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ANALYSIS, EVALUATION, EXECUTION OF I-GIRDER

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ABSTRACT The new design aids provide bridge designers with different alternatives of girder section size, girder spacing, number of pre-stressing strands, pre-stressing strand diameter,and compressive strength of concrete. The I- Girder is normally comprise either pre stressed concrete, structural steel (or) a composite of steel and reinforced concrete. I- Girder bridges are commonly used for High-Way fly over and for modern elevated structures of light rail transport. Although normally the IGirder bridge is a form of beam bridge. IGirders may also be used on cable-stayed bridges and other forms. I- Girder bridges are invented on in the early's of 1960. If it is made of concrete, I- Girder bridges may be cast in place using false work supports, removed after completion (or) in sections. If a segmental I- Girders may also be prefabricated in a fabrication yard, then transported and emplaced using cranes. For steel I- Girders, the Girders are normally fabricated off site and lifted into the place by crane with sections connected by bolting (Riveting) (or) welding. If a composite concrete bridge deck is used it is often cast in place using temporary false work supported by steel Girder. Gantry cranes are used to new segments onto the complete portions of the bridge until the bridge super structure is completed. IGirders are more expensive to fabricate and they are more difficult to maintain. The need for access to a confined space inside the box. Corrosion of the steel cables that provide the post-tensioning for I- Girder bridges has become a major concern.

1.INTRODUCTION

1.1 INTRODUCTION TO I-GIRDERS:

The new design aids provide bridge designers with different alternatives of girder section size, girder spacing , number of pre-stressing strands , pre-stressing strand diameter , and compressive strength of concrete. The I- Girder is normally comprise either pre stressed concrete, structural steel (or) a composite of steel and reinforced concrete. I- Girder bridges are commonly used for High-Way fly over and for modern elevated structures of light rail transport. Although normally the I- Girder bridge is a form of beam bridge. I- Girders may also be used on cable-stayed bridges and other forms. I- Girder bridges are invented on in the early's of 1960. If it is made of concrete, I- Girder bridges may be cast in place using false work supports, removed after completion (or) in sections. If a segmental I-Girders may also be prefabricated in a fabrication yard, then transported and emplaced using cranes. For steel I- Girders, the Girders are normally fabricated off site and lifted into the place by crane with sections connected by bolting (Riveting) (or) welding. If a composite concrete bridge deck is used it is often cast in place using temporary false work supported by steel Girder. Gantry cranes are used to new segments onto the complete portions of the bridge until the bridge super structure is completed. IGirders are more expensive to fabricate and they are more difficult to maintain. The need for access to a confined space inside the box. Corrosion of the steel cables that provide the post-tensioning for I-Girder bridges has become a major concern.

LITERATURE REVIEW:

TECHNICAL DETAILS: HTS Wires:

Pre-stressing wire is a single unit made of steel. Strands: Two, three or seven wires are wound to form a pre-stressing strand.

Tendon:

A group of strands or wires are wound to form a pre-stressing tendon. Cable: A group of tendons form a pre-stressing cable. Bars: A tendon can be made up of a single steel bar. The diameter of a bar is much larger than that of a wire. Nature of Concrete-Steel Interface: Bonded tendon: When there is adequate bond between the pre-stressing tendon and concrete, it is called a bonded tendon. Pretensioned and grouted post-tensioned tendons are bonded tendons. UN bonded tendon: When there is no bond between the pre-stressing tendon and concrete, it is called UN bonded tendon. When grout is not applied after post-tensioning, the tendon is an UN bonded tendon Stages of Loading: The analysis of pre-stressed members can be different for the different stages of loading. The stages of loading are as follows.

1) Initial: It can be subdivided into two stages. a) During tensioning of steel b) At transfer of pre-stress to concrete.

2) Intermediate: This includes the loads during transportation of the Pre-stressed members. 3) Final: It can be subdivided into two stages.

a) At service, during operation.

b) At ultimate, during extreme events.

2.2 Advantages of Pre-stressing:

The pre-stressing of concrete has several advantages as compared to traditional reinforced concrete (RC) without prestressing. A fully pre-stressed concrete member is usually subjected to compression during service life. This rectifies several deficiencies of concrete. The following text broadly mentions the advantages of a pre-stressed concrete member with an equivalent RC member. For each effect, the benefits are listed.Section remains UN cracked under service load: Reduction of steel corrosion.

