Feasibility Study

Three Creeks Trail Railroad Trestle at Los Gatos Creek

Prepared for

City of San Jose

October 08, 2012

CH2MHILL

1737 N. First Street, Suite 300

San Jose, California 95112

(408) 436-4936

(408) 436-4829 FAX

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Acronyms and Definitions

Acronyms

AASHTO: American Association of State Highway and Transportation Officials

AASHTO Pedestrian: AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges

AASHTO Sign: AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals

AISC- American Institute of Steel Construction

AREA- American Railway Engineering Association

AREMA- American Railway Engineering and Maintenance-of-Way Association

ARS- Acceleration Response Spectrum (Definition below).

Caltrans SDC: California Department of Transportation's Seismic Design Criteria

Caltrans LRFD: AASHTO LRFD, 4th Editions with California Amendments

LRFD- Load Resistance Factor Design

Definitions

ARS- Acceleration Response Spectrum. This is a plot of the acceleration vs. period for a structural system. Curves are based on a series of oscillators (of varying natural frequency), which are forced into motion by the same ground motion at the base.

Pile Bent- Part of the bridge substructure. Uses a row of driven piles with a pile cap to transfer loads to the soil.

Pile Cap- Horizontal member between the stringers and piles. This member carries the load of the superstructure and distributes it amongst the piles.

Sash Brace- Horizontal brace spanning between and bolted to all piles.

Skew Angle- The acute angle between a line perpendicular to the alignment of the superstructure and the alignment of the substructure.

Stringer- A beam aligned with the length of a span which supports the deck.

Sway Brace- Cross braces above and/or below the sash brace bolted to the piles.

1.0 Executive Summary

This report summarizes the findings of a retrofit study by CH2M HILL of the existing railroad trestle at Los Gatos Creek (near Lonus Street) in San Jose, CA. The study determines whether or not the existing timber trestle should be considered for re-use as a pedestrian and bicycle structure in a network of local trails. Inspection of the existing structure's condition served as the basis of the feasibility study. From this information, the overall current condition of the structure was assessed and a retrofit approach selected. Two options for retrofit, a concrete decked option and an IPE wood decked option, were considered in the analysis. A pre-fabricated replacement bridge was also analyzed as an option.

The current condition of the structure requires extensive repairs to the bracing and complete replacement of the decking. In addition, the bridge has been the victim of several fires over the years which will require quite a bit of work to clean up. If returned to a useable state, this structure would require on-going maintenance and inspection above and beyond typical City practice. Additional equipment would also need to be purchased or rented in order to annually clear debris away from the base of the bridge. The bridge should also be provided with a fire protection system to minimize the risk of further fire damage. While retrofit of the existing structure was found to be feasible, due to its age, the bridge will continue to deteriorate and will need additional repairs at regular intervals.

To address the concerns over repairing the existing bridge, the study also looked into using a single-span prefabricated replacement bridge as a design option. CH2M HILL worked with Contech® Engineering Services to find a single-span steel truss that could span over the creek and floodplain. It was found that a 210 foot long steel truss with a concrete deck could work. In order to compare all the pros and cons of each option, a comparison matrix was developed and a scoring system applied. It was found that the replacement option had a slightly higher upfront cost, but was the best value for the City over a 40 year time frame. CH2MHILL recommends that the bridge be replaced with a new prefabricated bridge to minimize the long term cost to the City.

2.0 Introduction

CH2MHILL was contracted by the City of San Jose to analyze and eventually design either a retrofit or replacement of the former UPRR Railroad Trestle over Los Gatos Creek in San Jose, California. Our agreement with the City, dated January 27, 2009, is a Master Services Agreement (MSA) with individually authorized task orders. Service Order No. #6 authorized the Three Creeks Trail Trestle Enhancement Feasibility Study, which is an investigation of the possible reuse and repair of the existing timber trestle that crosses Los Gatos Creek near Lonus Street. A repair and retrofit evaluation of the existing structure was performed as part of Task 2 of this service order.

The Los Gatos Creek Railroad Trestle is an open-deck pile supported trestle that has an overall span length of 210.5 ft and is approximately 25 ft high at its tallest point. The trestle was a former rail road structure constructed by the rail road but the tracks have been removed from the structure, which is now owned by the City of San Jose. The structure is supported by two timber pile abutments and thirteen timber pile bents. The bents range in size and geometry at each location, but the longitudinal spacing of the bents is approximately constant at 15 feet. The bents have a skew angle of approximately 9.5 degrees. The structure construction is generally in conformance with past editions of the AREA (American Railway Engineering Association) Manual for Railway Engineering.

The following contains the findings of our preliminary engineering task which utilized our previous field inspection work along with engineering analysis to evaluate seismic vulnerabilities, scour potential and repair needs. Utilizing the proposed design criteria we developed earlier (see Appendix A), we evaluated the structure for conversion to a bike path bridge. The open-deck of the existing trestle, consisting of stringers and ties, is inappropriate for use as a pedestrian or bicycle path. Two re-decking alternatives for reuse of the existing trestle were considered in our analysis: 1.) Replacement of the open deck with a concrete slab (pre-cast post-tensioned or cast-in-place) and 2.) Replacement of the existing ties with IPE wood decking and also new longitudinal stringers at each edge of the 12 foot wide deck. In both options a new 54-inch high galvanized metal bicycle safe railing system would be provided. This railing could be powder coated for aesthetics and would still be very low maintenance.

Recommendations for retrofit or replacement of the trestle, including cost estimates, will be discussed in this report. When referencing different members and locations, the numbering and names used in this report follow designations as follows: The southernmost abutment is designated “Abutment 1”. Moving northward, and starting with Bent 2, the bents are numbered consecutively up to “Abutment 15”. Looking ahead on line refers to a view looking from the south to the north. The west edge of the structure is referred to as the left edge, and the east is referred to as the right edge. The span numbering corresponds to the abutment and bent numbering, so, Span 1 goes from Abutment 1 to Bent 2, and so on.

2.1 Concrete Deck and Railing System

The concrete deck system will consist of either a precast slab system with longitudinal post tensioning or a cast-in-place on steel stay-in-place forms reinforced concrete system. Both options will have concrete approximately 8 inches thick and will contain two layers of bar reinforcement in both directions. A slight cross slope will be built into the slab to drain it to one side. A 54-inch high galvanized metal railing system will be supported by posts mounted to the side of the slab. The advantages of a precast slab compared to a cast-in-place deck include lower cost and speedier construction. The advantages of the cast-in-place deck include a more uniform and aesthetically pleasing walking/biking surface and less chance of leaks through the deck. The proposed concrete decked trestle cross section is shown in **Figure 2**.

If visual appearance is a concern, the concrete deck can be scored and stained to resemble the old railroad tracks for an aesthetically pleasing nod to the past life of the structure. This treatment has been used in other locations where a pedestrian facility has replaced a railroad track. The concrete stain could be something similar to what is shown in **Figure 1**.

Figure 1: Concrete Stain Example

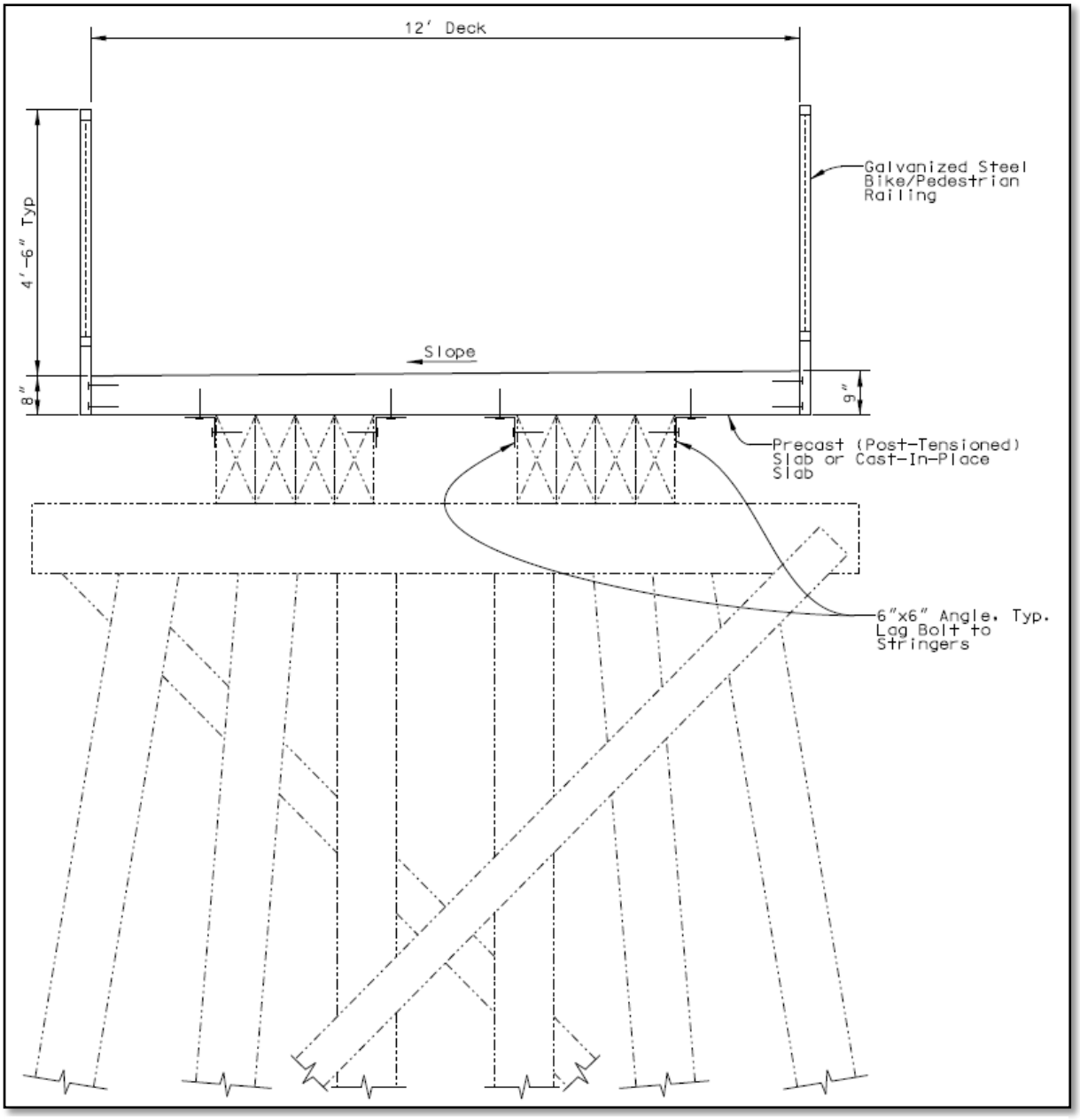

Figure 2: Concrete Deck Option

2.2 Timber Deck and Railing System

For the timber decked system, per City request, the walking surface planking will be IPE timber. Planks will be oriented transverse to the alignment to avoid longitudinal gaps that could trap or steer bicycle tires. The planks would sit on the existing stringers and an additional stringer (8-inch x 20-inch x 30-ft Doug Fir beam or equivalent Doug Fir Glulam) would be added to each edge of the 12 foot wide deck. Decking would be predrilled and screwed into the stringers, because nailing is not practical with the use of IPE. PVC drip guards (or flashing) would be provided to help prevent moisture collection on the tops of all timber stringers and on the tops of any bent caps that are replaced.

The proposed timber decked trestle cross section is shown in **Figure 3**.

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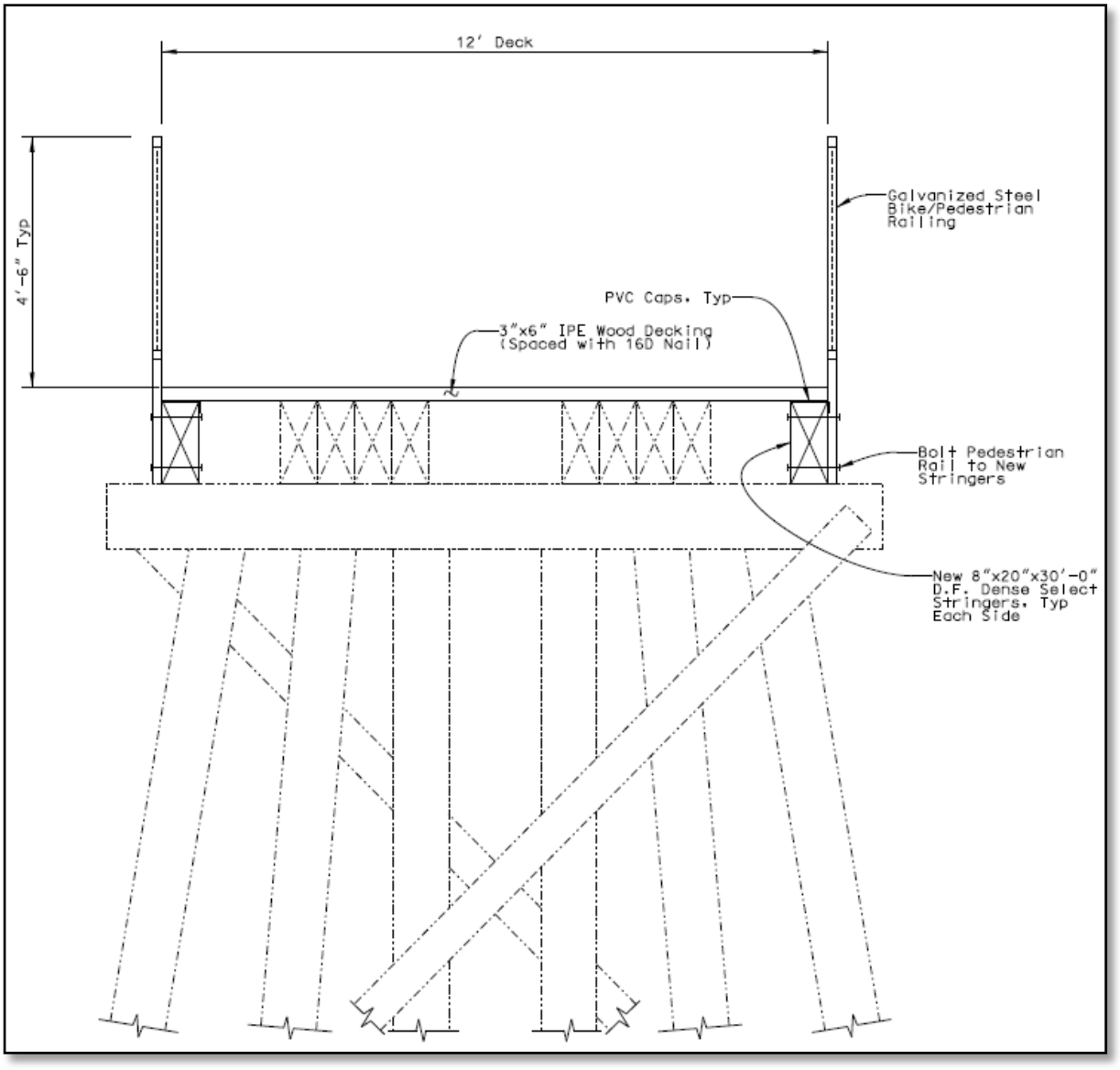


Figure 3: Timber Deck Option

2.3 Analysis Methods

For this preliminary analysis, the bridge was analyzed in parts using tributary areas for loading. Transverse bent models were built in a structural analysis program (SAP 2000) for selected bents. Bents that were analyzed were selected to limit the number of required models and to capture the worst case response. One bent with only a partial cross brace was analyzed (Type 1 Bent), one bent with upper cross braces was analyzed (Type 2 Bent), one with upper cross braces and sash braces was analyzed (Type 3 Bent), and two with upper cross braces, sash braces, and lower cross braces were analyzed (Type 4 Bent).

Type 4 bents included Bent 6 and Bent 7, which were both selected as they both have ineffective piles that are deteriorated near the ground line. Bent 6 has 5 piles that are good and one that is deteriorated near the ground line and Bent 7 has 4 piles that are good and 2 that are deteriorated near the ground line. Both bents were analyzed with all piles effective for one model and then again with only the effective piles. This was done in order to determine the minimum number of piles required to carry the design loads. Demand to capacity ratios were calculated for each component of the structure from each of the model types.

Typically the code requires that 100% of the forces from an earthquake in one orthogonal direction be combined with 30% of the forces in the other direction. For the simplified analysis performed, an equivalent static method in transverse direction was chosen. Typically combining the two directions of forces would be done using Square Root Sum of Squares (SRSS) methodology. If the stiffness in the two directions is similar and the bent has 100 kips of shear in a pile transversely, the longitudinal shear would be 30 kips. Using SRSS to combine forces the overall force would be 104.4 kips. This is a small increase from the 100 kips transverse. In the case of this timber trestle the stiffness of the structure transversely is larger than it is longitudinally. As such, analyzing the bents for transverse motion only is a good way to approximate the overall demand. For final design of either retrofit option, a full 3-D seismic model of the structure should be analyzed to confirm the findings of this report.

For this report the concrete deck option was analyzed first. The concrete alternative has an overhang beyond the existing stringers and an initial calculation was done to confirm that an 8 to 9-inch reinforced slab would work for a truck wheel load placed 1 ft from the railing. This same section was analyzed for 95 pounds per square foot of pedestrian loading and it was found that the demands were lower than with the truck loading. The stringers, cap, and substructure were then checked using a concrete deck.

The wood design option uses IPE decking. The decking was designed to run transversely on top of the existing stringers. Our calculations showed that a 3-inch by 6-inch IPE board would be capable of taking the demand of self-weight and the live load. To avoid driving a truck on a timber cantilever, the outside edges of the new 12 foot wide deck were supported by new 8-inch by 20-inch stringers. Dead load for this alternative was found to be less than that of the concrete deck option; therefore the overall seismic mass and forces would be less. Substructure checks were not completed for the timber decking system as the concrete decking worked.

Structure loading consisted of the following approaches:

Dead Load Approximation:

Dead load approximations for the two design options were done using known densities for the types of materials used. Nominal dimensions of timbers were used in all dead load calculations. Creosoted Douglas Fir was taken at 60 pounds per cubic foot per the AREA Manual Recommendation. This is heavier than pressure treated Doulas Fir and is intended to account for the added mass of the creosote in the timber. Any new timbers that were added to the structure, or any that replace existing components, were also taken at 60 pounds per cubic foot. This is to account for the possible use of creosoted Douglas Fir if the City selects to use that instead of pressure treated. Pressure treated material is lighter and therefore, the demands on the structure would only decrease.

All IPE planking was taken at 69 pounds per cubic foot (values for this vary and the USDA Forest Products Laboratory lists it at 64 pounds per cubic foot for 12% moisture). The overall weight of the timber deck option is less than that of the concrete deck option and is a factor in the seismic modeling choices that

will be discussed. Concrete was assumed to have a unit weight of 150 pounds per cubic foot and the steel pedestrian/cyclist safety railing was estimated at 40 pounds per linear foot.

Live Load Approximation:

Pedestrian loading of 95 pounds per square foot and truck loading of 20 kips (H10 Design Truck) were both used in accordance with the AASHTO LRFD Pedestrian Bridge Guide Specifications. During work on the superstructure it was found that the H10 truck governed the live load forces and that the total reaction in the stringers was higher than those seen from pedestrian loading. Thus, all LL checks were performed using the H10 Truck. Per AASHTO Pedestrian Guide Specification no impact factors were applied. Also, braking, collision, and centrifugal forces were assumed to be insignificant since only maintenance vehicles traveling 5 miles per hour or less will be on the structure. For the purpose of the analysis the H10 Truck is considered to be the maximum allowable vehicle load allowed on the bridge.

Seismic Load Approximation:

Seismic loading was done using the Caltrans Probabilistic ARS curve that was provided by Parikh Consultants. In order to characterize overall performance of the bridge, specific bents were chosen for transverse analysis in the structural analysis program SAP 2000. An iterative approach was used to determine the bent's performance. Force displacement curves for each pile group were characterized and modeling of the selected bents started by assuming an initial depth of fixity. An assumed lateral load was applied to the cap level of the bent and the ground line displacements were averaged and checked against the average requirement from L-pile for the same loading. Depth of fixity was adjusted until the two displacements matched (the model results vs. the L-Pile results). The period of the bent was then calculated based on its stiffness and tributary mass and a new lateral force was calculated using the ARS curves.

The new lateral force displacement was applied to the top of the cap and the deflections were again checked against L-pile. Depth of fixity was again adjusted until L-pile deflections at the ground line were achieved and a new period and seismic force was calculated. This process was repeated until the period of the bent converged. This ensured that the L-pile properties were applied correctly to the model and that the forces in the substructure were correct based off of the applied seismic forces.

The following AASHSTO LRFD load cases were considered in the analysis:

Strength 1:

This load takes into account 125% of dead load combined with 175% of live load and 100% of water load. Stream loading found to be less than 1 kip transversely and was therefore neglected. The final load case analyzed was 125% of dead load combined with 175% of live load. All elements of the bridge were checked at this force level.

Strength 3:

This load case takes into account 125% of dead load combined with 100% of water load and 140% of wind on the structure. Stream loading found to be less than 1 kip transversely and was therefore neglected.

Extreme Event 1:

This load case takes into account 125% of dead load combined with 100% of water load and 100% of earthquake load. Stream loading found to be less than 1 kip transversely and was therefore neglected.

Extreme Event 2:

This load case takes into account 125% of dead load combined with 50% of live load and 100% of water load. Stream loading found to be less than 1 kip transversely and was therefore neglected. Since the Strength 1 case would result in larger forces the Extreme Event 2 load case was ignored.

Service 1:

This load takes into account 100% of dead load combined with 100% of live load, 100% of water load, 30% of wind on the structure, 100% of wind on live load, and 100% of thermal load. Stream loading found to be less than 1 kip transversely and was therefore neglected. Wind on live load is not considered since a long row of vehicles is never expected to be present on the bridge. Longitudinal thermal effects are not accounted for as timber is a high insulator for temperature changes. Thus, the overall load combination was reduced to 100% dead combined with 100% live and 30% wind.

Fatigue 1:

Fatigue was not considered per the AASHTO Pedestrian Guide Specification.

3.0 Vulnerabilities

3.1 General

The Los Gatos Creek Trestle is in generally good condition and can be modified to perform as a bicycle pedestrian crossing of Los Gatos Creek. Originally designed to carry heavy freight train loads, the structure has significant capacity to accept both pedestrian and light maintenance vehicle loading. Typically, for bridges in use, the railroad would periodically inspect the bridge and replace individual structural elements as they decay. There is some evidence that previous inspections and replacements were done. However, because the trestle was removed from service for freight a number of years ago, the decay in structural members has likely accelerated because the regular cycle of bridge inspection and repair has not occurred.

For the structural analysis performed for this report, it has been assumed that the deck will be replaced with either of the alternatives listed above in Section 1. It is also assumed that all of the sway bracing and sash bracing that is damaged or unusable will be repaired. The analysis also considered the need for piling replacement or repair since some of the existing piles are damaged and unusable in their current condition.

3.2 Dead and Live Load Analysis and Repairs

The existing structure was investigated for the two deck replacement options described above. The weight of the new deck and the live loads resulting from the new 12-foot wide width were imposed on the structure to check the various elements. The design criteria in **Appendix A** was used for the analysis.

3.2.1 Timber Ties

None of the existing ties will be reused in either of the retrofit cases. The 8-inch by 8-inch ties are not required for the concrete deck option and were found to be inadequate for the timber deck option. This was due to the fact that longitudinal runners would be needed as a buffer between the transverse IPE and the transverse ties. The size of the longitudinal runners that would be needed (assuming the use of Douglas Fir) became larger than expected due to shear reactions from the H10 trucks. This design was considered to be uneconomical and a new alternative in which two new stringers would be added was selected.

3.2.2 Longitudinal Stringers

Our analysis indicated that the existing timber stringers are adequate to support either the concrete slab or timber decked bridge without modification.

The areas with voids or soft spots on Spans 7, Span 9, and Span 13 should be repaired by filling them with a penetrating epoxy. When the existing ties are removed, the bolt holes should also be sealed.

The char areas on the stringers between Bent 6 and Bent 10 should be pressure washed to remove the char then coated with a penetrating waterproofing sealer.

The tops of all of the stringers should be cleaned of all debris and pressure washed. For the timber deck option, the tops of the stringers should be sealed and PVC drip caps or flashing should be installed.

Table 1: Stringer Maximum Demand to Capacity Ratio (Due to Dead and Live Loads)

Bridge Element	Axial D/C	Moment D/C	Shear D/C
Stringers	0.00	0.37	0.32

3.2.3 Pile Caps

Pile caps consist of 14-inch by 14-inch by approximately 18 foot long timber sections that are set atop driven timber piles. Our analysis indicates that the existing pile caps are adequate to accept the load of either of the new deck alternatives. The caps at Bents 3, 5, and 13 need to be replaced due to significant deterioration and loss of section. This will require removing the through bolts to the stringers then jacking the stringers up to allow removal and replacement of the caps. Prior to the replacement of any cap, the tops of the existing piles should be treated with preservative and covered with flashing in accordance with AREMA specifications (see **Figure 4**). Once the new cap is in place, new drift pins should be installed into the piles. Where the stringers sit over the existing piles and drift pins cannot be installed a pair of side bolted clips should be used (see **Figure 5**). Connection between the stringers and caps is through bolts that also pass through the existing ties. When the ties are removed, the through bolt connecting the stringers to the caps should be replaced. Connection between the piles and caps is through drift bolts and toe nails. Our analysis indicates that these connections are adequate for dead and live loads.

Table 2: Pile Cap Maximum Demand to Capacity Ratio (Due to Dead and Live Loads)

Bridge Element	Axial D/C	Moment D/C	Shear D/C
Pile Caps	0.00	0.17	0.68

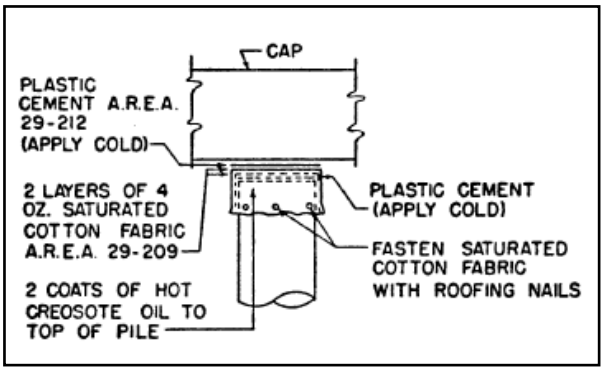


Figure 4: Pile Flashing at Bents with Replacement Caps

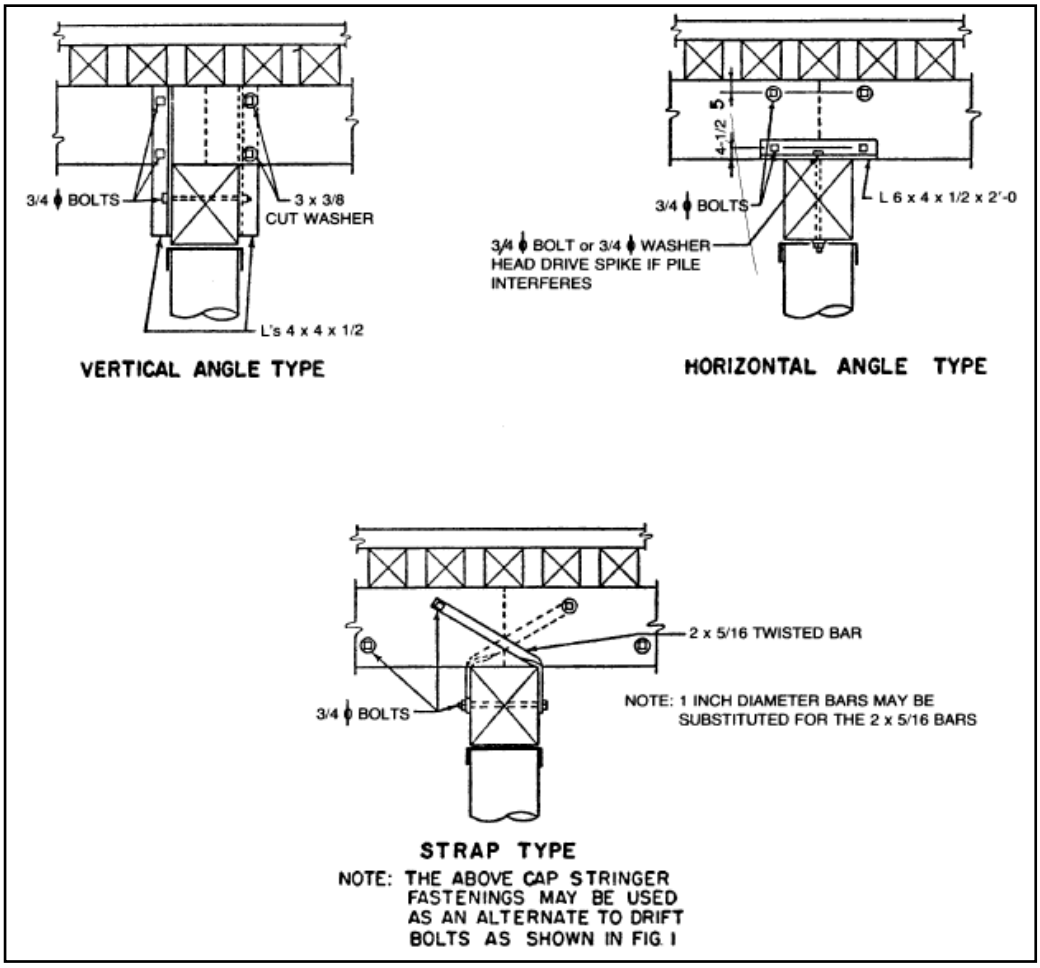


Figure 5: Cap/Stringer Alternate Fastening

3.2.4 Abutments

At Abutment 1 and 15 the existing bulkhead timbers should be excavated and removed as they are deteriorated. If they are replaced in kind with pressure treated lumber, a drainage mat, granular backfill and a drainage pipe should be used against the new timber. Wingwalls at Abutment 1 could be re-constructed with a stackable concrete block wall system to reduce cost. If a concrete deck is used, consideration should be given to using a concrete backwall and wingwalls. A paving notch might also be provided, if the trail approaches are to be paved with asphalt concrete in the future.

