



सत्यमेव जयते

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण

(सड़क परिवहन और राजमार्ग मंत्रालय, भारत सरकार)

National Highways Authority of India

(Ministry of Road Transport and Highways, Government of India)

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भाराराप्रा/ नीति दिशानिर्देश / गुणवत्ता आश्वासन/ 2026 नीति परिपत्र सं. 15.12 / 2026 दिनांक 30th मार्च, 2026

{ई-ऑफिस फाइल सं. SRDQ-11020/9/2025-SRD&Q Division (कम्प्यूटर सं. 272527 पर लिया गया निर्णय)}

NHAI/ Policy Guidelines/ Quality Assurance/2026

Policy Circular No. 15.12/ 2026 dated 30th March, 2026

{(Decision taken on E-Office File No. SRDQ-11020/9/2025-SRD&Q Division(Comp No. 272527)}

विषय: भाराराप्रा परियोजनाओं में प्रीकास्ट कंक्रीट उत्पादों के लिए गुणवत्ता आश्वासन योजना (क्यूएपी) के कार्यान्वयन के संबंध में।

Sub.: Implementation of Quality Assurance Plan (QAP) for Precast Concrete Products in NHAI Projects - Reg.

संदर्भ: सड़क परिवहन और राजमार्ग मंत्रालय पत्र संख्या आरडबल्यू/एनएच-34049/01/2020-एसएंडआर(बी) (कंप्यूटर संख्या -182692) दिनांक 18.03.2026

Refer: MoRT&H letter no. RW/NH-34049/01/2020- S&R(B) (Computer No. -182692) dated 18.03.2026

सड़क परिवहन और राजमार्ग मंत्रालय (एमओआरटीएच) ने कुछ निर्धारित शर्तों के अनुसार राष्ट्रीय राजमार्ग परियोजनाओं में प्रीकास्ट कंक्रीट घटकों के उपयोग को अनिवार्य कर दिया है। तत्पश्चात, ऐसे घटकों की गुणवत्ता, टिकाऊपन और निष्पादन सुनिश्चित करने के लिए प्रीकास्ट कंक्रीट उत्पादों के लिए एक विस्तृत गुणवत्ता आश्वासन योजना (क्यूएपी) जारी की गई है।

Ministry of Road Transport & Highways (MoRTH) has mandated the use of precast concrete components in National Highway Projects under specified conditions. Subsequently, a detailed Quality Assurance Plan (QAP) for precast concrete products has been issued to ensure quality, durability and performance of such components.

2. क्यूएपी, प्रीकास्ट कंक्रीट प्लांट की बुनियादी आवश्यकताओं, डिजाइन, और उत्पादन के सभी चरणों के गुणवत्ता नियंत्रण को शामिल करता है—जिसमें कच्चे माल की सोर्सिंग, विनिर्माण प्रक्रियाएँ (निर्माण/ढलाई), प्रोडक्ट टॉलरेंस, वितरण से पूर्व अंतिम निरीक्षण, उठाना एवं संभालना, परिवहन और परिनिर्माण (लॉन्चिंग / स्थापना / जोड़ना) शामिल हैं। उचित कार्यान्वयन रीवर्क को कम करता है, जीवनचक्र लागत को कम करता है और निर्दिष्ट गुणवत्ता मानकों के अन्पालन की गारंटी देता है।

QAP covers the basic requirements of precast concrete plants, design, quality control of all stages of production including raw material sourcing, manufacturing processes (fabrication/casting), products tolerances, final inspection before delivery, lifting & handling, transportation and erection (launching /installation /jointing). Proper implementation minimizes rework, reduces lifecycle costs and guarantees compliance with specified quality standards.

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3. तदनुसार, सभी क्षेत्रीय अधिकारियों/परियोजना अधिकारियों द्वारा सख्ती से अनुपालन हेतु उपर्युक्त क्यूएपी की एक प्रति इसके साथ संलग्न है।

Accordingly, a copy of aforementioned QAP is Enclosed herewith for strict compliance by All ROs/PDs.

4. यह सक्षम प्राधिकारी के अनुमोदन से जारी किया जाता है।
This issues with the approval of Competent Authority.

संलग्नक: यथोपरी।

Encl.: As stated above.


30/03/2026

(सीएस. संजय कुमार पटेल/ CS. Sanjay Kumar Patel)
प्रभारी मुख्य महाप्रबंधक(समन्वय) (i/c) Chief General Manager (Coord.)

प्रति/ To:

भाराराप्रा मुख्यालय/आरओ/पीआईयू/सीएमयू/साइट कार्यालयों के सभी अधिकारी।
All Officers of NHAHQ/ ROs/ PIUs/ CMUs/ Site Offices.

