

# **PART – III (A)**

## **ADDITIONAL TECHNICAL SPECIFICATIONS-I**

### **3.1 STUD SHEAR CONNECTOR**

#### **3.1.1 Material:-**

The stud shear connector and ceramic ferrules shall conform to type SD1/UF as per BS EN ISO 13918-2008. The diameter of ceramic ferrule D 7 as per Figure 13/Table 18 of BS EN ISO 13918 shall be 26. Mechanical properties of stud shear connectors shall be as per ISO 6892/BS EN ISO 13918–2008. Shape of tip of stud shear connectors may be chosen by manufacturer. The stud tip shall be supplied with flux in the form of press fitted aluminium ball or Aluminium spray coating.

#### **3.1.2 Welding:-**

The welding of stud shear connectors shall be done by “Drawn arc stud welding with ceramic ferrule” Technique. The stud and the surface to which studs are welded shall be free from scale, moisture, rust and other foreign material. The stud base shall not be painted, galvanized or cadmium plated prior to welding. Welding shall not be carried out when temperature is below 10 degrees Celsius or surface is wet or during periods of strong winds unless the work and the welder are adequately protected. The welds shall be visually free from cracks and shall be capable of developing at least the nominal ultimate strength of studs. The procedural trial for welding the stud shall be carried out when specified by the Engineer

#### **3.1.3 Testing:-**

##### **(a) Appearance test**

1. The weld to a stud shear connector should form a complete collar around the shank and free from cracks, excessive splashes of weld material, free from injurious laps fins, seams, twist, bends or other injurious defects.
2. Weld material should have a ‘Steel Blue’ appearance.

##### **(b) Test to check the fixing of shear studs**

All studs need to be checked by a ring test.

1. Ring Test : Involves striking the side of the head of the stud with a 2 kg hammer. A Ringing tone achieved after striking indicates good fusion whereas dull tone indicates a lack of fusion (BS 5400 – 6).
2. Bend Test : Test requires the head of a stud to be displaced laterally by approximate 25% of its height using a 6 kg hammer.
  - The weld should then be checked for signs of cracking or lack of fusion
  - Stud should not be bent back as this is likely to damage the weld.
  - The testing rate should be 1 in 50 (BG 5400 – 6).

#### **3.1.4 Measurements:-** The work shall be enumerated. It's unit is "each".

#### **3.1.5 Rates: -** The rate shall include the cost of material, labour, equipments, tools and plants, etc. complete required for all operations described above.

### **3.4 NON-DESTRUCTIVE INTEGRITY TESTING OF PILE**

#### **3.4.1 SCOPE**

This specifications covers the methods on non-destructive testing as per IS: 14893 of all types of concrete piles covered in IS 2911 (Part I/Sections 1, 2, 3 and 4).

#### **3.4.2 SITE INFORMATION REQUIRED FOR THE TESTS**

The following information is generally required to carry out integrity tests:

- (a) Location of site
- (b) Pile types including size, material and reinforcement
- (c) Layout of piles
- (d) Details of pile installation (including construction and driving sequence and rest periods)
- (e) Number of piles to be tested;
- (f) Subsurface profile/driving details of the piles  
(More if variations are noted)
- (g) Depth of water table and soil investigation report, if any
- (h) Density of concrete; Strength of concrete
- (i) Abnormal conditions noted while driving/boring or concreting of piles. The normal daily report produced by the piling site should contain this information. In addition, any other information concerning planning and conducting the tests including relevant past experiences covering similar test(s) in the area, and
- (j) Details of test piles(s), if any.

#### **3.4.3 TYPES OF TESTS**

Various methods are available for checking the integrity of concrete piles after installation. In the most widely used method, impulses or vibrations are applied to the pile and measurements made of timings and attenuation of reflected signals.

The commonly used sonic methods, vibration methods, sonic logging techniques, etc, have been tried within the last 15-20 years in different parts of the world. However, the methods based on One Dimensional Stress Wave approach known as Sonic Integrity Testing, a Low Strain Integrity testing or Sonic Echo Testing have been used successfully in various parts of the world. The method is simple and quick enabling dozens of piles to be examined in a single working day without much interference in site activities.

