

## Quality Assurance Plan for Roads – CLEAN DRAFT 3 (8 JUL 14)

**Project Title:** Bangladesh Agricultural Infrastructure Development Program

### 1. Project Background:

The Bangladesh Government has entered into an agreement with the US Government to support Bangladesh for its future food security initiative. The goal of the Feed the Future (FTF) program is “to sustainably reduce poverty and hunger” which aligns well with both USAID/ Bangladesh’s goals for Bangladesh to “Become a knowledge based healthy, food secure and climate resilience middle income democracy “and to achieve the GOB’s goal of the Sixth Five-Year Plan and the vision “ to become a middle income country by 2021”

The Bangladesh Agricultural Infrastructure Development Program (BAIDP) is a three & half-year project financed by USAID to address the rural agricultural infrastructure need within targeted districts in Bangladesh. The project is now being implemented by Local Government Engineering Department (LGED) under Local Government Division. The total project cost is BDT 1426.00 million. The Ag-infra project has the following objectives:

- Improvement of vertical infrastructure Like markets and collections
- Improvement horizontal infrastructure like roads, irrigation and drainage systems.

### 2. Quality Assurance Program

The BAIDP Quality Assurance Program is a key part of the US and Bangladesh Government Agreement. All aspects of the BAIDP program are being implemented by LGED and their staff using well established tender processes. LGED will contract with a local construction contractor who will implement the work. LGED will utilize their staff to monitor quality, safety and environmental aspects of the work. LGED has the organizational structure in place to execute construction work in the various Districts and Upazilas throughout Bangladesh.

In the case of the BAIDP effort, all work must be certified by US Government personnel. USAID has reached an agreement with the US Army Corps of Engineers (USACE) to provide this certification. This adds a new layer of monitoring and communication that requires careful planning prior to field implementation. Furthermore, USACE will utilize a local Quality Assurance (QA) Contractor to augment the certification process, leading to another line of communication.

All construction work under the program is divided into construction Milestones that must be certified against multiple requirements prior to payment. Because LGED will have contractual arrangements with local contractors that require payment, any miscommunication in the required quality process will have significant impact.

This Quality Assurance Plan for Roads has been prepared to define the process for implementing quality under the BAIDP program. Figure 1, BAIDP Quality Program Process and Interfaces, provides a summary of the process.

### 3. Project Implementation Arrangement:

The project will be implemented by LGED establishing a Project Management Office (PMO) headed by one Project Director (PD) at the headquarters level. The PD is a Senior LGED official with a Civil Engineering background. At the headquarters level, he will be supported by one Executive Engineer, two Assistant Engineers, one Sub-Assistant Engineer and other supporting staffs at PMO. At the field level, he will be supported by District Executive Engineers, Senior/Assistant Engineers, Upazila Engineers, Sub-Assistant Engineers and other technical and accountant staffs. The District Executive Engineers, Upazila Engineers and Assistant Engineers have a civil engineering background. All Sub-Assistant Engineers are Diploma in Civil Engineer and other technical staffs are trained to supervise the construction works. In addition to LGED's organization, USAID has acquired support from the US Army Corps of Engineers (USACE), Alaska District, to assist with project management, scoping, design review, environmental review and site quality assurance inspections. USACE will procure support from a local Quality Assurance (QA) Contractor to augment site monitoring of the various projects during the construction phase. Key personnel supporting USACE are the USACE PM, USACE QA Personnel and the QA Contractor. The organizational Setup for Project Implementation is shown in Figure 2 and is discussed below:

### **3.1 The Role of Project Director:**

The Project Director (PD) is the head of Project Management office (PMO) to look after day to day activities of the project. He is responsible for monitoring the works and providing guidance and necessary instruction to District Executive Engineers, Upazila Engineers and contractors to implement the project in accordance with specifications and design. The PD has the overall responsibility to ensure compliance with the QA Plan, EMMP, EM, and the other applicable program documents.