प्रतिलिपि/ Copy to:

1. पुस्तकालय की साइट पर प्रकाशन के लिए पुस्तकालय को।
Library for hosting the Circular on Library site.
2. परिचालन के लिए वेब एडमिन को।
Web Admin for Circulation.
3. सचिव, सड़क परिवहन और राजमार्ग मंत्रालय के प्रधान निजी सचिव को सूचनार्थ।
PPS to Secretary, MoRTH for Kind Information.

2541635/2026/NTHD

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All Members

EFile No.:RW/NH-34049/01/2020-S&R(B) (Computer No.-182692)

Government of India

Ministry of Road Transport & Highways

(S&R (P&B/New Technology) Zone)

Transport Bhawan, 1, Parliament Street, New Delhi-110001

1970.13

Dated:18th March 2026CIRCULAR

To

1. The Chief Secretaries of all the State Governments/ UTs.
2. The Principal Secretaries/ Secretaries of all States/ UTs Public Works Department/ Road Construction Department/ Highways Department (dealing with National Highways and other centrally sponsored schemes).
3. The Chairman, National Highways Authority of India, G-5 & 6, Sector-10, Dwarka, New Delhi-110 075.
4. The Managing Director, NHIDCL, World Trade Centre, New Delhi-110029.
5. The Director General (Border Roads), Seema Sadak Bhawan, Ring Road, New Delhi-110 010.
6. All Engineers-in-Chief and Chief Engineers of Public Works Department of States/ UTs/ Road Construction Department/ Highways Departments (dealing with National Highways and other centrally sponsored schemes).
7. The Secretary General, Indian Roads Congress.
8. The Director, IAHE, Noida, UP.
9. All CE-ROs, ROs and ELOs of the Ministry.

Subject: Quality Assurance Plan (QAP) for Precast Concrete Products in National Highways (NHs) Projects- Reg.

Ref: i) Ministry circular No. EFile No.RW/NH-34049/01/2020-S&R (B) (Computer No.-182692) dated 24.06.2025

Madam/Sir,

Ministry had issued policy circular vide under reference regarding 'Mandatory Use of Precast Concrete Components in National Highways Projects'. In continuation of the same, Quality Assurance Plan (QAP) is enclosed herewith.

2. This QAP is intended to assure the quality precast concrete products. It covers basic requirements of precast concrete plants, design, quality control of all stages of production, including raw material sourcing, manufacturing processes(fabrication/casting), products tolerances, final inspection before delivery, lifting & handling, transportation, and erection (launching/installation/jointing). Proper implementation minimizes rework, reduces lifecycle costs, and guarantees compliance with specified quality standards.

3. It is requested that the contents of the circular may be brought into the notice of all concerned for needful compliance.

4. This issues with the approval of the Competent Authority.

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File No. RW/NH-34049/01/2020-S&R(B) (Computer No. 182692)

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Bidur Kant Jha.

1

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Page 1 / 2

2541635/2026/NTHD

Yours sincerely,
Bidur Kant Jha
18.03.2026
(Bidur Kant Jha)
Director
(New Technology for Highway development)
For DG (RD) & SS

Enclosure: (QAP) for Precast Concrete Products (13pages).

Copy to:

1. All CEs in the Ministry of Road Transport & Highways
2. All ROs of the Ministry of Road Transport & Highways
3. All CE(NH) of PWD/R&B dealing with National Highways
4. Technical circular file of S&R (P&B) Section
5. NIC for uploading on Ministry's website under "What's new" & "Comprehensive Compendium Circulars with CODE 1970.13.

Copy for kind information to:

1. PS to Hon'ble Minister (RT&H)
2. PS to Hon'ble MOS (RT&H)
3. Sr. PPS to Secretary (RT&H)
4. Sr. PPS to DG (RD) & SS
5. Sr. PPS/ PPS to Addl. Secretary (Road Safety)/ Addl. Secretary (RT&H & LA)
6. Sr. PPS/ PPS to AS&FA
7. Sr. PPS/ PPS to all ADGs/CEs
8. Sr. PPS/ PPS to JS (RT&MVL)/ JS (EIC) / JS (Logistics)/ JS (NHIDCL)

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Quality Assurance Plan(QAP) for Precast Concrete Products

1. INTRODUCTION

Precast concrete is widely used in modern infrastructure projects for its speed of construction, consistent quality and durability. Ministry of Road Transport & Highways (MoRT&H), recognizing the benefits of the precast technology has formulated and issued the "National Highway Pre-cast Concrete Policy" in April 2022. Policy, for the first time, made provisions for mandatory usage of precast concrete elements in national highway projects was introduced under certain conditions. A follow up Circular dated 24th June 2025 was issued to further strengthen the mandate for usage of precast concrete components in all National Highways/ centrally sponsored projects costing more than ₹300 crore in civil cost. The aforesaid circular provides for mandatory uses of precast concrete products such as Box Culverts of specified sizes, Storm Water Drain cum footpath, Chute drain with dissipation chamber, Boundary wall/Toe Wall/fence, RCC Crash Barrier/RS Wall Friction Slab-cum-Crash Barrier, Kerbs/Channels and Pedestrian Railing/Median Railing.

