevant Indian Standards (IS) codes.
- Keep all documentation and test reports on record for regulatory compliance and future reference during construction.
- 1.3.2 Framing Structural Design and Other Specifications

I. Structural Design Development

- Prepare the structural design, including foundation plans, columns, beams, and slab layouts, based on the geotechnical report and soil properties.
- Follow relevant IS Codes for structural design.

II. Specifications for Materials and Components

 Define material specifications for concrete, steel, and other structural elements, adhering to relevant IS Codes.

III. Safety and Compliance Considerations

- Incorporate safety features into the design, such as earthquake resistance, fire safety, and load-bearing capacity, to meet both National Building Code (NBC) and Haryanaspecific guidelines.
- Ensure the design complies with relevant IS codes for earthquake-resistant construction, and durability and strength of concrete.

IV. Approval and Documentation

- Submit the structural design, along with detailed calculations and material specifications, to the competent authority for approval.
- Maintain records of all design calculations, material specifications, and compliance documents for future reference and audits.

V. Integration with Other Systems

- Ensure the structural design is compatible with architectural, electrical, plumbing, and mechanical systems.
- Coordinate with other engineers and architects to ensure that all design elements align with the overall project requirements.

1.4 Cost Analysis, Budget Planning, and Timeline Estimates

1.4.1 Preparation of Detailed Estimates

I. Data Collection and Cost Assessment

- Collect all relevant data such as material quantities, labour rates, equipment usage, and other expenses required for the project.
- Refer to the latest State PWD Schedule of Rates, or Haryana-specific rates for accurate cost estimates.
- Include price escalation factors based on inflation, material cost fluctuations, and market conditions up to the expected completion period.

II. Preparation of Detailed Estimates

- Prepare detailed cost estimates for all aspects of the project, including civil works, structural elements, utilities, horticulture planning, aesthetics and other finishing items.
- Incorporate the Cost Index applicable in Haryana for accurate reflection of costs as per the timeline, referencing standards like the Haryana PWD B&R Department Cost Indices.

III. Estimation Review and Compliance

- Ensure the estimate follows relevant codes for Preparation of Detailed Estimates, and meets the budgeting guidelines provided by the local authority.
- Submit the cost estimate for internal review by the project team and external review by financial authorities, ensuring accuracy and compliance with standards.

1.4.2 Identification of Funding Agency with Annual Budget Allocation

I. Identify Funding Sources

- Identify the relevant funding agencies for the project, such as the Haryana State Government, Central Government schemes (e.g., Smart Cities Mission, AMRUT), or international agencies like the World Bank or ADB for larger projects.
- Verify the eligibility of the project for specific government grants or subsidies.

II. Budget Planning and Allocation

- Prepare an annual budget plan detailing the fund requirements for each phase of the project, including construction, material procurement, labour, and contingencies.
- Ensure the budget aligns with the Five-Year Plans or Annual Budget approved by the Haryana State Government or other funding agencies.
- Submit the budget plan to the concerned department for approval and secure the necessary funding for each fiscal year.

III. Funding Approval and Documentation

- Ensure timely submission of funding proposals, applications, and supporting documents, such as detailed project reports (DPR) and cost estimates, to the identified funding agencies.
- Keep records of approvals, disbursements, and fund utilization reports, ensuring compliance with agency guidelines and transparency in fund usage.

1.4.3 Period for Approval of Detailed Estimates, Call of Tenders, Award of Work, and Its Implementation

I. Timeline for Approval of Estimates

- Submit the detailed estimates to the concerned authority of the department for approval as per the standard procedures.
- Allow a defined time frame (typically 30-60 days) for the review and approval process. Ensure follow-up with the authorities to expedite the process.

II. Tendering Process

- Following approval of the estimates, initiate the tender process as per the Haryana PWD Guidelines. Prepare tender documents, including specifications, BOQs, and terms of contract.
- Advertise the tenders on appropriate platforms (e.g., e-procurement portals, state websites) and allow sufficient time for bidders to submit proposals.

III. Tender Evaluation and Awarding Work

- Conduct technical and financial evaluations of received bids, ensuring compliance with the specifications and financial norms set by the concerned department.
- Prepare a detailed evaluation report and recommend the most suitable bidder for approval.
- Award the contract to the selected bidder after obtaining the necessary departmental approvals.

IV. Project Implementation

- Plan the project execution in phases as per the approved timeline, incorporating milestones for, construction activities, and inspections.
- Monitor the implementation to ensure the project adheres to the approved budget and timeline. Regularly update the project management team and on progress.

V. Compliance and Monitoring

 Follow state PWD Works Manual to ensure proper implementation and adherence to approved timelines and costs.

## 2. EXECUTION, INSPECTION, AND TESTING

2.1 Use of Construction materials as per relevant Codes and Manuals

2.1.1 Procurement of Items like Steel, Cement, CGI Sheets, WS&SI, Electric Fittings, etc., from Approved Make and Manufacturers

I. Approved Vendor Selection

- Procure materials such as steel, cement, CGI sheets, water supply and sanitary installations (WS&SI), and electrical fittings only from approved manufacturers or suppliers.
- Follow the procurement guidelines provided by Haryana PWD Manual, and other relevant authorities complying IS codes.

II. Vendor Approval and Documentation

- Prepare a list of approved manufacturers and suppliers, verified for quality and compliance with relevant IS standards and Haryana government guidelines.
- Maintain records of material quality tests.

III. Material Inspection

 Only accept materials that meet the project's technical specifications and IS code standards.

2.1.2 Use of Materials Such as Aggregate, Sand, Stones, Bricks, etc., from Approved Source Only

I. Source Approval

• Ensure that all raw materials like aggregates, sand, stones, and bricks are sourced from approved quarries or manufacturers.

II. Quality Assurance

- Carry out regular quality checks on material stockpiles at the construction site to ensure the materials match the project specifications.
- Reject substandard materials or materials that deviate from the approved source.
- 2.1.3 Use of Design Mix of Concrete as per Specification

I. Concrete Design Mix Approval

- Design concrete mixes in accordance with project specifications and relevant
- Engage NABL accredited laboratory to determine the optimum design mix based on structural requirements and site conditions.

II. Design Mix Testing

- Conduct trial mixes to verify that the concrete mix meets strength and durability requirements as per the project specification.
- Ensure the design mix incorporates appropriate cement content, water-cement ratio, aggregates, and admixtures.

III. Compliance Monitoring

 Conduct routine tests such as compressive strength, slump, and workability tests to ensure the concrete mix consistently meets the required standards throughout the construction phase.

#### 2.2 Supervision by Skilled Manpower/TPIA

2.2.1 Deployment of Appropriate Qualified Personnel

- I. Identification of Key Roles
  - Identify and define the roles required for the project, including project manager, site engineers, quality control engineers.
  - Ensure the personnel deployed have the necessary qualifications, certifications, and experience.

II. Qualification and Competency

- Personnel should possess appropriate qualifications:
- Civil Engineers with B.E./B.Tech or Diploma in Civil Engineering for site supervision and project management.
- Ensure that all deployed personnel have experience in similar types of building projects, especially within the regulatory framework of Haryana.

III. Third-Party Inspection Agencies (TPIA)

- Engage a Third-Party Inspection Agency (TPIA) for independent quality assurance and compliance verification, as per state guidelines.
- Regular audits and supervision by TPIA to ensure the project adheres to quality standards and timelines.

IV. Approval and Documentation

- Maintain records of the qualifications, certifications, and professional experience of all personnel deployed on the project.
- Ensure personnel are approved by the relevant authorities (eg., PWD Haryana, or local municipal authorities) before starting the work.

2.2.2 Manpower Deployment as per Requirement

I. Assessment of Workforce Requirements

- Estimate manpower requirements based on the scope and timeline of the project, including skilled and unskilled labour.
- Plan deployment as per project phases, ensuring the right mix of professionals such as engineers, technicians, labourers, and safety personnel is available.

II. Compliance with Labor Standards

- Ensure that the manpower deployed meets the labour standards and regulations prescribed by the Building and Other Construction Workers (BOCW) Act and local labour laws of Haryana.
- Regularly monitor the availability of adequate labour to meet deadlines and ensure safe working conditions.

III. On-Site Supervision and Monitoring

- Adherence to timelines, and quality of workmanship.
- Implement a system of reporting tracking progress, productivity, and identifying any shortages or surpluses.

IV. Documentation and Reporting

• Keep detailed records of manpower deployment.

#### 2.3 Use of Modern Facilities for Construction and Treatment

#### 2.3.1 Automated Batching Plants

- I. Selection and Installation
  - Use fully automated concrete batching plants that comply with relevant codes to ensure accurate proportions of cement, aggregates, and water.
  - Select batching plants that support real-time monitoring and ensure consistent mix quality as per the project's design mix.