- Increase in durability.
- Full section is utilized.
- Higher moment of inertia (higher¬ stiffness). Less deformations (improved¬ serviceability). Increase in shear capacity.
- Suitable for use in pressure vessels,¬ liquid retaining structures.
- Typical values of span-to-depth ratios in slabs are given below
- Improved performance (resilience)
- under dynamic and fatigue loading.

High span-to-depth ratios:

Larger spans possible with pre-stressing (bridges, buildings with large column-free spaces) For the same span, less depth compared to RC member.

Reduction in self weight .

- More aesthetic appeal due to slender sections.
- More economical sections.
- Suitable for precast construction:
- The advantages of precast construction are as follows.
- Rapid construction
- Better quality control
- Reduced maintenance
- Suitable for repetitive construction
- Multiple use of formwork ⇒

3.0 TYPES OF PRE-STRESSING

Limitations of Pre-stressing:

Although pre-stressing has advantages, some aspects need to be carefully addressed. Pre-stressing needs skilled technology. Hence, it is not as common as reinforced concrete

- The use of high strength materials is costly.
- There is additional cost in auxiliary equipments.
- There is need for quality control and inspection.

Types of Pre-stressing: Pre-stressing of concrete can be classified in several ways. The following Classifications are discussed. Source of pre-stressing force: This classification is based on the method by which the pre-stressing force is generated. There are four sources of pre-stressing force: Mechanical, hydraulic, electrical and Chemical. External or internal pre-stressing: This classification is based on the location of the pre-stressing tendon with respect to the Concrete section. Pre-tensioning or post-tensioning: This is the most important classification and is based on the sequence of casting the Concrete and applying tension to the tendons. Linear or circular pre-stressing: This classification is based on the shape of the member pre-stressed. Full, limited or partial pre-stressing: Based on the amount of pre-stressing force, three types of pre-stressing are defined. Uniaxial, biaxial or multi-axial prestressing: As the names suggest, the classification is based on the directions of pre-stressing a member. Source of Pre-stressing Force: Hydraulic Pre-stressing: This is the simplest type of pre-stressing, producing large pre-stressing forces. The hydraulic jack used for the

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tensioning of tendons, comprises of calibrated pressure gauges which directly indicate the magnitude of force developed during the tensioning. Mechanical Pre-stressing:n this type of pre-stressing, the devices includes weights with or without lever transmission, geared transmission in conjunction with pulley blocks, screw jacks with or without gear drives and wirewinding machines. This type of prestressing is adopted for mass scale production. Electrical Pre-stressing: In this type of pre-stressing, the steel wires are electrically heated and anchored before placing concrete in the moulds. This type of pre-stressing is also known as thermo-electric pre-stressing. External or Internal Pre-stressing: External Pre-stressing: When the pre-stressing is achieved by elements located outside the concrete, it is called external pre-stressing. The tendons can lie outside the member in I-girders or walls or inside. This technique is adopted in bridges and strengthening of buildings. In the following figure, the I-girder of a bridge is pre stressed with tendons that lie outside the concrete.

Stressed With Tendons That Lie Outside The Concrete

Concrete Will Be Cast Around The Ducts For Placing The Tendons

Pre-Tensioned Electrical Poles

Post tensioned grinder

4.0 GROUTING This manual was prepared to provide guidance in the use of pressure grouting as a means to correct existing or anticipated subsurface problems. Information on procedures, materials, and equipment for use in planning and executing a grouting project is included, and types of problems that might be solved by pressure grouting are discussed. Methods of pressure grouting that have proven to be effective are described, and various types of grouts and their properties are listed. Purpose: Pressure grouting involves the injection under pressure of a liquid or suspension into the voids of a soil or rock mass or into voids between these materials and an existing structure. The injected grout must eventually form either a gel or a solid-within the treated voids, or the grouting process must result in the deposition of suspended solids in these voids. The primary purposes of pressure grouting a soil or rock mass are to improve the strength and durability of the mass