The work carried out on sonic integrity testing of pile in the country has shown its efficiency; in assessing the structural quality of piles and therefore it is appropriate to frame in this code the salient features of this method.

##### **3.4.3.1 The Low Strain Integrity Testing**

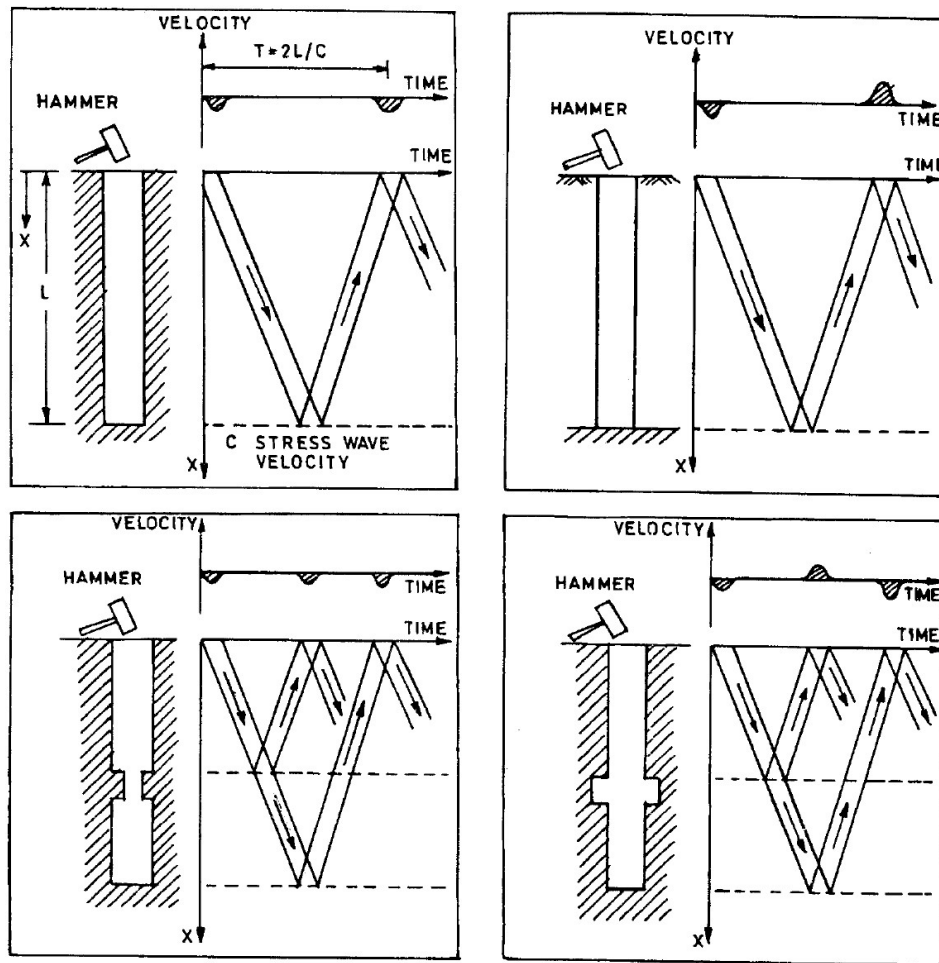
This is a system of assessing the integrity of piles by the use of low stress wave imparted to the pile shaft and is also known as Sonic Integrity or Sonic Echo Test. A small metal/hard rubber hammer is used to produce a light tap on top of the pile. The shock travelling down the length of the pile is reflected back from the toe of the pile and recorded through a suitable transducer/accelerometer (also held on top of the pile close to the point of impact) in a computer disk or diskette for subsequent analysis.

The primary shock wave which travels down the length of the shaft is reflected from the toe by the change in density between the concrete and sub-strata. However, if the pile has any imperfections or discontinuities within its length these will set up secondary reflections which will be added to the return signal. (See Fig.).