#### II. Operational Efficiency

- Implement batching plants with automatic control systems for precise measurement and mixing of ingredients to minimize human error.
- Ensure that plant operators are trained and certified in operating automated batching systems, following relevant IS Codes.

III. Calibration and Maintenance

 To ensure regular calibration of the batching plant to maintain accuracy in material proportions

2.3.2 Cranes, Hoists, Transit Mixer Trucks, etc. to be arranged by the Executing Agency

- To ensure that selected cranes, hoists, and transit mixers that meet the requirements as per the relevant IS codes.
- Ensure that operators of cranes, hoists, and transit mixers are licensed and trained in the safe handling of these machines.

#### 2.3.3 Use of Other Mechanized and Digital Equipment

I. Digital Equipment and Automation Tools

- Employ advanced digital equipment such as laser levels, total stations, and GPS devices for precise measurements and alignment during construction, in line relevant IS Codes.
- Integrate Building Information Modelling (BIM) software for planning, design, and project management, enhancing accuracy in construction workflows and facilitating collaboration between teams.

II. Mechanized Tools

 Use modern mechanized tools such as vibratory compactors, power trowels, and hydraulic cutters for enhanced efficiency and quality control in construction activities. Ensure all mechanized equipment complies with relevant IS codes for Mechanical Handling Equipment.

III. Training and Safety Compliance

- Provide specific training to operators of mechanized and digital equipment to ensure proper usage and safety.
- Regularly update equipment and machinery to ensure the project uses the latest, most efficient tools and technology, complying with industry standards.

IV. Monitoring and Data Collection

- Use digital tools for monitoring and reporting project progress, material usage, and performance metrics in real-time.
- Ensure all equipment and tools undergo periodic calibration, inspection, and maintenance to avoid breakdowns and maintain construction quality.

#### 2.4 Conformity to Relevant Standards

- 2.4.1 Work Executed as per Approved Bid Document
- I. Compliance with Bid Specifications
  - Ensure that all construction activities strictly follow the approved bid document, which includes design specifications, construction methods, material requirements, and timelines.
  - Adhere to the technical and financial provisions outlined in the bid document, ensuring that the work is executed within the approved scope and in compliance with relevant standards.
  - Ensure that horticultural developments, as well as the aesthetic enhancements and finishing details for the building project, are executed in accordance with the bid document.

II. Alignment with Tender Conditions

 Ensure that all work aligns with the tender conditions, including adherence to the Haryana PWD Manual, depending on the specific project, and any other conditions set by local or national regulatory authorities.

III. Periodic Quality Audits

- Conduct regular audits and inspections by the project team and Third-Party Inspection Agencies (TPIA) to ensure that construction activities conform to the approved bid document. The quality audits should focus on:
- Structural integrity,
- Compliance with approved materials and work methods,
- Safety measures.

IV. Documentation and Record Keeping

- Maintain detailed records of all construction activities, including daily progress reports, material usage, and quality control test results, to demonstrate compliance with the bid document.
- Document any deviations from the original scope and ensure necessary approvals and justifications are recorded for such variations.

V. Approval for Changes

Any changes in design, material, or execution methodology must be approved by the project authority in alignment with the approved bid document. Seek approvals for variations through appropriate change orders and maintain records.

VI. Final Inspection and Handover

- Before the final handover of the project, ensure that all elements of the work have been executed as per the bid document and relevant IS codes, ensuring full compliance with contract obligations.
- Submit completion reports, including all relevant testing and quality control documentation, to verify conformity to the approved bid document.

#### 2.5 Testing Laboratory at Site

2.5.1 Setting up Testing Laboratory Having All Testing Equipment, Relevant to the Project Specifications

I. Establishment of Testing Laboratory

- Set up an on-site testing laboratory as per project specifications, ensuring it meets the requirements outlined in the Haryana PWD Works Manual and follows the guidelines under relevant IS codes.
- The laboratory should be established early in the project timeline to support continuous testing throughout the construction phases.

II. Equipment and Facilities

- Equip the laboratory with all necessary tools and equipment as per relevant IS Codes, such as:
- Compression testing machines for concrete strength testing
- Sieve analysis apparatus for aggregate grading
- Concrete slump cones for measuring workability
- Soil testing equipment for moisture content, compaction, and permeability tests
- Equipment for steel tensile strength tests
- Ensure that all equipment is calibrated regularly as per

III. Staffing and Certification

- Appoint qualified laboratory personnel, such as material engineers and lab technicians, certified in relevant construction testing methods.
- Ensure laboratory staff undergo training in conducting various tests.

IV. Testing Protocols and Compliance

- Implement testing protocols for all materials used in construction (e.g., concrete, steel, soil, aggregates) in accordance with the project's approved specifications.
- Ensure that all testing procedures are carried out under the supervision of certified engineers and conform to relevant Indian Standards (IS codes).

V. Documentation and Reporting

- Maintain detailed records of all tests conducted, including test dates, results, and any deviations from standard requirements.
- Submit periodic test reports to the project management team, Third-Party Inspection Agencies (TPIA), and regulatory authorities for review.

VI. Quality Assurance and Audits

- Conduct routine internal audits of the laboratory's testing equipment, procedures, and staff performance to ensure ongoing quality assurance.
- Implement corrective actions in cases where test results show non-compliance with project specifications or IS standards.

VII. Third-Party Verification

 Engage accredited third-party laboratories to conduct additional testing when required to validate the on-site laboratory's results and ensure compliance with the relevant codes and project guidelines.

#### 2.6 Pre and Post Inspections of Materials

Conducting mandatory tests at required frequency during Implementation

- I. Establish Testing Schedule
  - Develop a testing schedule based on the project's timeline and milestones, ensuring that material tests are conducted at regular intervals and at each critical construction stage including after batching placement as prescribed by the Haryana PWD Manual and relevant IS codes.

- Perform tests on all incoming materials such as aggregates, sand, concrete, and steel during the construction process to ensure consistent quality.
- II. Third-Party Inspection
  - Engage third-party inspection agencies (TPIA) to verify the test results and ensure compliance with the quality control requirements.

I. Non-Conformance and Rectification

 If any material or test result fails to meet the required standards, document the nonconformance and take corrective actions, such as retesting, replacing the material, or adjusting the design mix.

III. Record and Review

 Maintain detailed records of all test results, including the dates, materials tested, and any deviations found. Share these reports with the project management team for review and corrective action, if necessary.

#### 2.7 Documentation and Reporting

2.7.1 Preparation of Site Inspection and Quality Control Registers

I. Site Inspection Register

- Maintain a dedicated site inspection register where all daily inspections, site activities, material deliveries, and work progress are logged.
- Ensure that the register includes details of:
- Date and time of inspections,
- Materials tested,
- Observations made by the engineer in charge and other officers of the department.
- Approvals, delays, or issues encountered.

II. Quality Control Register

- Maintain a separate quality control register for documenting the results of material tests, quality checks, and compliance with the project specifications.
- Include data for all key materials such as cement, steel, aggregates, concrete, and sand.
   Ensure tests are logged against relevant IS standards.
- Keep records of test dates, sample numbers, test results, and observations by the quality engineer or third-party inspection agency (TPIA).

III. Record-Keeping Protocol

- Ensure that the registers are regularly updated and reviewed by the project management team.
- All entries should be signed and dated by the responsible personnel to maintain accountability.
- 2.7.2 Checking of Test Results by Engineer in Charge

I. Review and Verification of Test Results

- The Engineer in Charge must review all test results documented in the quality control register and ensure they meet the relevant IS standards.
- Compare the test results with the project specifications and ensure conformity at every stage of construction.

II. Test Result Approval

- Before proceeding with subsequent construction activities, the Engineer in Charge should approve the test results.
- If there is any discrepancy or deviation from the standard, the Engineer in Charge must halt further construction and take corrective action.

III. Cross-Verification

- Engage third-party inspection agencies (TPIAs) for cross-verification of critical test results, especially for structural elements like columns, beams, and slabs, etc.
- 2.7.3 Submission of Non-Conforming Reports and Keeping the Record

I. Non-Conformance Reporting (NCR)

- For any material or construction activity that does not meet the required standards, prepare and submit a Non-Conformance Report (NCR) detailing the issue, its impact, and proposed corrective actions.
- The NCR should include:
- Description of non-conformance (e.g., failed concrete test, substandard material),
- Reference to the applicable standard or project specification,
- Recommended rectification measures.

II. Record of Non-Conformance

- Maintain a log of all NCRs in the quality control register, documenting the issue, actions taken, and final resolution.
- Ensure NCRs are signed off by the Engineer in Charge and relevant authorities once the issue is resolved.

