DESIGN CONSIDERATIONS FOR AN 150 CAR SIDING AND COAL YARD RAIL IMPROVEMENTS AT CALAVERAS LAKE GENERATING STATION

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A) ABSTRACT:

This paper outlines considerations for the design of a 150 car siding and various coal yard rail improvements at the Calaveras Power Station for CPS Energy (CPS). The rail improvements are part of the coal yard improvement project which was implemented to address increased coal demand from the construction of a new 750 MW coal-fired unit. Also planned as part of the improvements was an expansion of the on-site rail infrastructure to accommodate multiple 150-car unit trains in order to improve reliability of train deliveries to the site; and to increase the amount of track for coal car repair operations. The rail improvements include a 150 car siding adjacent to the existing spur track to the plant, expansion of the rail loop, increased rail car storage, sidings and car repair ladder track system, construction of an overpass structure over the existing coal yard loop, and installation of a new rack & pinion train positioner used for maneuvering unit coal trains during unloading operations.

Design challenges included the following: existing utility conflicts beneath and adjacent to the new track; limited land availability due to the proximity of Calaveras Lake and existing right of way limits; design of a new through-girder bridge structure crossing over Highway 181; coordination with Union Pacific regarding track/bridge design, radio controlled switch machines and presence detection; drainage improvements associated with the track; construction and commissioning of a new train positioner while the existing positioner remained in-service; and coordination of the existing employee entrance road relocation, as the existing road will be demolished during construction of the new rail siding.
B) BODY OF PAPER:

Introduction

The construction of JK Spruce #2, a 750 megawatt (MW) coal-fired unit, will increase coal demand at CPS Energy’s (CPS) Calaveras Lake Generating Station by approximately 60%. Powder River Basin coal is delivered by unit trains via Union Pacific (UP) mainline. Delivery schedules have been impacted by the limited number and location of sidings long enough to hold 135 car trains without breaking the trains, and train deliveries have been erratic. The increased coal demand, erratic delivery schedules, and requests from UP to provide temporary storage for up to three trains on-site prompted CPS to consider rail improvements including a 150 car siding.

The UP mainline is approximately 2.5 miles southwest of the Calaveras Lake Generating Station. The plant access spur is a single private track, consisting of 136 lb rail on wooden ties. The spur crosses Highway 181 by way of a bridge, and over Calaveras Lake in two locations, one with a bridge and the other with a causeway. On the east side of Highway 181 the spur is bound by a single lane of one-way roadway on either side of the track. These one lane roads act as an alternate employee entrance and exit for the plant.

An ash track splits off the access spur prior to the coal unloading loop and is being used for car storage. The coal loop utilizes a train positioner and rotary dumper for unloading of coal deliveries. Within the coal loop is a car repair shop and repair ladder tracks. There are miscellaneous tracks for the car classifier and repaired car storage. Current vehicle access to the coal yard within the loop is by at-grade crossings.

In addition to the new siding, upgrades to on-site rail infrastructure would be needed, as the existing rail infrastructure was not capable of holding or unloading current train lengths of 135 cars without breaking the trains into smaller segments. The upgrades would also take into account the anticipated increase in handling and storing bad order cars and repaired cars. These upgrades included a new train positioner, upgrades to the rotary dumper wash down system, considerations for increasing the capacity of the repair car siding, the classifier track bypass, and construction of an overpass to allow vehicle access to the inner portion of the coal loop when trains are being unloaded. Also planned in coordination with the
new siding and coal yard improvements was the construction of a new employee entrance road to access the plant.

**Design Considerations**

Construction of a new siding would provide a dedicated private siding which could improve delivery reliability. This would also meet UP’s request to be able to temporarily store three trains on-site. Additional benefits of a new siding would include reduced vandalism to cars left on uncontrolled private sidings, increased temporary storage (approximately 18,000 tons), and additional opportunity for inspection and maintenance of cars. The overall goal of the improvements was to increase the facility to handle and store 150 car trains and improve on-site rail movement while eliminating the need to break trains and perform reverse movements.

