

STRUCTURES FINAL HYDRAULIC REPORT

Los Penasquitos Creek Bridge

Located approximately 8 km southwest of City of Poway in San Diego
County

JOB:

Widening of Br. No. 57-0106R/L

LOCATION:

11-SD-15-KP M28.2/M30.6 (PM14.7/PM20.0)

DATE:

August 21, 2002

WRITTEN BY:

Joy Cheung

REVIEWED BY:

Steve Ng / Victor Lin

Summary Information for the Bridge Designer

Below is a summary of key design parameters based on the hydrology and hydraulic analysis performed for this structure:

Minimum Soffit Elevation*	94.27 m or Match Existing
Potential Scour Elevation at All Piers*	78.3 m or at Competent Rock
Potential Scour Elevation at Abutments*	Competent Rock or Match Existing
Required Waterway	113 m ²
Average Velocity	3.8 m/s

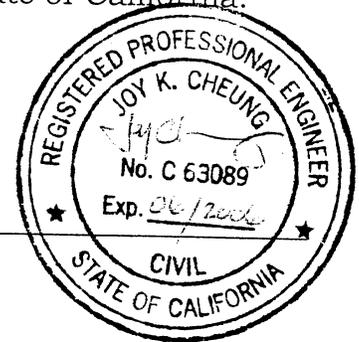
<u>HYDROLOGIC SUMMARY</u>			
Drainage Area: 111 km ²			
	Design Flood	Base Flood	Overtopping Flood
Frequency (yrs)	50	100	>>500
Discharge (m ³ /s)	285	435	>>1015
Water Surface Elevation at Bridge (m)*	93.6	94.3	123.8
Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.			

* All calculated elevations in this report are based on the 05/1975 Foundation Plans.

This report has been prepared under my direction as the professional engineer in responsible charge of the work, in accordance with the provisions of the Professional Engineers Act of the State of California.

Joy Cheung

REGISTERED CIVIL ENGINEER (SIGNATURE)



REGISTRATION NUMBER C 63089

DATE: August 21, 2002

Hydrology & Hydraulics Report

General

To increase the highway capacity of I-15 at Los Penasquitos Creek, the existing multi-lanes bridges (Br. No. 57-106R/L) are proposed to add two additional lanes at each direction.

The existing bridges are multi-column concrete structures with precast "I" beams supported by rectangular shape concrete columns and circular pileshafts, built in 1964 and widened in 1975 and 1988. The existing bridges are 199.37 m in length and have an average width of 24.84 m. The proposed sections will incorporate similar girders supported by 2.44 m x 2.44 m square column and 2.44 m diameter pileshafts. The new columns will match the existing bridge skew alignment. According to the Flood Insurance Rate Map by the Federal Emergency Management Agency (FEMA) dated January 19, 2001, bridge piers fall within the floodway boundaries. The January 17, 2002 Bridge Inspection Report (BIR) determined the existing bridge foundations to be stable for calculated scour conditions. Bridge foundations are founded on rock formations.

This hydraulic report makes extensive reference to data and analysis found in the Caltrans Bridge Maintenance Records for the existing Los Penasquitos Bridges (Br. Nos. 57-0106R/L); FEMA Flood Insurance Study dated January 19, 2001 and Flood Insurance Rate Map for San Diego County, California, Community Panel No. 06073C 1353F dated June 19, 1997.

Note: All calculated elevations in this report are based on the May 1975 Foundation Plans. Please verify datum references on the new bridge layouts and make elevation adjustments as required.

Basin

The Los Penasquitos Creek drains a watershed area of approximately 111 km² from both Rattlesnake Canyon and Iron Mountain to Interstate Highway 15. Elevation within the Los Penasquitos Creek basin varies from approximately 700 m at Rattlesnake Canyon to 91 m near the bridge site. This creek flows generally westward for about 12 km to the structure site and continues flowing westward through the northern portion of the City of San Diego, forming Soledad Canyon near the San Diego coast. Los Penasquitos Creek is formed by the confluence of Poway Creek and Rattlesnake Creek in the City of Poway. There is also a tributary called Beeler Creek which flows into the study reach of Los Penasquitos Creek, located about 100 m downstream from the confluence of Poway Creek and Rattlesnake Creek. The west end of the Los Penasquitos Creek starts out relatively flat and continues flowing into the steep-sided, meandering terrain of the Los Penasquitos Canyon. The above information was obtained from the 7.5 minute United States Geological Survey 1971 Photorevised Quadrangle Maps for San Vicente Reservoir and 1975 Photorevised Quadrangle Maps for Poway and Del Mar.

The basin is composed of rural-residential areas located along the lower portions of Poway Creek and in the hills between Poway and Rattlesnake Creeks. Floodplains are sparsely developed along the Los Penasquitos Creek. According to the FEMA Flood Insurance Study, the climate of the San Diego area is classified as subtropical Mediterranean

and has an annual rainfall average of 225 mm a year. The typical period when precipitation occurs in the San Diego area is from December to March.