III. Submission to Authorities

 Submit the NCRs to the project authority for review, along with the proposed corrective measures and timelines for rectification.

#### 2.7.4 Rectification of Defects

I. Defect Identification and Rectification Plan

- Upon identification of defects in construction work or materials (through site inspections or test results), develop a rectification plan.
- Ensure that the rectification measures are in line with the relevant IS codes and project specifications.

II. Timely Corrective Action

- The Engineer in Charge should initiate timely rectification of defects, ensuring that all non-conforming materials or workmanship are replaced or repaired before progressing with further construction.
- Conduct retesting of materials or structures after rectification to confirm that they now meet the standards.

III. Re-Inspection and Documentation

- After the rectification process, conduct a re-inspection to verify that the issue has been successfully addressed.
- Update the quality control register with the actions taken and obtain approval from the Engineer in Charge.

IV. Continuous Monitoring

• Monitor the rectified areas over time to ensure that the defect does not recur. Keep records of follow-up inspections in the quality control register.

#### 3. COMMISSIONING AND HANDOVER

#### 3.1 Testing and Commissioning

3.1.1 Inspection and Testing of All Water Supply and Sanitary Works

I. Pre-Commissioning Inspection

- Conduct a comprehensive inspection of all water supply and sanitary installations, including pipelines, valves, pumps, and fixtures, before commissioning the system.
- Ensure all installations conform to the relevant IS codes for water supply and sanitary installations.
- Verify the layout against the approved working drawings to ensure proper alignment and connectivity.

II. Pressure Testing of Water Supply Lines

- Carry out a pressure test of the water supply pipelines to detect any leaks or weak spots. The test should conform to relevant IS codes of Practice for laying water mains and local government norms.
- Document the test results, recording the pressure applied, duration of the test, and any observed leaks or issues.

III. Testing of Sanitary Systems

- Test the sanitary system for leaks, blockages, and backflow using water tests or smoke tests as per relevant IS Codes.
- Check that all plumbing fixtures are installed properly, ensuring no cross-connection between potable and wastewater systems.

IV. Approval and Documentation

- Obtain approval from the Engineer in Charge and relevant authorities for the commissioning of the water supply and sanitary works.
- Maintain detailed records of all tests conducted, including any non-conformities or rectifications performed.

3.1.2 Inspection and Testing of Electric Installation Work (EI), Lifts/Elevators, Fire Safety Works by Certified Authorized Personnel

I. Electrical Installation (EI) Testing

- Conduct inspection and testing of all electrical installations, including wiring, switchgear, and control panels, to ensure compliance with relevant IS codes of Practice for Electrical Wiring Installations.
- Engage certified electrical inspectors or engineers to carry out insulation resistance tests, earth continuity tests, and circuit breaker tests.
- Record the test results and ensure that all electrical installations meet safety standards and project specifications.

II. Lift/Elevator Testing

- Ensure lifts and elevators are inspected and tested by authorized personnel in accordance with relevant IS for lifts, and relevant local regulations.
- Test the mechanical and electrical systems, including load-bearing capacity, door operation, emergency brakes, and fire safety features.
- Obtain certification of elevator safety from a registered inspection body before handing over for public use.

III. Fire Safety Testing

- Test fire safety systems, including alarms, sprinklers, and extinguishers, to verify that they meet the standards specified in NBC (National Building Code) Part 4: Fire and Life Safety.
- Conduct smoke detector and sprinkler system tests to ensure proper function and responsiveness in case of a fire emergency.
- Obtain inspection certificates from certified fire safety auditors, ensuring compliance with local fire safety regulations.

#### 3.1.3 Inspection of Drainage Outlets

I. Visual Inspection

- Inspect all drainage outlets, including stormwater drains, sewer lines, and manholes, to verify correct installation and placement according to the approved drainage design.
- Ensure that the outlets are clear of obstructions, properly sloped for drainage, and comply with relevant IS codes of Practice for Building Drainage.

II. Flow Testing

- Conduct flow tests to confirm that the drainage system is working efficiently, with no blockages or backflows. This can involve pouring water through the system and monitoring for smooth flow through all outlets.
- Perform a smoke test or dye test if necessary to identify any leaks or improper connections in the system.

III. Approval and Reporting

- Upon successful inspection and testing, the drainage system should be approved by the Engineer in Charge and any other relevant regulatory authority.
- Keep records of all tests, any non-compliance issues encountered, and the corrective measures taken before final approval.

3.2 Submission of Completion Certificate and Adhering to Approved Timelines and Budget

3.2.1 Submission of Completion Certificate as per Approved Drawing

I. Verification of Work Against Approved Drawings

- Upon project completion, ensure that all construction work aligns with the approved architectural, structural, and service drawings.
- Conduct a final inspection to check that the construction adheres to the design specifications and project requirements, including the use of materials and workmanship as per the relevant IS codes.

II. Preparation of Completion Certificate

 Prepare a comprehensive completion certificate documenting that the project has been completed in accordance with the approved drawings, design, and project specifications.

III. Submission to Authorities

• Submit the completion certificate to the relevant authorities.

#### 3.2.2 Completion of the Project Within the Stipulated Timeline

I. Timeline Monitoring

- Ensure strict adherence to the approved project timeline, with periodic monitoring and progress reporting at regular intervals (e.g., weekly, monthly).
- Maintain a project Gantt chart or similar tool to track construction milestones, with critical path analysis to address any delays.

Mitigation of Delays

- In case of unavoidable delays (e.g., weather conditions, unforeseen site conditions), initiate corrective actions such as reallocation of resources or adjusting work schedules.
- Obtain approval for any necessary timeline extensions, ensuring that these are formally documented and justified.

II. Final Completion Date

- Verify that the project is completed within the originally stipulated timeframe or the revised timeline if an extension was granted.
- Obtain sign-off from the project management team and relevant stakeholders confirming that the project has met the agreed deadlines.

3.2.3 Total Expenditure Within Sanctioned Amount

I. Budget Monitoring

- Continuously monitor project expenditures against the approved budget allocation. Ensure that all costs, including materials, labor, and equipment, are within the sanctioned limits.
- Maintain detailed financial records, including invoices, receipts, and contractor payments, to track actual expenditure versus the budget.

II. Cost Control Mechanisms

- Implement cost control mechanisms such as regular financial audits, cost reviews, and variance analyses. This ensures that any cost overruns are identified early and corrective actions are taken to manage them.
- In case of any budget deviations, request formal approval from the funding agency or relevant authority before proceeding with additional expenses.

Completion Within Budget

- Upon project completion, prepare a financial statement summarizing the total expenditure, including all approved variations, change orders, and contingency costs.
- Ensure the final expenditure is within the approved budget and submit the financial documentation to the funding agency and relevant authorities for approval.

#### 3.3 Guarantee of Works

3.3.1 Post-Commissioning Monitoring and Support from the Contractor During the Defect Liability Period

I. Defect Liability Period (DLP)

- Define the Defect Liability Period (DLP) as per the contract agreement, during which the contractor is responsible for rectifying any defects or issues that arise after project commissioning.
- Typically, the DLP lasts for a specific duration (e.g., 12-24 months) depending on the project scale and agreement terms.

Monitoring of Works Post-Commissioning

- Conduct periodic inspections of the project during the DLP to monitor the performance of key systems and structures. This includes checking for any defects in construction quality, material degradation, or failures in installed systems.
- Engage the contractor to provide post-commissioning support, addressing any identified issues promptly. Regular site visits and inspections by the Engineer in Charge ensure the project remains operational and free of defects.

#### II. Contractor's Responsibilities

- The contractor is obligated to provide ongoing support, including repair and maintenance work, at no additional cost during the DLP for any defects that arise from construction or material quality.
- Maintain a clear reporting system for defect identification, including submission of rectification reports, timelines for corrections, and follow-up actions.

III. Record of Rectification

- Document all defect reports and corrective actions taken by the contractor during the DLP, ensuring transparency and accountability.
- Upon rectification, the Engineer in Charge should inspect the work and approve the corrections, ensuring the project remains in line with the original specifications.

#### 3.3.2 Withhold of Security Amount

I. Retention of Security Deposit

- As per the contract terms, retain a percentage of the contract value (usually 5-10%) as a security deposit or performance guarantee during the DLP. This ensures that the contractor fulfils their obligations for post-commissioning support and defect rectification.
- The security deposit is withheld until the end of the DLP to cover any unforeseen defects or issues that require rectification during this period.

Conditions for Release of Security Amount

- The security amount is only released to the contractor upon successful completion of the DLP, ensuring that no defects remain unresolved.
- Before the release of the security deposit, the contractor must:
- Complete all necessary rectifications to the satisfaction of the Engineer in Charge.
- Submit a final report confirming the completion of all obligations under the DLP.