3.2.5 Piles

Analysis of the piles compares the available strength of the piles themselves (due to bending and axial forces as well as due to shear) and the assumed available soil bearing strength. Initial research using the AREA Manual showed that 14-inch butt diameter piles typically have 9-inch tips and that for 25 feet of exposed length a 45 to 50 foot pile was used. We therefore asked Parikh Consultants to analyze both 20 and 25 foot cases and they found a log of test borings for a bridge that is located about 3,000 feet away. Our analysis indicated that the piles are adequate for both dead and live load as long as the recommended repairs on select Bents are made. Modeling of the critical bents was performed to evaluate the need for strengthening or repairs. Bent 7 has two piles (of six) that are deteriorated at the base. SAP Modeling of Bent 7 was broken into two models: one in which it was assumed the piles were repaired and another in which the piles were not repaired and were ineffective for vertical and lateral capacity. It was found that pile repair or replacement is required at Bent 7 as the axial loads exceed the capacities that were developed by Parikh Consultants.

Bent 6 has one pile (of six) that is deteriorated at the base. SAP Modeling of Bent 6 was broken into two models: one in which it was assumed the pile was repaired and another in which the pile was not repaired and was ineffective for vertical and lateral capacity. In this case, an extreme event demand of 42 kips in compression was found when only 5 piles were considered effective. With capacities given at 35 to 50 kips per pile (for the 20 and 25 foot deep piles assumption, respectively) it was decided that the damaged pile at Bent 6 should be repaired.

Based on the field investigation and the modeling of the selected bents it is determined that Bents 4, 6, 7, 11, and 12 should have piles repaired for either retrofit strategy. Bent 4 has a pile (see repair diagrams in **Appendix B**) that is spliced and is considered to be ineffective for lateral capacity and should be repaired in accordance with AREMA Volume 2, Section 3.3.3.3 (see **Figure 6**) in order to ensure proper lateral capacity. Bents 6, 7, and 12 have 6 piles each and exhibit some piles that are deteriorated at the base (see repair diagrams in **Appendix B**). Bent 11 has 8 piles total; however, the pile directly under the left stringers is deteriorated at the base and should be repaired in order to properly distribute loads evenly along the cap. These five bents should be repaired using epoxy in accordance with AREMA Volume 2, Section 3.3.3.3 (see **Figure 7**).

Table 3: Pile Maximum Demand to Capacity Ratio (Due to Dead and Live Loads)

Bridge Element	Axial D/C	Moment D/C	Shear D/C
Piles	0.81	0.04	0.07

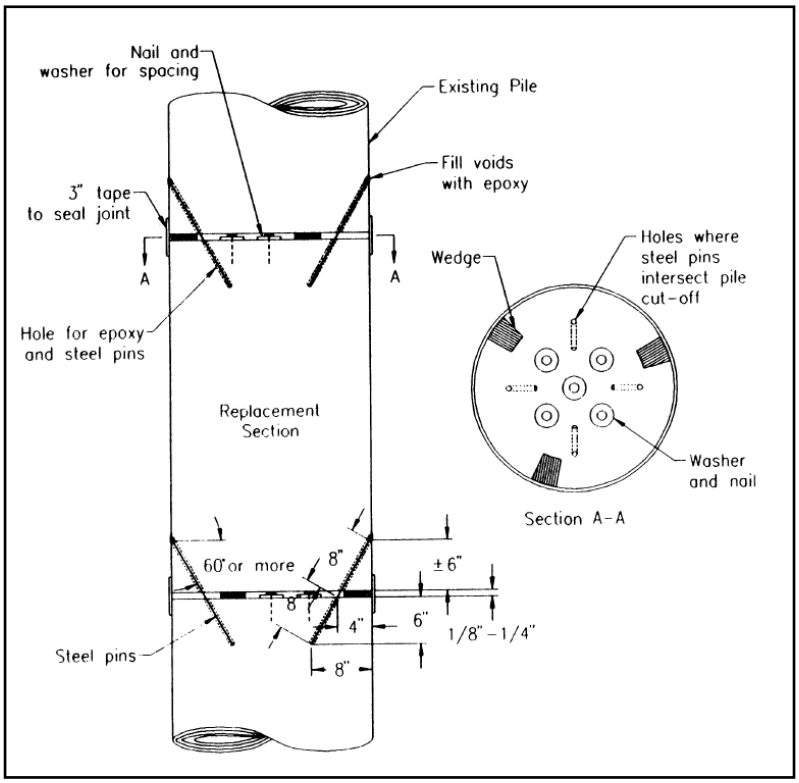


Figure 6: Column Splice Detail

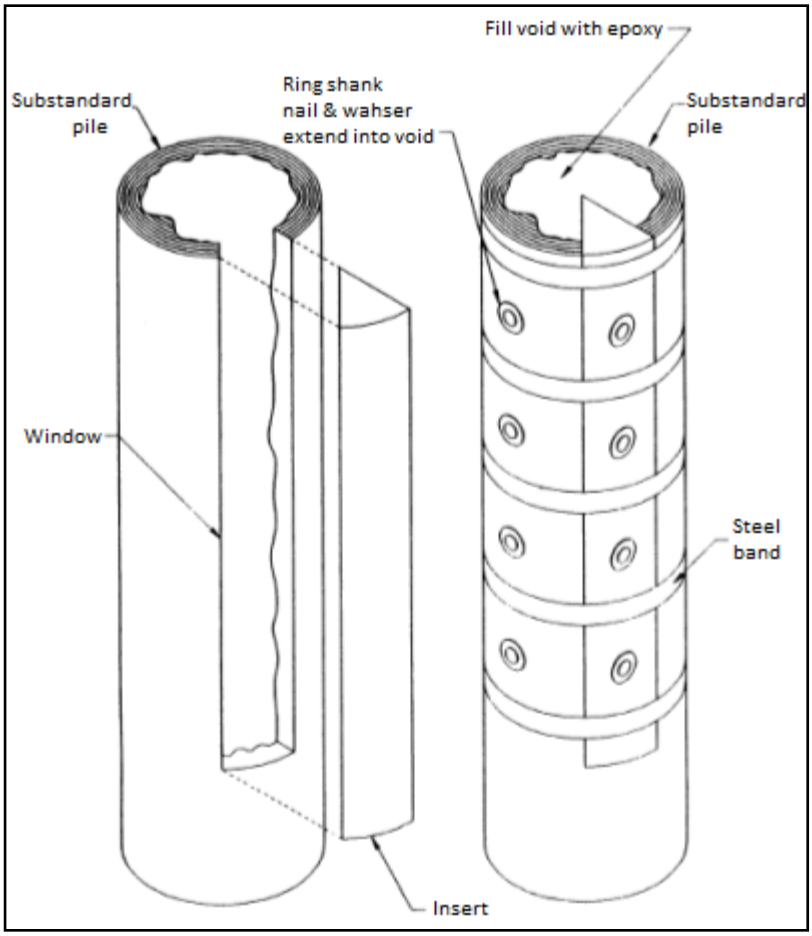


Figure 7: Epoxy Filled Piling Repair Detail

3.2.6 Sway and Sash Bracing

Sway and sash bracing on the piers is used to resist wind forces and to restrain lateral movement and vibration under live loads. The sway and sash bracing will also be important to help distribute seismic loads to the piles. As noted above, the railroad did not typically design for seismic loading. All lateral loads were originally considered to be from wind only and longitudinal forces came from train nosing. Our analysis indicated that the demand on bracing components due to Strength 1 and Strength 3 loading is much smaller than the demand that seismic loading induces. No demand to capacity ratios are reported here as seismic demand is reported below.

3.3 Weather and Decay

The timber of the existing trestle is subject to continued wetting and drying due to the current open deck configuration. In addition, due to the many horizontal surfaces, standing water and debris accumulates. Wetting and drying promotes decay and fungal growth that will weaken and degrade the structure over time. Reducing the amount of moisture that the stringers, cap beams and piles are subject to will lengthen the remaining life of the trestle. The concrete slab deck option would provide greater protection to the existing timber elements than would the timber deck option since rain will be drained away from these elements. Under the timber deck option, on the other hand, the timber elements will continue to be exposed. If the timber deck option is selected, protective measures such as flashing and capping should be implemented to promote moving moisture away from the timber as much as is practical.

3.4 Scour

3.4.1 Background

Los Gatos Creek originates in the Santa Cruz Mountains and flows most of the year, passing through the cities of Los Gatos, Campbell, and San Jose. There are two dams located on the creek. Lexington Reservoir and Lenihan Dam are located upstream of the Town of Los Gatos and Vasona Dam and Reservoir are located in the Town of Los Gatos. Los Gatos Creek joins the Guadalupe River in downtown San Jose at Confluence Point in the Guadalupe River Park.

The trestle is part of the Three Creeks Trail alignment. The trestle crosses Los Gatos Creek downstream of Lincoln Avenue and south of Interstate 280. The creek flows in a northeast direction.

The City of San Jose Flood Insurance Study (FIS) Revised August 17, 1998 currently represents the best available information for this reach of Los Gatos Creek. An existing conditions hydraulic model for Los Gatos Creek was provided by the Santa Clara Valley Water District (SCVWD). This model was developed in 1978 by George S. Nolte & Associates using the U.S. Army Corps of Engineers (USACE) Hydraulic Engineering Center (HEC) model HEC-2 (river hydraulics). The HEC-2 model was imported into the USACE HEC-RAS (River Analysis System) model as a starting point for establishing existing conditions for the Los Gatos Creek Trail Reach 5 study – Auzerais to the confluence with Guadalupe River. HEC-RAS is a newer, more computationally rigorous model than HEC-2 and has a better graphics interface.

This section of the HEC-RAS model, upstream from Auzerais Avenue, has not been reviewed or approved by the project owner, the SCVWD. However, the model is not now being used to analyze the present condition of the water surface profile (WSP), but rather to analyze scour conditions relative to the supports of the existing railroad trestle bridge. Abutment scour was not considered, as the channel through this section of Los Gatos Creek is wide, relative to the width of the creek upstream and downstream of this bridge location, and the banks in the channel are lower than at the location of the railroad bridge. It is likely that water would exceed the banks of the creek long before the water surface elevation would rise to the elevation of the abutments.

Two bulk soil samples were collected on the creek bed for the purpose of analyzing the potential for scour (Parikh, 2012).

The bridge is approximately 210 feet long, 2’-4” deep, eighteen feet wide, and is supported by 13 bents with 5 to 8 piles each (depending on the location along the longitudinal profile of the bridge), and two abutments. Bents are spaced 15 feet on center and are oriented at an angle of approximately 9.5 degrees. It is assumed that this angle was intended to offset the creek’s angle of approach to its intersection with the railroad crossing. However, this assumption is strictly being used for the purpose of this preliminary analysis. All assumptions used in this analysis should be reviewed and confirmed if and when a design level scour analysis is performed.

3.4.2 Hydraulic Features

The Santa Clara Valley Water District (District) manages Los Gatos Creek as a raw water recharge and flood control channel. In the lower watershed, Los Gatos Creek passes through urban areas (Cities of Los Gatos, Campbell, and San Jose), and much of the riparian corridor has been fragmented by bank stabilization for flood control purposes.

The centerline of the low flow channel appears to be located approximately 90 feet from the north bank of the channel. Based on the angle of the approach from the southeast, the location of the channel relative to the cross-section under the bridge is as expected. Field observations include debris buildup between bents 7 and 8, and no local scour. A significant amount of rip rap was observed on the south side or inside bend of the creek through the location of the bridge. The location of the riprap may be contributing to the lateral migration of the low flow channel to the north bank. The Manning’s roughness for the upstream approach to the bridge, for a distance of approximately 132 feet, as described in the San Jose, CA FIS is 0.045, which is relatively conservative. According to field observations of the vegetation conditions within this reach of creek, this assumption seems to be appropriate. The majority of area underneath the bridge, with the exception of the two bents previously

mentioned, was debris free and therefore the assumed roughness value of 0.035 at this location, as described in the San Jose, CA FIS, was left unchanged from the existing conditions model.

3.4.3 Scour Analysis Results

A scour analysis was conducted for the existing abandoned railroad trestle bridge. These results are presented below in **Table 5**. Assumptions include:

Bridge modeling methods used for this analysis: Yarnell and Standard Step. (Yarnell is the most conservative of these two methods. The results presented below are based on the Yarnell method).

Table 4: Assumptions and Coefficients Used for Scour Analysis

Assumptions	Value	Notes
D_{50}	9.52 mm	From Geotechnical Results
D_{90}	38.10 mm	From Geotechnical Results
Contraction Coefficient	0.2	Value between gradual and typical
Expansion Coefficient	0.3	Gradual
Drag Coefficient (CD)	1.2	Round nose pier
Yarnell's pier coefficient (K)	2.5	10 pile trestle bent (conservative assumption; maximum number of piles per bent is eight (8))
Pier debris loading	5-ft wide 3-feet deep	All piers assumed to catch debris (conservative assumption)
Flood events 10-year	1770 cfs	City of San Jose FIS (Revised August 17, 1998)
100-year	7550 cfs	

Table 5: Existing Railroad Bridge Scour Analysis Results

Feature	10-year flood Scour Depth (ft)	100-year flood Scour Depth (ft)
Pier	2.6	3.9
Contraction	0	0
Total	2.6	3.9

*Contraction scour was not detected or minimal and therefore no value was produced by the model

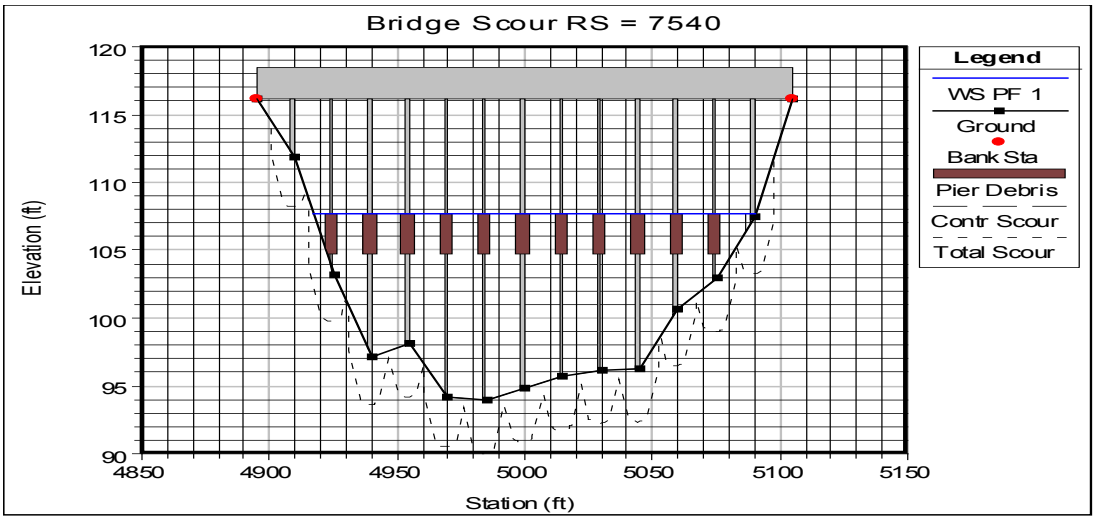


Figure 8: Cross-Section from HEC-RAS Model Illustrating Pier Scour Conditions for 100-year Flood Event

Based on initial analysis, it appears that the existing bridge does not impede flow under flood conditions. This change is slightly measureable (approximately 0.5 feet) for the conservative assumptions used in this analysis for debris loading of the piers. This means that were the bridge supports to be removed for aesthetic or other reasons, the hydraulic conditions downstream may change slightly. The SCVWD may require further analysis during the design phase, to determine the extent of this impact and overall channel performance in the absence of the bridge. This future analysis may also require some research on the geomorphologic characteristics of the channel to determine if degradation or aggradation is present. It is unclear if the creek at this location is being 'sediment starved' as a result of the sediment being captured upstream at Lexington Dam or in the creek at the Town of Los Gatos. If the retrofit alternative is chosen, the SCVWD may require additional surveyed cross-sections added to the HEC-RAS model, to better understand the impacts of the assumed migration of the low flow channel as well as to confirm the results from the preliminary scour analysis.

3.5 Seismic Analysis and Repairs

According to the AREMA manuals, Rail Road companies typically exempt timber trestles from seismic evaluation. This is likely due to their low mass, flexibility and redundancy. For this project, given that the City is the owner of the bridge, a seismic analysis was performed. Lateral earthquake forces on the trestle are primarily resisted by battered piles, sway bracing, and the connections made by steel drift pins and bolts. Analysis of the structure showed that some timber elements need replacement or retrofit due to decay. Also, the A36 steel bolts that connect bracing to the piles were insufficient for lateral seismic loading. Steel through bolts that connect the stringers to the caps should be replaced after ties are removed since they may not be usable after the ties are removed.

It is known that this structure survived the Loma Prieta earthquake (7.1 magnitude on the Richter scale). However, it is not known if any retrofits were needed (or done) following the earthquake. Our analysis showed that only the sway brace bolts would need to be replaced if the timbers were in excellent shape. Our field investigation, however, showed that several elements have become subject to fungus and decay. It is primarily the loss of timber section due to deterioration that forces the replacement of many of the timber elements as described below.

3.5.1 Upper Sway Braces

The upper sway braces are typically constructed using 4-inch wide by 10-inch deep timbers. It is typical to see a carriage bolt at each pile; however this is not consistent throughout the structure. Also, some of the timbers have been notched and have a less effective section. Some of the bracing was retrofit at some point by adding additional timbers above or below the existing braces. Overall, 38% of the upper sway braces are damaged and

are likely in need of repair or replacement. Replacement of damaged braces with similar 4-inch wide by 10-inch deep timbers is adequate. It should be noted that the moment demand to capacity ratios shown in **Table 6** show that the braces are inadequate. This ratio is from Bent 14 and is due to the fact that the braces are incomplete. Both braces on this bent should be replaced and should be longer so that all of the piles are engaged by bracing. Detailed demand to capacity ratios for each bent modeled can be found in **Appendix C**. For full details of which braces need to be replaced see the drawings attached in **Appendix B**.

Table 6: Upper Sway Brace Maximum Demand to Capacity Ratios (Due to Lateral Seismic Loading)

Bridge Element	Axial D/C	Moment D/C	Shear D/C
Upper Sway Braces (Compression)	0.28	1.07	0.28
Upper Sway Braces (Tension)	0.32	1.10	0.22

3.5.2 Sash Braces

The sash braces are typically constructed using 8-inch wide by 10-inch deep timbers. They seem to have been installed on bents that have more than 13 feet of exposed pile as they are located 13 feet down (measured from the top of pile to centerline of brace). This height is inconsistent with newer versions of the AREA Manual where the typical distance to the sash on a 6 pile bent is 11 feet 6 inches. It is also typical to see a carriage bolt at each pile; however this is not consistent throughout the structure. Bents 7, 8, and 9 have some char damage, but it is not significant. Overall, 90% of the sash braces are damaged and are in need of repair or replacement. Replacement of damaged braces with similar 8-inch wide by 10-inch deep timbers is adequate. For details of which sash braces need to be replaced see the drawings attached in **Appendix B**.

Table 7: Sash Brace Maximum Demand to Capacity Ratios (Due to Lateral Seismic Loading)

Bridge Element	Axial D/C	Moment D/C	Shear D/C
Sash Brace (Compression)	0.04	0.04	0.02
Sash Brace (Tension)	0.05	0.04	0.03

3.5.3 Lower Sway Braces

Only some of the bents have both upper and lower sway braces. Lower sway braces are included at Bents 5, 6, 7, 8, 9, 10, 11, and 12. Overall, 50% of the lower sway braces are damaged and in need of repair or replacement. Replacement of damaged braces with similar 8-inch wide by 10-inch deep timbers is adequate. For details of which braces need to be replaced see the drawings attached in **Appendix B**.

Table 8: Lower Sway Brace Maximum Demand to Capacity Ratios (Due to Lateral Seismic Loading)

Bridge Element	Axial D/C	Moment D/C	Shear D/C
Lower Sway Braces (Compression)	0.24	0.18	0.05
Lower Sway Braces (Tension)	0.27	0.14	0.05

3.5.4 Piles

Seismic analysis of the piles assumed that the piles are repaired as discussed in Section 2.2.5 of this report. Also, connections and braces were all assumed to be in good condition as insufficient sections would be replaced as part of the retrofit. Analysis found that the piles were sufficient for the demands that the design earthquake produced. Combined bending and axial demands were not checked due to the fact that the demand to capacity ratios appear to be low enough to show that the system is adequately braced against buckling failures.

Table 9: Pile Maximum Demand to Capacity Ratios (Due to Lateral Seismic Loading)

Bridge Element	Axial D/C	Moment D/C	Shear D/C
Piles (Compression)	0.81	0.34	0.32
Piles (Tension)	0.79	0.25	0.32

3.5.5 Connections

Bolts from stringers to caps should be replaced after ties are removed since they may not be usable after the ties are removed. The use of ASTM A325 1 inch diameter bolts or threaded rod is desired in order to avoid addition drilling and desired strength increase. Drift pins from cap to piles are of sufficient strength; however, in locations where pile caps are replaced and new drift pins cannot be installed the connection should be achieved using the details shown in **Figure 5**. Sway brace bolts require replacement at all locations as the A36 steel that was used is inadequate for seismic demands. Sash brace bolts do not require replacement, however as 90% of the sash braces are damaged it is recommended to upgrade the bolts to current ASTM A325 1-inch bolts at all locations.

Table 10: Bolt and Drift Pin Maximum Demand to Capacity Ratios (Due to Lateral Seismic Loading)

Connection Element	Shear D/C
Drift Pins (Cap to Pile)	0.85
Sway Brace Bolts	1.40
Sash Brace Bolts	0.57
Stringer to Cap Bolts	0.55

Connection capacity was checked based on assumed bolt replacement. It was determined that the bolts will likely tear out of the timber cross braces at the ends of the braces during an earthquake equivalent to the maximum design earthquake. It was also found that other bolt locations could experience localized crushing of the timber and plastic hinging of the bolts. The maximum design earthquake is based off of 5% damping and a return period of 975 years (5% probability of exceedance in 50 years). This structure is timber and is likely to have a higher damping ratio than 5% and would therefore be likely to have less force in the elements than what has been calculated.

The failures found are not deemed to be detrimental because localized failure could alert the owner to a potential problem. The AREMA Manual says "***Providing for "yielding type response" at non-critical points of the structure to relieve seismic stresses***" is allowed (2010 AREA Volume 2, Chapter 9, Section 1.5.4.5). In order to allow localized failure, the structure needed to be checked assuming failure has occurred. In order to conserve budget Bent 7 was the only bent analyzed for the assumed failure.

Bent 7 was selected since it has the largest axial forces of the prior bents modeled. It should be noted that a failure of the ends would soften the structure which in turn, would increase the period. As a result, the overall force applied to the bent decreases. This decrease in force is not accounted for in the new SAP models for efficiency. D/C ratios for the individual elements were checked again and no critical failures are found. Net section tension was found to be okay and tear-out capacity was not exceeded at any other bolt locations.

Localized timber crushing and bolt hinging is probable due to a design level earthquake, but there will be no collapse.

It would become very expensive to retrofit the structure to a point where there is no longer any localized damage due to an earthquake. Since the structure is known to have survived the nearby Loma Prieta Earthquake, it is likely that the bridge once repaired can withstand similar sized future earthquakes. It is expected that the bridge will be inspected on a bi-annual basis and that if any components show signs of distress they are replaced or repaired. It is expected that this structure can withstand a design level event, but that there will be damage. If the structure is subjected to a seismic event in excess of 5.0 magnitude the City should close the bridge until an inspection can be performed.

3.6 Other Required Repairs

3.6.1 Replacement Timber

All replacement structural lumber (does not include IPE) shall be stress-grade Douglas Fir (Larch) and shall conform to AREMA specifications see, Part 1, Material Specifications for Lumber, Timber, Engineered Wood Products, Timber Piles, Fasteners, Timber Bridge Ties and Recommendations for Fire-Retardant Coating for Creosoted Wood. All lumber and piles, except IPE timber, should be pressure treated in accordance with AREMA Chapter 30.

3.6.2 Shimming and Fillers

Shimming of stringers and piles to provide proper bearing surface should be performed using a single hardwood shim under stringer. Shimming with stacked or multiple shims is not allowed. Replacement of the stringer shims is required at Bents 3, 4, 6, 8, and 9. Piles need shims at Bents 3, 4, 6, 8, and 9. For a detailed view of the shims that need replacing, see **Appendix B**.

Sash and sway bracing should bear firmly against the piles to which secured. When necessary, filler shall be placed to avoid bending the bracing more than 1 inch out of line when the bracing bolts or other fastenings are drawn up tight. Built-up fillers will not be permitted and each filler shall be a single piece of pressure treated lumber of like kind to that in the brace with a width of not less than 6 inches and a length of not less than 12 inches. Piling shall not be trimmed or cut to facilitate the framing of sway bracing.

3.6.3 PVC Deck Joist Drip Shields and Flashing

Flashing should be applied to top surfaces that are exposed during retrofit. This includes the top of the existing stringers, the new stringers, and the top of the new bent caps. Flashing may consist of PVC Drip Caps, Grace Vycor Self-Adhesive flashing, or similar.

3.6.4 Fire Protection and Maintenance

This trestle has been subject to multiple arson attempts. Several methods are available reduce the risk of fire. Fusible-link detector systems can be connected to alarm systems that notify the fire department of a fire allowing them to get there and extinguish it sooner. Housekeeping is another effective method of preventing fires. Housekeeping performed by the City should include:

- Decayed spots in exposed timbers should be trimmed.
- Brush and weeds are kept down for a distance of at least 25 feet from the bridge, both underneath and on the embankment at the ends of the bridge or trestle.
- Creek flow debris is removed from the piers after storms. Due to difficult access from the banks for equipment, this may require the use of equipment that can reach over the edge of the bridge deck to remove debris from the stream bed. Large pieces, such as logs and trees, can be cut by workers below to make the pieces more manageable. This maintenance should be completed at least once annually.

Fireproofing coatings are also available that can be sprayed on to the timber to make it less combustible from the outside. This should be considered cautiously as some fire protective coatings will change the appearance of the structure. Fire damage may continue to be a maintenance issue due to the fact that that there are homeless camps downstream of the bridge that may be the source of the fires (someone tried to light our timber inspection scaffolding on fire when it was left unattended overnight).

4.0 Replacement Bridge Considerations

As part of the scope of work and as an alternate to the retrofit options, a replacement bridge was also considered. A pre-fabricated Contech® "Capstone" steel truss bridge (details in **Appendix D**) was selected for the comparison. This bridge would utilize a poured concrete deck that can also be scored and stained to resemble the old railroad tracks for an aesthetically pleasing nod to the past life of the crossing. The bridge alignment would remain the same and the abutments would be replaced with new concrete abutments on cast-in-drilled-hole concrete piles. If the replacement option is selected, the existing timber piles could potentially be used as falsework supports to erect the prefabricated bridge on site, since it will come in pieces that need to be assembled.

The prefabricated truss option provides the City with many benefits. While the initial upfront cost to the City is slightly higher than the other two retrofit options, the cost of ownership and overall return on investment is greater with the replacement option. Benefits of replacing the structure include the following:

- Reduction in probability of damage due to either arson or wildfires.
- Less time and money spent on maintenance of both the creek and the structure itself.
- Less time and money spent on bi-annual inspections of the bridge.
- Less time and money spent on post-seismic event inspections.
- 25-35 year longer expected life span compared to the retrofitted trestle

Replacement of the trestle with a single span steel and concrete truss bridge would also remove all of the piers from the creek, which in turn keeps debris from collecting at the piers. Lack of debris collecting means the City's maintenance crews would no longer have to annually clear the piers. The lack of debris also lowers the risk of arson, because there is less fuel to ignite below the bridge. In addition, the bridge is not combustible and would not require alarms or fireproof coating for protection, (see **Table 11**).

Table 11: Fire Resistance and Protection Comparison

Design Option	Resistance to Fire Damage	Source of Fuel	Fire Protection Recommended	Type of Protection
New Pre-Fabricated Steel & Concrete Truss	High	Reduced	No	N/A
Trestle Rehab with Concrete Decking	Low to Moderate	Substructure and debris at bents in the streambed	Yes*	Fire proof coating, fire sprinklers, and/or alarms may be utilized
Trestle Rehab with IPE Decking	Low to Moderate	Superstructure and substructure and debris at bents in the streambed	Yes*	Fire proof coating, fire sprinklers, and/or alarms may be utilized

*While large timbers can resist significant section loss caused by some amount of burning, any damage by fire is not desired by the City. Fire protection is therefore recommended.

Another benefit of replacement is that structure maintenance costs decrease. This is because elements will not have to be replaced as they would in the timber option. A single span prefabricated bridge would also decrease inspection costs to the City since a two man crew can easily inspect the bridge in one working day. This inspection cost savings applies to both the bi-annual inspections as well as any post-earthquake inspections. The best cost benefit, however, can be seen in the lifespan difference between the structures. With a 25-35 year increase in

lifespan, the City can expect to avoid having to pay for both the retro fit now and a new bridge 25 to 50 years from now. This is where the largest return on investment can be seen.

It should be noted that one of the concerns when considering the replacement option seemed to be the overall environmental impact. However, a study of all three options showed disturbance within the Los Gatos Creek, including the active channel, to be unavoidable. A new Initial Study, a new CEQA document (and possibly NEPA clearance if federal funding is used), and regulatory permits would likely be required for all three options. The replacement option, would have slightly larger environmental impacts during construction, but would have less impact over the lifetime of the trail. For full details regarding the environmental assessment see the Environmental Consistency Memo (**Appendix F**).