A robust Quality Assurance (QA) and Quality Control (QC) framework in precast concrete for manufacturers is essential to eventually reap benefits of precast technology which ensures structural safety, durability and performance, alongwith improving efficiency and client satisfaction. A quality assurance plan (QAP) is a systematic program for monitoring and maintaining the quality of concrete components throughout the entire

production process to ensure that all products meet project specifications, design standards and safety requirements. This QAP is intended to assure the quality precast concrete products. It covers basic requirements of precast concrete plants, design, quality control of all stages of production, including raw material sourcing, manufacturing processes (fabrication/casting), products tolerances, final inspection before delivery, lifting & handling, transportation, and erection (launching/installation/jointing). Proper implementation minimizes rework, reduces lifecycle costs, and guarantees compliance with specified quality standards.

2. STANDARDS & SPECIFICATIONS

Design, fabrication/casting and launching/installation of pre-cast concrete components will be done as per relevant IRC/BIS standards/guidelines/codes such as IRC: 112/IRC: 122/IS: 456/IS: 15916 taking further into consideration of expected handling/lifting stresses, etc. Any international guidelines such as AASHTO, FHWA (Accelerated Bridge Construction Guidelines), Japan codes, American Precast Concrete Institute (PCI), World Roads Congress, Euro/British/French/Swiss/German, etc., may be followed in case of any gaps in IRC/BIS standards/ guidelines/codes till such time IRC/BIS guidelines are developed.

3. DESIGN & WORKING/SHOP DRAWINGS

Standard drawings of the precast concrete products should be included in Annex-I of Schedule-B/C as applicable. Concessionaire or Contractor shall prepare detailed working/shop drawings and submit for its

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approval. The primary function of precast concrete shop (erection and production) drawings is the translation of contract documents into usable information for accurate and efficient manufacturing, handling, and erection of the units. Production drawings shall be prepared to convey all pertinent information necessary for fabrication and inspection of the precast concrete products. Design & Drawings of the proposed pre-cast concrete components shall be checked & approved by the Authority Engineer (AE) / Independent Engineer (IE) of the Project. The precast concrete units shall be produced in accordance with the approved drawings. The drawings shall also clearly indicate location of handling arrangements for lifting and handling the prefabricated elements, sequence of erection with critical check points and measures to avoid stability failure during construction stage.

4. PRECAST CONCRETE PLANTS

Concessionaire/Contractor shall either establish their project specific precast concrete plants or procure from precast concrete manufacturing plants. The Concessniare/Contractor shall submit a proposal for approval of the precast concrete plants to Authority Engineer/Independent Engineer. The plant inspection shall be conducted by a team comprising representatives from IE/AE and Project Director(PD)/Regional Office (RO). Following the inspection, the PD/RO will grant the approval after duly satisfied with the following:

4.1 Zoned Areas

An ideal precast plant requires a robust, well-organized setup with dedicated areas for each stage of production to ensure quality, efficiency, and safety. The facility must be built around a linear production flow, from material storage to the finished

product yard, with heavy-duty material handling equipment and strict quality control measures throughout. The layout must create a logical flow of production, with distinct, well-defined zones to prevent cross-contamination and facilitate movement. Key areas include:

- **Material storage:** Separate storage areas are needed for cement (in silos), fine and coarse aggregates (on paved, clean ground), and steel reinforcement bars.
- **Batching and mixing plant:** A fully automatic batching plant near the production facility ensures consistent concrete quality and reduces transport time.
- **Reinforcement yard:** A covered area for curing, bending, and assembling reinforcement cages keeps steel dry and organized.
- **Casting yard:** A large, level area with dedicated casting beds where products are formed.
- **Curing facility:** This can be an open area for water curing or an enclosed, insulated chamber for steam curing.
- **Finished product yard:** A stacking yard with a hard, level surface for storing finished products on support blocks.