By a careful analysis of the captured signal and knowledge of the conditions of the ground, age of concrete, etc, a picture of the locations of such problems can be built up. The reflected stress wave can be monitored using either processing technique; the observed signals are amplified and converted into digital display as velocity versus length or frequency versus mobility records, providing information on structural integrity of piles.

The stress wave velocity and approximate pile lengths are provided as input for the integrity testing. The stress wave velocity is dependent on the Young's modulus and mass density of pile concrete. This value generally lies between 3000-4000 meter per second depending on the grade of concrete used (M15-M25).

- 3.4.3.2** Normally more than one recording of signals is done until repeatability of signals is achieved. If necessary, averaging of signals is also done to achieve more informative signals. In a suspected pile the test should be repeated at more than one location on top of the pile.
- 3.4.3.3** The tests shall be conducted on piles whose length is correctly recorded or on test piles where available, to determine the value of stress wave velocity and characteristic or reference signal for comparing the signals for testing subsequent piles.
- 3.4.3.4** The method of testing involves high skill and use of computerized equipment. Therefore, the tests should be performed and interpreted by trained and experienced personnel.



### 3.4.4 Data and Reporting

- (i) The assessment of structural integrity is based on two equally important aspects:
  - a) Quality of signals, and
  - b) Accurate analysis and interpretation of signal.
- (ii) Piles requiring remedial measures should be so marked immediately on completion of the field integrity testing, and rectification, measures selected.
- (iii) The final report should include signals of each integrity test and reflect on the structural condition of piles.

### 3.4.5 GENERAL REQUIREMENTS OF THE TESTS

- (i) Piles shall be trimmed to cut off level or sound concrete level before the test with all laitance removed. No pile cap blindage work should be undertaken prior to the test.
- (ii) The area surrounding the pile should be free from standing water and kept dewatered during the tests.
- (iii) The pile head should be accessible.
- (iv) Testing should be free of work likely to cause disturbance.

- (v) The cast-in-situ piles should not be tested normally before 14 days of casting.
- (vi) The test piles, if available at site, can be used to determine the pulse velocity and characteristic or reference signal generated. Where no test pile is available information can be obtained from cast piles whose length is accurately recorded.

#### **3.4.6 LIMITATIONS OF NDT METHODS**

- (i) Non-Destructive Testing of piles does not provide the load carrying capacity of piles.
- (ii) It does not provide information regarding verticality or displacement in position of piles.
- (iii) Minor deficiencies like local loss of cover, small intrusions or type of conditions of materials at the base of piles are undetectable. Integrity testing may not identify all imperfections, but it can be useful tool in identifying major defects within the effective lengths. The test may identify minor impedance variations that may not affect the bearing capacity of piles. In such cases, the engineer should use judgment as to the acceptability of these piles considering other factors such as load redistribution to adjacent pile, load transfer to the soil above the defect, applied safety factors and structural load requirements.
- (iv) Based on the latest information available, the limitations relating to the depths up to which the integrity tests can be carried on piles depends on the surrounding strata and damping within the concrete.
- (v) The present experience of Non-Destructive Testing of piles is up to a diameter of 1500 mm.
- (vi) Soil stiffness or founding on rock of similar density as the pile will attenuate the signals such that there will be little or no toe reflection.
- (vii) The low strain integrity method is applicable to cast – in – situ concrete bored and driven piles. Conclusive results are rarely obtained in case of segmented precast reinforced concrete driven piles or precast piles in pre bored holes.

#### **3.4.7 METHOD OF MEASUREMENTS:** It will be measured in number.

#### **3.4.8 PAYMENTS:** The rate includes cost of all materials, labour, equipments & operations required to do this test.