5.0 Conclusions

5.1 Proposed Rehabilitation Sequence

- The existing ties, walkway and the longitudinal steel strap should be removed.
- Remove damaged caps as indicated.
- Flash top of piles where caps are removed.
- Flash and install new caps.
- Replace all stringer to cap bolts.
- Clean and seal charred caps.
- Flash all existing caps in situ.
- Clean and seal charred portions of stringers.
- Install flashing on stringers.
- Repair piles as noted.
- Replace sway and sash bracing as noted.
- Repair abutment bulkheads and wingwalls.
- Install new decking system and pedestrian railing.

5.2 Additional Recommended Inspections

5.2.1 Stringers

With either the concrete slab or the timber deck alternatives, all of the existing ties will be removed. Once the ties are out of the way, the top portions of the stringers not previously inspected should be sounded for areas of decay. Any voids found during the inspection should be repaired with a two-part penetrating epoxy. **Table 12** and **Table 13** show the estimated quantities for both retrofit options. Repair of stringer voids does not have a quantity listed since more may be found once the existing ties are removed. However, since there were so few voids found during our inspection, even if a few more are found, this is not expected to be a significant repair cost item.

5.2.2 Geotechnical Investigations

If the City decides that bridge replacement is the desired alternative, a geotechnical investigation which includes borings at each support should be completed. Although not required for the retrofit options, additional geotechnical work could be useful even if trestle is to remain. Our analysis work was based on an assumed pile embedment of 20 to 25 feet and a boring log from 3,000 feet away. While it would be difficult to obtain test borings in the stream bed itself due to access, borings at the abutments could provide useful information that could also be used for the approach pavement and or retaining wall designs.

5.3 Concrete Decked Alternative Quantity Estimate

Table 12: Estimated Quantities for Concrete Deck Alternative

Item	Units	Quantity
Structure Excavation, Bridge	CUYD	25
Structure Backfill, Bridge	CUYD	25
Existing Deck Demolition and Disposal	LINFT	210
14”x14”x18’ PT DF Timber Cap	EA	3
Piling Repair	EA	5
4”x10” Upper Sway Brace Replacement	EA	11
4”x10” Lower Sway Brace Replacement	EA	7
8”x10” Sash Brace Replacement	EA	16
Structural Concrete, Bridge	CUYD	67
Bar Reinforcing, Bridge	LBS	13538
Miscellaneous Metal, Bridge	LBS	825
Metal Railing	LINFT	420
Repair Stringer Void	EA	TBD in Field
Pressure Wash and Treat	SQFT	2563
Replace Stringer to Cap Bolt, 1” ASTM A325	EA	30
Replace Bracing Bolts, 1” ASTM A325	EA	342
Flashing (Top of Stringers)	SQFT	1190
Flashing (Top of Pile Cap)	SQFT	300
Flashing (Top of Pile)	SQFT	30
Abutment Wingwall Replacement (Abutment 1)	SQFT	108
Abutment Backwall 8" x 20" x 25' DF Timber Beams (Abutment 1)	EA	5
Abutment Backwall 8" x 20" x 18' DF Timber Beams (Abutment 15)	EA	3
Fire Alarm	LS	LUMP SUM
2" Steel Pipe for Fire Sprinklers	LINFT	210
Fire Sprinkler Heads	EA	21
Connection to Water Supply	LS	LUMP SUM
Fire Proof Coating	SQFT	9480
Stream Bed Debris Removal	LS	LUMP SUM
Concrete Stain	SQFT	2520

5.4 Timber Decked Alternative Quantity Estimate

Table 13: Estimated Quantities for Timber Deck Alternative

Item	Units	Quantity
Structure Excavation, Bridge	CUYD	25
Structure Backfill, Bridge	CUYD	25
Existing Deck Demolition and Disposal	LINFT	210
14”x14”x18’ PT DF Timber Cap	EA	3
8”x20”x30’ PT DF Timber Beams	EA	14
Piling Repair	EA	5
4”x10” Upper Sway Brace Replacement	EA	11
4”x10” Lower Sway Brace Replacement	EA	7
8”x10” Sash Brace Replacement	EA	16
IPE Decking (3”x6”x12’)	EA	458
Metal Railing	LINFT	420
Repair Stringer Void	EA	TBD in Field
Pressure Wash and Treat	SQFT	2563
Replace Stringer to Cap Bolt, 1” ASTM A325	EA	30
Replace Bracing Bolts, 1” ASTM A325	EA	342
Flashing (Top of Stringers)	SQFT	1190
Flashing (Top of Pile Cap)	SQFT	300
Flashing (Top of Pile)	SQFT	30
Abutment Wingwall Replacement (Abutment 1)	SQFT	108
Abutment Backwall 8" x 20" x 25' DF Timber Beams (Abutment 1)	EA	5
Abutment Backwall 8" x 20" x 18' DF Timber Beams (Abutment 15)	EA	3
Fire Alarm	LS	LUMP SUM
2" Steel Pipe for Fire Sprinklers	LINFT	210
Fire Sprinkler Heads	EA	21
Connection to Water Supply	LS	LUMP SUM
Fire Proof Coating	SQFT	11075
Stream Bed Debris Removal	LS	LUMP SUM

5.5 Replacement Bridge Quantity Estimate

Table 14: Estimated Quantities for Replacement Option

Item	Units	Quantity
Structure Excavation, Bridge	CUYD	25
Structure Backfill, Bridge	CUYD	25
Trestle Removal	LS	LUMP SUM
Prefabricated Bridge	LS	LUMP SUM
24" Cast-in-drilled-hole concrete piles	LINFT	720
Structural Concrete, Bridge	CUYD	103
Bar Reinforcing, Bridge	LBS	15615
Installation of Bridge	LS	LUMP SUM

5.6 Repair Cost Estimates and Replacement Bridge Cost

Estimates for total costs were developed for each retrofit alternative. These costs include the prices of the materials, labor costs, equipment costs, design, and permitting costs for the duration of the work. These costs are only for the bridge work and do not include any trail connection work (ie trail retaining walls, approaches at either end of bridge, and trail paving). In addition to costs for the rehabilitation options, a cost estimate was developed for a replacement bridge (**Appendix E**).

Design costs are higher for the replacement option because a geotechnical investigation at the abutments would need to be performed. It should be noted that modeling of the trestle, if retrofit is selected, should consist of a full three dimensional structural model to better capture the overall force effect. The costs for each of the three options, as determined by the analysis methods discussed, are presented in **Table 15**. It should be noted that the costs presented include a 30% contingency. Also, market variance can occur before construction begins and therefore a market variance of 20% less in cost to 40% more in cost is presented in the table to show the possible cost range that can be expected.

Table 15: Cost Estimate for Alternatives

Design Option	Design Cost	Total Cost*	-20% Market Variance*	+40% Market Variance*
Trestle Rehab with IPE Decking	$ 161,111	$ 1,090,000	$872,000	$1,526,000
Trestle Rehab with Concrete Decking	$ 161,111	$ 959,000	$767,200	$1,342,600
Replacement with Pre-fabricated Truss	$ 194,444	$ 1,637,323	$1,309,858	$2,292,252

**These estimates include 30% contingency, 5% storm water/erosion control, 10% mobilization, and 10% construction engineering. For details on all assumptions see Appendix G.*

5.7 Recommended Alternative

It is the recommendation of CH2MHILL that the bridge be replaced with the pre-fabricated truss option. However, if the City decides to retain the existing trestle and rehabilitate it, then it is the recommendation of CH2M HILL that the concrete decked retrofit be selected. This alternative is less costly than the IPE decking and will decrease the cost of ownership over the remaining lifespan of the trestle. It should be noted that the concrete decked trestle is expected to outlast the IPE decked option by approximately 10+ years as the deck will partially protect the substructure from water exposure. A full comparison matrix (with a 1-3 point scoring system) for all three options can be found on the next page of this document (**Table 16**).

The trestle is already showing some signs of age and will only continue to require maintenance over the remainder of its useful life as the original timbers continue to decompose. While the retrofit plan would repair existing problems, the older portions of the structure will continue to deteriorate and at a faster rate than the repairs. This leads to components needing to be replaced on somewhat of a regular interval. While some in the community around the existing trestle may want the existing trestle to remain, it is in the City's best interest to remove the structure. Although a replacement bridge has a slightly higher initial cost, it is the best overall option to own and maintain in the long run if the cost of future inspections, future maintenance, and future bridge replacement are added in.

To compare the overall value, **Table 16** includes present value costs and overall ratings for all three options. The listed cost includes future inspections for all three options, future structure maintenance for all three options, and future replacement of the trestle for either of the rehab options once the bridge's useful life has been exceeded. Streambed maintenance cost has not been included in this table as it is a cost that the City would need to determine. The values shown in the table are calculated assuming a 3% rate of return on investment, no inflation, and a 40 year lifespan for the retrofits. This is done to show the City's total cost for each option (minus streambed maintenance), if the City were to invest a lump sum now to pay for the next 40 years. All values reported are in 2012 dollars and calculations do not include future streambed maintenance costs.

Table 16: Alternative Comparison Matrix

Three Creeks Trail Railroad Trestle

PEDESTRIAN BRIDGE DESIGN ALTERNATIVE

Bridge Design Alternatives	Streambed Maintenance		Structure Maintenance				Inspection				Construction/Design Cost		Time to Completion		Expected Lifespan		Neighborhood Aesthetics		Environmental Permitting		Rating Total	Overall Present Value**
	Streambed Maintenance	Rating	Superstructure Maintenance	Substructure Maintenance	Estimated Cost	Rating	Bi-Annual	Post-Seismic (Magnitude ≥ 5.0)	Bi-Annual Inspection Cost	Rating	Cost	Rating	Description	Rating	Description	Rating	Description	Rating	Description	Rating		
Alternative 1 Trestle Rehab with IPE Decking	Debris from streambed should be removed annually. This would likely require one day, a truck with a crane arm and dump bed, and a crew of 3 or 4.	1	IPE decking is almost maintenance free. Screws may occasionally need replacement. Non-IPE timber beams may need repair if decay is found.	Repair of piling and braces when decay or insect damage is found. Repair costs can be significant if a large seismic event occurs.	$25,000.00 **Every Five Years** **Note:** Total present value over 40 years is $108,848**	1	Inspection would rely on two people with a couple 25 ft ladders, safety gear, hammers, a drill, and oak dowels (to plug drill holes). Expect one full day of work. Decking and substructure need to both be checked for signs of rot, insects, fungus, and failed connections.	This inspection effort can vary depending upon the magnitude of the earthquake. Likely to take 3-4 days with a crew of two people to cover all elements of the bridge. Ladders and safety gear are needed.	$5,000.00 **Every Other Year** **Note:** Total present value over 40 years is $57,788**	1	$1,090,000.00 **Note:** Market prices can make this vary from -20% to +40%. Design effort for this option is considered medium.	2	This is the fastest option as the work could be started as soon as the design was finished and a bid accepted. All timber construction work could be completed in 4 months.	3	25-40 years with regular maintenance. **Note:** Total present value of a replacement bridge (similar to alternative 3) is $500,165**.	1	Some in the community desire to have the structure remain a trestle. As such, this alternative receives 3 points.	3	Disturbance of the Los Gatos Creek corridor, including the active channel, is unavoidable. A new Initial Study, a new CEQA document, and new permits would likely be required. For full details, see the Environmental Consistency Memo (Appendix F).	3	15	$ 1,756,798.00
Alternative 2 Trestle Rehab with Concrete Decking	Debris from streambed should be removed on an annual basis. This would likely be an all day activity involving a pickup with a crane arm and dump bed. A crew of 3 or 4 is likely needed to complete the work.	2	Minimal due to use of concrete	Concrete decking will help protect the substructure from water and rot. Repair of elements is less frequent than with the IPE option. However, seismic damage is still a factor.	$20,000.00 **Every Five Years** **Note:** Total present value over 40 years is $87,078**	2	Inspection would rely on two people with a couple 25 ft ladders, safety gear, hammers, a drill, and oak dowels (to plug drill holes). Expect one full day of work. Substructure checks similar to alternative one. Deck needs to be inspected primarily for signs of cracking or water infiltration.	This inspection effort can vary depending upon the magnitude of the earthquake. Likely to take 3-4 days with a crew of two people to cover all elements of the bridge. Ladders, safety gear, hammers, drills, and oak dowels (to plug drill holes) are needed.	$4,000.00 **Every Other Year** **Note:** Total present value over 40 years is $46,230**	2	$959,000.00 **Note:** Market prices can make this vary from -20% to +40%. Design effort for this option is considered medium.	2	This option would likely be slower than the wood deck option. Construction with concrete cast-in-place would take approximately 4.5 months. Precast could take about a month longer (dependant on how quickly they can get the segments cast).	2	30-50 years with regular maintenance. **Note:** Total present value of a replacement bridge (similar to alternative 3) is $500,165**.	1	Some in the community desire to have the structure remain a trestle. As such, this alternative receives 3 points.	3	Disturbance of the Los Gatos Creek corridor, including the active channel, is unavoidable. A new Initial Study, a new CEQA document, and new permits would likely be required. For full details, see the Environmental Consistency Memo (Appendix F).	3	17	$ 1,592,478.00
Alternative 3 Replacement with Pre-fabricated Truss	None	3	Minimal due to use of weathering steel truss and concrete deck	None	$0.00 **Every Five Years** **Note:** Total present value over 40 years is $0.00**	3	Most of the structural elements can be inspected without any special equipment. As weathering steel is used there is no paint to inspect and with a concrete deck, the underside of the truss is mostly protected. Two people could complete this inspection in a couple of hours.	This inspection could likely be completed in a day or less by two people. Ladders can be used to access the underside to determine if there has been any steel yielding. All other components can be inspected without the use of any special equipment.	$1,000.00 **Every Other Year** **Note:** Total present value over 40 years is $11,558**	3	$1,637,323.00 **Note:** Market prices can make this vary from -20% to +40%. Design cost is highest for this due to need for geotechnical investigations.	1	Fastest in field construction time. The trestle removal could be done in 2 weeks and the new bridge could be open within 2 months of construction start. However, due to prefabricating lead times and submittal reviews this option can take about 4.5 months total.	2	75 years. **Note:** No replacement at 40 years needed.	3	While this does not salvage the trestle, aesthetics could be made pleasing. Staining the concrete deck to resemble the old track could be done. Also, railroad themed signs could be incorporated at the approaches.	2	Similar to the retrofit options, a new Initial Study, a new CEQA document, and new permits would likely be required. The replacement option, however, would have slightly larger environmental impacts. For full details, see the Environmental Consistency Memo (Appendix F).	2	**19***	$ 1,648,884.00

Note: Ratings used above are based on a scale of 1 to 3, with 1 being the worst overall value and 3 being the best overall value. The total rating is the sum of the individual scores and the highest score is selected as the alternative of choice.

***Recommended Option:** Based on analysis of the table above, we recommend Alternative 3 (Replacement with pre-fabricated truss). While there appears to be some community sentiment to keep the existing trestle, it is the most difficult to maintain and inspect. The trestle would require more maintenance of the structure as well as the stream bed than the prefabricated replacement would. In addition, the trestle would have an inspection process that would require more effort and therefore an increased bi-annual cost. The pre-fabricated truss bridge would be the best option for the city based off of overall return on investment (if some sort of streambed maintnence costs were to be included). If it is decided that the trestle should remain then it is our recommendation that the second alternative (trestle rehab with concrete decking) be selected as this option helps to protect the substructure from accelerated water damage.

****These estimates were calculated assuming a 3% rate of return on investment over 40 years (the approximate retrofit useful life). Inflation was not taken into account and the values reported are in terms of 2012 US Dollar value. These estimates are intended to be used as guidance when comparing the overall cost for each alternative that could be expected if the City were to pay all costs everything for the next 40 years by investing a sum of money today.**

References

AASHTO. 2007. *AASHTO LRFD Bridge Design Specifications.* Fourth Edition with Caltrans Amendments. Washington, DC. American Association of State Highway and Transportation Officials.

AASHTO. 2009. *AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges.* Washington, DC. American Association of State Highway and Transportation Officials.

AASHTO. 2009. *AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.* Fifth Edition. Washington, DC. American Association of State Highway and Transportation Officials.

AISC. 2007. *AISC Steel Construction Manual.* Thirteenth Edition. Chicago, IL. American Institute of Steel Construction Inc.

American Wood Council. 2008. *National Design Specification for Wood Construction (NDS).* 2005 Edition, Fifth Printing. Washington, DC. American Forest & Paper Associations.

AREA. 1986. *Manual for Railway Engineering*. Washington, DC. American Railway Engineering Association.

AREA. 1996. *Manual for Railway Engineering*. Washington, DC. American Railway Engineering Association.

AREMA. 2010. *Manual for Railway Engineering*. Lanham, MD. American Railway Engineering and Maintenance-of-Way Association.

ASTM. 1986. *ASTM Standards in Building Codes-Volume II.* Twenty-Third Edition. Philadelphia, PA. American Society for Testing and Materials.

Caltrans. 2010. *Caltrans Seismic Design Criteria*. Version 1.6. Sacramento, CA. California Department of Transportation.

Forest Products Laboratory. 2010. *Wood Handbook-Wood as an Engineering Material.* Centennial Edition. Madison, WI. US Department of Agriculture, Forest Service, Forest Products Laboratory.

Appendix A

Proposed Design Criteria

Analysis and design of the Los Gatos Creek railroad trestle will conform to Caltrans LRFD (4th Edition) and Caltrans SDC 1.6 requirements. Section 3.6.1.6 of the Caltrans LRFD states that "*Bridges intended for only pedestrian, equestrian, light maintenance vehicle, and/or bicycle traffic shall be designed in accordance with AASHTO's LRFD Guide Specifications for the Design of Pedestrian Bridges*". Therefore, AASHTO Pedestrian shall be used in design of any retrofit or replacement strategy.

Loads that will be considered include: self weight, pedestrian load, maintenance vehicle load, wind loading, seismic loading, and fatigue loading. The City had noted that the superstructure should consist of either a concrete deck or an IPE wood deck. Therefore, the analysis will be performed using two different dead loads based off of the material choice. Also, the City mentioned that their pedestrian bridges are typically 12 feet between barriers. For either the rehabilitation or the replacement, 12 feet will be assumed to be the design width between barriers.

Dead Load (DC):

- Substructure self weight (includes stringers, pile caps, piles, and braces).
- Plus either a Concrete Deck or an IPE Deck

Pedestrian Live Load (PL):

- 90 psf per AASHTO Pedestrian (Section 3.1)
- Consideration of dynamic load allowance is not required for this load
- Equestrian Load will not be considered

Vehicle Load (LL):

- H10 truck per AASHTO Pedestrian (Section 3.2)
    - 4kip front axle and 16 kip rear axle spaced at 14 feet
    - Transverse spacing between wheels is 6 ft
- Consideration of dynamic load allowance is not required for this load

Wind Loads (WS):

- AASHTO Pedestrian states that wind design shall be in accordance with AASHTO Signs.
- A wind pressure will be applied in the transverse direction on the exposed edges of the bridge. This pressure will be calculated as per sections 3.8 and 3.9 in AASHTO Signs. The wind importance factor, I_r, in the wind equation will be taken as 1.15 (per AASHTO Pedestrian Section 3.4).
- A vertical uplift line load, caused by a 0.020 kips/ft^2 pressure applied over the full width of the deck will be applied at the windward quarter point of the superstructure. This load will be applied concurrently with the transverse wind loading in order to determine the effects of uplift caused by wind.

Seismic Loading:

- Seismic analysis will conform to Caltrans SDC. The bridge will be subjected to horizontal ground motions (in SAP 2000) using a site specific ARS Curve

Fatigue Loading (only applicable for a replacement bridge):

- Natural Wind Gust specified in AASHTO Signs 11.7.3 will be used (per AASHTO Pedestrian Section 3.5)
- Truck-Induced wind gust need not be considered as the bridge spans a creek and does not see traffic below.

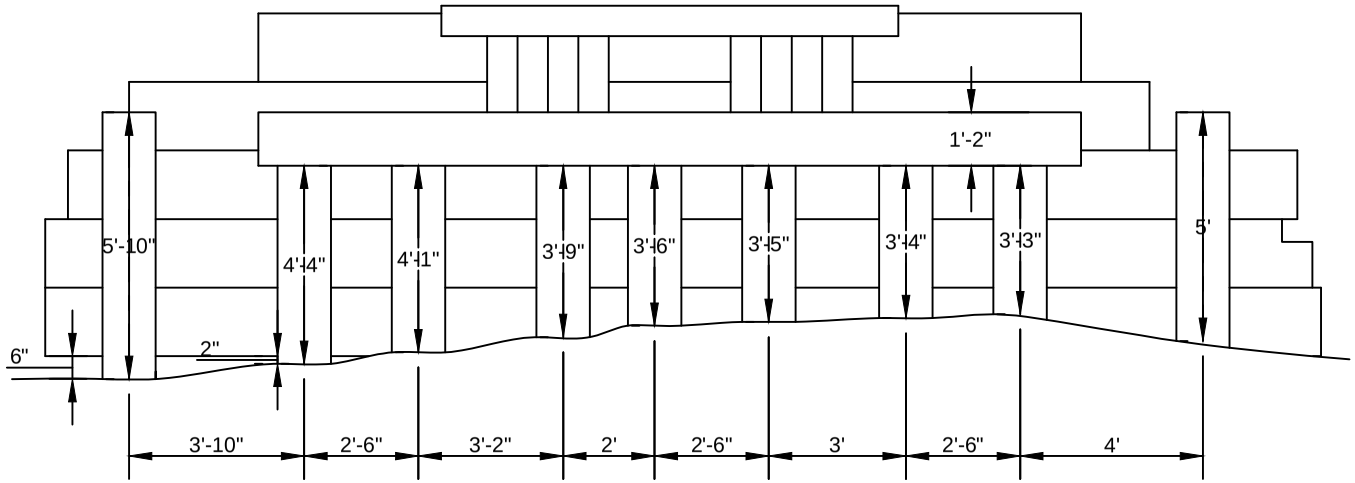
Vibrations and Deflections:

- Vibration and deflection will not be investigated for a rehabilitated trestle

Load Combinations:

- Will conform to Caltrans LRFD Table 3.4.1-1 in general.
- Load combinations Strength II, Strength IV, and Strength V need are not to be considered (per AASHTO Pedestrian Section 3.7).
- The load factor for Fatigue I load combination will be taken as 1.0 (per AASHTO Pedestrian Section 3.7) and Fatigue II will not be considered.

Appendix B



Abutment 1 (Looking Back on Line)

Notes:

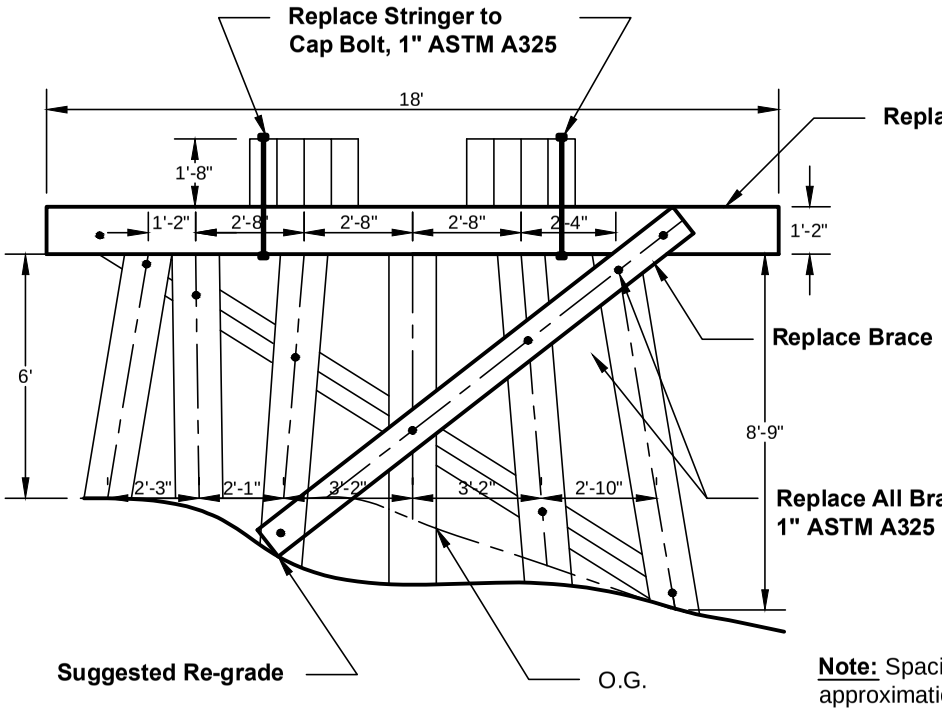
-Piles are 14" diameter (average)

-Soil is restrained by transverse planks. These planks are rotten.

-Location of transverse planks is approximate.

Retrofit:

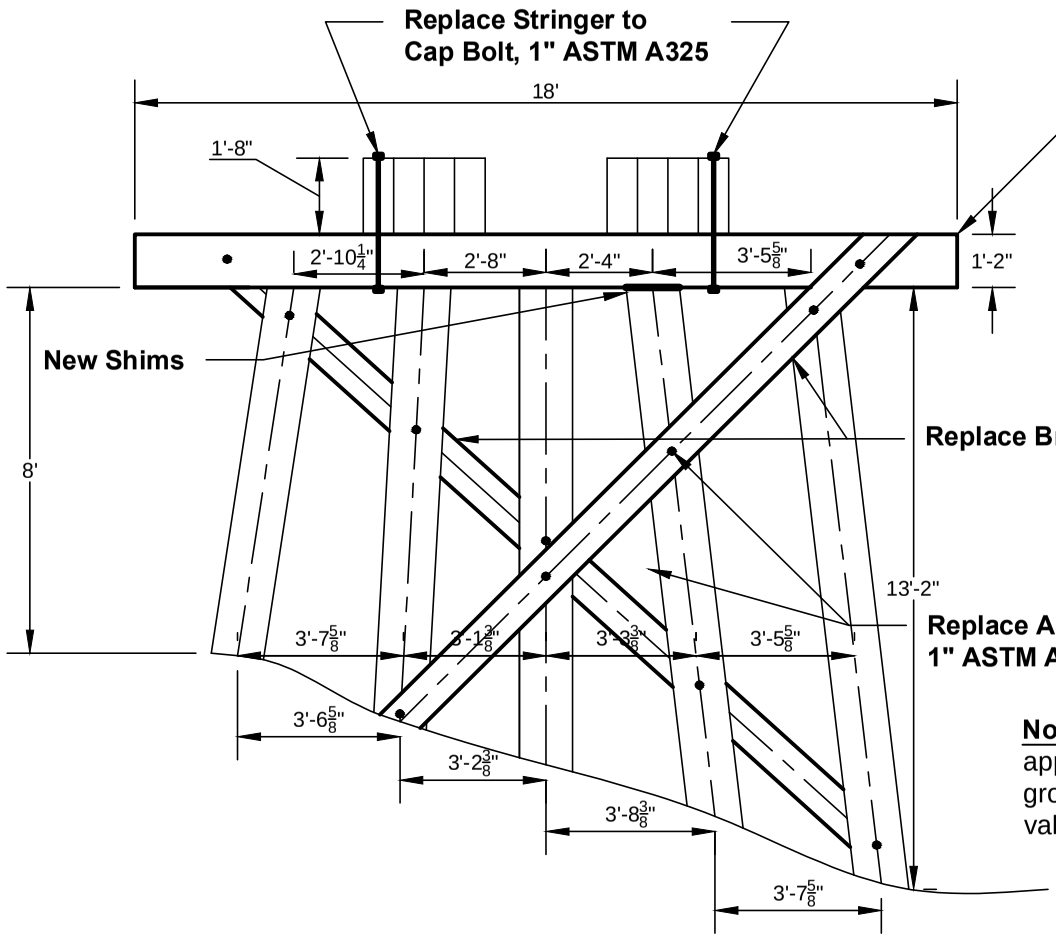
Piles, Cap, and Stringers are all in good condition. New timber for backwall is needed. New concrete block wingwalls to be provided. Concrete replacement could be used as well.



Bent 2 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	45	43	14	14
2	36.5	34	12	11
3	44.5	43	14	14
4	42.5	41.5	14	13
5	41.5	40	13	13
6	47	46	15	15
Note: Pile 1 is on the left (west edge) when looking ahead on line				

Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the ground (left edge) and the slope of the pile. These values may vary slightly.

