Zeitschrift: IABSE structures = Constructions AIPC = IVBH Bauwerke

Band: 3 (1979)

Heft: C-10: Bridges I

Artikel: Ruck-a-Chucky Bridge, California (USA)

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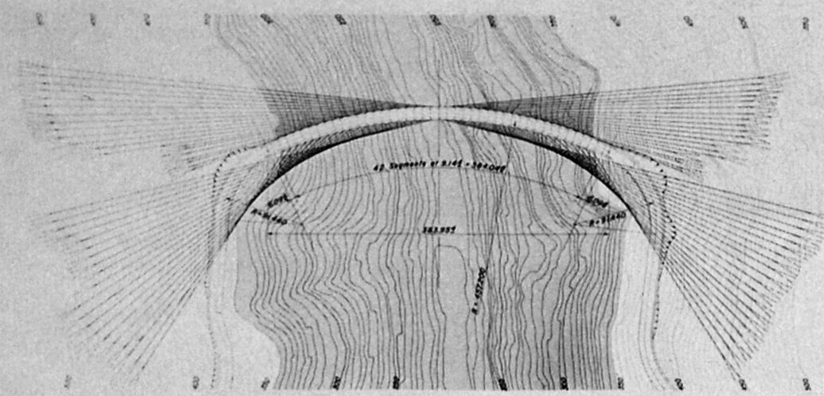
DOI: https://doi.org/10.5169/seals-15837

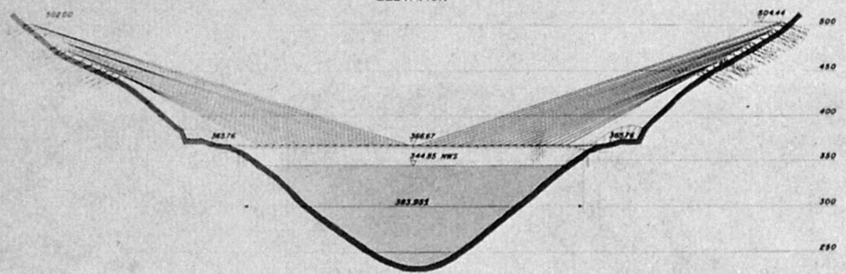
RUCK·A·CHUCKY BRIDGE AUBURN CALIFORNIA

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION

PLAN



ELEVATION

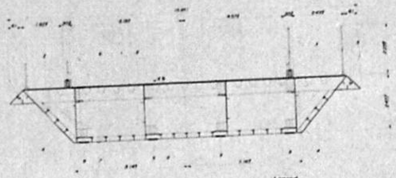


CONCRETE GIRDER

Legend

1 5 cm Epoxy Asphalt surfacing
2 Walkway
3 Equestrian pathway
4 Drainage
5 Stay cable trajectories
6 Loop anchorage
7 Transverse prestressing
8 Negative prestressing
9 Continuity prestressing

STEEL GIRDER



Legend

1 5 cm Epoxy Asphalt surfacing
2 Walkway
3 Equestrian pathway
4 Drainage
5 Stay cable trajectories
6 Bent Plate deck stiffeners
7 Longitudinal stiffeners
8 Diaphragms
9 Field connections

General

The Ruck-a-chucky Bridge will carry a local inter-county road across the proposed Auburn Dam reservoir northeast of Sacramento, California.
The hanging arc solution, curved in plan and suspended by cables reduces earthwork and eliminates tunneling at each approach. The structure consists of two basic components. The stay cables acting in tension and the curved girder carrying the traffic and absorbing the axial compression produced by the cables.
The cable formation and forces are determined in order to balance dead loads with no deflection, and to control the line of pressure within the girder, thus achieving an ideal stress condition with minimum bending or torsion. Stay cables are dimensioned in 1/2" Ø strand (190 kg/mm²). Parallel wire and bridge strand cables are alternative solutions. All stay cables are to be grouted.
The bridge deck girder was designed both in concrete and steel for competitive bidding.