4.2 Facilities and Equipment

The precast plant must be of modern standards with adequate capacity to supply large infrastructure projects. The plant facility shall be adequate for production, finish processing, handling, and storage of product. The precast concrete manufacturing plants should have the following facilities & equipment:

- **Batching Plant:** Fully automatic RMC plant for precise, high-volume production of concrete duly certified by BIS/QCI/ RCMA (Ready

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Mixed Concrete Manufacturers Association) is to be erected. The number and capacity of the batching plant commensurate with the requirement. Batching systems must conform to IS:4925 standards for accuracy.

- **Concrete Mixing, Handling and Transportation:** Plant should have availability of transit mixers, concrete distribution systems, or skip hoists for delivering concrete into moulds. Transit mixers or other transport wagons should be used to move the concrete mix from the plant to the casting beds.
- **Bar bending, cutting Machines, Rebar fabrication and cage assembly area:** Plant should have CNC (Computer Numerical Control) machines to automate the cutting and bending of steel reinforcement, ensuring precision and to produce reinforcement as per design for the precast units.
- **Water Treatment Plant / RO plant for water purification:** If the water has TDS more than 200, purified mixing water should be used.
- **Moulds Infrastructure:** Plant should have sufficient quantity of steel moulds/formworks to meet high-volume casting requirements for continuous production, aligns with project needs. Steel Moulds should be duly designed & inspected for Product Tolerances prescribed as per methodology approved in BIS 15916.
- **Curing Facilities:** Plant should have an accelerated steam curing facility for controlled application of low-pressure steam to achieve early strength gain. An alternative curing regimes (curing compounds, water

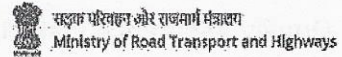
curing infrastructure such as sprinkling systems to keep precast products wet, etc.) should be available as a backup to ensure quality through timely curing. The curing of the precast products can be effected by the normal methods of curing by sprinkling water and keeping the elements moist.

- **Casting:** Plant should have high-strength, durable universal casting beds. These beds can be of required dimensions/suitable size on compacted soil and pedestal beds of sufficient numbers with requisite properly designed foundations. Steel-fabricated forms with sufficient thickness and bracing to withstand the forces of concrete placement and vibration should be used. Both needle and form vibrators should be used to ensure proper compaction and prevent honeycombing in the concrete.
- **Mechanical handling equipment for lifting and transporting of precast concrete products:** The production facilities shall include adequate product handling equipment that is maintained in good working condition. Handling equipment shall be capable of stripping, moving, stacking, retrieving, and loading units without damaging the products.

-**Overhead(OH) cranes:** Plant should have overhead cranes. A series of heavy-duty double-girder overhead traveling (EOT) or gantry cranes are needed to lift and move heavy products and moulds within the factory and loading areas.

-**Gantry cranes:** Plant should have gantry cranes to be used for lifting and loading materials and finished

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products, especially in the storage yard.

-Specialized lifting equipment: Plant should have specialised lifting equipment including lifting hooks and beams designed for the specific products.

-Transport wagons: If needed, transport wagons should be used for transporting finished products to the storage yard.

-Backup provisions with Fork lifts, Hydra crane etc for material movement.

- **Stacking Yard:** Plant should have covered sheds for raw material storages and covered sheds for production bays and covered stacking yard to stores finished products. There should be concrete flooring for material storages, production and casting floors.
- **Power backup and others:** The plant should have reliable power supply (and backup generators if needed) to ensure uninterrupted production, and facilities for environmental control (dust suppression, noise control) in line with ISO 14001 commitments. Plant should have Weigh bridge of suitable capacity, CCTV systems for monitoring operations and Vehicle tyre cleaning systems. For high Grade (> 60 MPa), Ice Flake manufacturing unit of suitable capacity should also be established.

4.3 MANDATORY CERTIFICATIONS

Precast factory shall have following valid certifications granted by BIS/QCI/other approved CBs:

- ISO 9001:2015 Quality Management System

- ISO 14001:2015 Environmental Management System
- ISO 45001:2018 Occupational Health & Safety Management System

Precast Concrete Factory shall have also valid products certification along with license for ISI label marking on the precast concrete components by BIS. This is applicable only for the products for which BIS does the certification. For products where BIS certification is available, the factory should possess the license to mark those precast products with the ISI mark.