At least 6 days in a month the PD will go field to monitor contracts. He will undertake periodic interim visits to project sites in order to provide necessary direction for smooth implementation of the project.

The PD will monitor construction work and advise the District Executive Engineer regarding adherence to specification and the Quality Assurance Plan. The PD is responsible for claim reimbursement to USAID and transfer funds to the concerned Executive Engineers for paying to contractors. He will prepare monthly progress monitoring report both physical and financial status and will maintain all expenditures records of the project and face audit

### **3.2 The Role of District Executive Engineer (also known as the Procuring Entity):**

The District Executive Engineer is at the District Level and is also the Procuring Entity (PE). He invites tender and signs contracts. The District Executive Engineer is responsible for implementation of the projects to include assigning works to the officials and staffs under his jurisdiction, supervising construction and assure adherence to quality requirements. He will provide technical guidance to Upazila Engineers and other engineers and staff in connection with the implementation process. He will prepare physical and financial progress and send them to the PD. The District Executive Engineer is also responsible for making payment to contractors against bills certified by Upazila Engineers and the USACE QA Contractor. He will also certify achievement of milestones of different schemes in conformity with the technical specification and prepare reimbursement claims for claiming fund from USAID. He will maintain all payment records and face audit.

According to LGED charter of duties all Sub-Assistant Engineers working in the Upazila report to the Upazila Engineer about activities of construction works. Then Upazila Engineer reports to the District Executive Engineer and Executive Engineer reports to regional Superintending Engineers, Project Director and Chief Engineers. The Project Director is responsible for reporting to Chief Engineers and others regarding all project related activities.

The PE will inspect the site at least two times in a month to monitor construction, quality, safety and environmental aspects. The PE will inspect after completion of each milestone and will provide necessary direction for proceeding with the next works.

The Executive Engineer will work for management of construction following the general and particular conditions of the contracts (GCC). The GCC is the main tool for implementing of construction sub-projects such as time, cost and quality control. He has the authority to stop the works for wrong doings and will be responsible to approve start of work after necessary correction.

The District Executive Engineer will provide the USACE PM with a list of Upazila Engineers and the Associated Sub-Assistant Engineers assigned to each project within 14 calendar days of contract award. This list is necessary to promote effective communication and planning between all parties responsible for monitoring construction quality. The list will include name, role, phone number and email address.

### **3.3 The Role of Upazila Engineer (also known as the Project Manager):**

The Upazila Engineer or Project Manager is the key person who is directly in control of monitoring the quality of the works by himself or through the Sub-Assistant Engineer and other technical staff. Under BAIDP he will work as the Project Manager (PM) of each sub-project and will be designated as the PM throughout this QA Plan. He is the technical representative of the PE and will deliver his duties in accordance with GCC and LGED charter of duties. He will visit the site at least once per week. He will deploy one Sub-Assistant Engineer and the necessary technical staff (work assistant) for supervising the sites.

Prior to commencing work, the contractor will provide a Work Breakdown Structure (WBS) and a schedule for conducting the work. These two items constitute the Work Plan for the project. The PM will issue approval letter of Work Plan with prior concurrence of PE.

The PM will review Weekly Reports submitted by the Sub-Assistant Engineer and will sign the report after approval. The Weekly Report Outline is included as Example 1 in Attachment A. The PM will prepare a Monthly Progress Report for submittal to the PE and PD. An example of the Monthly Report is included as Example 2 in **Attachment A**.