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## **PART – II (B)**

### **ADDITIONAL TECHNICAL SPECIFICATIONS-II**

#### **4.1. Special condition for contractor's Vehicle plying near Railway track.**

- 4.1.1 The contractor shall not allow any road vehicle belonging to him or his suppliers etc. to ply in railway land next to the running line. If for execution of certain works viz. earthwork for parallel railway line and supply of ballast for new or existing rail line gauge conversion etc. road vehicle are necessary to be used in railway land next to the Railway line, the contractor shall apply to the engineer-in-charge for permission giving the type and number of individual vehicles, names and license particulars of the drive, location, duration and timings for such work / movement. The engineer in charge or his authorized representative will personally counsel, examine and certify, the road vehicle drivers, contractor's flagmen and supervisor and will give written permission giving names of road vehicles drivers, contractor's flagmen and supervisor to be deployed on the work, location, period and timing of the work. This permission will be subject to the following obligatory conditions:
- 4.1.2 Road vehicles can ply along the track after suitable cordoning of track with minimum distance of 6 m from the centre of the nearest track. For plying of road vehicles during night hours, adequate measures to be communicated in writing along with a site sketch to the contractor / contractor's representative and controlling engineers / supervisors in charge of the work including officers and the in charge of the section.
- 4.1.3 Nominated vehicles and drivers will be utilized for the work in the presence of at least one flagman and one supervisor certified for such work.
- 4.1.4 The vehicles shall ply 6m clear of track. Any movement / work at less than 6 m and up to minimum 3.5 m clear track centre shall be done only in the presence of railway employee authorized by the engineer-in-charge. No part of the road vehicle will be allowed at less than 3.5 m from track centre. Cost of such railway employee shall be born by the railway.
- 4.1.5 The contractor shall remain fully responsible for ensuring safety and in case of any accident, shall bear cost of all damages to this equipment and men and also damages to Railway and its passengers.
- 4.1.6 Engineer-in-charge may impose other condition necessary for a particular work or site.
- 4.1.7 The staff engaged by the contractor at site should be competent enough for the job. They should possess the certificate of competency certificate, necessary training will be arranged by the contractor at his cost by an expert to enable officer nominated by sectional VICE PRESIDENT, GUDC/ Engineer-in-charge to accord permission for the job. Without a suitable competency certificate, the contractor's supervisors shall not be allowed to carry out concreting and earthwork.

#### **4.2. Issue of Identity Cards by Contractors:**

- 4.2.1. The contractor is bound to issue identity card to each and every person employed by him and deployed for execution of contract work as per the prescribed format provided in the tender at his cost. Failure on part of the contractor to issue of identity cards to their employees will be treated as breach of contract conditions.

It is mandatory on part of every employee, deployed by the contractor to keep in his possession the identity card, issued by the contractor throughout the execution of the work. Failure to possess such identity card will be treated as unauthorized presence in the railway premises and such person shall be liable for prosecution as per law. It is mandatory for the

contractor to submit the list of the employee issued with the identity cards and deployed for the particular contract, to Railway/THE VICE PRESIDENT, GUDC Engineer at site before commencement of the work and also for any changes made during the execution of the work. No claims whatsoever arising out of implementation of special conditions pertaining to issue of identity cards shall be admissible.

#### **4.3. Site Lab**

4.3.1. The contractor shall be set up a site lab with minimum equipment listed below;

1. IS sieve sets for sieve analysis.
2. 15 X 15 X15 cms cubes minimum 15 nos.
3. Cubes for cement test of 7.09 X 7.09 X cm
4. Vicate apparatus.
5. Cube testing machine of minimum 100 T capacities.
6. Measuring cylinder.

In case they have not brought the aforesaid articles or have not set up the lab, THE VICE PRESIDENT, . GUDC shall set up the same and actual cost plus 10% shall be recovered from the bills.

#### **4.4. Disaster management**

4.4.1. "All the available vehicles and equipment of the contractor can be drafted by the DFC/Railway Administration in case of accidents/natural calamities involving human lives. The payment for such drafting shall be made according to the rates as shall be fixed by the Engineer. However, if the contractor is not satisfied with the decision of the Engineer in this respect he may appeal to the THE VICE PRESIDENT,GUDC/Chief Engineer within 30 Days of getting the decision of the Engineer, supported by analysis of the rates claimed. The CPM-THE VICE PRESIDENT,GUDC/Chief Engineer's decision after hearing both the parties in the matter would be final and binding on the contractor and the Railway."