II. Documentation and Final Handover

- Ensure that all documentation related to the DLP, including inspection reports, defect correction records, and final approvals, is completed and submitted before releasing the security amount.
- After the final handover, a No-Objection Certificate (NOC) is issued by the Engineer in Charge, confirming the completion of all contractual obligations and authorizing the release of the withheld amount.

## 4. SAFETY AND SECURITY

#### 4.1 Adherence to Safety Standards & Regulations

4.1.1 Submission of All Safety-Related Clearances Such as Evacuation Plan in Case of Emergencies

#### I. Preparation of Safety Documents

- Ensure the preparation of all necessary safety-related documents, including emergency evacuation plans, fire safety plans, and other required protocols in compliance with the relevant safety standards and building codes.
- The evacuation plan should outline exit routes, assembly points, emergency contact numbers, and procedures for responding to fires, structural failures, or other emergencies.

Submission of Clearances

 Submit all safety plans and documents to the relevant authorities (e.g., local municipal authority, fire department)

II. Display of Safety Instructions

• Once approved, ensure that safety instructions and evacuation plans are visibly displayed at the construction site and key areas of the building for workers and visitors.

#### 4.2 Safety Measures for Workers

4.2.1 Providing First Aid Equipment, Safety Uniforms, and Housing for Workers

I. Provision of Safety Gear and Equipment

- Ensure that all workers on-site are equipped with safety uniforms, including helmets, reflective vests, gloves, and protective footwear, as per industry standards.
- Set up first aid stations with trained personnel and stock them with necessary medical supplies to handle minor injuries and emergencies.

Worker Housing and Amenities

- Provide clean, safe housing for workers as per government labour guidelines, especially in large-scale or remote projects where workers may need on-site accommodation.
- Ensure proper sanitation, clean water, and cooking facilities for the workers as part of their on-site housing requirements.

Safety Training

 Conduct regular safety training sessions for workers, focusing on the use of personal protective equipment (PPE), first aid procedures, and emergency response actions.

#### 4.3 Security Measures

#### 4.3.1 Physical Security Measures

I. Site Security Setup

- Implement robust physical security measures at the construction site, such as fencing, security personnel, and CCTV surveillance, to prevent unauthorized access.
- Establish controlled entry and exit points for both workers and visitors, ensuring all personnel are registered before entering the site.

24/7 Security Monitoring:

 Ensure that security personnel are deployed round the clock to monitor the construction site, especially in critical areas storing materials, equipment, and project documents. 4.3.2 Incident Response and Reporting

I. Incident Response Protocols

- Develop and implement an incident response plan to address accidents, breaches in security, or other emergencies at the construction site.
- The response plan should include immediate first aid, notification of authorities, and emergency containment measures.

II. Reporting Mechanisms

- Ensure that all incidents, whether minor or major, are promptly reported to the Engineer in Charge, project manager, and relevant authorities.
- Maintain a detailed log of incidents, investigations, and corrective actions taken to address the issue.

III. Post-Incident Review

- Conduct post-incident reviews to understand the root cause of the incident and implement corrective measures to prevent recurrence.
- Update safety and security procedures based on lessons learned from the incident to ensure continuous improvement.

## **5. OPERATION AND MAINTENANCE**

#### 5.1 Compliance to Prescribed Deliverables

5.1.1 Ensuring Proper Maintenance as per the Bidding Document

#### I. Adherence to Maintenance Requirements

Ensure that all maintenance activities are carried out in strict accordance with the terms and specifications outlined in the bidding document. This includes regular inspection and upkeep of structural elements, building services (electrical, plumbing, HVAC), landscaping, and upkeep of horticultural assets.

#### II. Scheduled Maintenance

- Establish a comprehensive maintenance schedule, detailing tasks such as cleaning, repairs, and servicing of critical components (e.g., electrical installations, water supply systems).
- Ensure periodic checks of all safety equipment, fire alarms, drainage systems, and other essential infrastructure, following the guidelines mentioned in the contract.

Monitoring and Reporting

- Assign qualified personnel to oversee maintenance activities and ensure that each task is completed to the standards defined in the bidding document.
- Submit regular maintenance reports to the relevant authorities, detailing all completed activities and any necessary follow-up actions.

#### 5.2 Timely Rectification of Defects

5.2.1 Rectification of Defects Within the Specified Time Period During the Defect Liability Period

I. Identification of Defects

- Regularly inspect the building for any defects, such as structural cracks, water leaks, or faulty electrical systems, during the Defect Liability Period (DLP).
- Ensure that all identified defects are promptly reported to the contractor for rectification within the specified time frame outlined in the DLP agreement.

II. Timely Rectification

- The contractor is responsible for addressing all defects within the time period stipulated in the contract. This includes conducting necessary repairs or replacements at no additional cost to the project owner.
- Maintain a strict timeline for defect rectification, ensuring that the contractor responds and resolves the issue within the agreed period, avoiding delays.

III. Final Inspection

- After rectification, conduct a thorough inspection to ensure the defect has been fully resolved and that the building complies with the original design and quality standards.
- Obtain sign-off from the Engineer in Charge and the relevant authorities once all defects have been satisfactorily corrected.

5.2.2 Documentation of the Maintenance Record

I. Comprehensive Record-Keeping

Maintain a detailed log of all maintenance activities, including dates of inspections, identified defects, and the actions taken for rectification. This log should include photographic evidence and detailed descriptions of the issues and solutions implemented.

II. Submission of Records

- Regularly submit maintenance and defect rectification records to the project management team and relevant authorities as required by the contract.
- Ensure these records are up-to-date and accessible for audit or review during the DLP and post-handover periods.

III. Post-DLP Handover

• At the end of the DLP, provide a complete set of maintenance and defect rectification records to the project owner as part of the final handover. This ensures transparency and accountability in maintenance efforts.

## **CHAPTER 3**

## List of relevant IS Codes for Building Construction

S. No.	IS Code	Description
1.	IS 456: 2000	Code of practice for plain and reinforced concrete
2.	IS 875 (Part 1 to 5): 1987	Code for design loads for buildings and structures
3.	IS 800: 2007	Code of practice for general construction in steel
4.	IS 1643: 1988	Code of practice for field surveys for engineering projects
5.	IS 2720 (Part 1 to 41)	Methods of test for soils, covering a range of soil properties such as moisture content, shear strength, and compaction characteristics
6.	IS 1892: 1979	Code of practice for subsurface investigation for foundations
7.	IS 962: 1989	Code of practice for architectural and building drawings
8. IS 1498: 1970		Classification and identification of soils for general engineering purposes based on grain size and plasticity characteristics
9.	IS 3792: 1978	Guide for preparation of site plans for building projects
10.	IS 6403: 1981	Code of practice for determination of bearing capacity of shallow foundations
11.	IS 1905: 1987	Code of practice for structural use of unreinforced masonry
12.	IS 2131: 1981	Method for standard penetration test (SPT) for soils, used to determine the soil's bearing capacity and properties
13.	IS 2062:2011	Hot Rolled Medium and High Tensile Structural Steel
14.	IS 432:1982	Specification for Mild Steel and Medium Tensile Steel Bars.
15.	IS 3370 (Part 1 to 4): 2009	Code of practice for concrete structures for storage of liquids
16.	IS 7272 (Part 1): 1974	Recommendations for labour output constants for building work
17.	IS 7272 (Part 2): 1974	Recommendations for equipment output constants for building work
18.	IS 6926: 1996	Code of practice for diamond core drilling for site investigation
19.	IS 1893: 2016	Criteria for Earthquake Resistant Design of Structures.
20.	IS 2116: 1980	Specification for sand for masonry mortars
21.	IS 13727: 1993	Guidelines for design of low-cost housing
22.	IS 8061: 1976	Code of practice for design of spaces in public buildings
23.	IS 13920: 2016	Code of Practice for Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces.