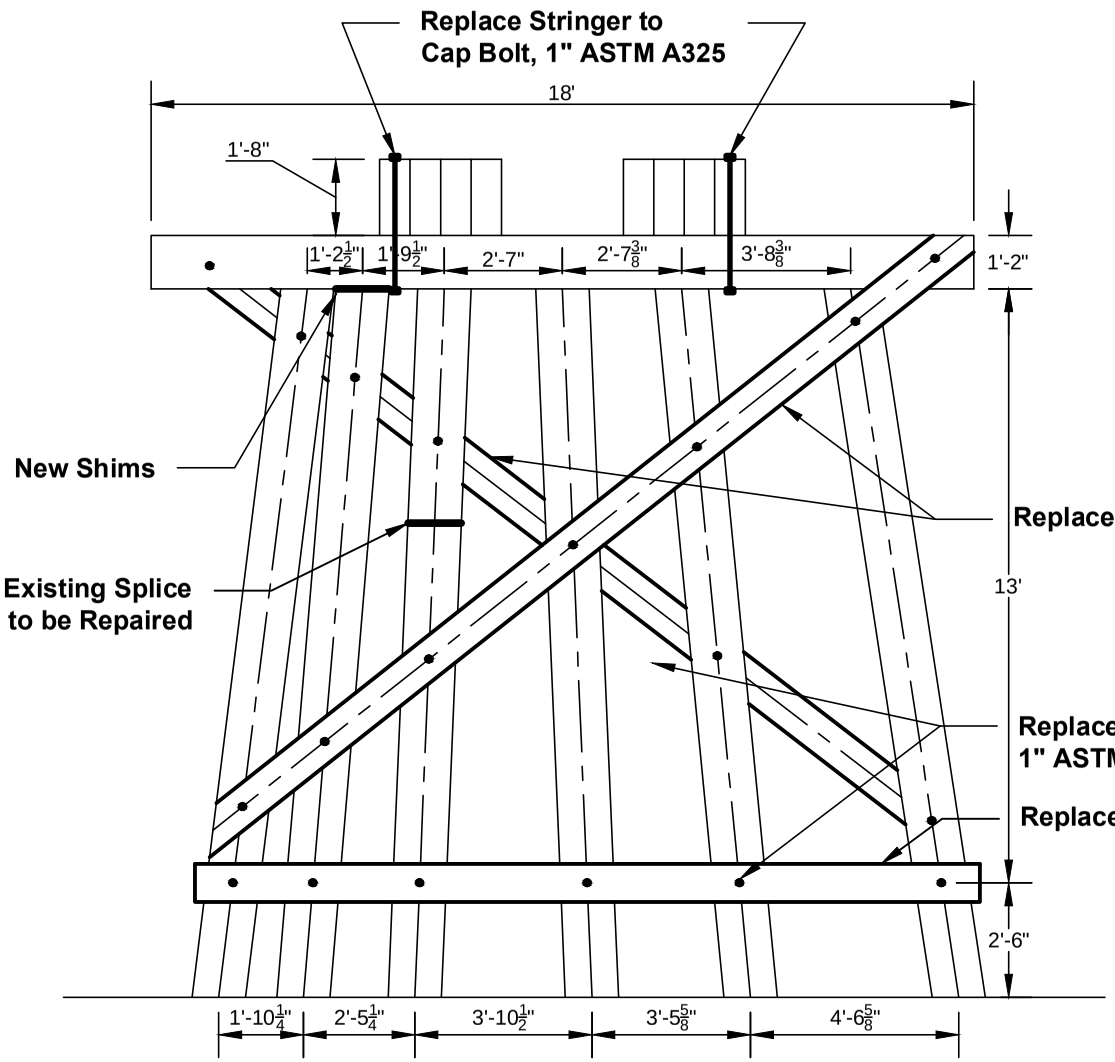
Bent 2 (Looking Ahead on Line)



Bent 3 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	45	42	14	13
2	43	41	14	13
3	42.5	39.5	14	13
4	43	40	14	13
5	46.5	42.5	15	14
Note: Pile 1 is on the left (west edge) when looking ahead on line				

Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the ground (left edge) and the slope of the pile. These values may vary slightly.

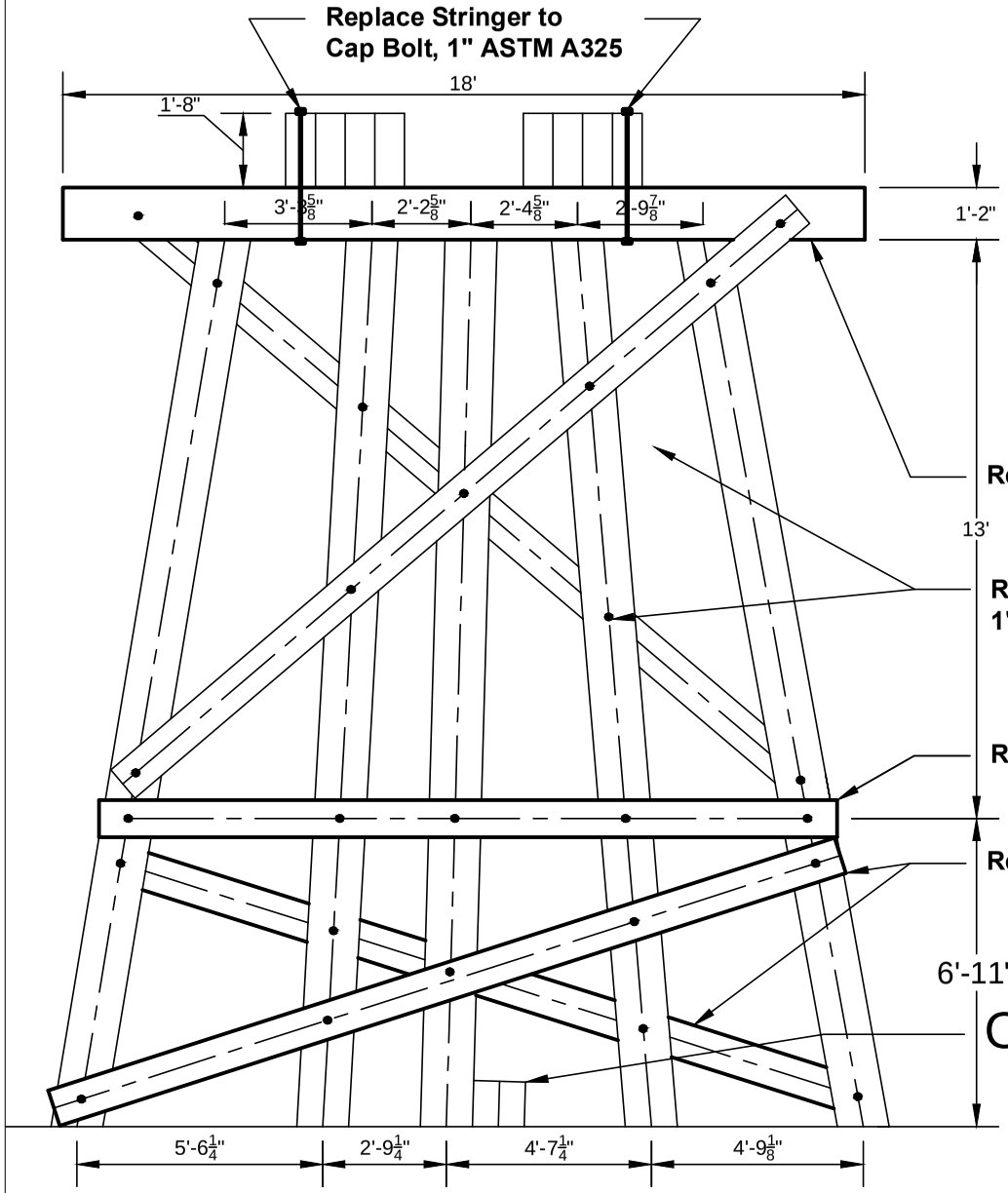
Bent 3 (Looking Ahead on Line)



Bent 4 (Looking Ahead on Line)

Bent 4 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	41.5	44	13	14
2	42	45.5	13	14
3	36	40	11	13
4	41	43.5	13	14
5	43.5	45.5	14	14
6	40	43	13	14
Note: Pile 1 is on the left (west edge) when looking ahead on line				

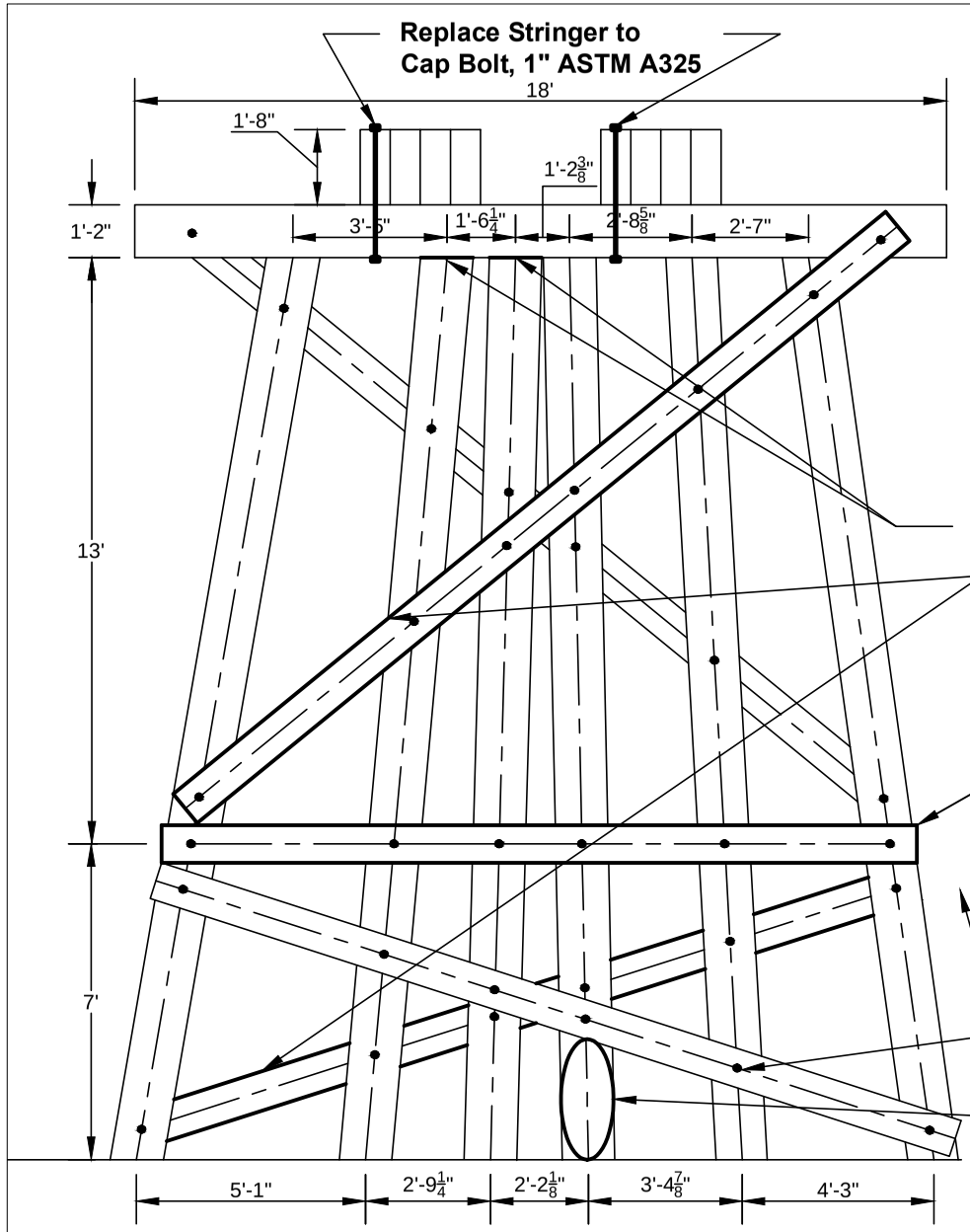
Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the sash and the slope of the pile. These values may vary slightly.



Bent 5 (Looking Ahead on Line)

Bent 5 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	41	37.5	13	12
2	42	38	13	12
3	48.5	43	15	14
4	44	39.5	14	13
5	41	37	13	12
Note: Pile 1 is on the left (west edge) when looking ahead on line				

Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the sash and the slope of the pile. These values may vary slightly.



Bent 6 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	42	37	13	12
2	42	38	13	12
3	46	42	15	13
4	46	39.5	15	13
5	43	39	14	12
6	42.5	41.5	14	13
Note: Pile 1 is on the left (west edge) when looking ahead on line				

Replace Shims

Replace Braces

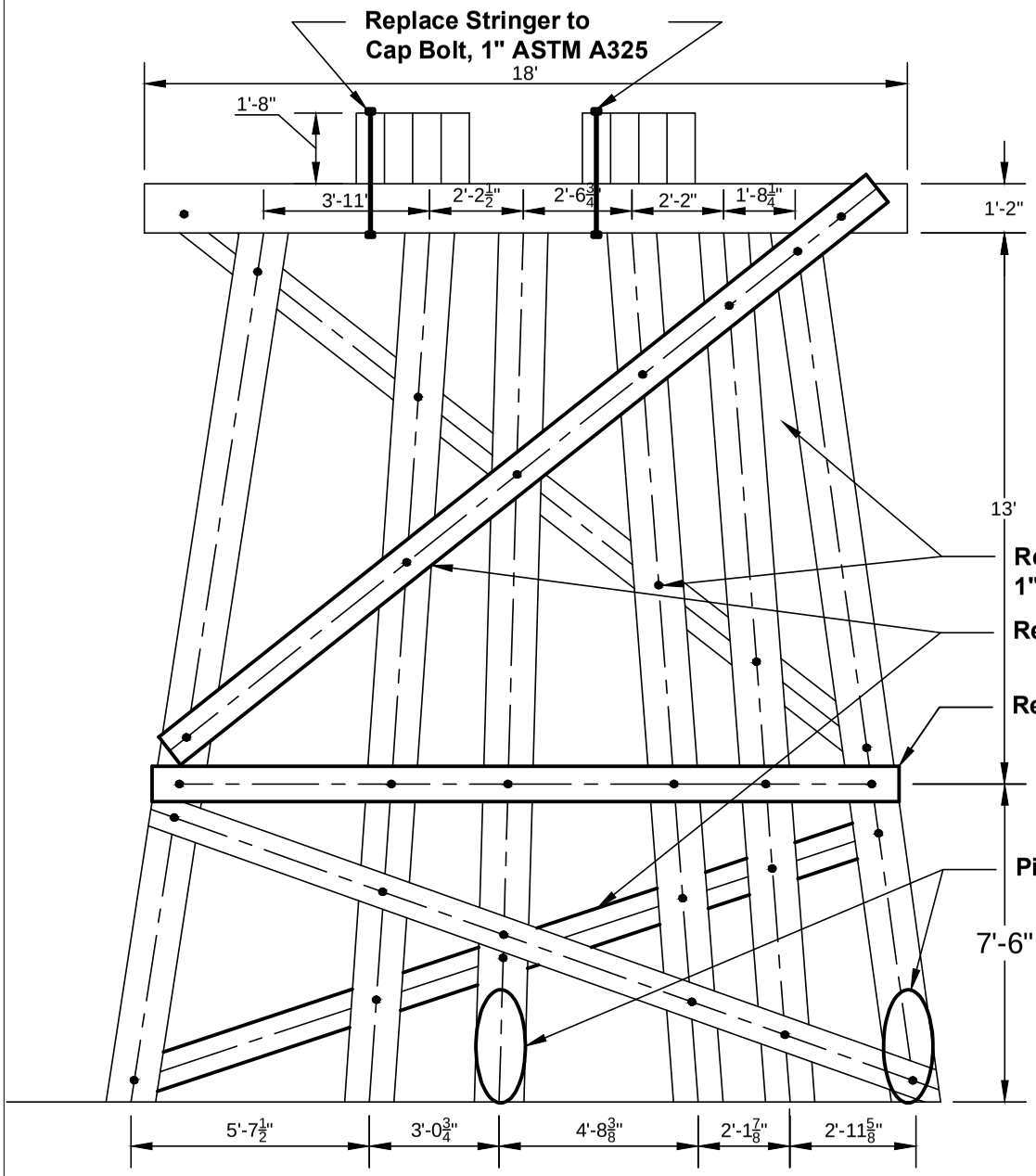
Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the sash and the slope of the pile. These values may vary slightly.

Replace Far Sash

Replace All Bracing Bolts, 1" ASTM A325

Piling Repair

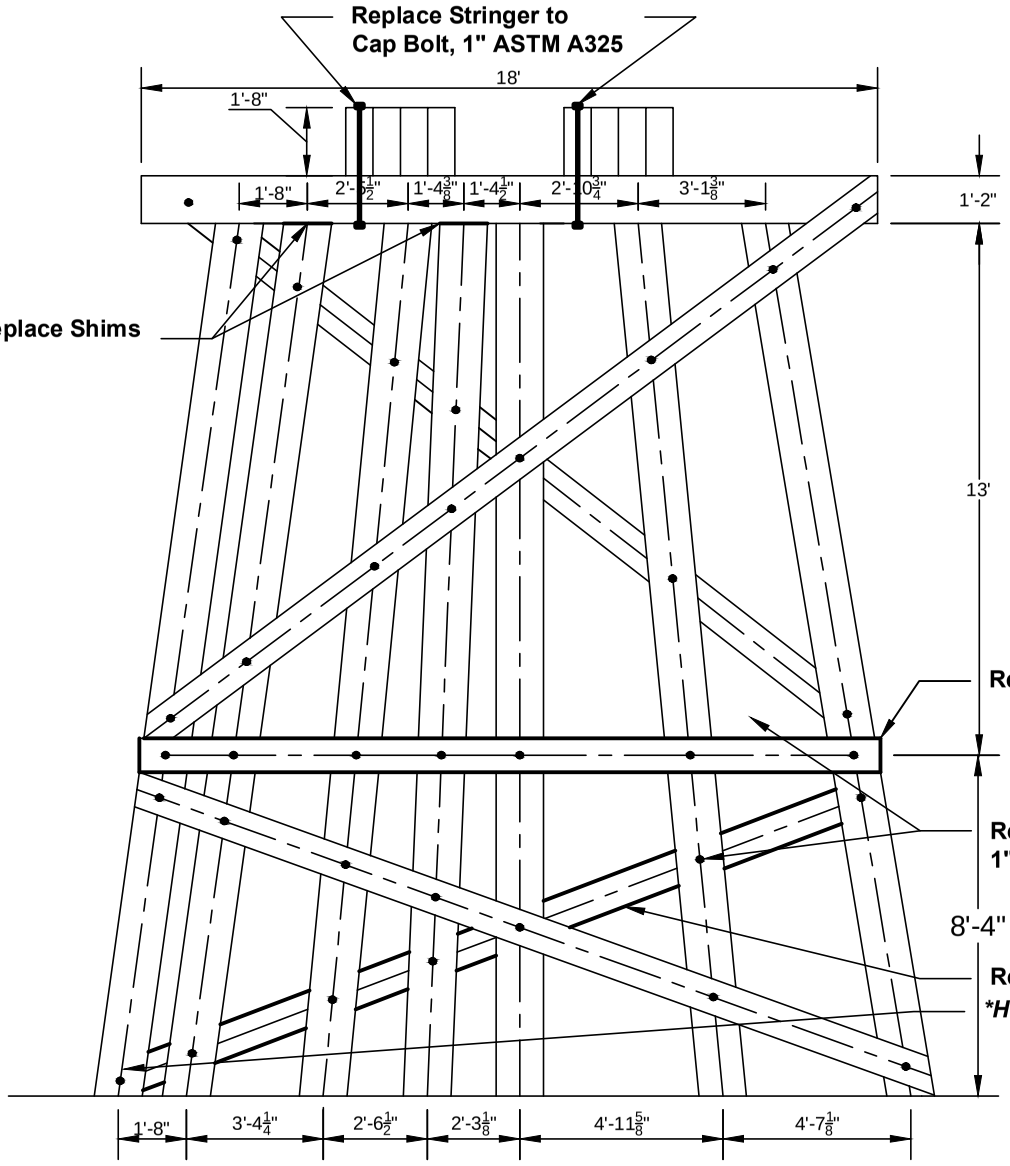
Bent 6 (Looking Ahead on Line)



Bent 7 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	43	39.5	14	13
2	41.5	37.5	13	12
3	47	41	15	13
4	40	40	13	13
5	42.5	38	14	12
6	43	40	14	13
Note: Pile 1 is on the left (west edge) when looking ahead on line				

Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the sash and the slope of the pile. These values may vary slightly.

Bent 7 (Looking Ahead on Line)

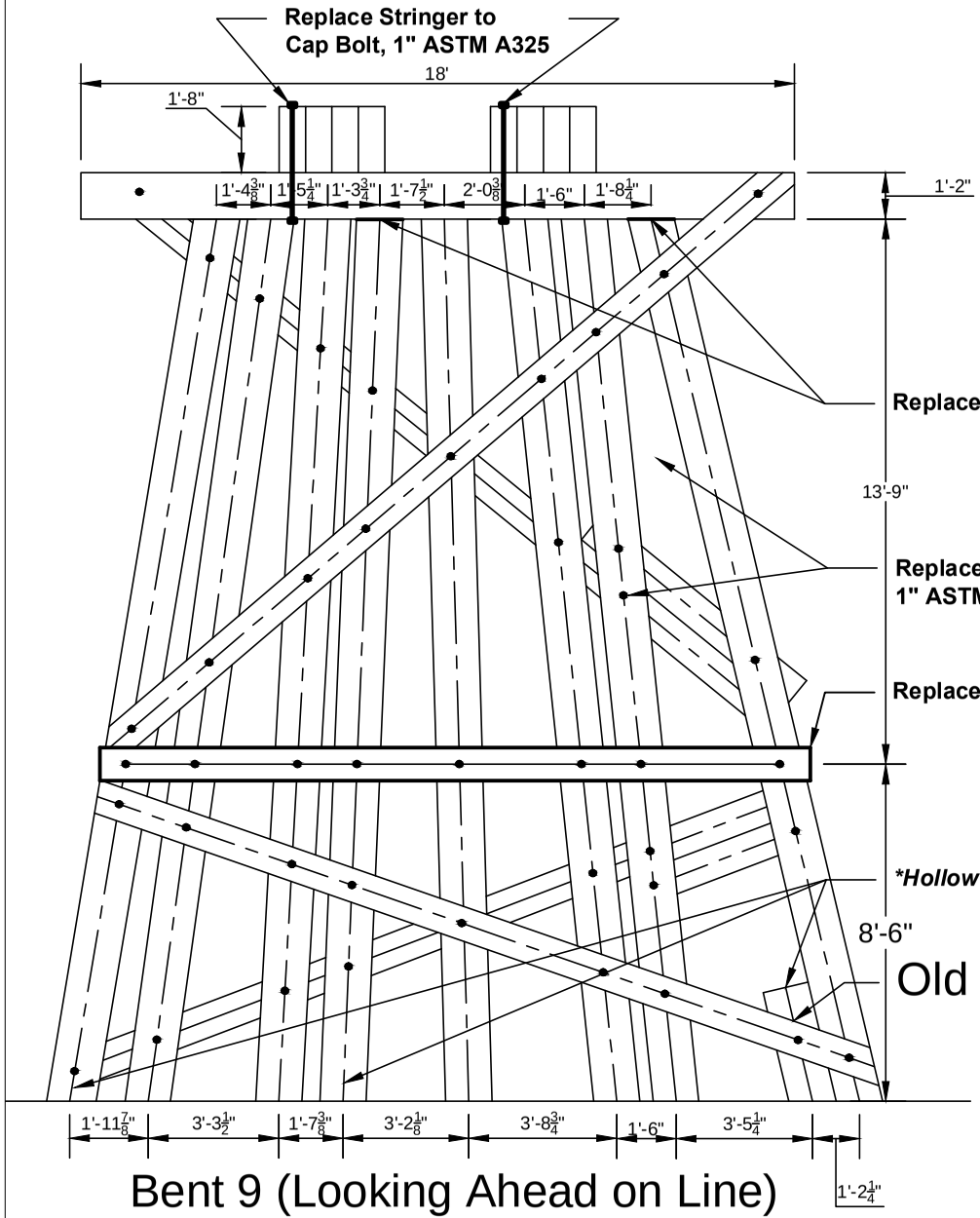


Bent 8 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	43	40.5	14	13
2	45	41.5	14	13
3	43	39	14	12
4	45	42.5	14	14
5	48	46	15	15
6	41	38.5	13	12
7	43	40	14	13
Note: Pile 1 is on the left (west edge) when looking ahead on line				

Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the sash and the slope of the pile. These values may vary slightly.

Hollow at pile base. No repair deemed necessary at this time.

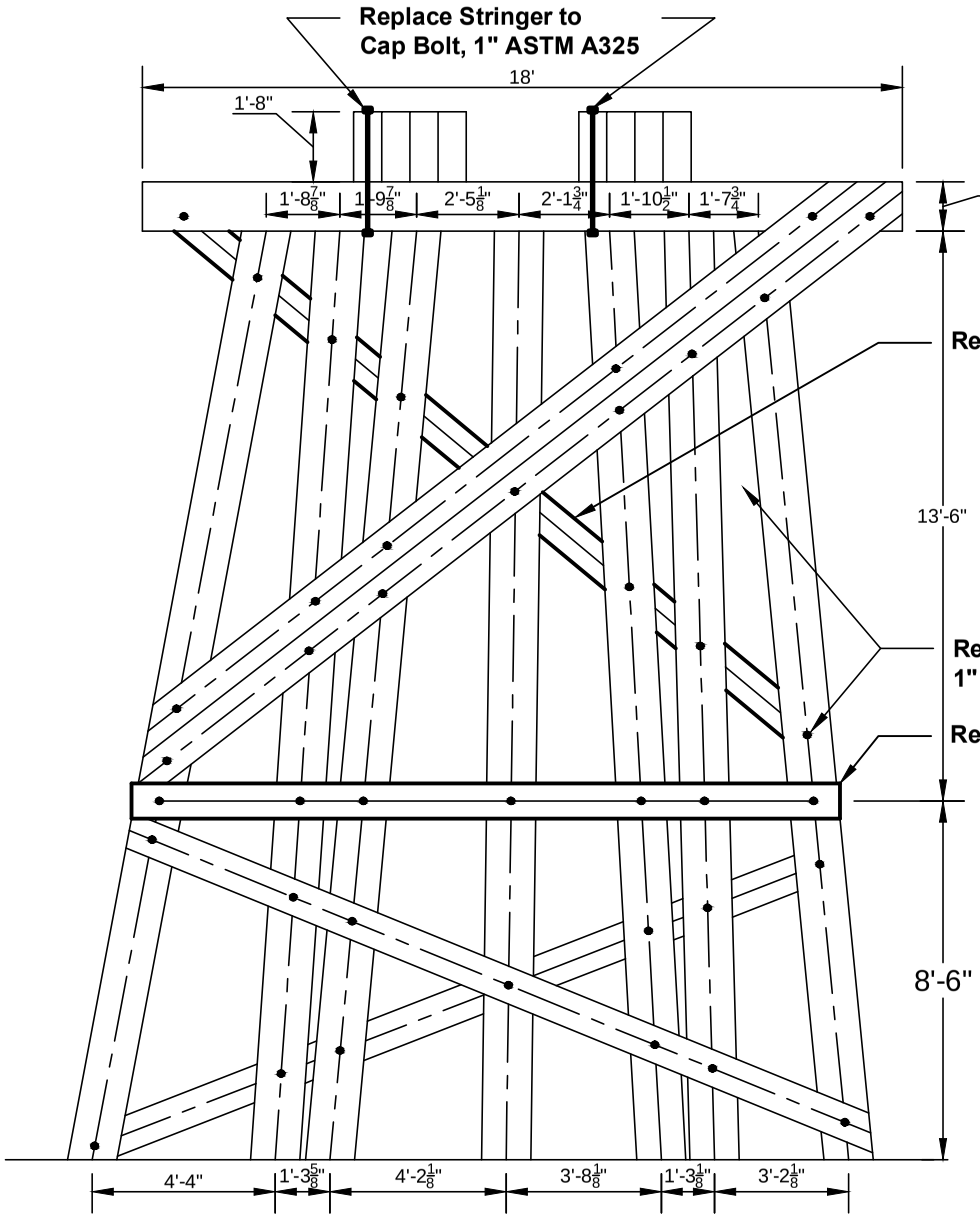
Bent 8 (Looking Ahead on Line)



Bent 9 (Looking Ahead on Line)

Bent 9 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	42	38	13	12
2	40	37	13	12
3	41	38	13	12
4	42	41	13	13
5	43	41	14	13
6	43	41	14	13
7	41	37	13	12
8	36.5	34	12	11
Note: Pile 1 is on the left (west edge) when looking ahead on line				

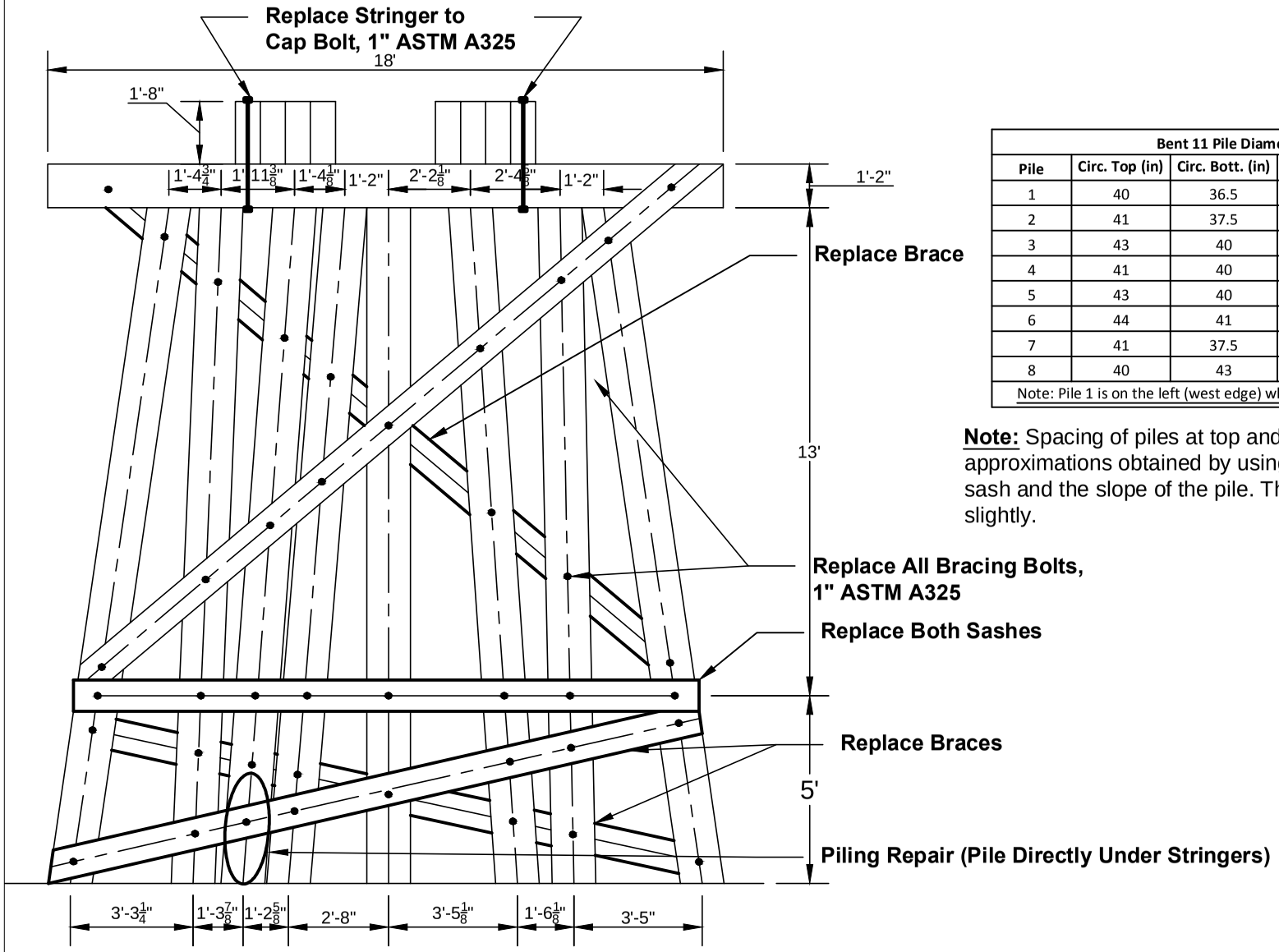
Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the sash and the slope of the pile. These values may vary slightly.