Though current unit trains received at the plant are comprised of 135 cars, the improvements were designed to accommodate 150 cars with four engines. Multiple locations for the new siding were evaluated, and the location chosen was adjacent to plant access spur. A siding at this location would not be as dependent on train delivery schedules, crew availability, or loading and unloading schedules. In addition, this was the only location that would allow the rail infrastructure to be expanded to temporarily accommodate three unit trains on-site.

For the siding to be long enough to accommodate 150 cars, a new bridge was needed adjacent to the existing bridge crossing Highway 181. The existing bridge was a through girder bridge. Based on the clearance requirements for the highway below and the desire to maintain similar infrastructure, a through girder bridge was chosen for the new siding as well. The bents for the new railroad bridge would also share a concrete deck for a maintenance road. The maintenance road crossing would serve as an inspection point for the railroad bridge and allow maintenance vehicles to cross over Highway 181.

The maintenance road bridge over Highway 181 would connect the existing alternate employee entrance road to a new maintenance road on the west side of Highway 181. The new maintenance road, maintenance road bridge, and alternate employee entrance road would be between the existing plant access spur and the new siding. Since a new employee entrance was being planned for another location, the existing alternate employee entrance and exit roads on either side of the existing plant access spur would be kept as maintenance and inspections roads.
The increased coal delivery frequency and the ability to handle and store longer unit trains required several rail yard improvements, starting with the train positioner. The existing train positioner consisted of a cable pulley system that could move 110 cars and unload coal at 3200 tons per hour (TPH). Since delivery train lengths were generally 135 cars, trains had to be broken into smaller segments to be handled by the existing positioner. The breaking of trains was inefficient, and added safety risks during reverse movements to recouple the train segments. CPS planned to replace the existing positioner with a rack & pinion positioner with a capacity to move 150 cars and unload coal at 3600 TPH. The existing positioner needed to be maintained and operated during the construction of the new positioner to maintain the ability to unload coal. To accommodate this, the new positioner was sited on the opposite side of the track from the existing positioner. Construction was phased so track work was performed during outages, and demolition of the existing positioner wasn’t performed until the new positioner was tested and put into service.

The new positioner could handle 150 car unit trains, but there wasn’t enough length on the existing loop on the exit end of the rotary dumper to store a full 150 car train after unloading without blocking the entry to the loop. Therefore the rail loop was expanded by relocating the loop turnout and adding new 115 lb rail track. By adding this track, there was storage for an empty train after unloading, without impacting the ability for a loaded train to enter the loop, as the existing loop track has enough space between the loop turnout and the exit end of the dumper for a 150 car train.

To handle the increased delivery of coal, CPS had planned to add approximately 790 new cars to their fleet. CPS provides storage and repair areas for approximately 10% of the fleet. Therefore additional track at the repair car ladder track and the repaired car storage track would be needed for 10% of the expanded fleet.

A 150 car train on the exit end of the dumper building would block vehicle access from outside the coal loop to the inside of the coal loop. To maintain vehicle access to the inside of the loop without having to break a train, a new overpass would be provided for continuous vehicle access to the coal yard and other facilities located in the inside of the coal loop. The overpass would also be a safety feature for the reliable access of emergency vehicles while coal is received and unloaded.
Design Challenges

Since Calaveras Lake Generating station is surrounded on three sides by Calaveras Lake and permitting restraints limited construction disturbances to the lake, the presence of the lake influenced the layout and location of the siding. The new track design was generally based on the UP’s Technical Specifications for Construction of Industrial Tracks. However, with the space constraints, special considerations were evaluated to keep the improvements in the space available. These special considerations included modifying switch stand layouts and the walkway layouts.

Several of the turnouts had the switch stand moved to the through track side of the turnout to reduce conflicts with the existing track. In this configuration, the access walkway was immediately adjacent to the existing maintenance road. Since the limits of the lake would not allow the road to be relocated, the road elevation was raised to the top of the tie, and the switch stand and walkway were protected with guard posts. UP agreed to these modifications if the new switch machines were radio controlled. This configuration allowed the access from the maintenance road to the walkway at a level grade. Since the majority of the switch movements would be done by radio control, there would be limited possibilities of both a rail worker and a vehicle being in the area of these switch stands.