4.4 MANPOWER

Plant/factory should have qualified and trained team consisting of

- **Management and administration team:**
 - Factory manager.
 - Project managers/coordinators
 - Sales and marketing team
 - HR and training
- **Technical and design team:**
 - Structural engineers:
 - Planning engineer
 - Design and detailing managers.
 - Detailers/drafters
 - Checkers
- **Production and quality control team:**
 - Production managers
 - Supervisors/foremen
 - Machine operators
 - Electricians, mechanics, and welders
 - Quality assurance/control (QA/QC) engineers
 - Finishing workers
- **Logistics and yard operations team:**

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 Ministry of Road Transport and Highways

Logistics/dispatch supervisors

Riggers and crane operators

Inventory and warehouse staff

4.5 QUALITY CONTROL LABORATORY

Precast factory shall have well-equipped laboratory at factory itself for internal quality control. A fully equipped quality control (QC) lab is mandatory for testing raw materials (cement, aggregates), in-process concrete (slump tests), and final products (cube tests for compressive strength). Laboratory shall have ISO: 17025 "General requirements for the competence of testing and calibration laboratories" certification granted by NABL or other approved certification bodies (CBs). Each equipment shall have valid calibration certificate. The laboratory shall be manned by a Quality Manager with min 10 yrs of experience, Inspectors of Concrete, REbars, Formwork & Safety with min 3 years' experience.

4.6 THIRD PARTY QA&QC

Precast Concrete Factory shall employ a third-party PMC for QA&QC for the supervision of daily activities/testing conducted at the factory. All the tests shall be witnessed by the personnel of the PMC & recorded using digitalisation of QC Process. Pre-cast Concrete Plant shall employ a third-party testing laboratory for calibration at the pre-cast concrete facility. In addition to it, AE/IE shall do surprise checks & audit the plant & its process as and when required by Authority.

4.7 DESIGN AND ENGINEERING CAPABILITY

Precast construction requires robust design support to customize component dimensions, check structural adequacy, and detail connections. The manufacturer

must have an in-house design/engineering team with qualified structural engineers to design precast elements and verify their conformity to relevant codes. The team should be capable of producing detailed shop drawings and calculation reports for each product type. At the least, there should be one senior structural engineer (with say 8-10 years' experience) leading the design unit, supported by other engineers/draftsmen proficient in precast design.

4.8 WORKER SAFETY

The factory must implement strict safety protocols for crane operation, electrical equipment, and general material handling. This includes routine inspections, personal protective equipment (PPE) for all workers, and training on safe work procedures. Features like anti-sway devices and movement sensors on cranes, barricades for crane swing radius, and clear signage throughout the facility minimize risks.

4.9 COMPLIANCE AND CERTIFICATIONS

- **Permits and licensing:** Secure all necessary regulatory approvals, including local factory licensing and environmental clearance. Consent to establish, Consent to operate, Periodic air & noise monitoring, permits as per applicable labour laws.
- **Industry certification:** Obtain and maintain a plant certification from an organization like BIS, which requires adherence to specific quality manuals.
- **Personnel training:** Establish a training program for staff to ensure they are proficient in standard operating procedures for production and quality control.

5. QUALITY CONTROL
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QC is the practical application of inspection and testing to verify that the precast concrete products meet the required quality standards before delivery and installation. The factory shall carry out Quality Control Tests on the Materials, Processes and Works to the frequency stipulated in Project's Specification with digitalisation of QC Process. All the tests prescribed in MORTH Specifications for Road & Bridge Works shall be conducted at various stages and frequencies stipulated therein, during the construction stage. Besides additional tests shall be conducted for factory manufactured materials, products and specialized items as per Section 5 of IRC:SP:112. Requirement and procedure of testing during different stages of construction are given below:

5.1 Key QC Measures

• Pre-Production Checks

- **Mould inspection:** Cleanliness, dimensional accuracy, alignment, and release agents.
- **Reinforcement inspection:** Placement, cover blocks and binding.

• Concrete Production Stage QC

- Workability test (Slump, Flow table, Vebe time).

Concrete temperature and ambient conditions monitoring.

- Proper vibration and compaction to eliminate honeycombing.

• Curing & Strength Monitoring

- **Controlled curing** (steam/accelerated/natural) as per design.
- **Instrumentation:** Temperature probes for monitoring concrete curing, and other sensors to ensure quality standards.

- Cube compressive strength tests at 7 and 28 days.
- Non-destructive testing (NDT) like rebound hammer and ultrasonic pulse velocity, if required.

• Dimensional & Surface Finish Checks

- Measurement of precast element dimensions with tolerances.
- Inspection of surface finish, cracks, air voids, and defects.

• Final Inspection & Certification

- Load testing (if specified).
- Marking and labelling for traceability.
- Issuance of QC release certificates prior to dispatch.

• Transportation & Erection Quality Control

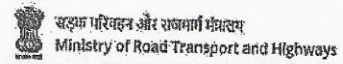
- Proper handling, lifting hooks, and transport supports to prevent cracks/damage.
- On-site inspection of received precast elements.
- Alignment, joint grouting, and connection inspection during erection.