Bent 10 (Looking Ahead on Line)

Bent 10 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	42	39	13	12
2	42	39	13	12
3	44	41	14	13
4	48	42	15	13
5	46	43.5	15	14
6	38	34.5	12	11
7	47	44	15	14
Note: Pile 1 is on the left (west edge) when looking ahead on line				

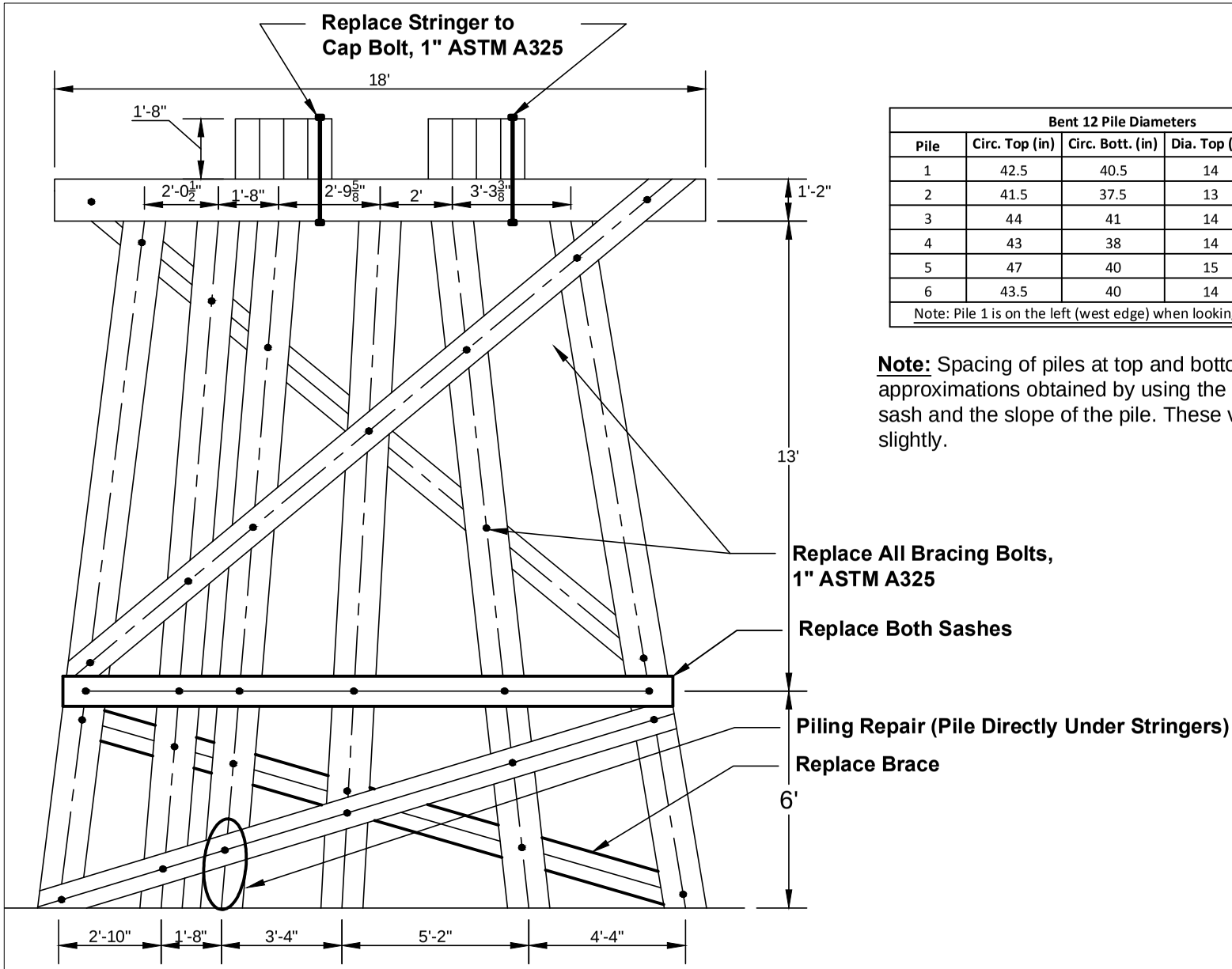
Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the sash and the slope of the pile. These values may vary slightly.



Bent 11 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	40	36.5	13	12
2	41	37.5	13	12
3	43	40	14	13
4	41	40	13	13
5	43	40	14	13
6	44	41	14	13
7	41	37.5	13	12
8	40	43	13	14
Note: Pile 1 is on the left (west edge) when looking ahead on line				

Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the sash and the slope of the pile. These values may vary slightly.

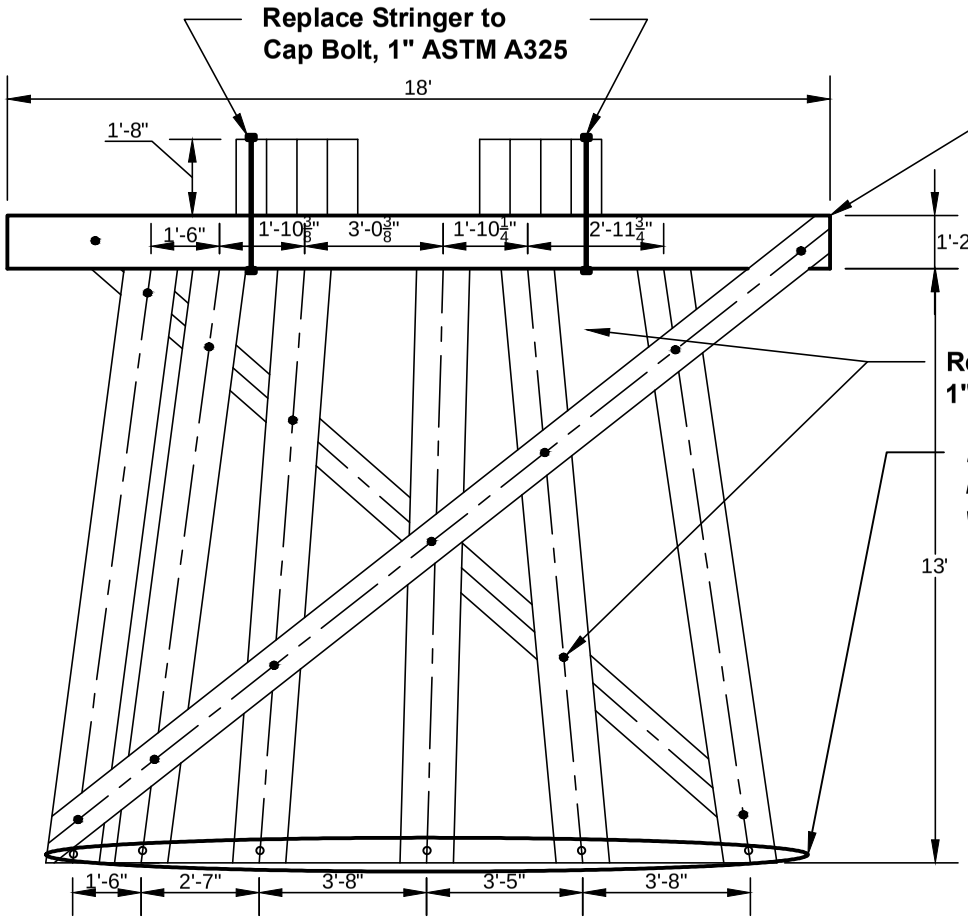
Bent 11 (Looking Ahead on Line)



Bent 12 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	42.5	40.5	14	13
2	41.5	37.5	13	12
3	44	41	14	13
4	43	38	14	12
5	47	40	15	13
6	43.5	40	14	13
Note: Pile 1 is on the left (west edge) when looking ahead on line				

Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the sash and the slope of the pile. These values may vary slightly.

Bent 12 (Looking Ahead on Line)



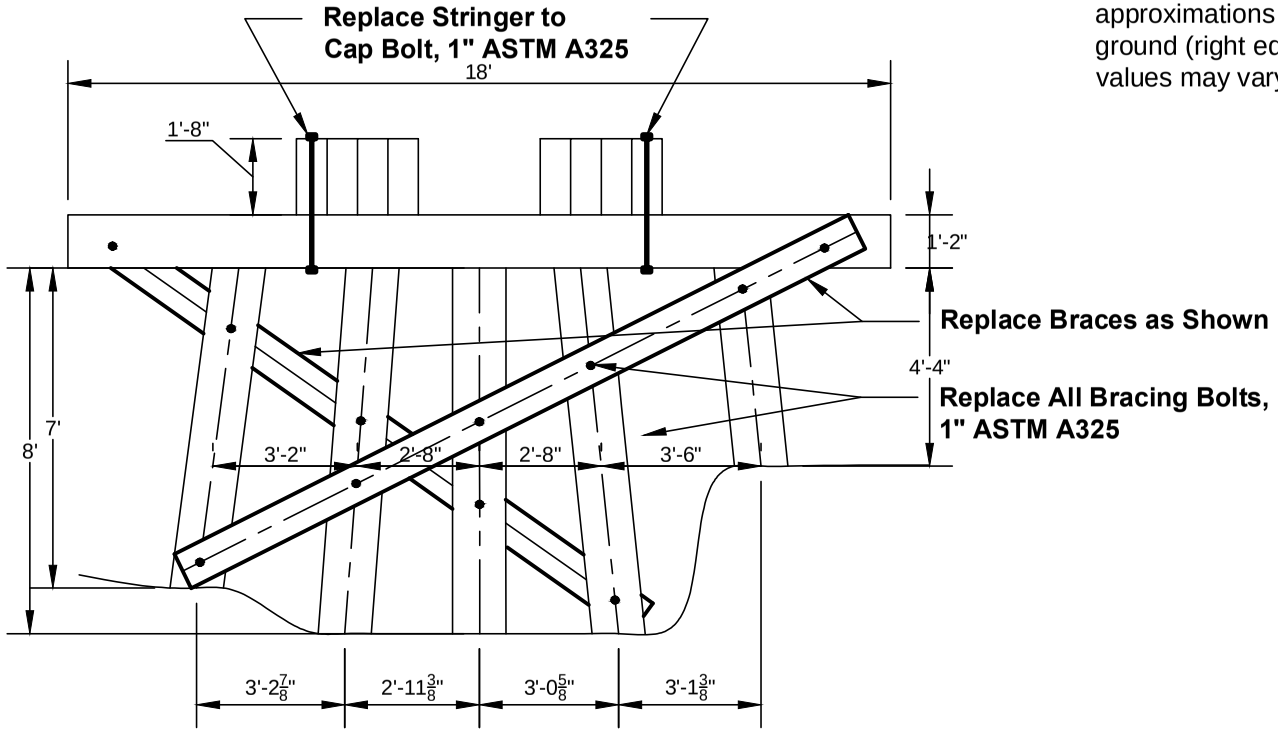
Bent 13 (Looking Ahead on Line)

Bent 13 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	43	41.5	14	13
2	39.5	37	13	12
3	43	38	14	12
4	41	39	13	12
5	46	40	15	13
6	42.5	39	14	12
Note: Pile 1 is on the left (west edge) when looking ahead on line				

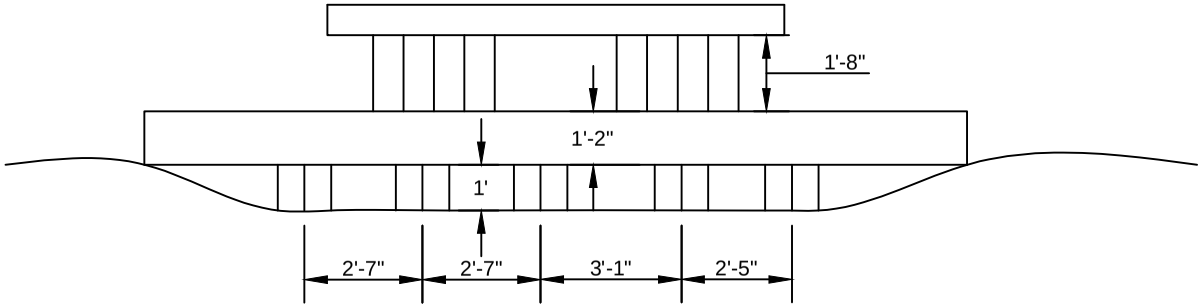
Note: Spacing of piles at the top is an approximation obtained by using the spacing at the ground and the slope of the pile. These values may vary slightly.

Bent 14 Pile Diameters				
Pile	Circ. Top (in)	Circ. Bott. (in)	Dia. Top (in)	Dia. Bott. (in)
1	41	39.5	13	13
2	44.5	41.5	14	13
3	47	43	15	14
4	44	43	14	14
5	43	43	14	14
Note: Pile 1 is on the left (west edge) when looking ahead on line				

Note: Spacing of piles at top and bottom are approximations obtained by using the spacing at the ground (right edge) and the slope of the pile. These values may vary slightly.



Bent 14 (Looking Ahead on Line)



Abutment 15 (Looking Ahead on Line)

Notes:

-Piles are 14" diameter (average)

-Soil is restrained by transverse planks.

-Transverse plans are all rotten and falling apart.

-Location of transverse planks not shown as they are not clear in the field

Retrofit:

Piles, Cap, and Stringers are all in good condition. New timber for backwall is needed. A concrete replacement could be used as well.

Appendix C

Bent 4 D/C Ratios

CH2MHILL
Sacramento Office
2485 Natomas Park Dr., Suite 600
Sacramento, California, 95833

Project Name: Three Creeks Trail
Job Number: 393685
Structure Name: Los Gatos Creek RR Trestle
Date: 8/8/2012
By: R. Coomes

Bent 4 Strength Demands

Bridge Element	Axial Force - Strength Limit State			Moment - Strength Limit State			Shear - Strength Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Stringers	N/A	N/A	N/A	90.04	241.06	0.37	34.05	106.08	0.32
Pile Caps	N/A	N/A	N/A	13.04	95.56	0.14	16.28	33.08	0.49
Piles	28.25	35	0.81	1.9	50.4	0.04	1.36	27.71	0.05

Note *: Demands come from Bent 4 modeling that assumes the piles are repaired.*

Bent 4 Extreme Event Demands

Bridge Element	Axial Force - Extreme Limit State			Moment - Extreme Limit State			Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Piles (Compression)	29.21	50	0.58	16.60	62.91	0.26	11.03	34.89	0.32
Piles (Tension)	20.49	35	0.59	15.76	62.91	0.25	8.35	34.89	0.24
Upper Sway Braces (Compression)	24.81	89.78	0.28	2.80	5.66	0.49	1.73	11.3	0.15
Upper Sway Braces (Tension)	24.19	76.48	0.32	3.05	5.66	0.54	2.47	11.3	0.22
Lower Sway Braces (Compression)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lower Sway Braces (Tension)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sash Brace (Compression)	6.86	185.93	0.04	1.56	35.7	0.04	0.39	16.15	0.02
Sash Brace (Tension)	7.85	156.75	0.05	1.56	35.7	0.04	0.39	16.15	0.02

Note *: Demands come from Bent 4 modeling that assumes the piles are repaired.*

Connection Element	Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C
Drift Pins (Cap to Pile)	6.06	7.69	0.79
Sway Brace Bolts	19.14	13.66	1.40
Sash Brace Bolts	7.85	13.66	0.57
Stringer to Cap Bolts	15.11	28.3	0.53

Capacity assumes exisiting bolts replaced by ASTM A325 1" threaded rod

Note *: Values listed are for the worst bolt in the bent. Directional Shears have been combined using SRSS Method.*

Bent 6 D/C Ratios

CH2MHILL
Sacramento Office
2485 Natomas Park Dr., Suite 600
Sacramento, California, 95833

Project Name: Three Creeks Trail
Job Number: 393685
Structure Name: Los Gatos Creek RR Trestle
Date: 8/8/2012
By: R. Coomes

Bent 6 Strength Demands

Bridge Element	Axial Force - Strength Limit State			Moment - Strength Limit State			Shear - Strength Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Stringers	N/A	N/A	N/A	90.04	241.06	0.37	34.05	106.08	0.32
Pile Caps	N/A	N/A	N/A	15.97	95.56	0.17	22.65	33.08	0.68
Piles	20.56	35	0.59	1.95	50.4	0.04	1.92	27.71	0.07

***Note** : Demands come from Bent 6 modeling that assumes the piles are repaired.*

Bent 6 Extreme Event Demands

Bridge Element	Axial Force - Extreme Limit State			Moment - Extreme Limit State			Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Piles (Compression)	40.35	50	0.81	12.28	62.91	0.20	11.16	34.89	0.32
Piles (Tension)	27.61	35	0.79	12.4	62.91	0.20	10.36	34.89	0.30
Upper Sway Braces (Compression)	24.05	89.78	0.27	6.04	5.66	1.07	2.05	11.3	0.18
Upper Sway Braces (Tension)	23.53	76.48	0.31	6.01	5.66	1.06	2.21	11.3	0.20
Lower Sway Braces (Compression)	20.61	89.78	0.23	0.92	5.66	0.16	0.38	11.3	0.03
Lower Sway Braces (Tension)	20.51	76.48	0.27	0.80	5.66	0.14	0.34	11.3	0.03
Sash Brace (Compression)	1.96	193.08	0.01	0.50	32.9	0.02	0.30	16.15	0.02
Sash Brace (Tension)	2.57	163.88	0.02	0.98	32.9	0.03	0.49	16.15	0.03

***Note** : Demands come from Bent 6 modeling that assumes the piles are repaired.*

Connection Element	Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C
Drift Pins (Cap to Pile)	4.06	7.69	0.53
Sway Brace Bolts	18.38	13.66	1.35
Sash Brace Bolts	1.47	13.66	0.11
Stringer to Cap Bolts	15.61	28.3	0.55

***Capacity assumes exisiting bolts replaced by ASTM A325 1" threaded rod**

***Note** : Values listed are for the worst bolt in the bent. Directional Shears have been combined using SRSS Method.*

Bent 7 D/C Ratios

CH2MHILL
Sacramento Office
2485 Natomas Park Dr., Suite 600
Sacramento, California, 95833

Project Name: Three Creeks Trail
Job Number: 393685
Structure Name: Los Gatos Creek RR Trestle
Date: 8/8/2012
By: R. Coomes

Bent 7 Strength Demands

Bridge Element	Axial Force - Strength Limit State			Moment - Strength Limit State			Shear - Strength Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Stringers	N/A	N/A	N/A	90.04	241.06	0.37	34.05	106.08	0.32
Pile Caps	N/A	N/A	N/A	16.02	95.56	0.17	14.47	33.08	0.44
Piles	25.91	35	0.74	1.67	50.4	0.03	1.76	27.71	0.06

***Note** : Demands come from Bent 7 modeling that assumes the piles are repaired.*

Bent 7 Extreme Event Demands

Bridge Element	Axial Force - Extreme Limit State			Moment - Extreme Limit State			Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Piles (Compression)	31.99	50	0.64	11.15	62.91	0.18	10.27	34.89	0.29
Piles (Tension)	26.51	35	0.76	12.45	62.91	0.20	11.30	34.89	0.32
Upper Sway Braces (Compression)	24.44	89.78	0.27	2.61	5.66	0.46	1.73	11.3	0.15
Upper Sway Braces (Tension)	23.65	76.48	0.31	2.86	5.66	0.51	2.54	11.3	0.22
Lower Sway Braces (Compression)	21.71	89.78	0.24	1.04	5.66	0.18	0.60	11.3	0.05
Lower Sway Braces (Tension)	20.32	76.48	0.27	0.73	5.66	0.13	0.53	11.3	0.05
Sash Brace (Compression)	0.62	193.08	0.00	0.58	32.9	0.02	0.31	16.15	0.02
Sash Brace (Tension)	2.45	163.88	0.01	0.94	32.9	0.03	0.38	16.15	0.02

***Note** : Demands come from Bent 7 modeling that assumes the piles are repaired.*

Connection Element	Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C
Drift Pins (Cap to Pile)	6.26	7.69	0.81
Sway Brace Bolts	17.23	13.66	1.26
Sash Brace Bolts	1.99	13.66	0.15
Stringer to Cap Bolts	15.60	28.3	0.55

Capacity assumes exisiting bolts replaced by ASTM A325 1" threaded rod

***Note** : Values listed are for the worst bolt in the bent. Directional Shears have been combined using SRSS Method.*

Bent 7 D/C Ratios (End Bolt Failure)

CH2MHILL
Sacramento Office
2485 Natomas Park Dr., Suite 600
Sacramento, California, 95833

Project Name: Three Creeks Trail
Job Number: 393685
Structure Name: Los Gatos Creek RR Trestle
Date: 8/8/2012
By: R. Coomes

Bent 7 Strength Demands (Assuming failure of end bolts in bracing)

Bridge Element	Axial Force - Strength Limit State			Moment - Strength Limit State			Shear - Strength Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Stringers	N/A	N/A	N/A	90.04	241.06	0.37	34.05	106.08	0.32
Pile Caps	N/A	N/A	N/A	17.14	95.56	0.18	15.01	33.08	0.45
Piles	27.08	35	0.77	4.56	50.4	0.09	2.16	27.71	0.08

Note *: Demands come from Bent 7 modeling that assumes the piles are repaired.*

Bent 7 Extreme Event Demands (Assuming failure of end bolts in bracing)

Bridge Element	Axial Force - Extreme Limit State			Moment - Extreme Limit State			Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Piles (Compression)	47.63	50	0.95	29.27	62.91	0.47	14.82	34.89	0.42
Piles (Tension)	16.26	35	0.46	31.73	62.91	0.50	13.50	34.89	0.39
Upper Sway Braces (Compression)	38.49	89.78	0.43	3.15	5.66	0.56	1.35	11.3	0.12
Upper Sway Braces (Tension)	31.74	76.48	0.42	3.66	5.66	0.65	3.32	11.3	0.29
Lower Sway Braces (Compression)	27.7	89.78	0.31	1.54	5.66	0.27	1.11	11.3	0.10
Lower Sway Braces (Tension)	27.78	76.48	0.36	1.65	5.66	0.29	1.07	11.3	0.09
Sash Brace (Compression)	4.43	193.08	0.02	1.21	32.9	0.04	0.4	16.15	0.02
Sash Brace (Tension)	5.8	163.88	0.04	1.21	32.9	0.04	0.44	16.15	0.03

Note *: Demands come from Bent 7 modeling that assumes the piles are repaired.*

Bent 13 D/C Ratios

CH2MHILL
Sacramento Office
2485 Natomas Park Dr., Suite 600
Sacramento, California, 95833

Project Name: Three Creeks Trail
Job Number: 393685
Structure Name: Los Gatos Creek RR Trestle
Date: 8/8/2012
By: R. Coomes

Bent 13 Strength Demands

Bridge Element	Axial Force - Strength Limit State			Moment - Strength Limit State			Shear - Strength Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Stringers	N/A	N/A	N/A	90.04	241.06	0.37	34.05	106.08	0.32
Pile Caps	N/A	N/A	N/A	11.56	95.56	0.12	13.45	33.08	0.41
Piles	23.82	35	0.68	2.18	50.4	0.04	0.93	27.71	0.03

Bent 13 Extreme Event Demands

Bridge Element	Axial Force - Extreme Limit State			Moment - Extreme Limit State			Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Piles (Compression)	28.93	50	0.58	14.23	62.91	0.23	5.91	34.89	0.17
Piles (Tension)	11.78	35	0.34	10.2	62.91	0.16	5.19	34.89	0.15
Upper Sway Braces (Compression)	23.32	89.78	0.26	3.40	5.66	0.60	3.14	11.3	0.28
Upper Sway Braces (Tension)	22.05	76.48	0.29	2.72	5.66	0.48	1.12	11.3	0.10
Lower Sway Braces (Compression)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lower Sway Braces (Tension)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sash Brace (Compression)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sash Brace (Tension)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Connection Element	Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C
Drift Pins (Cap to Pile)	5.71	7.69	0.74
Sway Brace Bolts	10.29	13.66	0.75
Sash Brace Bolts	N/A	N/A	N/A
Stringer to Cap Bolts	14.30	28.3	0.51

***Capacity assumes exisiting bolts replaced by ASTM A325 1" threaded rod**

***Note** : Values listed are for the worst bolt in the bent. Directional Shears have been combined using SRSS Method.*

Bent 14 D/C Ratios

CH2MHILL
Sacramento Office
2485 Natomas Park Dr., Suite 600
Sacramento, California, 95833

Project Name: Three Creeks Trail
Job Number: 393685
Structure Name: Los Gatos Creek RR Trestle
Date: 8/8/2012
By: R. Coomes

Bent 14 Strength Demands

Bridge Element	Axial Force - Strength Limit State			Moment - Strength Limit State			Shear - Strength Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Stringers	N/A	N/A	N/A	90.04	241.06	0.37	34.05	106.08	0.32
Pile Caps	N/A	N/A	N/A	15.09	95.56	0.16	13.64	33.08	0.41
Piles	27.29	35	0.78	2	50.4	0.04	1.24	27.71	0.04

Bent 14 Extreme Event Demands

Bridge Element	Axial Force - Extreme Limit State			Moment - Extreme Limit State			Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C	Demand (k-ft)	Capacity (k-ft)	D/C	Demand (kips)	Capacity (kips)	D/C
Piles (Compression)	16.7	50	0.33	21.29	62.91	0.34	9.75	34.89	0.28
Piles (Tension)	4.35	35	0.12	14.70	62.91	0.23	6.04	34.89	0.17
Upper Sway Braces (Compression)	12.39	89.78	0.14	6.08	5.66	1.07	2.10	11.3	0.19
Upper Sway Braces (Tension)	21.63	76.48	0.28	6.75	5.66	1.19	2.20	11.3	0.19
Lower Sway Braces (Compression)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lower Sway Braces (Tension)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sash Brace (Compression)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sash Brace (Tension)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Connection Element	Shear - Extreme Limit State		
	Demand (kips)	Capacity (kips)	D/C
Drift Pins (Cap to Pile)	6.57	7.69	0.85
Sway Brace Bolts	15.47	13.66	1.13
Sash Brace Bolts	N/A	N/A	N/A
Stringer to Cap Bolts*	14.10	28.3	0.50

***Capacity assumes exisiting bolts replaced by ASTM A325 1" threaded rod**

***Note** : Values listed are for the worst bolt in the bent. Directional Shears have been combined using SRSS Method.*

Appendix D

CONTECH
ENGINEERED SOLUTIONS

9025 Centre Pointe Drive
Suite 400
West Chester, Ohio 45069
(513) 645-7000
(800) 344-2102
Fax: (513) 645-7689
www.contech-cpi.com

8/3/2012

Mr. Neil Erickson
Contech Engineered Solutions

Subject: Three Creeks Trail, San Jose, CA , (CONTECH Project #)

The following is a Continental Pedestrian Bridge System ENGINEER'S COST ESTIMATE for the subject project. This ESTIMATE is intended for preliminary estimating purposes only and should **not** be interpreted as a final QUOTATION. The information presented is based on the most current data made available to CONTECH.

CONTECH will fabricate and deliver the following described Continental Pedestrian Bridge components and appurtenances:

DESCRIPTION OF SUPPLIED MATERIALS:

1 - 210 x 12 Capstone Model
Weathering steel finish utilizing plated top and bottom chords
6" Concrete Deck (Galv. Form Deck)
Design and seismic stresses in accordance CALTRANS
Vertical picket safety rail system to 54" above the deck

Uniform Live Load of 90 psf (LRFD) psf
Vehicular Live Load of 20000 lbs
Bridge delivered with each side truss in 4 sections and all stringer, floor beams and wind bracing field bolted in place

ESTIMATE: $498,600 Delivered (F.O.B.)

Lifting weight of assembled bridge 186,300 lbs

These costs do not include the foundation, or installation costs. As part of the construction process, the contractor is to perform the items listed below in accordance with the installation drawings:

- Excavate and/or construction for the structure & foundations
- Provide and install anchor bolts
- Unload and set structure utilizing crane
- Touch-Up paint work
- Third-party testing
- Materials and work for reinforced concrete deck slab

Please contact me should you have any questions or need additional information. Thank you for your interest in the Continental Pedestrian Bridge System.

Respectfully,

Courtney Smith
320-852-5339

Note: 5'-0" top of deck to low steel dimension, 5'-6" at the abutments due to bearings. Total dead load per bearing is 90,600 lbs at each corner of the bridge, live load reaction is 56,700 lbs at each corner of the bridge.

CONTECH®
ENGINEERED SOLUTIONS

Pedestrian & Vehicular Steel Truss Bridges



CONTINENTAL® BRIDGE

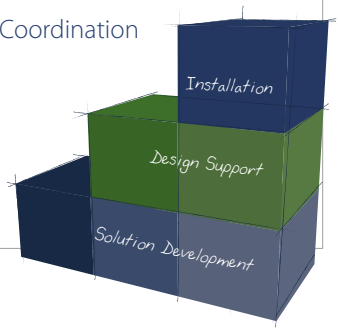
EXPRESS™

U.S. BRIDGE®
BRIDGING AMERICA SINCE 1936

Building Blocks to a Successful Project.