Prior to starting the project, the PM will conduct a Project Kickoff Meeting. This meeting will be attended by key project staff to include the SAE, technical staff, the critical contractor staff, and the Quality Assurance Engineer. Additionally, prior to starting a new Definable Feature of Work, the PM will conduct a Preparatory Phase meeting with the Sub-Assistant Engineer, key contractor staff and other technical staff responsible for monitoring work. The USACE QA Contractor will be notified of preparatory meetings three days in advance to allow sufficient time to attend. The Kickoff Meeting may also be held in conjunction with the First Definable Feature of Work. Definable Features of Work

are discussed in Section 4.0 of this plan. The PM will prepare an agenda for the meeting and will discuss key aspects of the work to include work processes, inspections, reporting, materials and planned samples, safety, environmental requirements, and schedule. The Sub Assistant Engineer's Quality Control Checklist will be reviewed as part of each Preparatory Phase Meeting. Preparatory Phase Meetings will be documented in meeting minutes showing all attendees. Examples of Preparatory Phase Meeting Agendas and Meeting Minutes Outlines are included in **Attachment A**.

The PM will coordinate material testing with the District Executive Engineer. The District Executive Engineer will send the test results to the PM. The PM will be responsible for maintaining records of test approval at the Upazila Office for inspection.

The PM will immediately notify the USACE QA Contractor and USACE PM in the event of design changes.

The PM has the authority to stop all work or any portion thereof affected by the contractor's failure to comply with the contract requirement but he shall inform the PE about action taken. He will certify the milestones and the contractor bill and forward to the PE for payment. The PM will notify the PE of any potential contract variations, time extensions, safety concerns or activities that may be in violation of environmental issues for action.

The USACE QA Contractor will notify the PM prior to inspections, site visits or milestone certifications. The PM will inspect after completion of each milestone and will provide necessary direction for proceeding to the next layer of works if completed works meets specification supported by test results. The PM will coordinate with the SAE to ensure full cooperation from the SAE during site inspections and certification of milestones. The USACE PM will coordinate issues identified during QA Contractor or independent USACE QA inspections with the PE and the PM.

### **3.4 The Role of Sub-Assistant Engineer (SAE):**

The Sub-Assistant Engineer (SAE) is the lawful representatives of the PM. He is responsible for supervising the construction works regularly for a particular project. They are responsible for providing lay out of structures, setting out the road alignment as per the design and monitoring quality of works as per specification under the guidance of the PM. The SAE will complete all necessary forms associated with site quality to include Form R-1: Site Layout Form, Form R-2: Road Alignment Form, Form R-3: Quality Control Checklist and Form R-4: Daily Inspection Reports. He will maintain the Contract Inspection Book. He will fill up the format of EMMP for pre-construction and during construction period. He will collect samples (materials) in the presence of the Contractor and other representatives for necessary tests. He will verify the contractor's bills, certify them and submit to the PM. He will provide necessary instruction to clean the site and maintain compliance with the environmental requirements.

The Sub-Assistant Engineer will prepare and maintain daily inspection forms and will submit weekly inspection reports to the PM. Daily inspection and weekly report formats are included in **Attachment A**. The Sub-Assistant Engineer has no right to terminate or stop work without permission of PE or PM but can give direction for rectification of any unspecified works.

In conjunction with the PM, the SAE will be responsible for coordinating activities with the USACE QA Contractor. The SAE will support the PM and the QA Contractor during site inspections and certification of milestones.

### **3.5 Role of the USACE Project Manager (USACE PM):**

USACE has entered into an agreement with USAID to provide project management, engineering and quality assurance support. The USACE PM is responsible for scope, schedule and budget under this agreement.

In relation to construction quality assurance support, the USACE PM is responsible for monitoring LGED's adherence to overall quality, safety and environmental requirements as detailed in the associated standard designs, site specific designs, EMMP, and EM. The USACE PM is responsible for coordinating other USACE resources such as environmental, design engineering, contracting and site inspection support. The USACE PM will communicate frequently with the PD, PM and the QA Contractor on all aspects of the project. The USACE PM has the authority to request work stoppage from the PM. The USACE PM may inspect sites as needed but will coordinate site visits with the PM. The USACE PM may review all documentation as needed to confirm compliance with the requirements. The USACE PM is the Contracting Officers Representative for the QA Contract and has the authority to direct the QA Contractor within the terms of the contract.

