The Oceanside Passing Track and Bridge Replacement Project

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Abstract

Oceanside Passing Track and Bridge Replacement Project

The Oceanside Passing Track and Bridge Replacement Project is located in Oceanside, CA between MP 226.6 and MP 228.4 on the San Diego Northern Railway (SDNR). The SDNR is owned by North County Transit District (NCTD) and is a part of the Los Angeles to San Diego rail corridor (LOSSAN).

The LOSSAN corridor is the second busiest rail corridor within the Amtrak system. NCTD operates Coaster commuter trains and hosts Metrolink commuter trains, Amtrak’s Intercity Pacific Surfliner trains, and BNSF freight operations.

The project’s purpose is to provide the extension of an existing siding track by 1.4 miles creating two main line tracks, each 2.5-mile long to accommodate operating speeds of 90 mph for passenger trains and 55 mph for freight trains. Provisions were made for clearing freight trains for NCTD’s Sprinter DMU operations on the Escondido Subdivision via a new number 11 power cross-over at CP Escondido Junction. The project included track work, signals, grading, utilities, drainage, grade crossing improvements (two), and the construction of two new main track bridges. Detail of the bridge types include the replacement an existing 16-span, 6-pile bent timber trestle bridge over the Loma Alta Creek at MP 227.6 built by the Atchison Topeka and Santa Fe (AT&SF) railway in 1925. The trestle was replaced with a 5-span concrete bridge. An adjacent main track second 5-span concrete bridge was constructed after shoo flying over the first new bridge. The new second main track consists of 136# rail on concrete ties. Both bridges were constructed by driving 18” diameter steel friction piles with 12 piles for the abutments, 6 plumb and 6 batter. 10 plumb piles were required for
the 4 intermediate piers. The pile tip elevation was driven to a minimum 50 feet, with rebar cages installed in the upper 35 feet, and concrete placed by tremie method. Upon completion of the bridge substructure, the cast-in-place abutments and piers were constructed. Civil, signal, and track work progressed during this phase. In order to shoofly the rail traffic over to the new bridge a No. 24 turnout was installed at future relocated CP Longboard, MP 228.4. After installation of the turnout and completion of the first new bridge, the rail traffic was diverted via the new main track/shoofly in order to construct the new second main track bridge.

After completion of the second bridge, the new CP Longboard was placed into service with both tracks open for service on February 15, 2009.

This project is unique due to the bridge movement encountered during pile driving for the second bridge and the weather related issues during construction.

Key Words

Bridge Replacement
Loma Alta Creek
Oceanside Passing Track
Pile Driving
Shoofly Track
Timber Trestle
INTRODUCTION

The Oceanside Passing Track and Bridge Replacement Project is located in the City of Oceanside, California, on North County Transit District’s San Diego Northern Railway and is a part of the Los Angeles to San Diego (LOSSAN) Corridor, San Diego Subdivision. NCTD itself operates the Coaster commuter train service and accommodates the operation of Amtrak, BNSF, and Metrolink from the San Diego/Orange County lines (MP 207.5) to downtown San Diego (MP 267.7). NCTD also owns and operates the Escondido Subdivision, a 21-mile mixed use line from Oceanside to Escondido that supports NCTD’s Sprinter light rail service and BNSF operations. NCTD also provides bus service for the entire north San Diego County area including feeders for Sprinters.

The LOSSAN corridor is owned and operated by various railroads and agencies that include BNSF, Orange County, NCTD, and MTS in San Diego. Metrolink operates trains between Oceanside and Los Angeles in addition to various other routes serving the greater Los Angeles basin area. Amtrak provides intercity service from Los Angeles to San Diego as well as the other lines to and from Los Angeles. The Burlington Northern Santa Fe Railway (BNSF) operates freight trains over the entire LOSSAN route. The Oceanside Transit Center is an inter-modal facility connecting passengers to bus, commuter rail, light rail and intercity trains.
HISTORY

The first railroad bridge to cross the Loma Alta Creek, formerly Crouch’s Slough, was the California Southern Railway, a subsidiary of Atchison, Topeka & Santa Fe Railway, in 1881 with a 17-span, open-deck pile trestle bridge. AT&SF field records indicate that in 1925 the original bridge was replaced with a single-track, 6-pile, 16-span ballast deck pile trestle. In 1949 bents 1, 2, &17 were reposted. Walkways and handrails were added in 1950. In 1956 the City of Oceanside added a 12-inch sanitary sewer timber pile trestle bridge crossing the creek adjacent to the railroad bridge. Over its 83-years of service little maintenance was required to keep the trestle in a state of good repair. Prior to the start of the Project, track speeds over the bridge were 90 mph for passenger and 55 mph for freight trains.
A project study report was developed in October of 2001 and submitted to Caltrans Division of Rail (DOR) and NCTD for approval. After receipt of design funding and approval from DOR to begin the design, Amtrak issued a design contract in September of 2002. Upon completion of the design in December of 2003, construction funding was not available and the project was put on hold. In September of 2006 the funding was secured and a new design contract was issued to re-visit the design and complete the permitting process.
The design parameters to be considered were as follows:

How to cross a sensitive tidal creek and pose no negative impacts to the sensitive habitat and environment while improving the hydrology of the creek.