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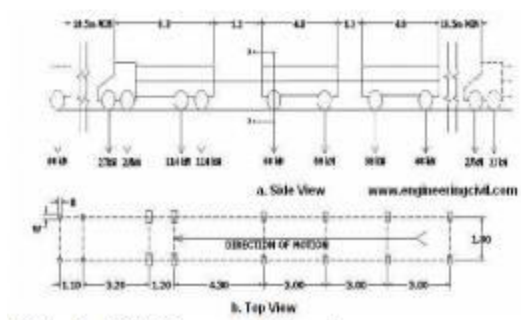
and/or to reduce the permeability of the mass. Field Tests: (1) Pressure tests: Pressure testing by pumping measured amounts of water into exploratory boreholes under known pressures serves a useful purpose if the injection of gel-forming grouts is contemplated. The results of the pressure tests will show the permeability of the soil or rock mass to water or other fluid of the same viscosity. The best way to determine the permeability of uniform, porous , water-bearing soil layers is by a pumping test, as discussed in Civil Works Technical Letter 63-16. Pressure testing of rock to learn whether it will accept a cement or clay grout is rarely worthwhile. If pressure testing is done for this purpose each tested increment of borehole should be examined by television or borehole camera to obtain information on the size of the openings that are presumed to take water. (2) Test grouting: The most reliable means of obtaining realistic answers to questions on the capability of rock to take a grout containing solids in suspension is by test grouting. The test-grout program should be planned not only to provide information on the grout ability of the rock, but also on the most suitable mixes and probable quantities of grout, if the rock takes grout. Laboratory Tests : (1) Permeability: Test procedures for determining the permeability of soil samples are described in EM 1110-2-1906. Laboratory permeabilities are generally somewhat smaller than field permeabilities determined from field pumping tests. (2) Gradation: Procedures for performing grain-size tests are given in EM 1110-2- 1906. The effective grain size (D10 size) of Mississippi River alluvial sands has been correlated with field permeability values and the results of this correlation. (3) Density: The density and void ratio of undisturbed samples should be determined for use in making calculations and in evaluating the stability and permeability characteristics of the in place soil mass. Test procedures are outlined in EM 1140- 2-1906. (4) Chemical tests: Chemical analysis of groundwater samples should be made to determine the presence of calcium sulfate, magnesium sulfate, sodium sulphate,organic or mineral acids, and alkalies that may be detrimental to cement or chemical grouts. The pH of the water should also be determined



Details Of Class A Wheel

B. Thickness of Web:

The thickness of the web shall not be less than d/36 plus twice the clear cover to the reinforcement plus diameter of the duct hole where'd' is the overall depth of the box girder measured from the top of the deck slab to the bottom of the soffit or 200 mm plus the diameter of duct holes,whichever is greater.

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C. Thickness of Bottom Flange:

The thickness of the bottom flange of box girder shall be not less than 1/20th of the clear web spacing at the junction with bottom flange or 200 mm whichever is more.

D. Thickness of Top Flange:

The minimum thickness of the deck slab including that at cantilever tips be 200 mm. For top and bottom flange having pre-stressing cables, the thickness of such flange shall not be less than 150 mm plus diameter of duct hole.

CONCRETE MIX DESIGN

CONCRETE MATERIALS:

Aggregates:

The first consideration in proportioning a concrete mix is the aggregates since they will make up the largest portion of most concrete mixes - about 65% to 80% by volume. Consideration should be given to all properties of both the coarse and fine aggregates including: hardness, absorption, specific gravity, alkali reactivity and gradation

Cementitious Materials: Since the cementitious material and water form the paste or "glue" that binds the aggregates together, maximizing it's quality is prudent. The cementitious material for concrete pipe may consist of the following combinations according to

ASTM standards for concrete pipe and

boxes:

- Portland cement only: cement must conform to ASTM C 150 (includes requirements for several types of cement developed for a range of applications).
- Portland blast furnace slag cement only: conforming to ASTM C 595. Portland pozzolan cement only: conforming to ASTM C 595 except the
- Pozzolan constituent in Type 1P shall be fly ash and not exceed25% by Weight.

CONCRETE MIX DESIGN:

Cement Concrete Mix Design means, determination of the proportion of the concrete ingredients i.e. Cement, Water, Fine Aggregate, Coarse Aggregate which would produce concrete possessing specified properties such as workability, strength and durability with maximum overall economy.