### **3.6 Role of the USACE Quality Assurance (USACE QA) Staff:**

Various USACE QA personnel will support site inspection efforts. USACE QA personnel are employed directly by the US Government and are not contract personnel. At a minimum, USACE QA personnel will conduct quarterly visits to projects sites to confirm compliance against site-specific designs, quality plans, QA Contractor work, environmental and safety requirements. The USACE QA will report through the USACE PM but has authority to request work stoppage directly to the PM. If the USACE QA request work stoppage, they will immediately report this to the USACE PM.

### **3.7 Role of the USACE Quality Assurance Contractor (QA Contractor)**

During construction the QA Contractor shall conduct periodic site visits and monitor the LGED QA process to verify that it follows the LGED QA Plan and provides adequate documentation for reviewing and accepting work certified as complete by LGED. In-depth review of each completed milestone for construction is required. The QA Contractor will use QA documentation generated by the LGED QA Staff, observations made during site visits, inspections and tests that have been witnessed, and a thorough visual inspection of the completed work to determine if the work is complete and in compliance with the approved design. A Milestone Acceptance Report summarizing the inspection and documentation that supports milestone completion will be issued by the QA Contractor. Within 3 working days of completing the review and inspection, a Milestone Acceptance Report will be completed and submitted. If the milestone is not complete, a detailed listing all deficiencies will be developed. In addition, the QA Contractor will conduct both periodic and final reviews of as-built drawings. They will work closely with the USACE PM, the PM and SAE and the LGED Contractor and will notify LGED QA staff immediately if unsafe work is observed.

The QA Contractor will develop a QA Work Plan that will detail their process for conducting quality assurance monitoring and reporting. The QA Contractor will follow this plan when executing monitoring activities.

At the completion of each construction milestone the QA Contractor will review each completed construction milestone and make a recommendation to the USACE PM that the milestone be accepted as complete or be rejected. In completing this review the QA Contractor will verify that all components of the milestone segment have been completed per the design, materials comply with the specifications, as-built drawings are up to date, and all environmental requirements are in compliance. To complete this review the QA Contractor will verify that receipt and placement of contract compliant materials is documented, all testing required by the contract has been completed successfully and fully documented, including compaction tests, asphalt tests, and concrete tests, and all environmental requirements have been completed and are fully documented.

In addition, the QA Contractor will do a physical inspection of all constructed components of the milestone segment including the environmental mitigation measures required to be in place. The QA Contractor will start the review and physical inspection within 2 working days from the day that review and acceptance of a completed milestone is requested and proceed diligently until it is completed, but not longer than 3 working days. During review, the QA Contractor will notify the USACE PM, the PM and the SAE immediately of any item(s) found to be deficient. The Milestone Acceptance Report will be completed and submitted. If deficiencies are found and the milestone completion cannot be accepted, the review and inspection process will be suspended and a complete list of deficiencies will be provided by the QA Contractor. When the PM notifies the QA Contractor that all deficiencies have been corrected, the review and inspection process will resume.

At the completion of the final construction milestone the QA Contractor will also conduct a final inspection. This inspection shall be in addition to the examination to certify completion of the last road segment, and will include a complete review of the entire project. A separate report will be submitted for the final inspection. **Figure 3** provides a graphical representation of the certification process.

#### **4. Definable Features of Work**

The following Definable Features of Work are anticipated with the BAIDP road construction projects.

- 1 - Construction of Site Support Facilities
- 2 - Removal of Existing Road Surface (damaged BC or Bricks)
- 3 - Earth Work
- 4 - Filling and Road Compaction
- 5 - Brick Edging
- 6 - Applying Prime Coat
- 7 - Applying BC and Seal
- 8 - Turfing
- 9 - Final Cleanup and Demobilization

Because each Definable Feature of Work has differing quality, safety, testing and environmental requirements, it is critical the key staff review all requirements prior to starting the work. By reviewing

requirements together, it provides key staff the opportunity to resolve potential issues, establish lines of communication, review responsibilities and requirements, and to conduct training before work is started in the field.