**Solution**

To reduce the hydraulic backwater elevation upstream of the bridge, it was decided to use 43'-6" standard precast concrete box girders with concrete piers installed in-line with every third existing timber trestle bent of the existing spans of the 1924 timber trestle. By eliminating the numerous bents with the concrete piers, the hydraulic calculations confirmed that the new pier arrangement would reduce the overall backwater upstream of the new bridge as compared to the existing condition. This design also created additional benefits by reducing the substructure footprint. Aside from the hydraulic considerations, Loma Alta Creek would also need to be returned to a suitable condition comparable to the existing condition after construction. To facilitate the crossing of the creek while maintaining the tidal flow during construction, the environmental permitting agencies allowed temporary fill impacts and construction of a coffer dam at pier #4.
Determining substructure pile type, e.g. - H pile, cast in steel shell pile (CISS), pipe pile, or cast in drilled hole pile (CIDH).

Solution

The geotechnical evaluation determined that the alluvial soils in the area had a potential for liquefaction below the water table. Therefore, bored and or vibratory piles were eliminated from selection because of the known high water table and the expectation of
liquefaction. The designer recommended a driven-pile foundation; using 50-foot, 18-inch diameter, and concrete filled steel shell pipe piles.

- Developing a track alignment that would accommodate a new second track bridge and demolition of the existing timber trestle bridge for a new second concrete bridge that would replace the existing one while maintaining rail traffic:

**Solution**

The construction phasing plan required the installation of the new #24 turnout at CP Longboard and the new second main track over the new single-track bridge. This new second track functioned as the shoofly track through a diverging route of the turnout for later removal and replacement of the existing Loma Alta Creek timber bridge. Once the new bridge was constructed replacing the existing timber bridge, Main Track 1 was then connected to CP Longboard which placed both tracks in service. Protection of rail traffic was secured by using the method of Form B protection within the General Code of Operating Rules. This proved to be the best cost effective method of protection for the majority of the project work. Form B protection allows for construction to occur between trains with R.W.P. flagging protection, GCOR, Rule 15.2 and 15.2.1.
FIGURE 4 – TRACK STAGING DIAGRAM #1
FIGURE 5 – TRACK STAGING DIAGRAM #2

PEDESTRIAN CONSIDERATIONS

➢ Maintain pedestrian traffic under the bridges during construction.

Solution

Provide detour and sidewalk shoofly paths around the construction area. Several one-day sidewalk closures were required during excavation, pile driving, and the girder erecting phases.
PROTECTION OF EXISTING UTILITIES

- Protect existing 12” sanitary sewer line/bridge adjacent to the existing railroad bridge.

**Solution**

Since the sewer line on its own bridge was old and in need of repair, and that the City wanted to remove the potential for a sewage spill into the creek, the City permanently re-routed the sewer line through City streets to allow for the complete abandonment and removal of the line over the creek. This removed a potential environmental problem for the City and also facilitated the construction of the Main Track 1 Bridge.

- The existing MCI/Verizon fiber cable crosses the creek on the timber trestle that required protection.

**Solution**

Protect in place and relocate to a new conduit attached to first new bridge on the fascia girder.

CONSTRUCTION

Amtrak awarded a construction contract to Kiewit Pacific Company on August 17, 2007 with a Notice-to-Proceed issued on September 17, 2007.

TEMOPORARY SHORING

Temporary sheet pile shoring with tie backs under the existing track structure was installed to protect the existing timber bridge and track prior to the start of pile driving.

This would also allow for the construction of the new abutments.
SUBSTRUCTURE

Both bridges were constructed by driving 18” diameter steel friction pipe piles. The piles had a wall thickness of ½” and a minimum length of 50-feet. Each of the four abutments consisted of 6 plumb and 6 batter piles. The 4 intermediate piers for each bridge contained 10 plumb piles each. Reinforcing cages 35-feet long were prefabricated off-site and delivered ready for installation into each pile. The pile cages were encased with 3,000 psi concrete by tremie method.

PILE DRIVING

The steel pipe piles were delivered to the site and end caps were welded in place. Pile driving for the first bridge began at abutment number 1. The piles were driven using a staggered pattern to reduce the amount of liquefaction encountered during the pile driving sequence.

REINFORCING AND CIP CONCRETE

Due to the tidal influence, mud slabs were placed behind the coffer dams prior to the installation of the reinforcing steel for each of the footers. The abutment footers are 11 ‘(w) x 22’ (l) x 3’ (d). The intermediate piers footers are 9’ (w) x 19'-6” (l) x 3’ (d).
FIGURE 6 – PILE REINFORCING AND MUD SLAB
CAST IN PLACE CONCRETE

Abutments and intermediate piers were constructed using standard construction method practices. Between the two bridges, a separation of 6-inches was held for the footers and 2-feet for the intermediate piers. All CIP concrete was 4,000 psi.