24.	IS 14435: 1997	Code of practice for fire safety in educational institutions
25.	IS 15883 (Part 1 to 4): 2009	Building design and budget estimates for energy-efficient buildings
26.	IS 1200 (Part 1 to 28): 1992	Methods of measurement for building and civil engineering works
27.	IS 383: 2016	Specification for coarse and fine aggregates
28.	IS 1786: 2008	High Strength Deformed Steel Bars and Wires for Concrete Reinforcement – Specifies requirements for high strength deformed steel bars and wires for use as reinforcement in concrete.
29.	IS 269: 2015	Ordinary Portland Cement – Specifies the requirements and methods of sampling and testing for ordinary Portland cement used in construction work.
30.	IS 277: 2018	Galvanized Steel Sheets (Plain and Corrugated) – Specifies the requirements for plain and corrugated galvanized steel sheets used in various structural applications.
31.	IS 10262: 2019	Guidelines for concrete mix design
32.	IS 2502: 1963	Code of practice for bending and fixing of bars for concrete reinforcement
33.	IS 16601: 2017	Quality requirements for supervision of construction projects
34.	IS 15916: 2010	Guidelines for construction project management
35.	IS 2185 (Part 1 to 3): 2005	Testing of concrete masonry units
36.	IS 1077: 1992	Common Burnt Clay Building Bricks – Specifies the classification, general quality, dimensions, and physical requirements of common burnt clay building bricks.
37.	IS 1608: 2005	Mechanical Testing of Metals – Tensile Testing – Specifies the method for tensile testing of metals and metal products.
38.	IS 4925: 2004	Concrete Batching and Mixing Plant – Specifies the requirements for concrete batching and mixing plants for use in civil construction.
39.	IS 13367: 1992	Safe Use of Cranes – Guidelines on various types of cranes and their safe operational practices.
40.	IS 4573: 1982	Specification for Manufacture of Roofing Slates – Lays down the requirements for roofing slates for use in buildings.
41.	IS 5892: 2004	Specification for Portland Slag Cement – Specifies the requirements and methods of sampling and testing for Portland slag cement.
42.	IS 2386: 1963	Methods of Test for Aggregates for Concrete – Part 1 to Part 8 cover sampling, testing, and analysis of aggregates.

43.	IS 1199: 1959	Methods of Sampling and Analysis of Concrete – Specifies methods for sampling and analysis of fresh concrete.
44.	IS 8900: 1978	Criteria for the Structural Design of Reinforced Concrete Shell Structures – Guidelines for designing reinforced concrete shell structures used in industrial buildings.
45.	IS 9103: 1999	Specification for admixtures for concrete
46.	IS 7205: 1974	Safety code for erection of structural steelwork
47.	IS 516: 1959	Methods of test for strength of concrete
48.	IS 4031 (Part 1 to 15): 1996	Methods of physical tests for hydraulic cement
49.	IS 4926: 2003	Code of practice for ready-mixed concrete
50.	IS 4326: 2013	Earthquake-resistant design and construction of buildings
51.	IS 1642: 1989	Code of practice for fire safety of buildings
52.	IS 15933: 2010	Guidelines for commissioning of building services
53.	IS 4877: 1968	Guide for commissioning of industrial units
54.	IS 3067: 1988	Code of practice for repairs and maintenance of buildings
55.	IS 14489: 1998	Code of practice on occupational safety and health audits
56.	IS 3696 (Part 1 & 2): 1987	Safety code for scaffolds and ladders
57.	IS 3764: 1992	Safety code for excavation work
58.	IS 7293: 1974	Safety code for working with construction machinery
59.	IS 8923: 1978	Guidelines for industrial security
60.	IS 9668: 1980	Code of practice for provision and maintenance of water supply for buildings
61.	IS 3067: 1988	Code of practice for repairs and maintenance of buildings
62.	IS 11972: 1987	Code of practice for energy conservation in buildings

# **CHAPTER 4**

## Description of components of Building Construction

## Types of Buildings

The buildings are categorised mainly into the following two subcategories:

- 1. Residential
- 2. Non-Residential

The Public Works Department (PWD) plays a vital role in building and maintaining the physical infrastructure necessary for government functioning across India. Below is a detailed expansion of the Types of residential and non-residential buildings constructed by PWD:

#### 1. Residential Buildings

#### A. Government Quarters

These quarters are built for various categories of government employees and are typically categorized based on the rank and position of the officials. They are located in urban areas and townships across India.

I. Type I Quarters: For lower-level government staff, such as clerks, peons, and other support staff. These units are smaller in size, usually comprising basic 1-bedroom or studio apartments.

II. Type II to Type IV Quarters: For mid-level officials, including teachers, nurses, junior engineers, and administrative officers. These houses are slightly larger, with 2-3 bedrooms, living spaces, and essential amenities.

III. Type V and VI Quarters: For higher-ranking officials like senior government officers, professors, and district magistrates. These quarters have 3-4 bedrooms, more luxurious facilities, and often come with attached garages and private gardens.

IV. VIP Quarters: For ministers, high-ranking officials, and sometimes visiting dignitaries. These are highly secured, large residences with luxurious amenities.

#### B. Hostels

PWD constructs hostels for:

I. Students: Hostels for students in various government educational institutions.

II. Government Employees: Working professionals attending government training programs or residing temporarily for official purposes.

III. Sports Hostels: For athletes undergoing training at government-run sports academies.

C. Police and Paramilitary Housing

PWD also undertakes the construction of residences for police and paramilitary personnel. These housing complexes are often located within or near police stations. They consist of individual houses or apartment complexes, sometimes provided with community amenities like parks and recreational facilities.

D. Rest House / Circuit House: Rest Houses and Circuit Houses are governmentowned accommodations intended for government officials, dignitaries, and other important guests during their official travel. They are often used during inspections, official visits, or temporary stays when traveling across different regions.

#### E. Staff Residences

PWD constructs houses for essential government service staff, including:

I. Teachers: In schools located in rural and remote areas.

II. Medical Staff: Residences for doctors, nurses, and healthcare personnel, typically attached to primary health centers, hospitals, and medical colleges.

III. Forest and Irrigation Department Staff: Residences in areas like forests, wildlife sanctuaries, and water management zones.

#### 2. Non-Residential Buildings

#### A. Administrative Buildings

PWD constructs a wide range of government office buildings where daily administrative functions take place:

I. Secretariat Buildings: High-level offices housing government departments and ministries. These are often large complexes with multiple departments and chambers for ministers and senior officials.

II. District and Block Offices: These are district collectorates, revenue offices, and block development offices, which handle local administrative matters, such as issuing certificates, licenses, and permits.

III. Sub-Divisional Offices: Buildings that provide administrative and public services at the subdivisional level, often including essential departments like revenue, social welfare, and public health.

#### **B.** Educational Institutions

PWD constructs and maintains buildings for educational institutions at all levels:

I. Government Schools: Infrastructure for primary, secondary, and senior secondary schools, including classrooms, staff rooms, laboratories, auditoriums, and playgrounds. Often, these buildings are constructed in a phased manner to allow for future expansion.

II. Colleges and Universities: PWD builds college buildings for arts, science, commerce, and technical education streams. In universities, PWD constructs classrooms, libraries, research laboratories, administrative blocks, and hostels.

III. Vocational and Technical Institutes: Buildings for ITIs (Industrial Training Institutes) and polytechnic colleges that include specialized workshops and laboratories for hands-on learning.

#### C. Healthcare Infrastructure

PWD handles the construction of critical healthcare facilities:

I. Hospitals: District, sub-district, and state-level hospitals are built and maintained by PWD. These hospitals include outpatient departments (OPDs), wards, operation theaters, ICUs, and medical colleges attached to major hospitals.

II. Primary Health Centers (PHCs): Small healthcare centers built in rural areas to provide basic medical care to the population. These centers are pivotal for healthcare delivery at the grassroots level.

III. Dispensaries and Clinics: Smaller health facilities set up in urban and semi-urban areas to cater to minor medical needs and public health programs like immunization.

IV. Medical Staff Residences: Quarters for doctors, nurses, and administrative staff located near hospitals to ensure quick access to healthcare services.

#### D. Police and Judicial Buildings

I. Police Stations: PWD constructs buildings for local police stations, district-level police offices, and special investigation units. These buildings typically include lock-up rooms, offices, record rooms, and sometimes residential quarters.

II. Judicial Complexes: These include courthouses at the district and state levels. They are designed with courtrooms, chambers for judges and advocates, waiting areas for litigants, and administrative spaces for the functioning of the judiciary.

#### E. Public Amenities

I. Bus Terminals and Depots: Construction of bus stands, offices for the transport department, and bus maintenance depots. These facilities often include ticket counters, waiting rooms, and parking spaces.

II. Community Centers and Auditoriums: PWD builds community halls for public gatherings, meetings, weddings, and social events. Auditoriums are constructed for cultural events and public meetings.

III. Public Libraries: PWD builds libraries in towns and cities for public use, with dedicated spaces for reading, research, and community events.

F. Recreational and Sports Infrastructure

I. Stadiums and Sports Complexes: PWD constructs sports facilities, including stadiums for cricket, football, hockey, and athletics. These complexes may also include indoor facilities for sports like badminton, basketball, and gymnastics.

II. Parks and Public Gardens: Landscaping and maintenance of public parks and gardens, often integrated into town planning to improve urban greenery.