At a minimum, a Preparatory Phase Meeting will be held prior to starting each Definable Feature of Work. The PM, SAE, key contractor staff and USACE QA Contractor will be invited to the preparatory phase meeting. The PM will ensure the QA Contractor is notified three working days prior to the preparatory phase meeting. It should be noted that Preparatory Meetings are required the first time the feature is started for that project. It is not required each time similar follow-on work starts.

## **5. Time Control**

After signing of the contract agreement by both parties the PM will give possession to the contractor within the stipulated date mentioned in the Contract. The contractor will submit a Work Plan to PM within requisite time of contract for approval. The PM will approve the Work Plan after receiving permission from PE. In that Work Plan, the WBS, general methods, arrangements, order, and timing for all activities will be shown clearly. The Work Plan will be used to guide monitoring activities. The Contractor will update the Work Plan schedule at intervals no longer than the period stipulated in Contract clause where actual progress achieved on each activity, timing of the remaining works including any changes to the sequence of the activities.

## **6. Monitoring the Contractor's Quality Control and Adherence to Requirements**

The contractor shall construct, install and carry out the works and physical services in accordance with the contract. Prior to starting work, the SAE will review all contract quality control requirements and develop a **Quality Control Checklist** (QC Checklist) specific to the project that will be used to verify and monitor the Contractor's compliance with contract specifications, safety and environmental requirements. The PM will review and approve the QC Checklist prior to use. Quality requirements are included in the contract clauses, the approved design, the BAIDP Standard Design for Roads and all associated attachments and references, the EMMP and the EM. The QC Checklist is included as Form R-3 in **Attachment A**. The QC Checklist will be used throughout the project to help guide the SAE's testing program, their daily monitoring and their weekly reporting.

## **7. Testing**

Quality of any construction works will be controlled by performing necessary tests. Testing includes initial materials testing and follow-on field testing conducted during implementation. The SAE will review the Test Schedule included in **Attachment B** prior to construction start to confirm understanding of the test program.

### **6.1 Testing Lab Requirements**

LGED has a well-equipped laboratory in each district with sufficient instruments. One Assistant Engineer is in charge of the laboratory supported by Laboratory Technician (LT) and one Laboratory Assistant (LA). All material and field tests shall be performed by LGED's laboratory in charge. Test reports will be signed

by the Lab Technician, Assistant Engineer and District Executive Engineer. In cases where the testing facilities are not available in the LGED laboratory; the tests shall be performed elsewhere as directed by the District Executive Engineer.

## **6.2 Materials and Field Testing**

All requisite tests for materials shall be performed by LGED before using in any works. The SAE shall oversee material sampling. The SAE will notify USACE LQAC prior to collecting samples from the stockyard three working days in advance to allow LQAC opportunity to witness or collect independent samples. The SAE will verify that the contractor has conducted material testing and that materials meet the requirements of the BAIDP Standard Design for Roads, the design drawings and the contract specifications. Copies of all sample test reports will be maintained at the Upazila Office. The approval authority for all material testing is the District Executive Engineer. The PM will be responsible for submitting material testing to the District Executive Engineer. Signed approval shall be received and will be maintained at the Upazila Office. In the event that materials fail testing, a written notice will be issued by the PM and all materials will be removed from the site immediately. The PM will ensure all unspecified materials are removed from site. If timely removal is not possible, the PM will direct the contractor to mark the materials as rejected until removed. Field testing will be conducted by LGED during project implementation. Material and Field Testing frequency and acceptance criteria are included in **Attachment B**.