Discharge

The highest flow on the Los Penasquitos Creek was recorded as 135 m³/s in 1980 by the gaging station number 11023340, located downstream of the existing structures and approximately 9 km southwest of City of Poway. There is no record of significant flooding along the creek. According to the FEMA Flood Insurance Study, the 50- and 100-year flood peak discharges of the creek at US Highway 395 (Interstate 15) are 285 m³/s and 435 m³/s, respectively. The 500-year flood flow is 1,015 m³/s. Chambers Dam is located about 1 km upstream from the Interstate 15 according to FEMA- Flood Insurance Study. Due to the size and the capacity of the dam, it does not influence the design flow of the bridge site.

Stage

A streambed analysis computer program, BrEase Version 2.4, was used to estimate the normal depth for the 50-year, 100-year and 500-year flood events for Los Penasquitos Creek Bridge (Bridge No. 57-0106R). The analysis was based on the preliminary profile of the proposed bridge, As-Built plans of the existing bridges, FEMA Flood Insurance Study and USGS – Poway Quadrangle Map. The average channel slope of 0.015 and Manning's roughness coefficient of 0.06 were used in the main channel for the normal depth calculation.

The calculated high water elevation from BrEase at the upstream face of the new widened bridge is estimated to be at elevation 93.6 m for

the 50-year discharge, 94.3 m for the 100-year discharge and 96.2 m for the 500-year discharge.

According to the FEMA Flood Insurance Rate Map, the 100-year base flood elevation for the existing bridge location is 95.1 m. In comparison to the elevation calculated from BrEase model and FEMA Study, FEMA study tends to provide a more conservative result. According to FEMA Flood Insurance Study, the cross section utilized in their hydraulics analyses for the water surface elevation was digitized from the aerial photographs and 1976 field data. Since the BrEase analysis was based on the 1975 As-Built plans and the cross section taken in 2002 field investigation, it will give us results based on current structure and channel condition. Use of different channel slope and manning "n" value will also effect the water surface elevation. Therefore, based on engineering judgement, the water surface elevations determined by BrEase model will be used for this project.

Streambed

The riverbed is composed of boulders, cobbles and sand. Mark Palmer of the Division of Engineering Services-Geotechnical Services performed a foundation evaluation on March 15, 2002 for the State Scour Critical Program for the existing structures. He indicated all of the existing mined shafts at Piers 3, 4 and 5 are founded in scour resistant material. For more information on the channel bed composition and its depths, please refer to the Log of Test Borings provided by the Foundation Investigation Branch, Division of Geotechnical Services.

Velocity

Based on the 100-year frequency discharge and the existing natural channel conditions, the channel velocities within the hydraulic model vary from 0.9 m/s to 4.6 m/s. An average velocity of 3.8 m/s is anticipated at the upstream face of the proposed structure.

Waterway

The required waterway of 113 m² below the high-water elevation of 94.3 m for the proposed structure will be adequate for the 100-year flow in the channel. This six span bridge (Bridge No. 57-0106R) with the four internal span lengths of 33.4 m and the end span lengths of 33 m will also be sufficient to pass the 50-year discharge plus freeboard.

Drift

There was no history of any debris and drift lodging at any of the piers for the existing bridges. Bridge maintenance records indicated only minor debris problem at Abutment 1 during the 1980's. Therefore, with internal span lengths of 33.4 m and end span length of 33 m should be sufficient for future debris to pass through the structure.

Minimum Soffit Elevation

Based on the BrEase model, the minimum soffit elevation of the new widened portion of the existing bridge is 94.27 m, which will be sufficient for a 50-year flood event with 0.61 m of freeboard and a 100-year flood event.

Scour and Channel Degradation

The stream channel can conceivably migrate over time with the possibility of increased scour around bridge piers and scour of bridge abutments. The probability of this occurring during the design life of the new structure is anticipated to be low since the structures were built on competent rocks. High flow skew of 15 degree at Pier 3 and 30 degree at Pier 4 were observed on January 17, 2002 field review by the DSM&I-Hydraulics.

Due to a 30-degree hydraulic skew at the bridge location and the structure is built on a multiple columns foundation, the potential local pier scour is calculated to be approximately 11.8 m. Since all of the existing mined shafts at Piers 3, 4 and 5 are sufficiently founded in the granite bedrock that underlies the site, a potential scour depth of 11.8 m is unlikely to occur for these bridges. The potential aggradation and degradation are insignificant based on historical cross sections taken at the existing bridges (Br. No. 57-0106R/L). Since the proposed widen abutments will not encroach into the base floodplain, contraction scour is not expected. Therefore, the total potential scour depth for the existing bridge is 11.8 m.

Using cross-section data taken from the January 2002 field visit, the existing thalweg elevation of 90.1 m is located in Span 3. The anticipated scour depth for all the piers is estimated to be at an elevation of 78.3 m.

It is recommended that all new pile foundations should be founded on competent bedrock or below the potential scour elevation of 78.3 m. The final unsupported elevation for all piers and abutments should be consulted with the Geotechnical Branch.

Bank Protection

The proposed bridge abutments are located near the flood plain away from the main channel. District is to recommend bank protection, if required for roadway approach.

Flood Plain Encroachment

This site is defined as Zone AE on sheet 1353F of the FEMA San Diego County, Flood Insurance Rate Maps, Community Panel No. 06073C dated June 19, 1997. The 100-year flood zone lies within the existing structure between Pier 3 and Pier 5. The new widened structures will not have any significant impacts to the existing hydraulic condition.