G. Cultural and Heritage Buildings

I. Museums: State-run museums are built by PWD to preserve and display historical and cultural artifacts. These buildings often require special design features to accommodate sensitive exhibits.

II. Cultural Centers: These include theaters, auditoriums, and other spaces for promoting art, drama, music, and local culture.

III. Heritage Conservation: PWD also works on the restoration and preservation of heritage sites, monuments, and historic buildings that have cultural significance.

#### H. Prisons

PWD constructs jail complexes that include barracks for inmates, administrative offices, courtrooms, medical facilities, and residential quarters for jail staff. Modern prison infrastructure often includes security systems, workshops, and educational centers for inmate rehabilitation.

## Various components used in Building Construction

In general, buildings across various categories (residential, and non-residential) share common structural and functional components. Below are the general components of building construction applicable across different types:

1. Foundation: Supports the entire structure and distributes the load to the ground.

I. Types of Foundation:

- Shallow foundations: Spread footings, raft foundation.
- Deep foundations: Pile foundations, caissons.

II. Materials used: Concrete, or reinforced concrete.

**2. Plinth:** A raised platform that separates the foundation from the superstructure, providing stability and protection from moisture.

I. Components Plinth beam, damp-proof course (DPC).

II. Materials used: Reinforced concrete

**3. Walls:** Enclose the building, provide privacy, protection from weather, and carry loads in some cases.

I. Types of walls:

- Load-bearing walls: Carry structural loads.
- Non-load-bearing walls: Serve as partitions.

II. Materials used: Brick, concrete blocks, stone, reinforced concrete, etc.

4. Columns: Vertical members designed to carry compressive loads from beams and slabs.

I. Types of columns:

- Reinforced concrete columns.
- Steel columns.
- Masonry columns.
- II. Materials used: Reinforced concrete, steel, or brick.

5. Beams: Horizontal members that transfer loads from slabs or walls to columns.

I. Types of beams:

- Primary beams: Support slabs directly.
- Secondary beams: Support primary beams or other structural elements.

II. Materials used: Reinforced concrete, steel, wood.

6. Floors: Provide usable space and separate the building into levels.

I. Types of floors:

- Ground floor: The floor at ground level.
- Upper floors: Any floors above the ground floor.

II. Materials used: Reinforced concrete, steel, wood, tiles, marble, and other flooring materials.

7. Roof: Protects the building from weather conditions, such as rain, wind, and sunlight.

I. Types of roofs:

- Flat roofs: Common in commercial and industrial buildings.
- Sloped roofs: Common in residential and public buildings.
- II. Materials used: Concrete, steel, asphalt shingles, tiles, metal sheets.

8. Doors and Windows: Provide access to the building and ventilation; offer natural light.

I. Types of doors and windows:

- Doors: Wooden, steel, aluminium, uPVC, or glass.
- Windows: Sliding, casement, bay windows, or fixed windows.

II. Materials used: Wood, glass, steel, aluminium, uPVC.

9. Stairs, Ramps, and Elevators: Provide vertical circulation within the building.

I. Types of stairs, ramps, and elevators:

- Stairs: Different types like straight, spiral, or helical.
- Ramps: For disabled access and vehicles in parking lots.
- Elevators: Used in multi-story buildings for vertical transport.

II. Materials used: Reinforced concrete, steel, wood, etc.

**10. Ceilings:** Cover the underside of the roof or floor above, hiding utility installations and providing aesthetic finishes.

I. Types of ceilings:

- Suspended ceilings: For hiding wiring and HVAC ducts.
- False ceilings: Used for lighting and acoustics.

II. Materials used: Gypsum board, plaster, wood, or metal.

**11. Partitions:** Internal walls that divide spaces within a building.

I. Types of partitions:

- Movable partitions: Common in offices and commercial spaces.
- Fixed partitions: Permanent walls used in residential and institutional buildings.

II. Materials used: Gypsum board, glass, wood, aluminium.

**12. Finishing Materials:** Provide protection, durability, and aesthetics to building surfaces.

I. Types of finishing materials:

- Plastering: Interior and exterior walls.
- Painting: For protection and decoration.
- Tiling: For floors, walls, and roofs.

II. Materials used: Cement plaster, gypsum, paint, tiles, marble, and wallpaper.

**13. Electrical System:** Provide power supply to all the electrical appliances, lighting, and HVAC systems.

I. Components Wiring, switches, distribution panels, lighting fixtures, and sockets.

II. Materials used: Copper wiring, circuit breakers, conduits, and insulation.

14. Plumbing System: Supply water and remove wastewater from the building.

I. Components

- Water supply system: Pipes, fittings, tanks, pumps.
- Drainage system: Pipes, fittings, gutters, sewers, septic tanks.

II. Materials used: PVC, copper, steel, or cast iron pipes.

# **15. HVAC (Heating, Ventilation, and Air Conditioning):** Maintain thermal comfort and air quality in the building.

I. Components: Air conditioning units, ventilation fans, ductwork, radiators.

II. Materials used: Metal ducts, fiberglass insulation, and electrical components.

**16. Fire Safety Systems:** Prevent, detect, and respond to fire incidents.

I. Components: Fire alarms, Sprinkler systems, Fire extinguishers, Smoke detectors.

II. Materials used: Fire-resistant materials, fireproof doors, alarms, and sprinklers.

17. Insulation: Maintain temperature and reduce energy consumption.

I. Types of insulation:

- Thermal insulation: For reducing heat loss or gain.
- Acoustic insulation: For soundproofing.

II. Materials used: Fiberglass, foam, polystyrene, wool, etc.

18. Exterior Finishes: Protect and enhance the aesthetic appeal of the building.

I. Types of exterior finishes:

- Cladding: Protects the exterior wall.
- Painting: Weather-resistant coatings.

II. Materials used: Brick, stone, stucco, metal, glass, or composite materials.

19. Landscaping: Enhance the environment around the building.

I. Components Lawns, gardens, walkways, driveways.

II. Materials used: Concrete, stone, bricks, vegetation.

**20. Security Systems:** Protect the building and its occupants from unauthorized access and theft.

I. Components: Surveillance cameras, burglar alarms, biometric systems.

II. Materials used: Metal locks, security cameras, wiring for alarms.

These components cover the essential elements of building construction, addressing structural, functional, safety, and aesthetic needs across different building types.

## **ANNEXURE I**

## Technical Quality Audit Parameters: Buildings

Sr.	Parameter	Benchmark	Reference	Indicator	Sub indicators	Max.	Marks	Weightage
no.						marks	obtained	(%)
1	Planning &	Technical	DPR	1.1) Survey,	1.1.1) Site selection and feasibility	10		25
	Design	Framework		investigation and	1.1.2) Land survey/preparation of	10		
		and		regulatory	contour site plan			4
		comprehensive		compliances	1.1.3) NOC from country and town	5		
		Planning			planning/local municipal			
					authority/other department			
				1.2) Architecture	1.1.4) Land acquisition and	5		
					forest/other environmental			
					clearances if required			
					1.2.1) Requirement details from the	5		
			planning	concerned department				
				1.2.2) Preparation of preliminary	10			
					architectural drawings and its			
					approval from concerned department			
					1.2.3) Preparation of working drawings	10		
				showing all the details along with				
					specifications of each item			
				1.3) Design and	1.3.1) Conducting Geo technical/soil	10		
				specification	testing investigation to know the soil			
					composition and its characteristics			l

#### **Pre-implementation Stage**

estimates, call of tenders, award of work & its implementation etc.	estimates with annual budget allocation 1.4.2) Period for approval of detailed 10	timeline 1.4.2) Identification of funding agency 5		1.4) Cost Analysis, Budget planning and timeline estimates	<ul> <li>1.3.2) Framing structural design and other specification</li> <li>1.4.1) Preparation of detail estimates with cost index up to the implementation period.</li> <li>1.4.2) Identification of funding agency with annual budget allocation</li> <li>1.4.3) Period for approval of detailed estimates, call of tenders, award of work &amp; its implementation etc.</li> </ul>	10 10 5 10	25%
planning and       implementation period.         timeline       1.4.2) Identification of funding agency       5         estimates       with annual budget allocation       10	timeline 1.4.2) Identification of funding agency 5			Analysis, Budget	with cost index up to the		
Analysis, Budget       with cost index up to the         planning and       implementation period.         timeline       1.4.2) Identification of funding agency       5         estimates       with annual budget allocation       10	Analysis, Budget       with cost index up to the         planning and       implementation period.         timeline       1.4.2) Identification of funding agency	Analysis, Budget with cost index up to the		1.4) Cost	1.4.1) Preparation of detail estimates	10	
1.4) Cost       1.4.1) Preparation of detail estimates       10         Analysis, Budget       with cost index up to the       1         planning and       implementation period.       1         timeline       1.4.2) Identification of funding agency       5         estimates       with annual budget allocation       10	1.4) Cost       1.4.1) Preparation of detail estimates       10         Analysis, Budget       with cost index up to the       10         planning and       implementation period.       10         timeline       1.4.2) Identification of funding agency       5	1.4) Cost     1.4.1) Preparation of detail estimates     10       Analysis, Budget     with cost index up to the     10			other specification		
Image: other specification       other specification       Image: other specification         1.4) Cost       1.4.1) Preparation of detail estimates       10         Analysis, Budget       with cost index up to the       Image: other specification         planning and       implementation period.       Image: other specification         timeline       1.4.2) Identification of funding agency       5         estimates       with annual budget allocation       10	other specification       1.4) Cost       1.4.1) Preparation of detail estimates       10         Analysis, Budget       with cost index up to the       10         planning and       implementation period.       10         timeline       1.4.2) Identification of funding agency       5	other specification       1.4) Cost       Analysis, Budget       with cost index up to the			1.3.2) Framing structural design and	10	