## **8. Inspection**

There are layers of inspection will be performed during construction of works. After signing the Contract the Project Manager will deploy one Sub-Assistant Engineer and Work Assistant for regular supervision of works. They will supervise the works regularly and will give necessary instruction on environmental mitigation plan, quality of works or any other activities related to works. The PM will issue an Inspection Book for each Contract. Any comment or instruction during supervision or Inspection will be written into the inspection book. All inspections and testing will be included in Daily and Weekly Reports. The PM shall present in each casting and keep record of measurement. All inspections will be documented and records maintained.

The PM will supervise/inspection the works at least once a week but more frequently as needed. Specifically he shall inspect the ongoing works of each layer of works in each milestone. He will check each layer of works such as improve sub-grade, sub-base, base coarse and surfacing works and identify the defects if any. He will provide necessary instruction for removal or rectification if any problem regarding materials quality, thickness of layers. He is entitled to suspend the works temporarily for non-compliance. The PE will take action immediately and will instruct Contractor for necessary action.

The PE will inspect the site at least two times in a month. However, the PE will inspect after completion of each layer of a milestone and will provide necessary direction for proceeding next layer of works if completed works meets specification supported by test results.

The Project Director will undertake periodic interim visits to project sites in order to provide necessary direction for smooth implementation of the project. The Project Director will report to Chief Engineer and USAID and other government agencies if needed. The record of all inspection report will be maintained at the PE and PM offices.



The Setup for project implementation is mentioned in government approved documents. Monitoring, Inspection and supervision will be performed according to that Setup shown in **Figure 2**

Progress review meetings are held in each month at LGED headquarters and at the Local Government Division under chairmanship of Chief Engineer and Secretary respectively. In that meeting the project progress will be reported. The Chief Engineer, LGED will also monitor the implementation of the projects works through the Additional Chief Engineer (Implementation). Moreover, a high level inter-ministerial Steering Committee headed by the Secretary, Local Government Division will review progress and solving problems at least once a year. The Project Director will present all project activities before the meeting.

Design Engineers will also undertake interim visit to check and verify the design of the works. He will make modification if necessary for site condition. Any design changes will be submitted to the USACE PM.

## **10. Record Keeping**

All records of project related activities will be kept in Upzila Engineer's office and Executive Engineers Office. Contractor will notify PM (Upazila Engineer) for testing of materials as well as works. A log of material testing will be maintained at the LGED district laboratory. This log will be available to QA during inspection.

## **11. Record and As-built Drawings**

LGED is responsible for producing necessary drawings and designs. Contractor will follow this design and drawing. During construction some aspects of the road/structure may need to be built differently than designed. In that event, the Design Engineer will visit site and if necessary modification would be made and contractor will do accordingly. At the conclusion of the project the design drawings will be updated to produce the as-built drawings. All construction drawings will be maintained at field by Contractor. One set of drawing will be available in the Upazila office and SAE will be responsible. The Contractor will be responsible for recording field changes and maintaining record drawings. The SAE will notify the PM if changes occur that affect the design. The PM will notify the USACE QA Contractor and USACE PM in the event of design changes.

## **12. Documentation**

The PE will maintain all records and documents in his/her custody at least 5 years for any audit, post review. This will include:

- Tender documents, invitation of tender, copy of advertisement
- Tender Opening Sheet, Tender Evaluation Report, copy of approved estimate, approval of evaluation
- All submitted tenders
- All correspondences with Contractor, USACE, and USAID
- Inspection Books, Daily, Weekly and Monthly Reports
- Measurement book, Bills, copy of all test reports, payment voucher etc.