Methods of Concrete Mix Design:

- I.S. Method
- British Method
- A.C.I. Method etc

These Methods are based on two basic assumptions:

- Compressive Strength of Concrete is governed by its Water-Cement

  Ratio.

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- Workability of Concrete is governed by its Water Content. Data required for concrete mix design:
- Grade of Concrete

  E.g.: PSC-M50-A20

- Slump required in mm

  E.g.: 75 – 110 mm

- Degree of Site Control

  E.g.: Good

- Type of Exposure

  E.g.: Mild

- Grade of Cement E.g.: OPC53 Grade

0 STEPS INNVOLVED IN

CONCRETE MIX DESIGN

- DETERMINE THE PHYSICAL PROPERTIES OF CONCRETE INGREDIENTS.
- FINE AGGREGATE
- COARSE AGGREGATE
- MECHANICAL PROPERTIES

8.0 CALCULATION OF AGGREGATE TESTS

8.1 CRUSHING VALUE TEST:

Size of the Aggregate :

12.5MM-10MM

Rate of Application of Load : 4 T/M

Total Load Applied : 100 KN

SAMPLE-I:

Total weight of dry sample w1 =3000gm

Weight of fines passing 2.36mm IS sieve

w2 =1100gm

Aggregate crushing value (%) = (w2/w1)

×100= (650/3000)×100= 21.66%.

Total weight of dry sample w1 =3000gm

Weight of fines passing 2.36mm IS sieve

w2 =1050gm

Aggregate crushing value (%) = (w2/w1)×100= (680/3000)×100= 22.66%.

Aggregate crushing value (%) =

(21.66+22.66)/2=22.12%

BLENDING OF COARSE AGGREGATE

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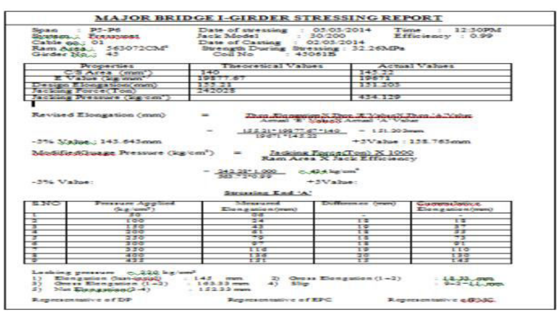
SAMPLE-II:

As Per IS: 2386(Part I),IS:383,Table-2

SIEVE SIZE (MM)	IS:383-1970 SPECIFICATIONS (GRADED)	% PASSING			
		20 mm	10 mm	60%+40%	50%+50%
40	100	100	100	100	100
20	95-100	90	100	94	95
10	25-55	3	85	40	44
4.75	0-10	0	19	7	10


MAJOR BRIDGE I-GIRDER STRESSING REPORT

Span : P5-P6 Date of stressing : 05/03/2014 Time : 12:30PM
Cable no. : 01 Jack Model : 30/200 Efficiency : 0.99
Ram Area : 563072CM² Date of Casting : 02/03/2014
Girder No. : 45 Strength During Stressing : 32.26MPa
Coil No : 43061B

Properties	Theoretical Values	Actual Values
CS Area (mm²)	140	145.22
E Value (kg/mm²)	19877.87	19871
Design Elongation(mm)	155.21	151.203
Jacking Force(Ton)	242028	
Jacking Pressure (kg/cm²)		434.129

CONCLUSION As a part of engineering curriculum projects really guide the student to understand the subjects with practical exposure. By doing this project we understand the different technical terms like pre tensioning, post tensioning and also we really learned the subject o psc practically. The difference between psc and rcc clearly observed. From IS456:2000 - Concrete mix designs. IS1343& IS 10262 - Stressing. IS383 - Aggregate testing. IS2502 - Bar bending schedule. By doing this project the knowledge of the drawings of the structures and how to execute the structures according to drawings and estimating the quantities from the drawings. From this project we know about the pre stressing ; in this pre stressing having two types they are pre tensioning and post tensioning. In those we are doing post tensioning. By doing this project we observed the site situations, what are the problems generally arise in the site and how to complete a task. The construction of any structure in any project is not easy and it is not a single man achievement it is a team effort. The project really explained the importance of team work to complete this project (or) any task.

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