• Documentation & Records

- QA/QC plans and checklists.
- Test reports (material, fresh concrete, hardened concrete).
- Non-conformance reports (NCRs) and corrective actions.
- Final Quality Dossier submission to client/consultant.

The supplier/manufacturer shall furnish its quality management plan and accurate reports of its in house testing and third party laboratory test reports to the purchaser (employer/authority/contractor). AE/IE shall

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review and approve the quality management plan.

5.2 Laboratories Facilities

- **General:** The plant shall maintain an adequately equipped laboratory or retain the services of a testing agency in which investigation and development of suitable concrete mixes may be conducted, and ongoing quality control testing may be performed. The laboratory facilities shall be in a protected area with environmental controls to ensure proper working conditions. Laboratory equipment shall be maintained in proper condition and calibrated as needed, but not less than annually. Calibration records shall be kept on file.
- **Quality Control Testing Equipment:** The plant shall have all equipment required for performing the testing procedures. Equipment shall meet the requirements of the test procedure specification.
- **Test Equipment Operating Instructions:** Operating instructions shall be obtained for all testing equipment as well as national and industry standards, for materials and testing. These instructions shall be kept in the laboratory and shall be carefully followed by all testing personnel. Compression testing machines shall be kept clean, and no attempt shall be made to use the machines beyond the rated capacity. Machines shall be capable of applying loads at the specified rate. Testing machines shall be calibrated so that the maximum error is not more than $\pm 1\%$ of full scale reading or $\pm 2\%$ of

the maximum expected test load, whichever is less. Calibration shall be performed when there is reason to question the accuracy of indicated loads, or at least annually. Calibration curves shall be available at all times and used by testing personnel.

5.3 Equipment Calibration Records

- Records for calibration of equipment shall be maintained so that the equipment operator has ready access to the records. Current and legible calibration stickers shall be attached to and prominently displayed on all equipment requiring calibration. All of the following equipment shall be calibrated a minimum of once per year unless otherwise specified. Current calibration reports shall be dated not more than one year at the end of the month from the date of the last calibration or certification.
 - batch plant scales
 - Water meters
 - Admixture batching equipment
 - Concrete compression test machines
 - Portable scales
 - Slump Cone
 - Density (Unit weight) bucket
 - Rebound hammer (if used)
 - Thermometers, temperature recorders and clocks
 - Three-edge bearing test machines
 - Pipe and manhole measuring devices (i.e., go-no-go gages)
 - Vacuum and hydrostatic testing equipment
 - SCC testing equipment (if used)



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- Any other testing equipment used in the acceptance of product

Calibration of the air meter shall be intervals not to exceed three months, as per ASTM C231. Calibration of batching scales, compression testing machines and three-edge bearing testing machines shall be performed by an independent, third-party calibration company. Unless otherwise specified, all other calibrations shall be performed inhouse, by the supplier, or by an independent, third-party calibration company.

6. INSPECTION

Pre-pour and post-pour inspections to be performed in precast concrete plants shall include, but not necessarily be limited to, the following:

- All required plant testing and inspection of materials and embeds for acceptance prior to initial concrete placement and daily check testing for quality maintenance.
- Mix design for all concrete and required ingredients for concrete testing.
- Inspection of forms and new setup changes prior to placement of concrete. The plant shall prepare its own list of items to be checked as part of the pre-pour inspection, and emphasis shall be on items that cannot readily be checked after concrete placement.
- Checking of blockout position, cast-in items, position and amount of reinforcement, and any other critical tolerance items. This also includes verifying these items are properly secured during placement of concrete.
- Check forms and appurtenances for adequate maintenance by verification of tightness, dimensions, and overall general quality.
- Daily detailed inspection of batching, mixing, conveying, placing, compacting, curing, and finishing of concrete.
- Daily inspection of stripping product from the forms.
- General observation of plant, equipment, weather, and other items affecting production.
- Preparation of concrete specimens for testing and performing slump, air content, compressive strength, and other concrete tests.
- Inspection of finish to ensure that the product matches the standard established by the plant and client. Finish defects, cracking, and other problems shall be reported and a decision made as to acceptance, repairs, or required manufacturing changes. Products that are damaged are to be recorded, marked, and reinspected after being repaired.
- Check finished product against approved shop drawings and plant standards to ensure that proper finishes are on all required areas, product dimensions are correct, cast-in items are correctly located, product is properly identified and marked, and all measurements are within allowable tolerances.
- Check initial camber on at least 25% of each day's production within 72 hours after transfer of prestress force.
- General observations of storage area for proper blocking, methods for prevention of chipping, warping, cracking, contamination, and blocking stains, or any other items that may adversely affect the quality of the product.
- Final inspection of product during loading for proper blocking and observation of problems such as chips, cracks, warpage, or other defects.