Radio controlled switch machines were used at three of the turnouts that would be used by the UP. Based on their past use, UP recommended GE Hydra Switch machines. In addition, UP prohibited the used of wheel counters for presence detection, but allowed either track circuits or loop detection. For various reasons the loop detection system was chosen for the radio controlled switch stands.

As is often the case with the expansion of existing rail facilities, the availability of space also played a significant role in the design of the on-site rail improvements at the repair facility ladder tracks. The general layout of the existing yard rail was to be maintained, and the expansions to the loop track and ladder tracks were fixed at the respective tie in points by the location of the existing track. Therefore the new track and modifications had to fit within the existing yard features and tie in points. Since the ladder track turnouts were No. 8, the same size turnouts were used for the new ladder tracks. The space constraints required the turnout track curves begin before the end of the turnout, and new switch tie layout diagrams were developed to assist the contractor with layout and construction.
Existing utilities also affected the design. An existing 24” diameter gas line was adjacent to the siding on the west side of Highway 181. To maintain cover and to prevent undermining of the gas line and provide enough room for the new siding and maintenance road, a retaining wall was planned. The type of retaining wall had to take into account the soil conditions; the close proximity to the adjacent maintenance road; and a construction method which would minimize the disturbance of the existing gas line. Due to the risk associated with undermining the gas main and soil conditions reported by the geotechnical engineer of record, a soldier pier retaining wall with concrete panels was selected over a traditional concrete retaining wall.

Other utilities that needed to be addressed included a 72” San Antonio Water Service Aquifer Recharge Line, an existing 48” corrugated metal pipe drain, and several gas, electrical, fiber optic and miscellaneous drainage structures. Some utilities were abandoned, others were left in place, and some were rerouted. The 48” corrugated metal drain pipe was severely corroded, and could not be extended beneath the new siding. To replace the pipe, a new pipe was placed by jack-and-bore methods. The advantage to this was that the track and employee maintenance roads were able to be left undisturbed. The existing pipe was abandoned in place.

The new rail bridge over Highway 181 was designed in general accordance with the AREMA Manual for Railway Engineering. Review by UP highlighted differences in design philosophies between UP review engineers and Burns & McDonnell. One particular concern brought up by UP was the use of welded flanges on the through girders. UP recommended the use of a bolt on flanges instead of welded on flanges. UP reasoned that bolted flanges would be easier to repair as they would simply be unbolted, removed, and a new flange be bolted on. Burns & McDonnell contended that damage done to a bridge that required the replacement of a flange would likely require further repair to the steel girders. This likely would be more complicated than unbolting a flange. In addition, it was pointed out that painting, inspection, and maintenance of a welded connection would be easier than for a bolted connection. Other design challenges included draining of the decks, spacing of the bridges and use of protective fencing between the bridges. Burns and McDonnell conformed to the UP’s requested design changes. Since the bridge would be privately owned and maintained, the UP agreed the steel girders could have welded bottom flanges.
The entrance road was to be bid in the tradition TXDOT format, as many of the contractors likely to bid on the project would be familiar with this format. In addition, TXDOT standards were used for the design of the entrance road, as the TXDOT standard specifications were an integral part of the TXDOT bid process. CPS requested that the track construction bid package be prepared in general accordance with the TXDOT format, which did not contain specifications for the track construction. Therefore construction specifications referenced TXDOT Standard Specifications and specifications for track construction were included as special provisions to the contract.

In addition there were interface points between the new entrance road and the new 150 car rail siding, particularly in the area of Highway 181. There were several common obstacles such as utility conflicts for the entrance road and rail siding that needed to be coordinated between TXDOT standards and Union Pacific Standards.

Summary

The limited space constraints and presence of existing infrastructure associated with constructing rail improvements on an existing plant site imposed design challenges that were successfully overcome. Coordination with UP engineers led to a give and take compromise on design methodologies. Ultimately, since the new bridge would be privately owned and maintained, UP accepted some deviations from their standards.