Sr.	Parameter	Benchmark	Reference	Indicator	Sub Indicators	Max.	Marks	Weightage
no.						marks	obtained	
2	Execution,	Technical	contract	2.1) Use of	2.1.1) Procurement of items like steel,	5		45
	Inspection	methodology	Agreement,	construction	cement, CGI sheets, WS&SI, electric			
	and testing	for	test reports	materials as	fittings etc. from approved make and			
		implementation	and quality	per relevant	manufacturers			
		and inspection	control	codes &	2.1.2) Use of materials such as	5		
		& testing	register	manuals	aggregate sand, stones, bricks etc.			
					from approved source only			
					2.1.3) Use of design mix of concrete as	5		
					per specification			
					2.1.4) Carrying out tests at	5		
					manufacture's premises before			
					dispatch/inhouse facilities			
				2.2) supervision	2.2.1) Deployment of appropriate	5		
				by skilled	qualified personal			
				manpower/	2.2.2) Manpower deployment as per	5		
				TPIA	requirement			
				2.3) Use of	2.3.1) Use of automated batching	5		
				modern	plants			
				facilities for	2.3.2) Use of Cranes, Hoist, Transit	5		
				construction	mixer trucks etc.			
				and treatment	2.3.3) Use of other mechanized and	5		
					digital equipment etc.			

#### IMPLEMENTATION STAGE

Total	l			100	45%
			2.7.4) Rectification of defects	5	
			reports and keeping the record		
			2.7.3) Submission of non-conforming	5	
			Engineer in Charge		
		and Reporting	2.7.2) Checking of test results by	5	
		Documentation	and quality control registers		
		2.7)	2.7.1) Preparation of site inspection	5	
			fineness modulus of sand etc.		
			concrete gradation of aggregates		
			tests during execution at every stage of		
			2.6.3) Ensuring relevant mandatory	5	
			tests during implementation		
		materials	2.6.2) Ensuring required frequency of	5	
		Inspections of	aggregate, stone, sand etc.		
		2.6) Pre & Post	2.6.1) Selection of quarry site for	5	
		site	to the project specifications		
		laboratory at	having all testing equipment, relevant		
		2.5) Testing	2.5.1) Setting up Testing laboratory	10	
		standards			
		to relevant	bid document		
		2.4) Conformity	2.4.1) Work executed as per approved	10	

Sr.	Parameter	Benchmark	Reference	Indicators	Sub Indicator	Max.	Marks	Weightage
no.						marks	obtained	
3	Commissioning	Guidelines for	Completion	3.1) Testing	3.1.1) Inspection and testing of all	20		10%
	and Hand over	commissioning	report	and	water supply and sanitary works			
		and handover		commissioning	3.1.2) Inspection and testing of	20		
					Electric installation work (EI),			
					lifts/elevators, fire safety works by			
					the certified authorized personnel			
					3.1.3) Inspection of drainage	10		
					outlets			
				3.2)	3.2.1) Submission of completion	10		
				Submission of	certificate as per approved drawing			
				completion	3.2.2) Completion of the project	10		
				certificate and	within the stipulated timeline			
				adheringto	3.2.3) Total expenditure within	10		
				approved	sanctioned amount			
				timelines and				
				budget				
				3.3) Guarantee	3.3.1) Post commissioning	10		
				of works	Monitoring and support from the			
					contractor in the defect liability			
					period			
					3.3.2) Withhold of security amount	10		
Tota	l					100		<b>10</b> %

#### COMMISSIONING

Sr.	Parameter	Benchmark	Reference	Indicator	Sub Indicator	Max.	Marks	Weightage
no.						marks	obtained	
4	Safety and Security	Guidelines for Safety and Security	Safety plan	<ul> <li>4.1)</li> <li>Adherence</li> <li>to safety</li> <li>standards</li> <li>&amp;</li> <li>regulations</li> <li>4.2) Safety</li> <li>measures</li> <li>for workers</li> </ul>	<ul> <li>4.1.1) Submission of all safety related clearances such as evacuation plan etc. in case of emergencies.</li> <li>4.2.1) Providing first aid equipment, safety uniforms and housing for workers etc.</li> </ul>	2		5%
				4.3) Security measures	<ul><li>4.3.1) Physical Security measure</li><li>4.3.2) Incident response and reporting</li></ul>	2 3		
Tota	ો					10		5%

#### SAFETY AND SECURITY
#### **OPERATION & MAINTENACE**

Sr.	Parameter	Benchmark	Reference	Indicator	Sub Indicator	Max.	Marks	Weightage
no.			document			marks	obtained	
5	Operation and maintenance	Procedure for effective maintenance	Assets management plan	5.1) Compliance to prescribed deliverable 5.2) Timely rectification of defects	<ul> <li>5.1.1) Ensuring proper maintenance as per the bidding document</li> <li>5.2.1) Rectification of defects within the specified time period during defect</li> <li>5.2.2) Documentation of the</li> </ul>	4 4 2		5
					maintenance record			
					Total	10		5%

Sr. No.	Parameter	Marking Criteria	Weightage (%)	Marks obtained
1	Planning and Design		25*	
2	Execution, Inspection and Testing		45*	
3	Commissioning and handing over		10*	
4	Safety Measures		5*	
5	Operation & Maintenance		5*	
6	Environmental Measures	Consideration of environmental factors like sustainability, eco-friendly construction practices	5	
7	User Feedback	Feedback from beneficiaries, stakeholders to assess their satisfaction levels	5	
TOTAL			100	

\*The breakup of the weightage is given in the detailed framework for these parameters

\*Parameters that are not applicable to a specific project will not be considered in the audit scoring. The weightage will be adjusted accordingly.

### **ANNEXURE II**

#### Part A: Checklist for Approval of DPR for Building Construction

Name of Division: \_\_\_\_\_

Name of Project: \_\_\_\_\_

Sr. No.	Questionnaire	Yes	No	N/A	Remarks
1	Site selection finalized and feasibility study conducted for the				
1.	selected site				
2.	Land survey conducted				
3.	Contour site plan prepared				
	NOC obtained from				
1	I. Country and town planning				
4.	4. II. Local municipal authorities				
III. Fire services department					
5.	Land acquisition completed				
6.	Forest clearances obtained if required				
7.	Environmental clearances obtained				
8.	Geotechnical investigations completed				
0	Drainage study carried out to assess water runoff, drainage				
9.	patterns, and flood risks				
10	Detailed requirement specifications obtained from the				
10.	concerned department such as project specific requirements.				
11	Preliminary architectural drawings prepared and approved from				
	concerned department				

10	Detailed working architectural drawings prepared, showing all			
12.	construction details and material specifications			
	DPR includes provisions for advanced technologies like:			
10	I. SCADA			
13.	II. BIM			
	III. Automation			
	Structural designs, including beams, columns, and load-bearing			
14.	walls, framed as per standards accounting for seismic and wind			
	loads also			
15	Fire safety measures incorporated, including fire exits, alarms,			
15.	and suppression systems			
16	Energy-efficient design proposed, including solar energy			
10.	systems, efficient HVAC systems, and insulation			
17.	Water management system (rainwater harvesting proposed)			
18	Provision for horticulture planning and aesthetic enhancement			
10.	and finishing of the building project			
19	Detailed cost estimate prepared (DPR) including the cost index			
10.	for the entire implementation period			
20	Funding agency identified, and annual budget allocation			
20.	established			
21	Timeline for approval of detailed estimates, tender invitations,			
21.	and work award finalized			
22	DPR includes a detailed plan for procurement of materials,			
	equipment, and services for construction			
	Detailed drawings and specifications for electrical, water, and			
23.	sanitary installations, flooring , joinery, roofing, false ceiling,			
	railing, etc. prepared			
24	DPR includes provisions for post-construction operations and			
27.	maintenance (O&M)			

25.	Project scope finalized and communicated to all stakeholders to
	avoid scope creep
26	Project schedule defined and approved, including milestones
20.	and deadlines
27	Detailed risk assessment conducted, covering all potential risks
27.	in planning and design
20	Relevant building codes and standards reviewed and
28.	incorporated into the design

Note: This checklist is required to be appended with the DPR at the time of approval and duly signed by the concerned officers/officials.