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- Inspection of products following any repair.
- Disposition of nonconforming products.

7. FINISHED PRODUCT DIMENSIONAL TOLERANCES

Product tolerances are necessary in any manufacturing process. Dimensional tolerances of the precast units as received on site should comply with those specified in the contract documents. The surface finishes of precast units when received on site should be checked for compliance with the requirements of the contract documents. Changes to the dimensions and shapes of units should be identified and assessed with regard to the overall tolerance and surface finish. The tolerances on the shapes, lines and dimensions of factory precast concrete products shown in the drawing shall be within the limits given below:

- Deviation from specified dimensions of cross-section (width & depth i.e. thickness) - $\pm 2\text{mm}$
- Deviation from specified dimensions of Length of segment- $\pm 5\text{mm}$
- Deviation from specified spacing of reinforcement - $\pm 10\text{mm}$
- Deviation from specified nominal cover- $+10\text{mm}$ and -0mm .

The above applicable product tolerances shall be clearly conveyed to production and quality control personnel.

8. PRODUCT IDENTIFICATION & TRACEABILITY

Precast concrete units shall be clearly marked with a unique identification as shown on the shop drawings. Identification shall be sufficient to distinguish the date of casting and trace the precast unit to associated quality control records. Each

precast component dispatched should carry an identifying mark or QR/barcode for traceability. On each of the precast concrete components bar code/QR code should also be engraved for traceability of lot, other QA&QC tests, etc.

9. RECORDKEEPING

In order to establish evidence of proper manufacture and conformance with plant standards and project specifications, a system of recordkeeping shall be used that will provide full information regarding testing of materials, mix designs, production tests, and any other information specified for each project. Records shall be designed to allow minimum effort to compile. Include the date of manufacture in the product marking in order to facilitate the tracking of product and raw materials. Each precast concrete unit shall be marked on the backside or edges of the unit with the date produced and a unique identification number that can be referenced to production, erection drawings, and testing records. Unless otherwise noted herein, recordkeeping shall be the responsibility of the quality control inspection personnel. In the absence of project specification requirements or state statute, records shall be kept for a minimum of 5 years after final acceptance of the structure, or for the period of product warranty provided by the manufacturer, whichever is longer.

10. LIFTING & HANDLING EQUIPMENT

Lifting inserts used shall have minimum capacity of four times the maximum load applied or transmitted to them. Lifting hardware such as slings, lift bars, chains, hooks etc. shall have minimum capacity of five times the maximum load applied or transmitted to the lifting hardware. Handling equipment such as hoists, overhead cranes, gantries, mobile cranes,



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and fork lift trucks shall be used to lift and handle products which weigh less than the rated capacity of the equipment. Inspection and maintenance records for all handling equipment must be maintained in accordance with applicable requirements.

A record of full load test on the finished product alongwith deflection shall be maintained and available for inspection to AE/IE and the client.

All records pertaining to production/manufacturing of concrete, QA and QC, load testing, etc. shall be preserved and available for inspection to AE/IE and the client.

11. TRANSPORTATION

Precast concrete units shall be shipped when it achieved 28.0 MPa or 80.0% of the specified compressive strength, whichever is higher. Proper devices should be used to support, secure and wedge the precast units and its edges throughout their journey . The units should be adequately secured and supported to prevent them from overturning, shifting or being damaged during transportation. Adequate non staining cushioning should be provided between the unit and any securing chains, cables or ropes to prevent localised damage. Precautions should also be taken to ensure that no undesirable stresses will be transmitted to the precast unit due to any flexing of truck or trailer. Transportation of Precast Elements should be done by flat bed Trailor (Double / Triple axle 40ft Length with proper accessories like A frame etc) from factory.

12. MANUFACTURER'S/SUPPLIER'S TEST REPORT

Manufacturers/Suppliers Test Certificate for each lot of the products shall be provided by Precast Concrete factory, which shall be submitted by the Contractor

along with bills. Manufacturers must issue a Test Certificate for each lot of products, to be submitted by the contractor with billing. Certified test reports for materials not tested in-house shall be required of suppliers. These reports shall show the results of suppliers' mill or plant tests, tests by an independent testing laboratory, petrographic analysis of aggregates for concrete mixes, and other testing required by the project specifications. These reports shall state compliance with applicable specifications.

These records shall be kept for the same period of time as the other project records.

