Design of cable stayed bridge

Of the newly-built bridges, cable-stayed bridges are today very common worldwide for spans ranging between 200 and 900 meters. A cable stayed bridge has one or more towers (Pylons) from which the cables support the deck. This paper provides modeling, analysis and design of a overstressed harp type single pylon cable stayed bridge using MIDAS Civil. Keywords: cable stayed, box girder, progressing, MIDAS Civil Introduction more towers (Pylons) from which the cables support the deck.

There are two major lasses of cable-stayed bridges: harp and fan. Len the harp design, the cables are nearly parallel so that the height of their attachment to the tower is similar to the distance from the tower to their mounting on the deck. Len the fan design, the cables all connect to or pass over the top of the towers. The cable-stayed bridge is optimal for spans longer than cantilever bridges, and shorter than suspension bridges.

This is the range where cantilever bridges would rapidly grow heavier If the span was lengthened, and suspension bridge cabling would not be more economical if the pan was shortened Cable-stayed bridges may appear to be similar to suspension bridges, but in fact they are quite different in principle and in their construction. In suspension bridges, large main cables (normally 2) hang between the towers (normally 2), and are anchored at each end to the ground whereas In the cable- stayed bridge, the towers are the primary load-bearing structures which transmits the bridge loads to the ground.

A cantilever approach is often used to support the bridge deck near the towers, but lengths further from them are supported by cables inning directly to the towers. General presentation of the structure The bridge Is a single pylon cable stayed bridge having a harp-type arrangement of the cables. The total length of the cable stayed bridge Is mm with a main span of mm. The bridge structure carries 6 road lanes divided into 2 carriageways.

The deck consists of cast in place overstressed box girders Total width of the bridge is 29. Mm. The main 350 m span will be built using the cantilever method, starting from the piers PA & PA simultaneously. The two cantilevers will be connected at mid span by he mean of a stitch segment. The balanced cantilevers are cast by segments of 3. 5 m long, using a form traveler. The segment (n) is connected to previous segment (n-l) by tendons (internal pre-stressing). This method is used for the first ten segments from pylon.

After eleventh segment, no cantilever tendon is needed as the segments will be supported by stay cables tensioned progressively with construction of segments. Hence construction cycle of segments after eleventh one includes installation and tensioning of stay cable before removal and launching of form traveler. Material characteristics: Concrete: MOM grade concrete will be used for deck and pylons. MOM grade concrete will be used for Piers. Concrete properties shall be based on SHASTA LARD Bridge Design Specifications.

Young modulus as per IIRC code is given in the next table (IIRC: 21 5303. 1 .): Shear modulus of concrete, G, is calculated using the following equation: E= Sec/2(1 +0) The coefficient of thermal expansion and contraction for normal weight concrete is taken as 1. Xx-5 /co. Density of the pre-stressed concrete is taken equal to 25 INK/mm. Steel reinforcement: Thermo-mechanically treated reinforcement bars of grade 414 conforming to

IS: 1786 will be adopted. Yielding strength of passive steel reinforcement is considered equal to 414 Amp and Young modulus equal to 200 000 Amp.

Modular ratio between concrete and steel will be taken equal to 10. Progressing steel:- Progressing steel will be conforming to IS: 14268 , class 2 Low Relaxation uncoated stress relieved strands with the following characteristics: Nominal Area of a strand: Ap = 140 mm Strength Characteristic Stress: up = 1860 Amp; Modulus of elasticity: PEP = 195 OHO Amp; Relaxation Loss at 1000 hours under 0. 70 up: plot = 2. 5 %; Friction Coefficient for internal PET: p = 0. 25 raid-l ; Friction Coefficient for external PET: p = 0. 5 raid-l ; Wobble Coefficient: Stay cables: k= o. 003 ran-l; The stays are seven wire strands TTL 5 Class 1770 Amp The characteristics of the stay strands are: Nominal diameter 15. 7 mm; Nominal area Nominal mass 150 mm; 1. 18 keg/m; Ultimate tensile stress if's = mamma; Allowable stress FSP = mamma; Modulus of elasticity: 190 000 Amp; Strain under maximum load: at least 3. 5 %; Loads: SIDE: Element unit load quantity Load per meter unit Crash barriers 0. 75 4 3. 00 Median strip Utilities 150 keg/m 0. 5 Road overlay (the= O. Mm) 2. 024 2 4. 05 Footpath overlay (the= O. Mm) 0. 30 Drain pipes 0. 10 0. 20 Miscellaneous Total 8. 55 Dead loads: The self-weight is calculated assuming a density of 25 INK/mm for reinforced and overstressed concrete. A density of 7. 85 t/mm is to be considered for steel. Live Loads: Traffic live loads- The live loads are in accordance with IIRC: 6-2000. The bridge has two carriageways of three lanes each and of 11 m width. Each carriageway will be loaded with three ones of IIRC class A loading.

Pedestrian live load(PL)- The foot path loading shall be as per clause 209 of IIRC: 6 with intensity of loading equal to 500 keg/mm. Wind load for cable stayed bridge: According to Is: 875 (part 3)-1987 Wind loads on live loads (WALL)- The lateral wind force against moving live loads shall be considered as acting at 1. 5 m above the roadway and shall be assumed equal to 300 keg/m. Creep and Shrinkage(C Creep and shrinkage effects to be considered as per CUBE-PIP code for cable stayed bridge Earthquake loads Restaurants is located in seismic zone II.

The horizontal seismic coefficient in Normal vertical loads- A construction load of 50 keg/mm shall be considered during cantilever erection. Weight of the traveler form is assumed to be equal to 85 tons. An impact of 10 % shall be considered for the moving construction loads.