## FIGURES

## ATTACHMENT A – FORMS AND EXAMPLES

Form R-1: Site Layout Check

Form R-2: Road Alignment Form

Form R-3: Quality Control Checklist

Form R-4: Daily Inspection Form

Form R-5: Preparatory Phase Meeting Agenda

Example 1: Sub-Assistant Engineer Weekly Report Format

Example 2: Upazilla Engineer Monthly Progress Report Format

ATTACHMENT B – TEST FREQUENCY AND TEST FEE CHART

TEST FREQUENCY AND TEST FEE CHART – **REQUIRES REVISION**

The following test shall be carried out in the LGED specific laboratories and in the field for each batch of materials stored in the contractor stockyard. All test types and quantities described are considered “Normal Testing”, whereas anything beyond that in type and quantity is considered as “Special Testing”. The District Executive Engineer may increase the frequency of testing as required. The QA test frequency for pavement works and Reinforcement Concrete shall be performed as per following;

The following test will be performed per km or part during execution of work. The rates of individual test and total cost shown which is borne by the contractor and the tenderer should quote his item wise rate considering above requirements.

Item of Work	Type/Name of Test	Test Frequency	No.Of Test
<b>Embankment/ Sub-base</b>	i) Liquid/ Plastic Limit	1/km or part (greater than 1 if soil character changes)	01
	ii) MDD (Standard Proctor)	1/km or part (greater than 1 if soil character changes)	01
	iii) Field Density Test	1 per 500 m <sup>2</sup> per layer	10
	iv) Laboratory CBR	1/ contract (greater than 1 if soil character changes)	01
<b>Improved Sub-Grade</b>	i) Liquid/ Plastic Limit	1/ km or part (greater than 1 if materials character changes)	01
	ii) Gradation & FM	1/ km or part (greater than 1 if materials character changes)	01
	iii) MDD (Standard proctor)	1/ km or part (greater than 1 if materials character changes)	01
	iv) Laboratory CBR	1/ contract (greater than 1 if soil character changes)	01
	v) Field Density Test	1 per 100m per layer	10
<b>Sub-Base</b> (For approval of materials to be used in works re following tests are to be done)	8. Water absorption	1 per 500m	02
	AIV/LAA Test	1 per 500m	02
	) Laboratory Test	1/ km (greater than 1 if materials	01
	MDD (Standard	1 per 500m	02
	. gradation Test	1 per 500m (greater than 1 if materials character changes)	02
	. -ec Density Test	1 per 100m per layer	10
<b>WBM' Hard Shoulder</b>	Water Absorption	1 per 500m	02
	k .LAA Test	1 per 500m	02
	-aooratory CBR	1/ km (greater than 1 if materials	01
	• MDO (Standard	1 per 500m	02
	vi jraoasor Test	1 per 500m (greater than 1 if materials character changes)	02

Item of Work	Type/Name of Test	Test Frequency	No.Of Test
	Compressive Strength Test		10
Brick on end edging	Comp-BSS Test		05
	Water absorption	05 nos. per Km	05
<b>Bituminous carpeting and Seal Coat</b>	Gradation of stone cftps	1 per 500m (greater than 1 if materials character changes)	02
	ii) LAAs: Vtes:	1 per 500m	02

### TEST FREQUENCY FOR CONCRETE WORK

Item of Work	Type/ Name of Test	Test Frequency	No. of Test
<b>Coarse Aggregate</b>	Gradation	Test shall be carried out for each days	As per
	Water absorption	Casting or per 15m <sup>3</sup> of concrete -	work
	AIV/LAA Test	Whichever provides the greater no. of	
<b>Fine Aggregate Cement</b>	Gradation	-Do-	-Do-
	Setting Time	1 no. per batch/brand	-Do-
	Normal Consistency	-Do-	-Do-
	Compressive Strength	-Do-	-Do-
<b>Concrete Strength</b>	a) Cylinder	6 nos. cylinder for each days/15m <sup>3</sup> casting (whichever provides the greater no. of tests) for 7 and 28 days testing	-Do-
<b>Workability</b>	Slump Test	Min. 1 m per hour during concreting	-Do-
<b>Reinforcement</b>	a) Unit weight	One for each dia per batch	-Do-
	b) Diameter	One for each dia per batch	-Do-
	c) Tensile strength	One for each dia per batch	-Do-