Contech® prefabricated truss bridges are durable and aesthetic solutions. Prefabricated manufacturing means fast installation and substantial cost-savings. Contech truss bridges are typically erected and installed in one to three days, without the need for field welding. Contech truss bridges feature efficient bridge design and construction that is customized and manufactured to your specifications.

SOLUTION DEVELOPMENT	DESIGN SUPPORT	INSTALLATION
• Product Design Worksheet • Structure Selection • Siting & Layout • Design Your Own Bridge (DYOB®) • Engineer Estimates • Site Simulation • Proposal Preparation • Design Build Support	• Specifications • Contract Drawings • Permitting Assistance • Structural/Fabrication Drawings • Approval Assistance • Custom Solutions • Horizontal/Vertical Alignment • Hydraulics & Scour Support • Foundation Support	• Preconstruction Meeting • On-Site Installation Assistance • Logistics Coordination



Rockingham County, VA

Wolverton Road, NJ

Vehicular Steel Truss Bridges

U.S. Bridge® is known for its safe, durable, affordable and aesthetic solutions. U.S. Bridge truss structures are suitable for residential and commercial developments, Department of Transportation, municipal roads, parks and trails, as well as industrial and mining facilities.

U.S. Bridge Offers:

- Clear spans to 300 feet
- Aesthetic solutions
- Quick and straightforward installation with onsite support
- Improved hydraulics
- A variety of rail, deck, and finish options
- Extensive technical support
- Manufacturing with AISC major bridge certification
- Fracture critical and sophisticated paint coating endorsements

U.S. BRIDGE®
BRIDGING AMERICA SINCE 1936

Pedestrian Steel Truss Bridges

Since 1972, Continental® has been North America's premier brand for pedestrian steel truss bridges. With more than 14,000 installations worldwide, Continental truss bridges are ideal for parks and trails, golf courses, skywalks, environmentally sensitive areas and developments.

Continental Bridge Offers:

- Clear spans to 250 feet and more
- Pedestrian crossings over highways, railroad tracks, rivers and wetlands
- Rapid installation
- Aesthetic solutions
- A variety of rail, deck, and finish options
- Extensive technical support
- Manufacturing with AISC major bridge certification
- Fracture critical and sophisticated paint coating endorsements

CONTINENTAL® BRIDGE

Greenway, TN


Cincinnati, OH


Ridgeway, CO

EXPRESS™

Pre-Engineered Pedestrian Bridges

The Steadfast EXPRESS™ bridge is a pre-engineered pedestrian steel truss bridge designed for owners, engineers and contractors who know "time is money." This standardized truss system provides stamped drawings within three business days after receipt of order and a bridge ready for shipment in less than six weeks, significantly reducing construction time. The speed, quality and value of Steadfast EXPRESS™ bridges will ensure you receive the industry's best customer experience.

EXPRESS Bridges Offer:

- Stamped drawings within 3 business days after receipt of order
- Bridge ready for shipment within 6 weeks of approved drawings
- Quick and straightforward installation
- Designed in accordance with IBC and AISC

MUNICIPALITIES & COUNTIES

Rebuilding Our Infrastructure

Time-sensitive projects and emergency bridge replacements often lead municipalities to a U.S. Bridge vehicular or Steadfast EXPRESS pedestrian structure. The clear span structures can improve hydraulics and minimize road and trail closure time with a quick installation, while fitting within a budget. Structures are typically installed in 1-3 days and require minimal maintenance.

Cambridge — Union, ME

Keystone® — Raleigh, NC

Gateway® — Apopka, FL

Connector® — Eagle, ID

ENERGY, MINING & INDUSTRIAL

Helping to keep America Working

Continental steel truss structures have been utilized for pipe support, conveyor support and other elevated crossings. U.S. Bridge vehicular structures, which meet AASHTO loading criteria, will accommodate large construction vehicles and equipment for the transport of heavy materials. The strength and durability of these systems allow for a wide range of unique solutions.

Connector® — Morris,IL

Cambridge — Calera, AL

Connector® — Stephens Point, WI

Cambridge` — Gillette, WY

Custom — Pella, IA

PARK, RESORTS, GOLF COURSES & MORE

Enjoying Life & Leisure

Resorts, tourist attractions and signature golf courses all over the country have turned to Contech pedestrian and U.S. Bridge vehicular truss structures with a wide variety of styles, rail, deck and finishing options available. Truss structures combine aesthetic designs with solid construction to handle golfers, their carts, and maintenance vehicle traffic.

Connector® — Lancaster, PA

Connector® — Moab, UT

Custom Gateway® — Atlanta, GA

Gateway® — Dedham, MS

RESIDENTIAL & COMMERCIAL

Providing **Community Solutions**

Continental pedestrian and U.S. Bridge vehicular truss structures have been selected by developers throughout the U.S. to provide practical, yet aesthetic structures in residential developments, hospitals, schools and communities. These structures are available in an array of style and finish options to provide a signature look as well as guarantee safe, reliable bridges for every day use.

Developers also look to Continental pedestrian and U.S. Bridge vehicular truss solutions for busy commercial sites. Often times, these bridges are main entrances or centerpieces for business parks, shopping centers and local communities.

Gateway® — Moline, IL

Cambridge — Shelbyville, IN

Custom — Warren, OH

Cable-Stayed — Mishawaka, IN

CUSTOM DESIGNS & SIGNATURE LOOKS

Looking Ahead We Can Help

Speciality truss bridges by Contech can be custom designed to specifically fit your project's needs. Our bridges have been successfully designed to replicate a particular bridge style or create a brand new signature look.

These custom options have included:

- Gangways onto floating docks, wildlife crossings, material handling and pipe support systems within buildings
- Bridges enclosed with stone, stucco, wood or other materials
- Multi-color paint systems and decorative lighting
- Cable-stayed bridges and skywalks
- Specialized railing, decking and finish options
- ADA accessible ramps

Gateway® — Sturtevant, WI

Gateway™ — Daytona Beach, FL

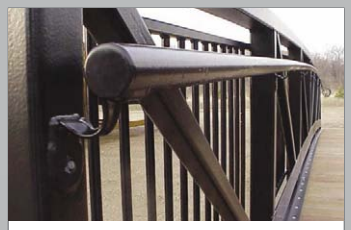
Connector® — Dulles, VA

Rail Options

Thrie-Beam*

W-Beam*

Safety Rail/Wood Rub Rail

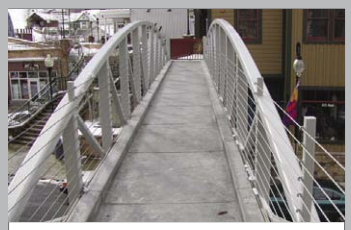


Vertical Picket/Pipe Handrail

Deck Options

Wood

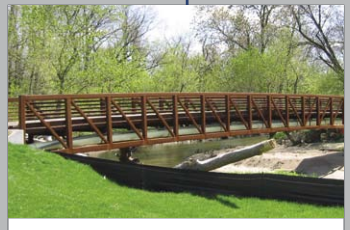
Steel Grate



Concrete

Asphalt*

Finish Options



Weathering Steel

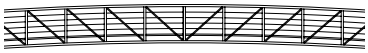
Painted Steel

Galvanized Steel

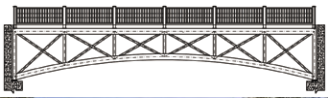
*Our truss structures offer a wide range of rail, deck and finish options that guarantee a distinctive look for any bridge. * Applies to Vehicular Truss Only.*

Pedestrian Truss Styles*

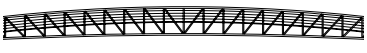
Connector®



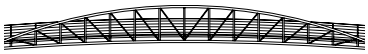
Archway®



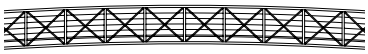
Capstone®



Keystone®



Link®

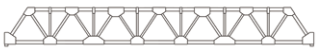


Gateway®

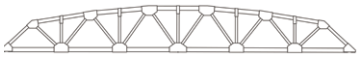
**Custom styling is available to make your project a reality (e.g. skywalks, cable-stayed bridges).*

Vehicular Truss Styles

The Cambridge Flat



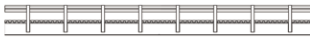
The Cambridge



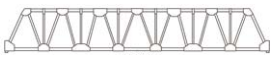
The Viking

The Seneca

The Cortez



Thru Truss



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For Vehicular & Pedestrian Truss Bridges

DESIGN SPECIFICATIONS:

- AISC
- AASHTO Standard Specs for Highway Bridges
- AASHTO Guide Specs for Pedestrian Bridges
- AWS D1.1, D1.5
- Registered Professional Engineers

MATERIAL & FINISHES
Steel Types Used (50 ksi material)**:**

- ASTM A588 Weathering Steel
- ASTM A572 Painted (2 Coat and 3 Coat (Zinc Rich Primer) – Any Color)
- ASTM A572 Galvanized (35-year Limited Warranty)

MANUFACTURING/INSTALLATION SPECIFICATIONS:

- AISC Shop Certification
- Simple Bridge Certification
- Major Bridge Certification
- Sophisticated Paint Endorsement
- Fracture Critical Endorsement
- AWS Certified Welders

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Maine (Scarborough)	207-885-9830
Maryland (Baltimore)	410-740-8490
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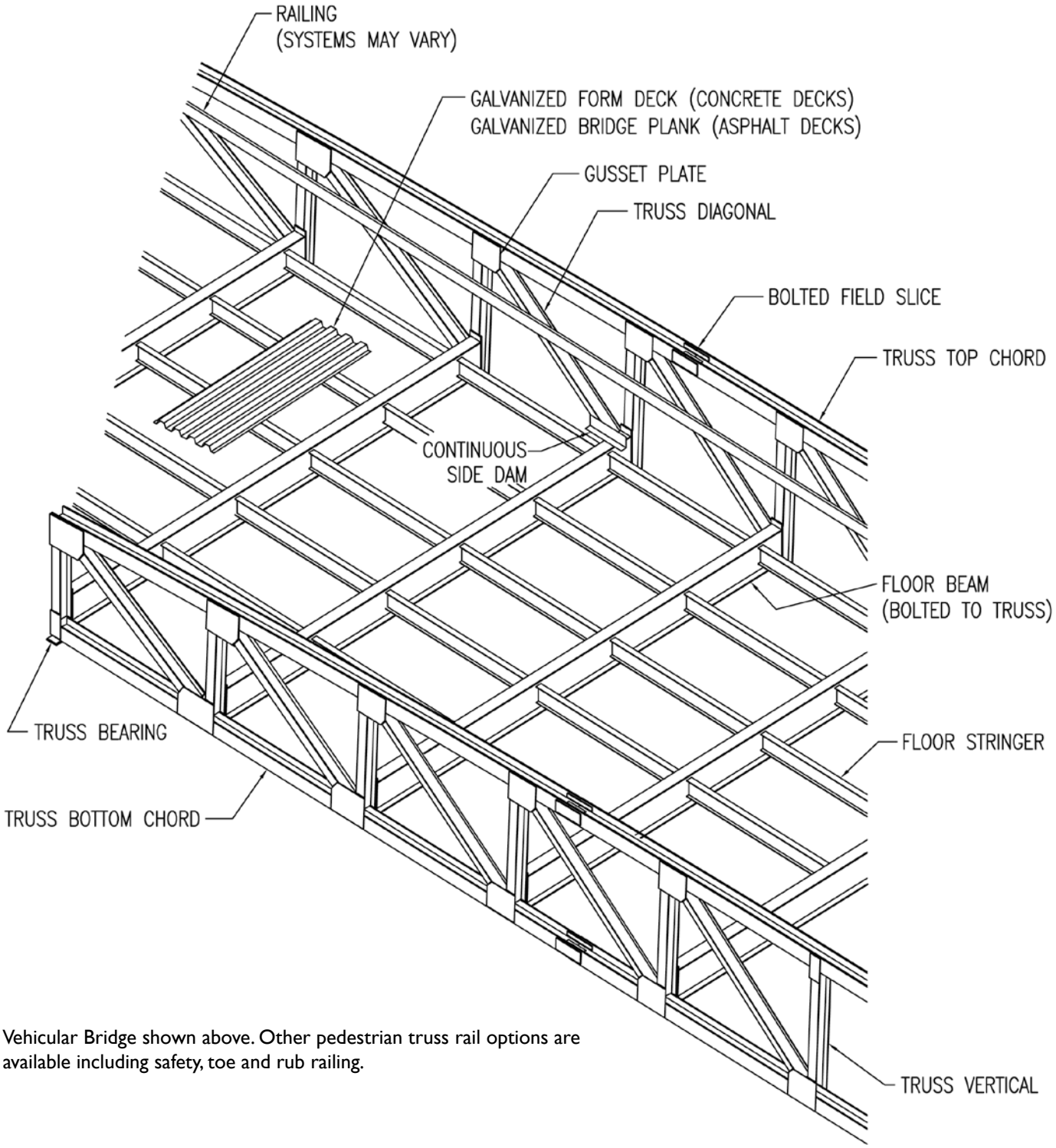
Truss Bridge Details

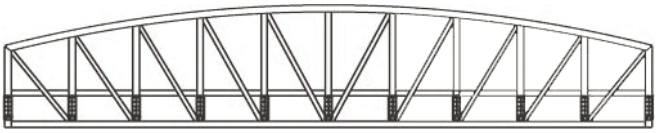


*Vehicular Bridge shown above. Other pedestrian truss rail options are available including safety, toe and rub railing.

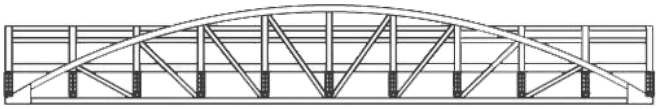
STEADFAST BRIDGES®

CONTINENTAL® BRIDGE

Typical Truss Styles (Pedestrian and Vehicular)

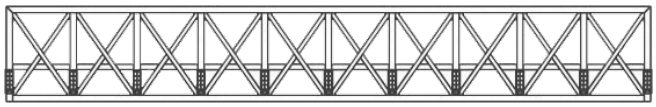


Capstone® Modified Bow Truss



Keystone® Bow Truss

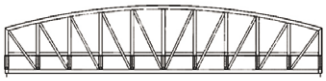
Connector® Standard Truss



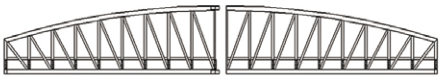
Link® X-Brace Truss

Archway® Underhung Truss

Typical Shipping Splices



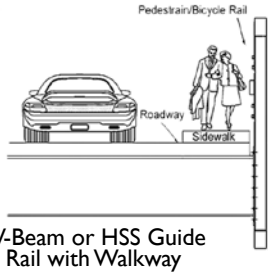
Up to 70 feet



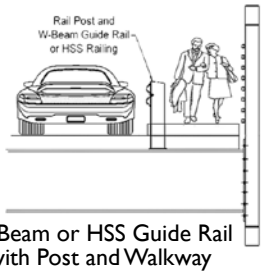
70 feet to 135 feet

135 feet to 160 feet

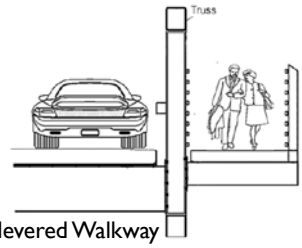
Typical Sidewalk and Railing Arrangements



W-Beam or HSS Guide Rail with Walkway

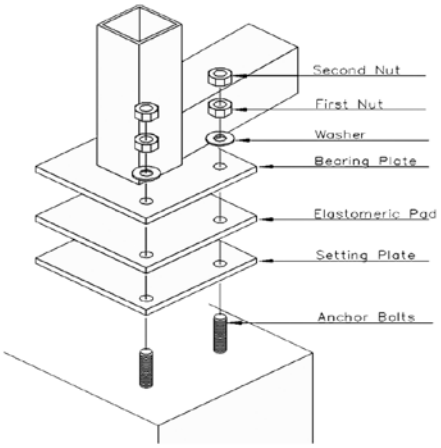


W-Beam or HSS Guide Rail with Post and Walkway

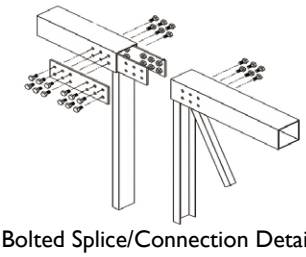


Cantilevered Walkway

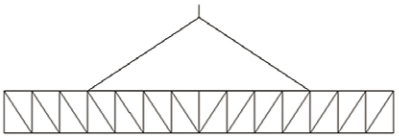
Bearing Details



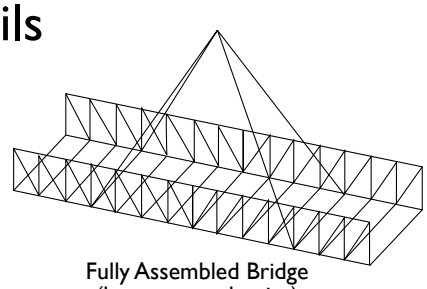
Typical Installation Details



Bolted Splice/Connection Detail

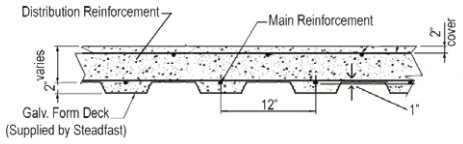


Fully Assembled Truss Only (top chord lift)

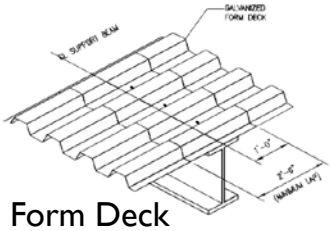


Fully Assembled Bridge (bottom panel point)

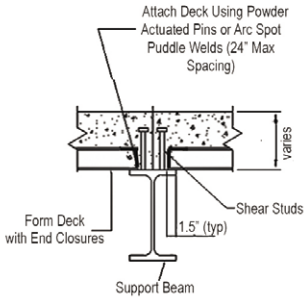
Concrete Floor Connections



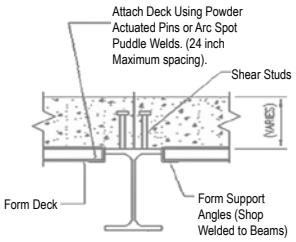
Concrete Deck Reinforcing



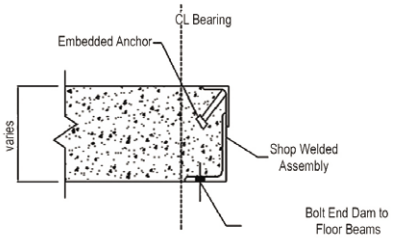
Form Deck



Section View Option #1

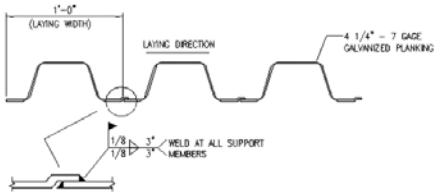


Section View Option #2

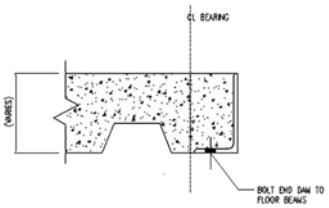


End Dam Detail

Asphalt Floor Connections

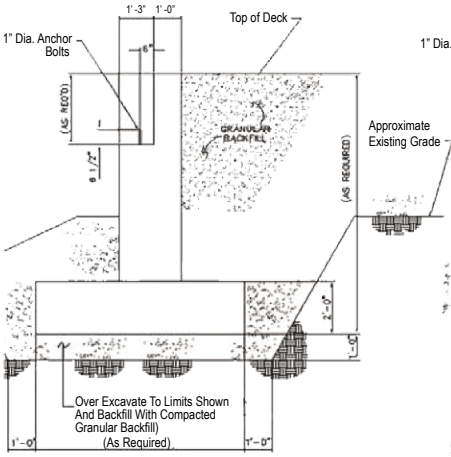


Concrete Deck Reinforcing

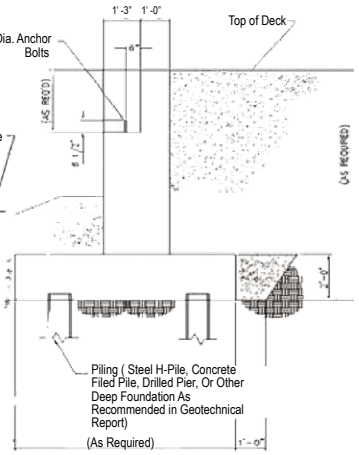


End Dam Detail

Foundations

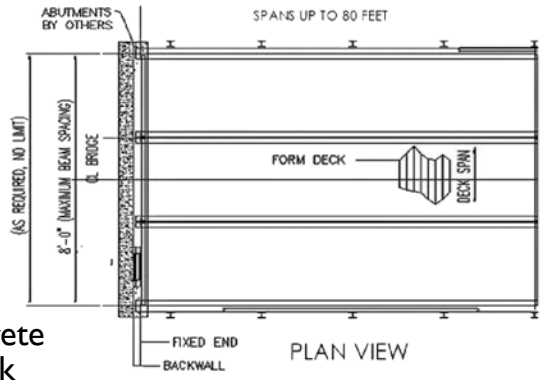


Soil Supported

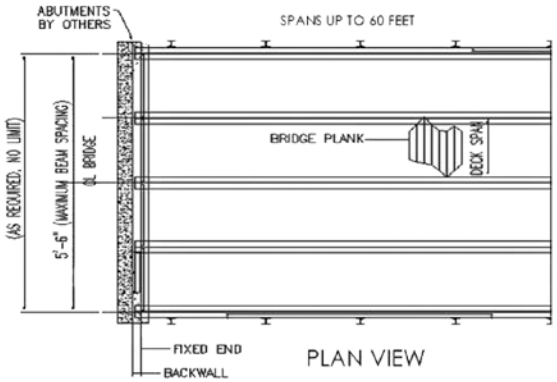


Pile Supported

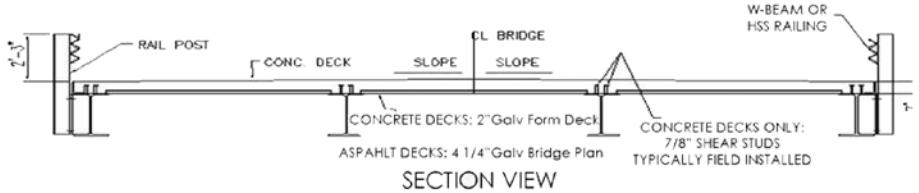
Steel Stringer



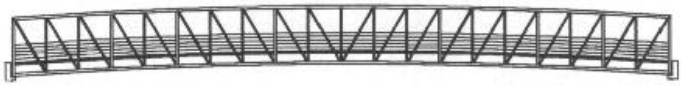
Concrete Deck



Asphalt Deck

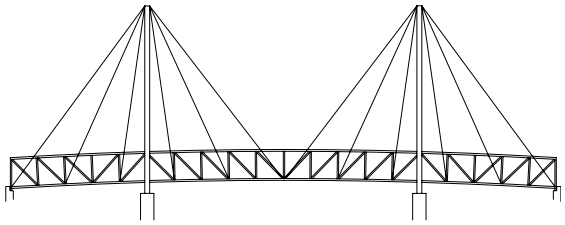


Pedestrian Only Truss Styles



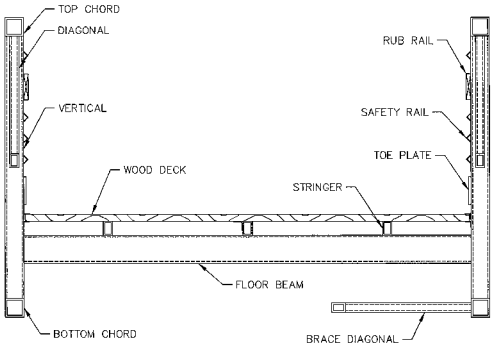
Gateway®

Expressway®

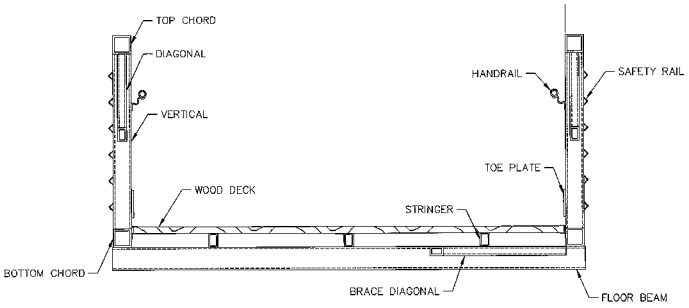


Cable Stayed

Section Views

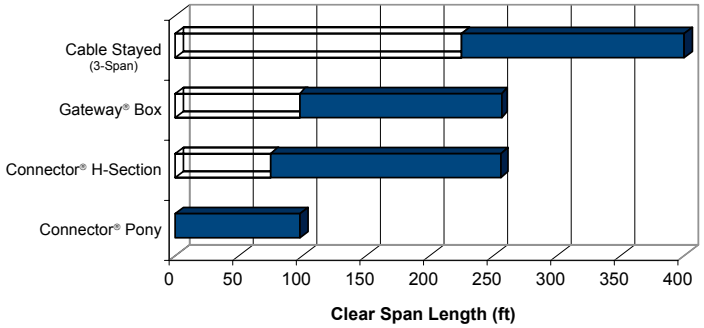


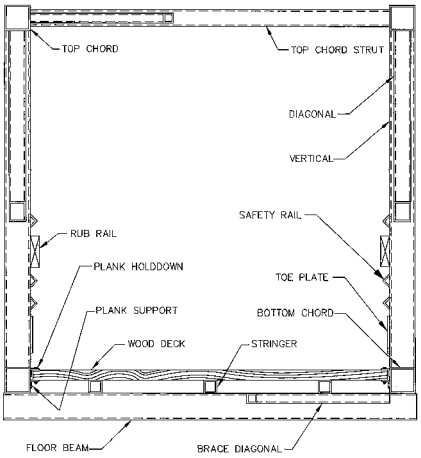
Connector® - H-Section



Connector® - Underhung Floor

Optimum Pedestrian Bridge System Types





Gateway® - Through Box

For Vehicular & Pedestrian Truss Bridges

Material & Finishes:

Steel Types Used (50 ksi material):

- A588 Weathering or A847 (Pedestrian Only)
- A500 Painted (Pedestrian Only)
- A572 Painted (2 Coat and 3 Coat (Zinc Rich Primer) – Any Color)
- A572 Galvanized (35-year Limited Warranty)
- A325 Galvanized or Type 3 Weathering (Bolts Provided)
- A307 Galvanized Anchor Bolts are Specified (By Contractor)

Design Specifications:

- AISC
- AASHTO Standard Specifications for Highway Bridges
- AASHTO Guide Specifications for Pedestrian Bridges
- AWS D1.1, D1.5

Manufacturing/Installation Specifications:

- AISC Shop Certification
  - Fracture Critical Endorsement
  - Sophisticated Paint Endorsement
- AWS

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CONTINENTAL BRIDGE

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Appendix E

Contech 210 ft Prefabricated Capstone Truss Cost Estimate

CH2MHILL
Sacramento Office
2485 Natomas Park Dr., Suite 600
Sacramento, California, 95833

Project Name: Three Creeks Trail
Job Number: 393685
Structure Name: Los Gatos Creek Trestle
Date: 9/28/2012
By: R. Coomes

Work item	Cost	Cost Source
Trestle Removal	$58,800	Estimate from Rick Hultz (CH2M HILL). Includes labor and equipment cost.
Prefabricated Bridge	$498,600	Estimate from Contech ES. This is delivered cost and doesn't include installation, abutments, or equip (note the installation cost below).
Abutment Piles	$144,000	Need 6 piles at 60 ft each per abutment. $200/ft estimate based off of 2011 Caltrans Contact Cost Data. Includes labor and equipment costs.
Abutment Concrete	$33,600	Estimated at $600/yd^3
Abut. Reinforcing Steel	$6,804	Estimated at $1.35/lb by Rick Hults (CH2M Hill)
Deck Concrete	$28,200	Estimated at $600/yd^3
Deck Reinforcing	$14,276	Estimated at $1.35/lb by Rick Hults (CH2M Hill)
Installation of Bridge	$54,000	From a recent CH2M HILL construction cost estimate for a similar structure.

Subtotal (A)		$838,280	
Stormwater/Erosion	$	41,914	5% of Subtotal A
Mobilization	$	88,019	10% of Subtotal A + Stormwater/Erosion
Subtotal (B)		$968,214	
Design Engineering		$194,444	
Construction Engineering		$96,821	10% of Subtotal B
Subtotal (C)		$1,259,479	
Construction Contingency	$	377,843.72	30% of Subtotal C
Total		**$1,637,323**	

Low Range	$1,309,858	-20%
High Range	$2,292,252	40%

Appendix F

Three Creeks Trail - Trestle Repair Environmental Consistency

PREPARED FOR: Humin Mu/City of San José
Jan Palajac/City of San José
Yves Zsutty/City of San José

COPY TO: Hans Strandgaard/CH2M HILL
Robert Coomes/CH2M HILL
Dave Von Rueden/CH2M HILL
René Langis/CH2M HILL

PREPARED BY: Matthew Franck/CH2M HILL

DATE: August 16, 2012

PROJECT NUMBER: 393685

Summary

This memorandum evaluates the design alternatives for the Three Creeks Trail Trestle at Los Gatos Creek for consistency with the previously approved environmental impact assessment. Based on the extent of the proposed activities, it appears that all three alternatives would require a new environmental document. All three alternatives would require similar permits from environmental resource agencies for work within Los Gatos Creek. Once conceptual design is completed for the preferred alternative, the City of San José should allow time for completion of a new environmental document – estimated at approximately 6 months. During that time, it is recommended that resource agency consultation occur with participation by the Santa Clara Valley Water District.