Special Analytical Studies

Wind stability studies made on both section and terrain models show the bridge to be torsionally stiff and relatively insusceptible to wind excitation. Wind velocities of up to 200 km/hr do not produce flutter. The 100 year wind velocity of the site is below 150 km/hr.
The response of the bridge to seismic disturbances was predicted by dynamic analysis and scale model tests demonstrating the following:
1 Vertical acceleration controls the design
2 Linear theory is sufficiently accurate
3 Expansion joints are undesirable due to impacting
4 Under any conceivable earthquake, the bridge remains virtually undamaged

Other Special Studies

1 Effect of broken cable
2 Effect of cable sag
3 Effect of hillside fire
4 Construction camber

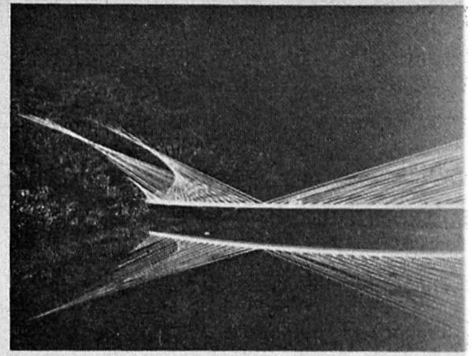
Abutments

The horizontally oriented concrete abutments follow the curve of the approach road and the contours of the hillside slope. In the concrete alternative the girder thrust is distributed to the foundation through ribs and diaphragms. The steel girder alternative requires an additional transition between the two materials. Rock anchors increase the stability of the foundation.

Pedestals

Cable anchorages on the hillsides are compact piers post-tensioned by rock anchors and later loaded by the stay cables. Dimensioning of the rock anchors and stay cables gives a vertical resultant force inclined into the hillside, increasing slope stability.

CONSTRUCTION



Legend

1 Abutment
2 Falsework
3 Traveller
4 Segment
5 Prestressing
6 Rock anchors
7 Pedestals
8 Stay cables
9 Horizontal erection cables
10 Central closure

Concrete Girder

The concrete box girder will be fixed at the abutments to provide stability and strength during cantilever construction. The central closure will be made continuous dissipating creep, shrinkage and temperature strains within the curved structure.
The closed box shape has maximum torsional rigidity with minimum material requirements. The element thicknesses are partly governed by the placement of prestressing steel, reinforcement, and concrete.
With transverse post-tensioning along both the top and bottom surfaces of the box, the entire deck structure is placed under bi-axial compression. The stay-cable-to-box attachment consists of a loop cable arrangement. A pair of loop anchors will be buried in each concrete box segment and post-tensioned prior to attachment of the stay cables. This detail simplifies the problem associated with stay cable attachment at varying angles. Internal longitudinal prestressing against the abutments and across midspan helps to maintain compression along the entire girder length.

Construction

The construction method is dictated by the steepness of the hillside and the depth of the ravine. The permanent stay cables as well as the temporary horizontal erection cables set predetermined stress distributions in the structure. Each stay cable is installed with the aid of a pilot cable between girder and hillside. The superstructure erection time is estimated at 10 months working simultaneously from both abutments.

Concrete Girder Alternative

Girder width	16.46 m
Girder height	2.59 m
Average Girder weight	18.9 t/m
Stay cable support interval	9.14 m
Number of stay cables	80
Material: Lightweight concrete $f_c' = 350$ kg/cm²	
Prestressing steel	87 000 kg
Stay cable strand	885 000 kg
Rock anchors	127 000 kg

Steel Girder

The steel girder alternative, similar to the concrete girder, will be fixed at the abutments in order to resist horizontal construction moments.
The multi-cell steel box section simplifies erection problems and is efficient for service loads.
Stay cables are attached to the box girder through the nose fairing detail at each border.
Each segment of the steel box girder is assembled on a travelling platform suspended below the structure, allowing all connections to be made before the steel is stressed.

Steel Girder Alternative

Girder width	15.85 m
Girder height	2.48 m
Average Girder weight	10.1 t/m
Stay cable support interval	15.24 m
Number of stay cables	48
Material: ASTM A588 $f_y = 35$ kg/mm²	
Structural steel	2 814 000 kg
Stay cable strand	482 000 kg
Rock anchors	71 000 kg