# Part B: Checklist for Execution, Inspection and Testing Commissioning & Handover for Building Construction

Name of Division: \_\_\_\_\_

Estimated Cost of Project: \_\_\_\_\_

Date of Sanction of Project: \_\_\_\_\_

Name of Project:	
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Name of Agency: \_\_\_\_\_

Date of Award of Contract: \_\_\_\_\_

Contract Value of the Work: \_\_\_\_\_

Sr. No.	Questionnaire	Yes	No	N/A	Remarks
1	Procurement of items like steel, cement, CGI sheets, WS&SI,				
1.	electric fittings, HVAC etc. from approved manufacturers				
2	Materials such as aggregate, sand, stones, and bricks sourced				
Ζ.	from approved suppliers				
3.	Design mix of concrete approved				
1	Relevant tests (e.g., strength, durability) conducted at the				
4.	manufacturer's premises or on-site				
5	All materials stored and handled as per safety and				
5.	environmental regulations				
6	System for material tracking and inventory management				
0.	established				
7.	Manpower deployment aligned with the project requirements				
Q	Deployed manpower skilled in critical construction tasks				
0.	(e.g., structural work, electrical installations)				
٥	Workers properly trained and equipped with safety gear for				
9.	high-risk tasks				
10	Automated batching plants used for concrete production to				
10.	ensure uniform quality				

11	Cranes, hoists, transit mixers, and other equipment used			
11.	appropriately, and operators certified			
10	Sufficient use of modern digital equipment, including GPS,			
12.	drones, and BIM for project execution			
12	Construction waste handled and disposed of in accordance			
15.	with environmental guidelines			
1/	Work executed as per the approved bid document and			
14.	construction standards			
15	Any deviations from the design documented and approved by			
15.	relevant authorities			
16	Weather-related delays or site-specific issues accounted for			
10.	in the project timeline			
17	On-site testing laboratory equipped with all necessary testing			
17.	equipment as per project specifications			
18	Quarry site for aggregate, stone, and sand selected with			
10.	proper clearance and approval			
	Mandatory tests such as cube tests of concrete, gradation of			
19.	aggregates, and fineness modulus of sand performed			
	regularly			
20	Site inspection and quality control registers maintained and			
20.	updated regularly			
21.	Test results reviewed and approved by the Engineer in Charge			
22	Non-conformance reports (NCR) documented and corrective			
	actions implemented			
23	Defects or deficiencies identified during inspection promptly			
23.	rectified			
24	Formal system for reporting project progress to stakeholders			
24.	on a regular basis			
25	Technology like SCADA or remote monitoring tools used to			
20.	oversee project quality and efficiency			

26	All water supply and sanitary works inspected and tested				
20.	thoroughly				
27	Electrical installation, lifts, elevators, and fire safety systems				
27.	inspected and tested by certified personnel				
20	All drainage outlets checked for proper functionality and				
20.	compliance with regulations				
29	Commissioning activities documented and approved by the				
20.	relevant authorities				
30	Completion certificate submitted as per the approved				
50.	drawings and construction documents				
31	Final inspection conducted to ensure all work meets the				
51.	quality and safety standards				
32	Contractor submitted all required as built drawings and O&M				
52.	manuals				
33	Handover documents (including warranties, guarantees,				
	certificates) provided to the client				
34	Post-commissioning monitoring and support from the				
04.	contractor in place during the defect liability period				
35	System for addressing post-handover issues, including				
	contractor support for defects or deficiencies				
36	All post-commissioning system tests carried out to confirm				
	operational readiness				
37	Final project report (completion report) submitted,				
07.	summarizing the key project deliverables and any deviations				
38	Training sessions conducted for the client on the operation				
	and maintenance of installed systems				
39	Feedback collected from the client on the handover process				
	and project quality	<u> </u>			
40	All safety-related clearances (e.g., fire safety, emergency				
-0.	evacuation plan) obtained				

11	Safety plan reviewed and updated based on the latest site			
41.	conditions and risks			
40	First-aid equipment and emergency medical facilities			
42.	available on-site for workers			
12	Workers provided with safety uniforms, PPE, and proper			
43.	housing if necessary			
11	Regular safety audits conducted to assess compliance with			
44.	safety standards			
45	All workers trained in safety procedures and incident			
45.	response protocols			
46	Incident response plan created, covering evacuation, fire			
40.	safety, and accident reporting			
47	Physical security measures (e.g., site fencing, security			
47.	personnel) in place to protect against unauthorized access			
10	Fire drills and evacuation exercises conducted regularly for			
40.	workers and site personnel			
10	Effective system for reporting safety incidents, near-misses,			
49.	or security breaches			
50	Safety signages and hazard markings clearly displayed across			
50.	the site			
51	Emergency communication systems (e.g., alarms, intercoms)			
51.	in place and tested regularly			
50	Security personnel trained and briefed on site-specific risks			
52.	and emergency procedures			
52	Systems for the secure storage and management of			
55.	hazardous materials (if applicable)			
54	Safety audit conducted post-completion, ensuring		 	
54.	compliance with safety standards			

Note: This checklist is required to be signed by the Executive Engineer in charge of the work and other officers during their visit.

## Part C: Checklist for Operation and Maintenance of Building Construction

Name of Division: \_\_\_\_\_

Cost of Project at Completion:	

Name of Project: \_\_\_\_\_

Date of Completion: \_\_\_\_\_\_

Name of Agency:	
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Sr. No.	Questionnaire	Yes	No	N/A	Remarks
1.	Proper maintenance carried out as per the bidding document and				
	contract specifications				
2.	Preventive maintenance scheduled and conducted regularly to				
	avoid major breakdowns or defects				
3.	Appropriate resources (manpower, materials, and equipment)				
	allocated for routine maintenance activities				
4.	Regular maintenance of horticultural assets				
5.	Operation and maintenance (O&M) manuals and guidelines				
	followed strictly				
6.	Regular inspection schedule in place to ensure all building				
	systems (e.g., electrical, plumbing, HVAC) are functioning properly				
7.	Contracts in place for third-party services like cleaning, HVAC,				
	plumbing, horticulture maintenance/landscaping, security, or any				
	other maintenance				
8.	Defects rectified within the specified time period during the defect				
	liability period				
9.	Comprehensive maintenance record documented and updated				
	regularly				
10.	Designated team responsible for responding to operational issues				
	and emergencies				

11.	Spare parts and critical components stocked to ensure quick			
	repair and replacement			
12.	Detailed service logs for all equipment maintained (e.g., lifts,			
	generators, fire systems)			
13.	Maintenance schedules aligned with warranty requirements for			
	equipment and machinery			
14.	Routine inspections conducted to ensure that all systems are			
	functioning properly			
15.	System performance metrics (e.g., water flow, power			
	consumption) tracked and analyzed for optimization			
16.	Energy-saving initiatives (e.g., energy-efficient lighting, automated			
	systems) implemented and monitored			
17.	Renewable energy systems (like solar panels) maintained regularly			
	for optimal performance			
18.	Water management systems (rainwater harvesting, greywater			
	reuse) maintained effectively			
19.	Modifications or upgrades planned for the system based on			
	changing requirements or emerging technologies			
20.	Training provided to staff for the operation and maintenance of			
	new or complex equipment			
21.	Third-party inspections or audits conducted to ensure adherence			
	to maintenance standards			
22.	Feedback mechanism in place for reporting and addressing			
	operational inefficiencies			
23.	Safety checks regularly conducted on critical systems like fire			
	suppression, alarms, and emergency exits			
24.	Emergency response protocols, including evacuation plans, in			
	place and up to date			
25.	Systems for waste management and sanitation services			
	maintained as per health and safety standards			

26.	Upgrades or replacements planned for equipment nearing the end		
	of its life cycle		
27.	Protocols in place for the smooth transfer of knowledge and		
	responsibility during staff turnover		
28.	Post-operation performance evaluations carried out to improve		
	future maintenance practices		

Note: This checklist is required to be signed by the Executive Engineer in charge of the work and other officers during their visit.