- (1) Non- employment of labourers below the age of 15:- the contractor shall not employ children below the age of 15 as labourers directly or through petty contractors or sub-contractors for the execution of work.
- (2) (2) Medical certificate of fitness for Labour:- It is agreed that the contractor shall not employ a person above 15 and below 19 years of age for the purpose of execution of work under this contract unless a medical certificate of fitness in the prescribed form (proforma at annexure II) granted to him by a certifying surgeon certifying that he is fit to work as an adult is obtained and kept in the custody of the contractor or a person nominated by him, in this behalf and he person carries with him, while at work, a token giving a reference to such certificate. It is further agreed that the responsibility for having the adolescent examined medically at the time of appointment or periodically till he attains the age of 19 years shall devolve on the contractor and all the expenses to be incurred on this account shall be borne by him, and no fee shall be changed from the adolescent or his parent for such medical examination.
- (3) Period of validity of Medical fitness certificate: - A certificate of fitness granted or renewed for the above said purposes shall be valid only for a period of one year at a time. The certifying surgeon shall revoke a certificate granted or renewal if in his opinion the holder of it is, no longer for work in the capacity stated therein. Where a certifying surgeon refuses to grant or renew a certificate or revoke a certificate, he shall, if so required by the person concerned state his reasons in writing for doing so.
- (4) Medical Re-examination of Labourer:- Where any official appointed in this behalf by the Ministry of Labour is of the opinion that any person employed in connection with the execution of any work under this contract in the age group 16-19 years is without a certificate of fitness or is having a certificate of fitness but no longer fit to work in

the capacity stated in the certificate, he may serve on the contractor or the person nominated by him in this regard, a notice requiring that such person shall be examined by a certifying surgeon and such person shall not, if the concerned official so directs, be employed or permitted to do any work under this contract unless he has been medically examined and certified that he has been granted a certificate of fitness or a fresh, as the case may be.

**4.5. Submission of Photographs and Videos:**

- 4.5.1. The contractor shall arrange to submit three sets of minimum 200 Nos. of photographs of size 5"x7" showing various operations and stages of different activities of the project. The photograph shall be taken for every important activity during execution of work as decided by the Engineer for display and record purpose. In addition, the contractor will submit 3 sets of 2 laminated photographs of size 20"x30". If the photograph as listed above are not submitted then recovery of Rs.75,000/- shall be made from the contractor's bill.
- 4.5.2. The successful tenderer will be required to prepare video film (on CDROM) recording of entire construction and edit the same with proper commentary. The same shall cover the whole work in duration of about 2 hours. This film shall pictorially represent the entire work of Linking, Various Execution Stages, CRS Inspection and final completion stages. Two copies of video films (On CDROM) shall be handed over to be Railway along with necessary details, instructions, literature etc. The rate includes cost of such filming. Nothing shall be paid on this account. If the contractor fails to submit the Video Film on CDROM then Rs. 1,00,000/- shall be recovered from bill.

**5. Special Conditions for working of Road Cranes:**

- 5.1. No machine shall be selected to do any lifting on a specific job until its size and characteristics are considered against the weights, dimensions and lift radii of the heaviest and largest loads.
- 5.2. The contractor shall ensure that a valid Certificate of Fitness is available before use of Road Cranes.
- 5.3. Contractor can utilise the services of any competent person as defined in Factories Act, 1948 and approve by Chief Inspector of Factories.
- 5.4. The laminated photocopies of fitness certificate issued by competent person, the operator's photo, manufacturer's load chart and competency certificate shall always be either kept in the operator cabin or pasted on the visible surface of the lifting appliances.
- 5.5. All lifting appliances including all parts and gears thereof, whether fixed or movable shall be thoroughly tested and examined by a competent person once at least in every six months or after it has undergone any alterations or repairs liable to affect its strength or stability.
- 5.6. In addition, it is also advised that for all the works being executed by the Road Cranes, the above stipulations should be checked. These instructions should be strictly observed.