• Concrete Records:

Records of concrete operations and tests shall be kept so the following data will be available:

- Unit and job identification
- Production date
- Mix proportions by weight
- Mixing water corrections and/or aggregate corrections due to surface moisture
- Yardage, design and actual yield or unit weight
- Identification of production area, form, or bed
- Test specimen identification
- Concrete temperature
- Air temperature, weather conditions, if applicable, and any measures taken for cold or hot weather concreting
- Slump
- Air content
- Unit weight (fresh)
- Inspection of batching, mixing, conveying, placement, consolidation, and finishing of concrete

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- Method and duration of curing, e.g., temperature charts for accelerated curing
- Strength at stress release or stripping
- 28-day strength
- Absorption for concrete exposed to weathering
- Cylinder strength tests and air-dry unit weight for lightweight concrete
- Fresh unit weight for lightweight concrete
 - Inspection reports

Also the precast concrete manufacturers should submit the product surveillance form as given in Annex-II.

13. ERECTION AT SITE

Only those skilled foremen, trained workers and fitters who have been properly instructed about the safety precautions to be taken should be employed on the job. The loading, unloading & stacking at site should be done with the help of required capacity cranes. The gross weight of the precast product segment as well as rated capacity of the handling & lifting equipment should also be written.

14. SEALING OF JOINTS

Proper joint sealing are crucial to the performance of installed precast concrete products when infiltration or exfiltration are a factor in the project. Details of connecting joints of precast concrete products shall be given to an enlarged scale. As a proof of design, the plant shall maintain documentation on file showing that when assembled; the joint gap between any two segments is not greater than $\frac{3}{4}$ inch (19 mm) in any one location. The spigot of the segment is slipped inside the socket of the previously laid segment and adjusted in the correct position while erection. Joints shall be sealed with non-shrink flowable high strength cement

mortar mixture of stiff consistency, which shall be rammed with a caulking tool. The excess cement mortar shall be removed, and the joint shall be cured.

Joining of Two precast Box Culvert / U Shape Drain i) Non-shrink cementitious grout material such as Sikadur31N, Ultratech power grout NS 1 & 2 or similar shall be used to join two precast element at the groove. It ensures monolithic bonding, high compressive strength, and dimensional stability under dynamic and static loads. ii) It ensures tight joints without cracks, shrinkage, or voids between precast units. iii) Rubber gasket is a flexible sealing element to ensure watertight joints between two precast box culvert segments. This gasket shall be placed in the groove provided in the element during manufacturing. To prevent infiltration/exfiltration of water and soil through the joint. iv) The gasket is formulated to meet long-term performance requirements under dynamic and static loads. v) Each precast box culvert segment is cast with embedded steel flange plates along the four corners. During installation, high tensile bolts are used to connect the flange plates of adjoining units, forming a rigid, secure, and accurately aligned joint.

15. PROTECTION OF ERECTED PRECAST PRODUCTS

Construction machinery shall not be permitted on the top of the segment unless requisite earth cushion is proved and loads are considered in the designs.

16. RESPONSIBILITY OF CONCESSIONAIRE/CONTRACTOR

The concessionaire/contractor will remain responsible for the ultimate quality of an item produced using factory manufactured material or a finished item itself. The contractor shall therefore, exercise its



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checks pursuant to its own QAP for such materials.

17. REFERENCES

- Manual for Quality Control for Plants and Production of Structural Precast Concrete Products, Fourth Edition, MNL-116-99, Precast/Prestressed Concrete Institute PCI, USA
- SoP for Checks & Control on Quality of Factory Manufactured material/products being used in NHAI Projects, NHAI Policy Circular No 10.2.43 dated 20th February 2025
- NPCA Quality Control Manual for Precast Concrete Plants, 18th Edition, February 1, 2025, USA
- IRC:122 “Guidelines for Construction of Precast Concrete Segmental Box Culverts”
- IS 15916 : 2020 “Building Design and Erection Using Prefabricated Concrete – Code of Practice” (First Revision)
- IRC:SP:112-2017 “Manual for Quality Control in Road & Bridges Works”

Annex-II

Surveillance Proforma

PRODUCTS QUALITY SURVEILLANCE FORM

NAME OF PRODUCT:

Name and location of the Project:

Contractor

Contract to

Manufacturer/supplier/
Source

Purchase order

Inspecting Agency

Inspection
certificate

Delivery challan

Distinguishing mark

Date of manufacture
/supply

Drawing Nos.

Tender specification clause

Shipping storage and other Remarks

| Sl. no | Test | Method of test | Acceptance range | Obtained value | Remarks |
|--------|------|----------------|------------------|----------------|---------|
| | | | | | |

Inspected by:
(For QA Engineer)

Name:

Signed:

Date:

In presence of:
(For Contractor)

Name:

Signed:

Date:

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