Background

The City of San José is in the process of developing the Three Creeks Trail as part of a citywide effort to improve the pedestrian and bicycle trail system. As part of this effort, the City is considering improvements to (or replacement of) an existing railroad trestle, which crosses Los Gatos Creek near Coe Avenue and Lonus Street. Bridge repair and replacement options are being considered in a Retrofit Feasibility Report, which describes recommended actions to ensure safe use. Based on a range of decision criteria (including environmental review and permit processes), the City of San José anticipates selecting one of the repair or replacement options to carry forward for final design and construction. Because of schedule and budget considerations, environmental review processes and permit requirements are among the decision criteria.

In 2004, the City of San José completed an environmental impact assessment for the Los Gatos Creek Trail, Reach 4 project, including the existing railroad trestle that is the subject of the current analysis.[1] The assessment was completed pursuant to the California Environmental Quality Act (CEQA), and consisted of an Initial Study and Mitigated Negative Declaration (City Project No. PP04-014). The documents were approved and issued on June 28, 2004 and a CEQA Notice of Determination was filed on December 2, 2004. The railroad trestle repairs were described in the 2004 CEQA document based on what was known at the time, and did not include work within Los Gatos Creek. At this time, no permit actions have been initiated with the environmental resource agencies.

Project Description Consistency

Los Gatos Creek Trail, Reach 4 Initial Study

The 2004 CEQA document describes the trestle portion of the Reach 4 project as follows:

> The trail would travel to the north from Coe Avenue within the [railroad] right-of-way to the trestle bridge and to the northern side of the creek. Six to eight-foot high security fencing would be installed on both

[1] The entire Reach 4 project, as described in the Initial Study, includes trail improvements from Coe Avenue in Willow Glen to Auzerais Avenue in Midtown San José, and is part of the larger 19-mile Los Gatos Trail system from Lexington Reservoir to the Guadalupe River confluence in Downtown San José. The trail would be a Class I (off-street, paved) pedestrian and bicycle facility with two 6-foot lanes and unpaved shoulders.

sides of the trail on top of the trestle bridge, which will be covered with either wood or synthetic decking material. A stormwater outfall and associated riprap or sacrete apron would be constructed on the north bank of the creek, immediately adjacent to the eastern side of the railroad trestle bridge.

The description references a site plan (Figure 4B in the Initial Study) and a cross section drawing (Figure 5 in the Initial Study). The site plan is part of conceptual design drawings prepared by AN-West Consulting Engineers, and both it and the cross section show the improvements consistent with the project description text. The project description does not discuss safety retrofits to the existing trestle and, other than the stormwater outfall, does not mention work within Los Gatos Creek. Overall, however, the Reach 4 project included disturbance within the Los Gatos Creek corridor (e.g., between Interstate 280 and West Home Street), and included two riparian mitigation sites (Seacrist and Del Monte properties) where habitat would be restored to mitigate for project impacts.[2]

Current Alternatives

Three alternatives are evaluated in the Retrofit Feasibility Report: trestle rehabilitation using a water-resistant decking material such as ipe wood (Alternative 1), trestle rehabilitation using a concrete deck (Alternative 2), and a complete trestle replacement with a pre-fabricated steel truss bridge and concrete deck (Alternative 3).

Both bridge rehabilitation options (Alternatives 1 and 2) include structural repairs to improve bridge safety and long-term reliability. All proposed repairs are described in detail in the Retrofit Feasibility Report, and include the following:

- Removing the existing railroad ties and disposing the wood in a Class 1 landfill.
- Injecting epoxy into some of the longitudinal (stringer) boards to improve their structural integrity, and installing metal flashing. This would occur from the bridge deck following removal of the existing railroad ties. In addition, several stringer boards with charred wood would be pressure washed and sealed with a standard wood sealer, and a fireproof coating also may be applied using either roll-on or spray-on methods. These activities would occur from the bridge deck.
- Replacing pile caps at three of the bents with new pile caps made of pressure-treated or creosoted wood. Creosoted wood from the old pile caps would be disposed in a Class 1 landfill. This work would occur from within the Los Gatos Creek channel.
- Injecting epoxy into several pilings at Bents 4, 6, 7, 11, and 12, where there is evidence of rotting. Some of these piles are located within the active channel, and would require small cofferdams (e.g., using sand bags) to allow the repairs to occur “in the dry.” The repairs could occur without the use of heavy equipment.
- Repairing or replacing many of the sway and sash braces on all of the bents. Replacing these large, heavy timbers may require work within Los Gatos Creek.
- Rebuilding the bulkhead and wingwall timbers at both the north and south abutments. This would be accomplished by excavating the abutments (from the top of the north and south banks), replacing the decayed timbers, and backfilling the area. New bulkhead and wingwall timbers would be pressure-treated or creosoted wood, or possibly concrete would be used instead if a concrete bridge deck option is selected.

These structural repair options under Alternatives 1 and 2 are not discussed in the 2004 CEQA document.

Following the completion of structural repairs, both Alternatives 1 and 2 involve the installation of new decking and safety fencing. Under Alternative 1, new deck planks would be installed using a specialty hardwood that resists rot and decay. A 54-inch high galvanized metal railing system also would be installed. These project features are fully consistent with the 2004 CEQA document. Similarly, new decking would be installed under Alternative 2, but a concrete deck would be used. The concrete deck would either be poured onsite (cast in place)

[2] The Initial Study describes habitat impacts as follows: permanent impacts to 0.15 acres of dense, mixed riparian forest habitat and 34 linear feet of shaded riverine aquatic habitat. An additional 50 square feet of non-native herbaceous cover would be affected by construction of the stormwater outfall on the north side of Los Gatos Creek at the railroad trestle.

or pre-cast and delivered to the site. The concrete deck options also include a 54-inch high railing system consisting of galvanized metal. Installation of the concrete deck would require the use of heavy equipment, and there is some potential for encroachment into Los Gatos Creek under the pre-cast option – cranes would be needed to lift the pre-cast panels into place. Concrete is not described as a possible deck material in the 2004 CEQA document, and no installation from within the creek channel is discussed.

None of the structural repairs discussed above would be necessary under Alternative 3, which was not discussed in the 2004 CEQA document. Alternative 3 involves entirely removing the existing railroad trestle and replacing it with a new, prefabricated steel bridge with concrete abutments. Extensive work would be required in the Los Gatos Creek channel to remove the existing piles, which would occur either by pulling the piles with an excavator or cutting each of them 2 feet below the ground surface. Although extensive work would be required to install new concrete abutments, no piers would be necessary for this freestanding steel bridge. This alternative may have long-term benefits in terms of improved hydrologic conditions and reduced maintenance needs, as well as the removal of creosoted timbers within the creek channel.

For all three alternatives, disturbance of the Los Gatos Creek corridor, including the active channel, is unavoidable. The disturbance area has not been delineated for any of the alternatives, but likely would include vegetation removal and access improvements within the footprint of the existing trestle and some clear distance upstream and downstream – perhaps 16 to 20 feet for all alternatives. Specifications for the bridge repair or replacement contract would likely include extensive erosion control and revegetation requirements within the disturbed area.

Resource Analysis Consistency

This section briefly describes the potential impacts of the new project alternatives in comparison to the 15 environmental resources analyzed in the 2004 CEQA document.

- **Aesthetic** impacts were evaluated in the 2004 CEQA document, and it was determined that impacts would be less than significant because most of the trail area (including the railroad trestle) would not be visible from surrounding areas. This is still the case, and aesthetic impacts are not likely to be more severe than previously evaluated (even under the bridge replacement alternative).
- There would be no **agricultural** impacts as described in the 2004 CEQA document.
- **Air quality** impacts during construction would be greater than described in the 2004 CEQA document. The 2004 CEQA document stated that quantitative analysis of construction impacts was not necessary – the Bay Area Air Quality Management District prescribes standard mitigation measures to be applied during all construction activities, and does not require a detailed analysis. However, the Bay Area Air Quality Management District now requires a detailed analysis of construction emissions. Otherwise, the current project remains consistent with the prior analysis.
- The overall Reach 4 project would have impacts to **biological resources** as identified in the 2004 CEQA document; however, those impacts were not due to the trestle deck repair. The additional work associated with either the repair or replacement alternatives would result in greater impacts to riparian habitat than previously evaluated.[3] In addition, the tree inventory (for purposes of San José Tree Ordinance compliance) is likely out of date. No new species listings relevant to the project area have occurred, and mitigation is likely to be the same as prescribed in the 2004 CEQA document (e.g., work windows to protect steelhead spawning).
- No **cultural resources** were determined to be present in the project area, and the project as currently proposed would be consistent with the 2004 CEQA document including standard mitigation requirements.
- There would be no change to **geology, soils, and seismicity** compared to the 2004 CEQA document.

[3] The evaluation in the 2004 CEQA document references a Natural Environment Study (H.T. Harvey Associates, 2003) that was incorporated as Appendix A, but was not available for review.

- The 2004 CEQA document concluded that impacts from **hazardous materials** would be less than significant, but deferred to later studies associated with acquiring the railroad right of way. These studies have occurred and some remediation activities (e.g., removal of contaminated soils) have been implemented. The exact nature of potential contamination in the trestle area, however, is unknown. The current project would properly handle known hazardous materials (e.g., creosote logs), but additional documentation may be necessary to confirm how potentially hazardous materials disrupted during construction (e.g., from pressure washing charred timbers) would be contained in order to prevent water pollution.
- For the retrofit alternatives, **hydrologic and hydraulic impacts** would be the same as the 2004 CEQA document, but hydrologic and hydraulic conditions would improve under the bridge replacement alternative because the existing wood pilings would be removed. **Water quality** impacts would be potentially greater; however, a detailed water quality control plan would be developed as described in the 2004 CEQA document. Under all alternatives, rain falling onto the bridge deck would continue to run off into the creek.
- There would continue to be no **land use** impacts as described in the 2004 CEQA document.
- Construction **noise** would occur as described in the 2004 CEQA document, but greater noise impacts would occur because of increased construction activity at the trestle (especially under the bridge replacement alternative). Mitigation (primarily limits on nighttime construction) would occur consistent with the City of San José Municipal Code. Noise levels from trail use would be as described in the 2004 CEQA document.
- There would be no **population and housing** impacts as described in the 2004 CEQA document.
- Less-than-significant (and somewhat beneficial) impacts to **public services** (e.g., access for police and fire) would occur as described in the 2004 CEQA document.
- **Recreation** benefits would occur as described in the 2004 CEQA document.
- Construction **traffic** would be similar to what is described in the 2004 CEQA document, but construction activity in the trestle area would be more equipment intensive and last longer than previously described. Long-term traffic impacts would be as described in the 2004 CEQA document.
- There would be no impacts to **utilities and service systems** as described in the 2004 CEQA document.

Recommendations

Environmental Impact Assessment

The 2004 CEQA document evaluated the environmental impacts of the Reach 4 project, including placing new decking and safety railings on the existing railroad trestle. No work was anticipated to occur in the stream channel at the railroad trestle sites, but some disturbance in the channel was anticipated to occur elsewhere in the Reach 4 project area and mitigation sites were identified. As described above, all alternatives require work within the stream channel. Because of its environmental sensitivity, the stream channel is the key resource for evaluating the need for subsequent CEQA documentation.

Actions previously evaluated under CEQA may proceed as long as the CEQA tests for subsequent documentation are not met (State CEQA Guidelines Section 15162). When a Negative Declaration has been adopted, a subsequent CEQA document would be required if any of the following conditions were true:

(1) Substantial changes are proposed in the project that will require major revisions of the previous CEQA document due to the involvement of new significant environmental effects or the substantial increase in the severity of previously identified significant effects.

(2) Substantial changes occur with respect to the circumstances under which the project is undertaken that will require major revisions of the previous CEQA document due to the involvement of new significant environmental effects or the substantial increase in the severity of previously identified significant effects.

(3) New information of substantial importance that was not known at the time the previous document was approved shows any of the following:

(A) The project would have one or more significant effects not discussed in the previous document.

(B) Significant effects previously examined would be substantially more severe than shown in the previous document.

(C) Mitigation measures or alternatives previously found not to be feasible would in fact be feasible and would substantially reduce one or more significant effect of the project, but the project proponents decline to adopt the mitigation measure or alternative.

(D) Mitigation measures or alternatives that are considerably different from those analyzed in the previous document would substantially reduce one or more significant effect on the environment, but the project proponents decline to adopt the mitigation measure or alternative.

For both the trestle repair options and the replacement alternative, the additional work within the stream channel triggers the requirement to prepare a subsequent CEQA document pursuant to criteria 1 and 3B above. This work was not envisioned at the time of the 2004 CEQA document, and impacts to riparian and stream habitat would be substantially greater than previously analyzed.[4] For this reason, a new Initial Study (likely leading to a new Mitigated Negative Declaration) should be prepared. A new CEQA document will help current stakeholders (e.g., creek and trail interests, neighbors, permitting agencies) understand the current project description and provide comments on the environmental impacts and mitigation. However, the typical CEQA process for a project of this type may require 6 months to develop the Initial Study, solicit stakeholder and neighbor comments, and obtain final approvals.

Because of the similar expected footprint for all three alternatives, all alternatives would require similar effort. However, the replacement alternative would have greater overall environmental impacts. Demolition of the existing bridge along with construction of a new steel bridge would take longer and require more equipment-intensive construction activity; this would increase the duration of temporary impacts to a riparian area and cause greater disturbance to nearby residences. The relative increase in effects under the replacement alternative would require a greater level of analysis and greater effort to address neighborhood and stakeholder concerns.

Federal participation in the Three Creeks Trail trestle repair project (e.g., funding) may trigger a requirement to comply with the National Environmental Policy Act (NEPA). A new CEQA document would satisfy basic NEPA requirements for environmental impact assessment. Adding an equivalent level of NEPA documentation (e.g., Environmental Assessment) may increase overall documentation costs by 10 to 20 percent. However, added costs and schedule delays could be much greater depending on how the funding sources are administered. For example, federal trail funds administered by Caltrans trigger that agency's environmental review process and may require additional technical evaluations (e.g., Natural Environment Study).

Permits

The 2004 CEQA document identifies the following environmental permits that would be required for the Reach 4 project: federal Clean Water Act nationwide permit and water quality certification, state Streambed Alteration Agreement, and local permits for construction activities. Specific elements of the Reach 4 project that required these permits are not identified, but the new decking and safety fencing described in the 2004 CEQA document would not normally trigger these permit requirements. The three alternatives from the Retrofit Feasibility Report, however, would trigger the permits discussed for the overall Reach 4 project.

Because of the time delays typically associated with resource agency permits, the application should be submitted as soon as project details are finalized – for example, following conceptual design after the site plan has been confirmed and quantities can be estimated. Permit timeframes can be variable, but the permits themselves do not need to be issued until just prior to the construction period (although earlier permit issuance may provide greater certainty for the construction contractor). The required permits are described in greater detail as follows.

[4] One important consideration is the use of the mitigation sites identified in the 2004 CEQA document (Seacrist and Del Monte properties) if riparian habitat restoration is necessary. A detailed assessment of existing habitat conditions at the trestle will help determine if riparian habitat mitigation is likely to be required, and how much would be necessary. If space is not available at these two sites, then other mitigation sites should be considered.

- Clean Water Act, Section 404. The federal Clean Water Act requires that a permit be issued prior to discharging dredge or fill material into waters of the United States. Generally, construction activity falls under the Clean Water Act permitting requirements, and a standard permit has been issued for these activities throughout the United States (Nationwide Permit 33). Applicants who plan to undertake activities pursuant to Nationwide Permit 33 must file a pre-construction notification with the U.S. Army Corps of Engineers, including a discussion of wetland impacts and mitigation. Construction of any of the repair or retrofit alternatives would require filing a pre-construction notification and coordination with the U.S. Army Corps of Engineers to confirm impact calculations and mitigation.

  The U.S. Army Corps of Engineers typically consults with the U.S. Fish and Wildlife Service and National Marine Fisheries Service to determine any potential impacts to species listed as endangered or threatened by the Endangered Species Act. Because the project occurs within a creek, the National Marine Fisheries Service may require that strict in-channel work windows be followed in order to protect anadromous fish (e.g., steelhead) that may be using Los Gatos Creek for upstream migration. Work windows are not expected to be a significant challenge for this relatively simple bridge repair or replacement project. However, the consultation requirement adds time to the Nationwide Permit 33 process. In addition, the project lies within the anticipated permit area for the Santa Clara Valley Habitat Plan, which is expected to be adopted in late 2012. Preconstruction survey requirements and payment of mitigation fees would be required consistent with the final Habitat Plan. The U.S. Army Corps of Engineers also typically consults with the State Historic Preservation Officer for properties listed on or eligible for listing on the National Register of Historic Places. This consultation process is expected to be abbreviated (or not necessary at all) given the prior determination that the railroad trestle is not eligible for listing on the National Register.

- Clean Water Act, Section 401. The federal Clean Water Act also requires that the state water pollution control agency (in this case, the San Francisco Bay Regional Water Quality Control Board [RWQCB]) certify that that water pollution control standards are met. Consultation with the San Francisco Bay RWQCB will be required, and the certification would be issued pending their acceptance of the water pollution control plan. The San Francisco Bay RWQCB also may issue waste discharge requirements (or waive issuance) pursuant to state law. As an agency of the State of California, the San Francisco Bay RWQCB is subject to CEQA and the requirement to consider the environmental impacts of its actions, including its action to issue a water quality certification. The San Francisco Bay RWQCB may not accept the 2004 CEQA document as adequate for the current project, and for this reason an updated CEQA document may help streamline the water quality certification process.

- Rivers and Harbors Act, Section 10. Construction activities within a waterway considered “navigable” by the U.S. Army Corps of Engineers requires a permit under Section 10 of the Rivers and Harbors Act. This would be addressed in conjunction with the Nationwide Permit 33 process described above.

- California Fish and Game Code, Section 1600. The California Department of Fish and Game issues Streambed Alteration Agreements for activities with a stream zone. This is usually defined as the area with the tops of the banks, including the active stream channel and adjacent riparian areas. The permit would be issued following acceptance of the impact and mitigation calculations, requirements for water pollution control, and commitments to only conduct work in the creek corridor outside of the rainy season. Like the San Francisco Bay RWQCB, the Department of Fish and Game is a state agency subject to CEQA. An updated CEQA document also may help streamline the Department of Fish and Game action to issue a Streambed Alteration Agreement.

In addition to these federal and state processes, local consultation and permits would be required. Both the City of San José and Santa Clara Valley Water District have permit authority for the purposes of ensuring that water pollution control measures are properly implemented consistent with the San Francisco Bay RWQCB municipal discharge permit for the Santa Clara Valley. Early coordination with these agencies will help ensure that comprehensive water pollution control plan is developed for the project, which also would help ensure a successful permit application process through the U.S. Army Corps of Engineers, San Francisco Bay RWQCB, and the Department of Fish and Game.

Appendix G

Three Creeks Trail Railroad Trestle at Los Gatos Creek

City of San Jose, Santa Clara County, California

BASIS OF ESTIMATE

Project No:	393685
Estimate ID:	12-030
Project Name:	Three Creeks Railroad Trestle
Class Estimate:	Class 4
Requested By:	Hans Strandgaard/SAC, Robert Coomes/SAC
Estimated By:	Rick Hults/BAO
Estimator Phone:	510.587.7736
Estimated QC By:	Ben Kamph/SEA
Estimator Phone:	425.233.3033
Estimate Date:	September 23, 2012

Rick Hults /BAO
ESTIMATOR

Purpose of Estimate

The purpose of this estimate is to establish a feasibility level opinion of probable cost at less than 5% design to evaluate two design options. Option 1 is replace the timber decking with a new timber deck. Option 2 is to replace the timber decking with a concrete deck. Both options include repair/rehabilitation of the substructure.

General Project Description

The city is investigating the possible reuse and repair of the existing timber railroad trestle that crosses Los Gatos Creek near Lonus Street. The 14-span bridge is an open-deck pile supported timber trestle that has an overall span length of 210.5 ft.

Project Purpose and Need

The purpose of the project is to develop a trail system to connect Los Gatos Creek, Guadalupe River, Highway 87 Bikeway and Coyote Creek Trails. This project is trail segment WGS01 and is in the western alignment (Lonus Street to Guadalupe River).

Overall Costs

The following is a summary breakdown of the costs including contingency with an accuracy range per the AACE standard guidelines for a class 4 estimate of -30% and +50%. Since the level of design is low but a cost based estimate was prepared, a range of -20% to +40% is appropriate. See Appendix "C" for additional details.

See Appendix "A" for bid item breakdown and Appendix "B" for detailed estimate. At this level of design a 30% contingency is recommended per CH2M Hill. Two cost estimates options, as well bridge demo cost for a complete replacement, are provided.

Timber Deck Option:

Low Range	ESTIMATE RANGE	High Range
-20%	**Total $ 1,090,000**	+40%
$ 872,000		$ 1,526,000

Concrete Deck Option:

Low Range	ESTIMATE RANGE	High Range
-20%	**Total $ 959,000**	+40%
$ 767,000		$ 1,343,000

Replacement Option:

Low Range	ESTIMATE RANGE	High Range
-20%	**Total $ 253,000**	+40%
$ 202,000		$ 354,000

Markups/Allowances

The following typical contractor markups & engineering costs were applied to the Cost Estimate:

Contractor Indirects	12% (Included in bid unit prices)
Contractor Profit & Overhead	8% (Included in bid unit prices)
Storm Water/Erosion Control	5%
Mobilization	10%
Environmental	$50,000 (Including CEQA & Permits)
Engineering, Structure	$50,000
Engineering, Civil	$50,000
Geotechnical	$30,000
Construction Engineering	10%

Escalation Rate

Escalation was not considered for this estimate, however using 5% per year calculated compounded to the midpoint of construction would be appropriate.

Market Conditions

The current market conditions are drastically affecting the construction market, across the country. This is based upon recent bids and comparisons with Engineer's Estimates. Bids can be very erratic. Despite the estimator's best practices and adjustments, bids are being driven by current market conditions.

Estimate Classification

This cost estimate prepared is considered a Study or Feasibility Level or Class 4 estimate as defined by the American Association of Cost Engineering (AACE). It is considered accurate to +50% to –30%, based upon a 5% design deliverable. See Appendix "C" for additional details.

The cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final cost of the project will depend upon the actual labor and material costs, competitive market conditions, final project costs, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding. The estimate is based on material, equipment, and labor pricing as of July 2012.

Estimate Methodology

This cost estimate is considered a **Cost-based estimate** at 5% design.

Cost-based estimate methods do not rely on historical bid data, but rather are based on determining, for an item or set of items, the contractor's cost for labor, equipment, materials and specialty subcontractor effort (if appropriate) needed to complete the work. A reasonable amount for contractor overhead and profit is then added. This method is preferable on unique projects or where geographical influences, market factors and volatility of material prices can cause the use of historical bid-based methods to be unreliable. Also, since contractors generally utilize a cost-based estimating approach to prepare bids, this method can provide more accurate and defensible costs to support the decision for contract award/rejection and to support any future price negotiations with the contractor after contract award.

Quantities were provided by the engineer.

Cost Resources

The following is a list of the various cost resources used in the development of the cost estimate.

- Estimator Judgment
- CH2M Hill Historical Data
- R.S. Means

Allowance Costs

The cost estimate includes the following allowances within the cost estimate:

- Estimate Contingency 30% @ 5% Design Complete

Labor Costs

Labor unit prices reflect a burdened rate, including: workers compensation, FICA, unemployment taxes, Fringe Benefits, small tools & supplies.

Major Assumptions

The estimate is based on the assumption the work will be done on a competitive bid basis and the contractor will have a reasonable amount of time to complete the work working 5-eight hour days.

This estimate should be evaluated for market changes after 90 days of the issue date. It is assumed that most of the fabricated materials will be shipped from the continental USA.

- Contractor will have access and control of construction site during construction.
- Owner will coordinate with contractor and provide adequate notification when needing to perform operations within the construction area.
- Contractor will accommodate owner access in the construction area in event of emergency.
- Utility Companies (power & telephone) will perform own relocation and improvements.
- Dewatering when necessary can be accomplished using portable pumps. No well-point systems were assumed necessary.
- Costs do not include purchase of easements or right-of-way or owner costs beyond the capital construction costs.
- Site access for the contractor and contractor staging areas are adequate for the contractors needs.
- The only hazardous material is the creosote coated timber.
- Timber is Douglas Fir No. 1, rough-full sawn, pressure treated ACZA with retention level 0.60.
- Estimate is based on bid-build delivery.
- Sales Tax is included at 8.75% for materials and equipment.
- See Appendix "B" for detail estimate backup and assumptions.

Excluded Costs

The cost estimate excludes the following costs:

- Non-construction or soft costs for land and legal costs.
- Material Adjustment allowances above and beyond what is included at the time of the cost estimate.

Reference Documents

DeckAlternative_Concrete, 6/21/12
DeckAlternative_Timber, 7/16/12
Retrofit Quantities, by R. Coomes, 7/16/12
Quantity Calcs, by R. Coomes, 7/16/12
Field Inspection Report, 6/7/12
Draft Retrofit Feasibility Report, 6/25/12

Disclaimer
The opinions of cost (estimates) shown, and any resulting conclusions on project financial or economic feasibility or funding requirements, have been prepared for guidance in project evaluation and implementation from the information available at the time the opinion was prepared. The final costs of the project and resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors. The recent increases or decreases in material pricing may have a significant impact which is not predictable and careful review or consideration must be used in evaluation of material prices. As a result, the final project costs will vary from the opinions of cost presented herein. Because of these factors, project feasibility, benefit/cost ratios, risks, and funding needs must be carefully reviewed prior to making specific financial decisions or establishing project budgets to help ensure proper project evaluation and adequate funding.

APPENDIX A – Bid Item Breakdown

CH2MHILL Constructors, Inc.

THREE CREEKS TRAIL RAILROAD TRESTLE AT LOS GATOS CREEK
PRELIMINARY CONSTRUCTION COST ESTIMATE
CITY OF SAN JOSE, CA

TIMBER DECK OPTION

Construction Costs (A) (Includes indirect, profit and overhead costs)

Bid Item	Item Description	Quantity	Unit	Bid Price	Bid Total
1	Structural Excavation	25	CY	70.00	1,800
2	Structural Backfill	25	CY	143.50	3,600
3	Existing Deck Demolition & Disposal	210	LF	122.00	25,600
4	Stream Bed Debris Removal	1	LS	10,800.00	10,800
5	Piling Repair	5	EA	4,180.00	20,900
6	Repair Stringer Void	9	EA	1,560.00	14,000
7	Timber Replacement	1	LS	81,000.00	81,000
8	Abutment Wingwall Replacement	108	SF	43.00	4,600
9	Fire Alarm	1	LS	1,600.00	1,600
10	Fire Sprinklers	210	LF	95.00	20,000
11	Water Supply Connection	1	LS	19,250.00	19,300
12	Pressure Wash & Treat	2,563	SF	2.50	6,400
13	Timber Beams	14	EA	2,775.00	38,900
14	Timber Deck	1	LS	192,690.00	192,700
15	Fire Proof Coating	11,075	SF	2.00	22,200
16	Metal Railing	420	LF	166.00	69,700
	Subtotal (A)				**533,100**
17	Stormwater Pollution Prevention & Erosion Control (5% of A)			5%	26,700
18	Mobilization (10% of A+ Item 17)			10%	56,000
	Subtotal (B)				**82,700**
	Construction Total (A + B)				**615,800**
	Engineering & CM (C)				
19	Environmental, Including CEQA & Permits			LS	50,000
20	Engineering, Structure			LS	50,000
21	Engineering, Civil			LS	50,000
22	Project Management			LS	11,111
23	Construction Engineering (10% of A + B)			10%	61,600
	Subtotal (C)				**222,711**
	Total Design, CM & Construction Cost (A+B+C)		==========>	**$**	**838,511**
24	**Construction Contingency (D)**			30%	**251,600**
	Total Timber Deck Cost (A+B+C+D)		==========>	**$**	**1,090,000**

CONCRETE DECK OPTION

Construction Costs (A) (Includes indirect, profit and overhead costs)

Bid Item	Item Description	Quantity	Unit	Bid Price	Bid Total
1	Structural Excavation	25	CY	70.00	1,800
2	Structural Backfill	25	CY	143.50	3,600
3	Existing Deck Demolition & Disposal	210	LF	122.00	25,600
4	Stream Bed Debris Removal	1	LS	10,800.00	10,800
5	Piling Repair	5	EA	4,180.00	20,900
6	Repair Stringer Void	9	EA	1,560.00	14,000
7	Timber Replacement	1	LS	81,000.00	81,000
8	Abutment Wingwall Replacement	108	SF	43.00	4,600
9	Fire Alarm	1	LS	1,600.00	1,600
10	Fire Sprinklers	210	LF	95.00	20,000
11	Water Supply Connection	1	LS	19,250.00	19,300
12	Pressure Wash & Treat	2,563	SF	2.50	6,400
13	Structural Concrete Bridge	67	CY	1,467.00	98,300
14	Bar Reinforcing, Bridge	32,000	LB	1.35	43,200
15	Miscellaneous Metal, Bridge	825	LB	14.00	11,600
16	Concrete Stain	2,520	SF	3.50	8,800
17	Metal Railing	420	LF	151.00	63,400
18	Fire Proof Coating	9,480	SF	2.00	19,000
	Subtotal (A)				**453,900**
19	Stormwater Pollution Prevention & Erosion Control (5% of A)			5%	22,700
20	Mobilization (10% of A+ Item 19)			10%	47,700
	Subtotal (B)				**70,400**
	Construction Total (A + B)				**524,300**
	Engineering & CM (C)				
21	Environmental, Including CEQA & Permits			LS	50,000
22	Engineering, Structure			LS	50,000
23	Engineering, Civil			LS	50,000
24	Project Management			LS	11,111
25	Construction Engineering (10% of A + B)			10%	52,400
	Subtotal (C)				**213,511**
	Total Design, CM & Construction Cost (A+B+C)		==========>	**$**	**737,811**
26	**Construction Contingency (D)**			30%	**221,300**
	Total Concrete Deck Cost (A+B+C+D)		==========>	**$**	**959,000**

REPLACEMENT OPTION

Construction Costs (A) (Includes indirect, profit and overhead costs)