PRE CAST BOX GIRDERS

Each bridge span incorporated four box girders 43'-4" (l) X 3'-6" (w) X 3'-7" (h). The exterior fascia girder boxes were cast with a 2-foot high ballast retainer wall. All girders
were tied together with a 1 ¼" diameter, dywidag tie rods and post tensioned to 30 kips each. All Pre cast concrete members were 6,000 psi concrete.

FIGURE 8 – BOX GIRDER AND BRIDGE ARRANGEMENT

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WEATHER RELATED CHALLENGES

The winter rainy season of 2008 proved to be challenge during the construction of the first bridge. Storm drain pipes were installed through the temporary creek bottom construction access pads. During an unexpected rain event, the fill material was washed away and the pipes began to float downstream. The contractor was able to stop the pipes and retrieve them before causing additional problems downstream.

FIGURE 9 – FIRST MAJOR RAIN EVENT
Solution

Any forecast of rain and the temporary creek crossing with drain pipes would be removed prior to the forecasted rain event and reconstructed after the rain event.

ERECION OF GIRDERs

A 150-ton crane was used to set all girders. The first bridge girders were set in one 10-hour shift.

FIGURE 10 – FIRST GIRDER SET
FIGURE 11 – SET LAST SPAN BRIDGE # 1

TRACK CONSTRUCTION AND GRADE CROSSINGS

During construction of the first bridge (MT 2) the new track and warning devices for Cassidy Street grade crossing were built. New track was constructed between the future CPLongboard and Oceanside Blvd.

ESCONDIDO JCT CROSSOVER

A #11 crossover was installed at CP Escondido Jct. to facilitate the movement of freight traffic off the Sprinter line and provide the ability for continued use of the shoofly when the existing #20 turnout was removed at former CP Longboard. This cross-over has
also become quite useful for the dispatching of Amtrak trains at the Oceanside Transit Center.

**OCEANSIDE BLVD. GRADE CROSSING AND TRACKWORK**

New track was constructed across Oceanside Blvd. and the grade crossing warning devices relocated. New track was also built from the end of siding to Oceanside Blvd. in preparation for final line over.

**SHOOFLY TRACK LINE OVER**

The shoofly track (MT 2) was opened and rail traffic moved onto the new bridge at the completion of the track, grade crossing, and bridge work.

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**FIGURE 12 – SHOO FLY LINE OVER**

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DEMOLITION OF THE EXISTING TIMBER BRIDGE

Demolition of the existing timber bridge proceeded the week after moving the rail traffic onto the new bridge.

FIGURE 13 – TRESTLE DEMOLITION
BRIDGE MOVEMENT DURING PILE DRIVING

During the pile driving operation of the MT 1 Bridge, intermediate pier #4 of MT 2 Bridge shifted to the west for a total of 1-1/4”. Minimal vertical movement was detected during pile driving of the bridge for MT2. The horizontal movement created a buckle in the track alignment and trains were slowed to 30 mph. No movement of the existing timber bridge was encountered during the construction of MT 2 Bridge.

FIGURE 14 – PIER MOVEMENT MONITORING STATION
PROBABLE CAUSE

It was determined that a combination of liquefaction during pile driving and the end caps at the pile tips created displacement of this pier. The pier is located directly in the center of the creek’s channel. Minimal movement was measured in each adjacent pier.

SOLUTIONS DISCUSSED

- Remove pile tip end caps, drive pile and auger out material from center of shell pile. Over driving pile and interior auger work would result in a change order.
- Continue to stagger pile driving and drive piles with end caps on so the interior of the pile remains a clean shell. Monitor bridge movement during pile driving operation and proceed cautiously. If bridge movement is determined to be a minimal amount re-align track if required and continue pile driving until completion.

Selection

Drive pile as per plan and specifications. Monitor bridge movement through the placement of survey monuments and re-line track as required. Provide post construction monitoring. Minimal horizontal and vertical movement continued during pile driving and a slow order was placed on the track. The maximum horizontal movement was 1 ¼” and the maximum vertical movement was 3/8”. The track was re-aligned two addition times with the bridge movement stopping at the end of the pile driving phase.

LESSONS LEARNED

Include with the contract documents the provision for interior pile augering to remove the soil from the shell pile after driving the pile with no end cap.
CONSTRUCTION OF SECOND BRIDGE

At the completion of abutments 1 and 6 and after sufficient back fill was placed, the temporary shoring was removed. The second new bridge was constructed with no weather challenges as rainy season passed. The channel was re-established and the sidewalk for pedestrians completed.
With the completion of the second bridge and the two grade crossing ready for service, the existing CP Longboard #20 turnout and switch was retired from service. The tracks connected at the former siding end and shoofly track were lined back to main. New CP Longboard placed into service with two main tracks between CP Shell and CP Longboard.
CONCLUSIONS

Although the replacement of this bridge and similar projects are sometimes routine, this particular project proved challenging as a result of weather related and bridge movement issues. Given these challenges, with effective construction management, Amtrak with funding through Caltrans Division of Rail, completed the project ahead of schedule, within budget, with no injuries, no accidents, or major train delays. This is a testament to the project team’s tireless dedication and commitment to the project for a year and a half.
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