Bid Item	Item Description	Quantity	Unit	Bid Price	Bid Total
1	Complete Bridge Removal	210	LF	280.00	58,800
	Construction Total (A)				**58,800**
	Engineering & CM (C)				
4	Environmental, Including CEQA & Permits			LS	50,000
5	Geotechnical			LS	30,000
6	Engineering, Structure			LS	50,000
7	Engineering, Civil			LS	50,000
8	Project Management			LS	14,444
	Subtotal (B)				**194,444**
	Total Design, CM & Construction Cost (A+B)		==========>	**$**	**253,000**

APPENDIX B – Detailed Estimate

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 100				Land Item	SCHEDULE: 1		100			
Description = Structural Excavation				Unit = CY	Takeoff Quan:	25.000		Engr Quan:		25.000
202000	**Structure Excavation**			**Quan: 25.00 CY**	**Hrs/Shft: 8.00**		**Cal 508 WC CCISP**			
Figure lots of handwork and limited equipment access. Use Dump truck to offhaul spoils										
Crew costs include mobilization from one abut to other										
EXC3	Excavate 426 BH Loader	4.00	CH	Eff: 100.00	**Prod: 0.6400 MU**		Lab Pcs: 4.00		Eqp Pcs: 4.00	
31DFEXCCY	Excavation Dump Fee	25.00	CY	10.000			250			250
8BHLD426	BHL Cat 426C 1.25C 1.00	4.00	HR	34.500				138		138
8TRKHW10	Tandem Truck 12 CY 1.00	4.00	HR	59.896				240		240
8TRKHW30	Lowbed Trailer 60 T 1.00	4.00	HR	19.154				77		77
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	4.00	HR	11.828				47		47
GF	Grade Foreman 1.00	4.00	MH	31.950	189					189
LGEN	Laborer-General 2.00	8.00	MH	27.520	311					311
OPEXC3	Op Eng 3- Backhoe to 1.00	4.00	MH	32.390	191					191
$1,442.81	0.6400 MH/CY	16.00	MH	[19.101]	691		250	501		1,443
1.5625 Unit/M	0.5000 Shifts	6.2500	Units/H		27.65		10.00	20.06		57.71
=====> Item Totals: 100 - Structural Excavation										
$1,442.81	0.6400 MH/CY	16.00	MH	[19.101]	691		250	501		**1,443**
57.712	25 CY				27.65		10.00	20.06		57.71
BID ITEM = 200				Land Item	SCHEDULE: 1		100			
Description = Structural Backfill				Unit = CY	Takeoff Quan:	25.000		Engr Quan:		25.000
203000	**Backfill - Granular**			**Quan: 25.00 CY**	**Hrs/Shft: 8.00**		**Cal 508 WC CCISP**			
Figure lots of handwork and limited equipment access. Figure 2 tons/cy										
Crew costs include mobilization from one abut to other										
BACKF4	Backfill 426 BH Loader	4.00	CH	Eff: 100.00	**Prod: 0.6400 MU**		Lab Pcs: 4.00		Eqp Pcs: 6.00	
2EG01	Geotextile Fab@108.	1.00	ROLL	500.000		544				544
2SBF	Buy Str Backfi@108.	50.00	TON	12.000		653				653
5SBF	Haul Str Backfill@11	50.00	TON	10.000			550			550
8BHLD426	BHL Cat 426C 1.25C 1.00	4.00	HR	34.500				138		138
8COMPACA5	Compaction Wheel 46 1.00	4.00	HR	6.704				27		27
8COMPACW	Compactor Hand Ram 1.00	4.00	HR	3.634				15		15
8TRKHW10	Tandem Truck 12 CY 1.00	4.00	HR	59.896				240		240
8TRKHW30	Lowbed Trailer 60 T 1.00	4.00	HR	19.154				77		77
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	4.00	HR	11.828				47		47
GF	Grade Foreman 1.00	4.00	MH	31.950	189					189
LGEN	Laborer-General 2.00	8.00	MH	27.520	311					311
OPEXC3	Op Eng 3- Backhoe to 1.00	4.00	MH	32.390	191					191

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 200			Land Item	SCHEDULE: 1 100						
Description = Structural Backfill			Unit = CY	Takeoff Quan: 25.000				Engr Quan: 25.000		
$2,980.38	0.6400 MH/CY	16.00	MH	[19.101]	691	1,196	550	543		2,980
1.5625 Unit/M	0.5000 Shifts	6.2500	Units/H		27.65	47.85	22.00	21.71		119.22
=====> Item Totals: 200 - Structural Backfill										
$2,980.38	0.6400 MH/CY	16.00	MH	[19.101]	691	1,196	550	543		**2,980**
119.215	25 CY				27.65	47.85	22.00	21.71		119.22

BID ITEM = 300 Land Item SCHEDULE: 1 100
Description = Existing Deck Demolition & Disposal Unit = LF Takeoff Quan: 210.000 Engr Quan: 210.000

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210 LF x 12' = 2,520 SF
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133014 Remove Timber Deck **Quan: 2,520.00 SF Hrs/Shft: 8.00 Cal 508 WC CCISP**

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Remove Grating & Flat Bar  - 210 LF x 2 = 420 LF = 1 Shift
Remove Timbers = 214 Each @ 0.75 MH/Ea = 5.4 Shifts = 4 Shifts
Remove Posts/Cable/Fence Panels                    = 1 Shift
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DEMO22	Timber Deck Demo		48.00	CH	Eff: 100.00	**Prod: 6.0000 S**		Lab Pcs: 5.00	Eqp Pcs: 6.00	
31MATMISC	Misc Material@108.7		210.00	LF	5.000			1,142		1,142
8COMPR04	Compressor 185 CFM	1.00	48.00	HR	13.278				637	637
8DEMO02	Jackhammer 35#	2.00	96.00	HR	2.600				250	250
8EXC315	Excavator Cat 315D L	1.00	48.00	HR	53.312				2,559	2,559
8FORK04	Forklift Cat TL1055 1	1.00	48.00	HR	42.914				2,060	2,060
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	48.00	HR	11.828				568	568
LFORMN	Laborer-Foreman	1.00	48.00	MH	29.250	1,962				1,962
LPWR	Laborer-Power Tools	2.00	96.00	MH	28.020	3,791				3,791
OPEXC3	Op Eng 3- Backhoe to	1.00	48.00	MH	32.390	2,291				2,291
OPLDR6	Op Eng 2- Loader <6	1.00	48.00	MH	32.910	2,319				2,319
$17,578.57	0.0952 MH/SF		240.00	MH	[2.868]	10,363		1,142	6,073	17,579
10.5000 Unit/M	6.0000 Shifts		* 52.5000	Units/H		4.11		0.45	2.41	6.98

133500 Dispose of Timber (Haz) **Quan: 1.00 LS Hrs/Shft: 8.00 Cal 508 WC CCISP**

```
Main Ties are   10' x 8" x 8" = 53 BF x 171 each = 9,063 BF x 4.5#/BF = 40,784#
Handrail Ties are 18' x 4" x 8" = 48 BF x 43 each = 2,064 BF x 4.5#/BF = 9,288#
Disposal At $60/ton                                                Total...50,072#
(25.0 tons)
Two loads x 2 hours to load, 2 hours travel each way, 2 hour unload = 16 hours
trucking a 4 hours to offhaul steel
```

31DFTIMTN	Timber Dump Fee-To		25.00	TN	60.000		1,500			1,500
5TRKFB	Trucking - Flat Bed		20.00	HR	100.000		2,000			2,000
$3,500.00					[ ]		3,500			3,500
							3,500.00			3,500.00

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 300			Land Item	SCHEDULE: 1 100						
Description = Existing Deck Demolition & Disposal			Unit = LF	Takeoff Quan: 210.000			Engr Quan: 210.000			
=====> Item Totals: 300 - Existing Deck Demolition & Disposal										
$21,078.57	1.1428 MH/LF	240.00	MH	[34.421]	10,363		4,642	6,073		**21,079**
100.374	210 LF				49.35		22.10	28.92		100.37
BID ITEM = 400			Land Item	SCHEDULE: 1 100						
Description = Stream Bed Debris Removal			Unit = LS	Takeoff Quan: 1.000			Engr Quan: 1.000			
110050	**Stream Bed Debris Removal**			**Quan: 60.00 CY Hrs/Shft: 8.00 Cal 508 WC CCISP**						
Price for removal of debris in four 15 ft spans (assume 12 ft width). 4ea x 15'L x 12'W x 2'thick (Ave) = 53.3 CY, say 60 CY										
Use same equip as excavation, so no equip mob										
Use Highside trailer for debris										
EXC3	Excavate 426 BH Loader	8.00	CH	Eff: 100.00 **Prod: 0.6667 MU**			Lab Pcs: 5.00		Eqp Pcs: 4.00	
31DFBLDCY	Bldg Debris Dump Fe	60.00	CY	10.000			600			600
5TRKED	Trucking - End Dump	8.00	HR	100.000			800			800
8BDZR03G	Bulldozer Cat D3G X 1.00	8.00	HR	33.305				266		266
8BHLD426	BHL Cat 426C 1.25C 1.00	8.00	HR	34.500				276		276
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	8.00	HR	11.828				95		95
8WOOD2	Wood Chipper Verme 1.00	8.00	HR	33.354				267		267
GF	Grade Foreman 1.00	8.00	MH	31.950	378					378
LGEN	Laborer-General 2.00	16.00	MH	27.520	623					623
OPDZ9	Op Eng 3- Dozer to D 1.00	8.00	MH	31.950	378					378
OPEXC3	Op Eng 3- Backhoe to 1.00	8.00	MH	32.390	382					382
$4,064.49	0.6666 MH/CY	40.00	MH	[20.177]	1,761		1,400	904		4,064
1.5000 Unit/M	1.0000 Shifts	7.5000	Units/H		29.34		23.33	15.06		67.74
202045	**Access**			**Quan: 1.00 LS Hrs/Shft: 8.00 Cal 508 WC CCISP**						
Install/Remove Creek Access. Grade slope and restore as required.										
1 shift in/1 shift out										
EXC3	Excavate 426 BH Loader	16.00	CH	Eff: 100.00 **Prod: 2.0000 S**			Lab Pcs: 4.00		Eqp Pcs: 3.00	
31MATMISC	Misc Material@108.7	1.00	LS	500.000			544			544
8BDZR03G	Bulldozer Cat D3G X 1.00	16.00	HR	33.305				533		533
8BHLD426	BHL Cat 426C 1.25C 1.00	16.00	HR	34.500				552		552
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	16.00	HR	11.828				189		189
GC	Grade Checker 1.00	16.00	MH	29.470	711					711
GF	Grade Foreman 1.00	16.00	MH	31.950	756					756
OPDZ9	Op Eng 3- Dozer to D 1.00	16.00	MH	31.950	756					756
OPEXC3	Op Eng 3- Backhoe to 1.00	16.00	MH	32.390	764					764
$4,804.65	64.0000 MH/LS	64.00	MH	[2012.16]	2,987		544	1,274		4,805
0.0156 Unit/M	2.0000 Shifts	* 0.0625	Units/H		2,986.79		543.75	1,274.11		4,804.65
=====> Item Totals: 400 - Stream Bed Debris Removal										

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 400				Land Item	SCHEDULE: 1		100			
Description = Stream Bed Debris Removal				Unit = LS	Takeoff Quan:	1.000		Engr Quan:		1.000
$8,869.14	104.0000 MH/LS		104.00 MH	[3222.8]	4,747		1,944	2,178		**8,869**
8,869.140	1 LS				4,747.42		1,943.75	2,177.97		8,869.14

BID ITEM = 500 Land Item SCHEDULE: 1 100
Description = Piling Repair Unit = EA Takeoff Quan: 5.000 Engr Quan: 5.000

```
Actual epoxy injection volume unknown. Assume 5 ft high for section of each pile.
Pile diam=14", assume 50% void.
```

372020 Epoxy Crack Repairs **Quan: 13.40 CF Hrs/Shft: 8.00 Cal 508 WC CCISP**

```
14" dia = 1.069CF/Ft x 5' x 5 piles x 50% void = 13.4 CF
Surface Area = 3.67SF/FT x 5' x 5 piles = 92 SF
Repair per AREMA Volume 2, Section 3.3.3.3
Clean out, Install Wedge, Install Nails/Washers, Install Banding, Coat/Seal Pile
with Sikadur 33, Inject Sikadur 35 Hi-Mod LV Epoxy into the void.
4 crew hours per pile
Sikadur 35 yields 231 cubic inches per gallon (0.1337 CF/GAL) = 100 gallons, buy
34-3 gallon kits
Sikadur 33 yields 231 CI/GA (0.1337 CF/GAL) Allow 1/4" Thick = 2CF = 15 gallons,
buy 8-2 gallon kits
```

FORM3	Form Crew 3 Man		20.00 CH	Eff: 100.00	**Prod: 4.4776 MU**		Lab Pcs: 3.00		Eqp Pcs: 3.00	
2GRT21	Sealant Epoxy @108.		8.00 EA	184.000		1,601				1,601
2GRT22	Epoxy Injectio@108.		34.00 EA	257.000		9,503				9,503
31MATMISC	Misc Material@108.7		5.00 EA	500.000			2,719			2,719
8COMPR04	Compressor 185 CFM	1.00	20.00 HR	13.278				266		266
8GEN010	Generator 10 KW	1.00	20.00 HR	7.010				140		140
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	20.00 HR	11.828				237		237
CARPFRM	Carpenter Foreman	1.00	20.00 MH	34.720	995					995
CARPJ	Carpenter Journeyma	1.00	20.00 MH	31.920	933					933
LGEN	Laborer-General	1.00	20.00 MH	27.520	779					779
$17,171.18	4.4776 MH/CF		60.00 MH	[140.537]	2,707	11,103	2,719	642		17,171
0.2233 Unit/M	2.5000 Shifts		0.6700 Units/H		201.99	828.61	202.89	47.93		1,281.43

======> Item Totals: 500 - Piling Repair

$17,171.18	12.0000 MH/EA	60.00 MH	[376.64]	2,707	11,103	2,719	642		**17,171**
3,434.236	5 EA			541.35	2,220.68	543.75	128.46		3,434.24

BID ITEM = 600 Land Item SCHEDULE: 1 100
Description = Repair Stringer Void Unit = EA Takeoff Quan: 9.000 Engr Quan: 9.000

```
Actual epoxy injection volume unknown. Assume 1 CF in each spot for 9 locations
```

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 600			Land Item	SCHEDULE: 1			100			
Description = Repair Stringer Void			Unit = EA	Takeoff Quan: 9.000			Engr Quan: 9.000			
found in field inspection.										
372020	**Epoxy Crack Repairs**		**Quan: 9.00 CF**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Use the pile repair and change proportional from 13.4 CF to 9 CF Pile Repair Notes: 14" dia = 1.069CF/Ft x 5' x 5 piles x 50% void = 13.4 CF Surface Area = 3.67SF/FT x 5' x 5 piles = 92 SF Repair per AREMA Volume 2, Section 3.3.3.3 Clean out, Install Wedge, Install Nails/Washers, Install Banding, Coat/Seal Pile with Sikadur 33, Inject Sikadur 35 Hi-Mod LV Epoxy into the void. 4 crew hours per pile Sikadur 35 yields 231 cubic inches per gallon (0.1337 CF/GAL) = 100 gallons, buy 34-3 gallon kits Sikadur 33 yields 231 CI/GA (0.1337 CF/GAL) Allow 1/4" Thick = 2CF = 15 gallons, buy 8-2 gallon kits										
FORM3	Form Crew 3 Man	13.50	CH	Eff: 100.00	**Prod: 4.5000 MU**		Lab Pcs: 3.00		Eqp Pcs: 3.00	
2GRT21	Sealant Epoxy @108.	5.37	EA	184.000		1,075				1,075
2GRT22	Epoxy Injectio@108.	22.84	EA	257.000		6,383				6,383
31MATMISC	Misc Material@108.7	3.36	EA	500.000			1,827			1,827
8COMPR04	Compressor 185 CFM 1.00	13.50	HR	13.278				179		179
8GEN010	Generator 10 KW 1.00	13.50	HR	7.010				95		95
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	13.50	HR	11.828				160		160
CARPFRM	Carpenter Foreman 1.00	13.50	MH	34.720	672					672
CARPJ	Carpenter Journeyma 1.00	13.50	MH	31.920	630					630
LGEN	Laborer-General 1.00	13.50	MH	27.520	526					526
$11,545.61	4.5000 MH/CF	40.50	MH	[141.24]	1,827	7,458	1,827	434		11,546
0.2222 Unit/M	1.6875 Shifts	0.6667	Units/H		203.01	828.67	203.00	48.17		1,282.85
=====> Item Totals: 600 - Repair Stringer Void										
$11,545.61	4.5000 MH/EA	40.50	MH	[141.24]	1,827	7,458	1,827	434		**11,546**
1,282.846	9 EA				203.01	828.67	203.00	48.17		1,282.85
BID ITEM = 700			Land Item	SCHEDULE: 1			100			
Description = Timber Replacement			Unit = LS	Takeoff Quan: 1.000			Engr Quan: 1.000			
All replacement structural lumber (does not include IPE) shall be stress-grade Douglas Fir (Larch) and shall conform to AREMA specifications see, Part 1, Material Specifications for Lumber, Timber, Engineered Wood Products, Timber Piles, Fasteners, Timber Bridge Ties and Recommendations for Fire-Retardant Coating for Creosoted Wood. All lumber and piles, except IPE timber, should be pressure treated in accordance with AREMA Chapter 30. Trucking included in Demolition/Removals item #300										

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total

BID ITEM = 700 Land Item SCHEDULE: 1 100
Description = Timber Replacement Unit = LS Takeoff Quan: 1.000 Engr Quan: 1.000

389000 Timber Cap (14 x 14 x 18') Quan: 3.00 EA Hrs/Shft: 8.00 Cal 508 WC CCISP

Jack existing bridge, remove existing cap, install new 14" x 14" x 18' cap.
882 BF x 4.5#/BF = 3,969#
Disposal At $60/ton

FORM4F	Form Crew 4 Men Forklift		24.00	CH	Eff: 100.00	**Prod: 32.0000 MU**		Lab Pcs: 4.00		Eqp Pcs: 4.00	
2WDLCAP	14 x 14 x 18' @108.7		882.00	BF	1.650		1,583				1,583
31DFTIMTN	Timber Dump Fe@10		2.00	TN	60.000			131			131
31MATMISC	Misc Material@108.7		3.00	EA	500.000			1,631			1,631
3FA10	Form Access Sc@108		1.00	EA	500.000			544			544
8COMPR04	Compressor 185 CFM	1.00	24.00	HR	13.278				319		319
8FORK04	Forklift Cat TL1055 1	1.00	24.00	HR	42.914				1,030		1,030
8GEN010	Generator 10 KW	1.00	24.00	HR	7.010				168		168
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	24.00	HR	11.828				284		284
CARPFRM	Carpenter Foreman	1.00	24.00	MH	34.720	1,194					1,194
CARPJ	Carpenter Journeyma	1.00	24.00	MH	31.920	1,119					1,119
LGEN	Laborer-General	1.00	24.00	MH	27.520	934					934
OPLDR6	Op Eng 2- Loader <6	1.00	24.00	MH	32.910	1,160					1,160
$10,096.42	32.0000 MH/EA		96.00	MH	[1016.56]	4,408	1,583	2,306	1,801		10,096
0.0313 Unit/M	3.0000 Shifts		0.1250	Units/H		1,469.20	527.55	768.50	600.22		3,365.47

389005 Lower Sway Brace (4 x 10 x 20') Quan: 7.00 EA Hrs/Shft: 8.00 Cal 508 WC CCISP

Remove existing brace, install new 4" x 10" x 20' lower sway brace.
470 BFx 4.5#/BF = 2,115#
Disposal At $60/ton

FORM4F	Form Crew 4 Men Forklift		14.00	CH	Eff: 100.00	**Prod: 8.0000 MU**		Lab Pcs: 4.00		Eqp Pcs: 4.00	
2WDLSB	4 x 10 x 20' D@108.7		470.00	BF	1.500		767				767
31DFTIMTN	Timber Dump Fe@10		1.00	TN	60.000			65			65
31MATMISC	Misc Material@108.7		7.00	EA	50.000			381			381
8COMPR04	Compressor 185 CFM	1.00	14.00	HR	13.278				186		186
8FORK04	Forklift Cat TL1055 1	1.00	14.00	HR	42.914				601		601
8GEN010	Generator 10 KW	1.00	14.00	HR	7.010				98		98
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	14.00	HR	11.828				166		166
CARPFRM	Carpenter Foreman	1.00	14.00	MH	34.720	697					697
CARPJ	Carpenter Journeyma	1.00	14.00	MH	31.920	653					653
LGEN	Laborer-General	1.00	14.00	MH	27.520	545					545
OPLDR6	Op Eng 2- Loader <6	1.00	14.00	MH	32.910	676					676
$4,834.05	8.0000 MH/EA		56.00	MH	[254.14]	2,571	767	446	1,050		4,834
0.1250 Unit/M	1.7500 Shifts		0.5000	Units/H		367.30	109.53	63.70	150.05		690.58

389010 Upper Sway Brace (4 x 10 x 20') Quan: 11.00 EA Hrs/Shft: 8.00 Cal 508 WC CCISP

Remove existing brace, install new 4" x 10" x 20' Upper sway brace.
740 BFx 4.5#/BF = 3,330#

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 700			Land Item	SCHEDULE: 1 100						
Description = Timber Replacement			Unit = LS	Takeoff Quan: 1.000				Engr Quan: 1.000		
Disposal At $60/ton										
FORM4F	Form Crew 4 Men Forklift	28.00	CH	Eff: 100.00 **Prod: 10.1818 MU**	Lab Pcs: 4.00			Eqp Pcs: 4.00		
2WDLSB	4 x 10 x 20' D@108.7	740.00	BF	1.500		1,207				1,207
31DFTIMTN	Timber Dump Fe@10	1.70	TN	60.000			111			111
31MATMISC	Misc Material@108.7	11.00	EA	50.000			598			598
3FA10	Form Access Sc@108	1.00	EA	500.000			544			544
8COMPR04	Compressor 185 CFM 1.00	28.00	HR	13.278				372		372
8FORK04	Forklift Cat TL1055 1 1.00	28.00	HR	42.914				1,202		1,202
8GEN010	Generator 10 KW 1.00	28.00	HR	7.010				196		196
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	28.00	HR	11.828				331		331
CARPFRM	Carpenter Foreman 1.00	28.00	MH	34.720	1,394					1,394
CARPJ	Carpenter Journeyma 1.00	28.00	MH	31.920	1,306					1,306
LGEN	Laborer-General 1.00	28.00	MH	27.520	1,090					1,090
OPLDR6	Op Eng 2- Loader <6 1.00	28.00	MH	32.910	1,353					1,353
$9,702.95	10.1818 MH/EA	112.00	MH	[323.451]	5,142	1,207	1,253	2,101		9,703
0.0982 Unit/M	3.5000 Shifts	0.3929	Units/H		467.47	109.74	113.89	190.98		882.09

389015 Sash Brace (8 x 10 x 18') Quan: 16.00 EA Hrs/Shft: 8.00 Cal 508 WC CCISP

Remove existing brace, install new 8" x 10" x 18' sash brace.
1,920 BFx 4.5#/BF = 8,640#
Disposal At $60/ton

FORM4F	Form Crew 4 Men Forklift	32.00	CH	Eff: 100.00 **Prod: 8.0000 MU**	Lab Pcs: 4.00			Eqp Pcs: 4.00		
2WDLSAB	8 x 10 x 18' S@108.7	1,920.00	BF	1.600		3,341				3,341
31DFTIMTN	Timber Dump Fe@10	4.30	TN	60.000			281			281
31MATMISC	Misc Material@108.7	16.00	EA	50.000			870			870
8COMPR04	Compressor 185 CFM 1.00	32.00	HR	13.278				425		425
8FORK04	Forklift Cat TL1055 1 1.00	32.00	HR	42.914				1,373		1,373
8GEN010	Generator 10 KW 1.00	32.00	HR	7.010				224		224
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	32.00	HR	11.828				378		378
CARPFRM	Carpenter Foreman 1.00	32.00	MH	34.720	1,593					1,593
CARPJ	Carpenter Journeyma 1.00	32.00	MH	31.920	1,492					1,492
LGEN	Laborer-General 1.00	32.00	MH	27.520	1,246					1,246
OPLDR6	Op Eng 2- Loader <6 1.00	32.00	MH	32.910	1,546					1,546
$12,769.11	8.0000 MH/EA	128.00	MH	[254.14]	5,877	3,341	1,151	2,401		12,769
0.1250 Unit/M	4.0000 Shifts	0.5000	Units/H		367.30	208.80	71.91	150.06		798.07

389020 Abut 1 Backwall 8 x 20 x 25' Quan: 5.00 EA Hrs/Shft: 8.00 Cal 508 WC CCISP

Remove existing timbers, install new 8" x 20" x 25' Timber Beams.
1,667 BF x 4.5#/BF = 7,500#
Disposal At $60/ton

FORM4F	Form Crew 4 Men Forklift	10.00	CH	Eff: 100.00 **Prod: 8.0000 MU**	Lab Pcs: 4.00			Eqp Pcs: 4.00		
2WDLBW1	8 x 20 x 25' B@108.7	1,667.00	BF	1.750		3,173				3,173
31DFTIMTN	Timber Dump Fe@10	3.75	TN	60.000			245			245
31MATMISC	Misc Material@108.7	5.00	EA	50.000			272			272

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 700			Land Item	SCHEDULE: 1 100						
Description = Timber Replacement				Unit = LS	Takeoff Quan: 1.000			Engr Quan: 1.000		
8COMPR04	Compressor 185 CFM	1.00	10.00 HR	13.278				133		133
8FORK04	Forklift Cat TL1055 1	1.00	10.00 HR	42.914				429		429
8GEN010	Generator 10 KW	1.00	10.00 HR	7.010				70		70
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	10.00 HR	11.828				118		118
CARPFRM	Carpenter Foreman	1.00	10.00 MH	34.720	498					498
CARPJ	Carpenter Journeyma	1.00	10.00 MH	31.920	466					466
LGEN	Laborer-General	1.00	10.00 MH	27.520	389					389
OPLDR6	Op Eng 2- Loader <6	1.00	10.00 MH	32.910	483					483
$6,275.89	8.0000 MH/EA		40.00 MH	[254.14]	1,837	3,173	517	750		6,276
0.1250 Unit/M	1.2500 Shifts		0.5000 Units/H		367.30	634.50	103.31	150.06		1,255.18

389025 Abut 15 Backwall 8 x 20 x 18' Quan: 3.00 EA Hrs/Shft: 8.00 Cal 508 WCCCISP

Remove existing timbers, install new 8" x 20" x 18' Timber Beams.
720 BF x 4.5#/BF = 3,240#
Disposal At $60/ton

FORM4F	Form Crew 4 Men Forklift	6.00 CH	Eff: 100.00	**Prod: 8.0000 MU**	Lab Pcs: 4.00		Eqp Pcs: 4.00		
2WDLBW15	8 x 20 x 18' B@108.7	720.00 BF		1.750		1,370			1,370
31DFTIMTN	Timber Dump Fe@10	1.60 TN		60.000			104		104
31MATMISC	Misc Material@108.7	3.00 EA		50.000			163		163
8COMPR04	Compressor 185 CFM	1.00	6.00 HR	13.278				80	80
8FORK04	Forklift Cat TL1055 1	1.00	6.00 HR	42.914				257	257
8GEN010	Generator 10 KW	1.00	6.00 HR	7.010				42	42
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	6.00 HR	11.828				71	71
CARPFRM	Carpenter Foreman	1.00	6.00 MH	34.720	299				299
CARPJ	Carpenter Journeyma	1.00	6.00 MH	31.920	280				280
LGEN	Laborer-General	1.00	6.00 MH	27.520	234				234
OPLDR6	Op Eng 2- Loader <6	1.00	6.00 MH	32.910	290				290
$3,189.84	8.0000 MH/EA		24.00 MH	[254.14]	1,102	1,370	268	450	3,190
0.1250 Unit/M	0.7500 Shifts		0.5000 Units/H		367.30	456.75	89.18	150.05	1,063.28

389100 Purchase Bolts Quan: 1.00 LS Hrs/Shft: 8.00 Cal 508 WCCCISP

Replace Stringer to Cap Bolt, 1" ASTM A325 EA 30 Use 36" all thread for the bolt. Includes nuts and washers.
Replace Bracing Bolts, 1" ASTM A325 EA 342 2 lengths. Use 32" long all-thread for now. Includes nuts and washers.
Buy all 36" all thread 30 + 342 = 372 each, say 380 each
Nuts & Washers 380 + 380 = 760 each

2SA020	1" x 36" All-T@108.7	380.00 EA		29.000		11,984			11,984
2SA030	1" Heavy Hex N@10	760.00 EA		1.600		1,322			1,322
2SA040	1" Wood Washer@10	760.00 EA		5.750		4,752			4,752
$18,059.03				[ ]		18,059			18,059
						18,059.03			18,059.03

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 700			Land Item	SCHEDULE: 1 100						
Description = Timber Replacement			Unit = LS	Takeoff Quan: 1.000			Engr Quan: 1.000			
389150	**Buy Flashing**		**Quan: 1,520.00 SF**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Flashing (Top of Stringers) SQFT 1,190 Tops of existing stringers plus 2" over sides.										
Flashing (Top of Pile Cap) SQFT 300 Top of 3 new caps and tops of existing 12 (less stringer area)										
Flashing (Top of Pile) SQFT 30 Top of pile at cap replacement locations.										
TOTAL...1,520 SF 5% waste										
2SA050	Vycor Flashing	1.00 1,600.00	SF	1.000		1,600				1,600
=====> Item Totals: 700	**- Timber Replacement**									
$66,527.29	456.0000 MH/LS		456.00 MH	[14485.98]	20,936	31,099	5,939	8,553		**66,527**
66,527.290	1 LS				20,936.16	31,099.05	5,938.87	8,553.21		66,527.29
BID ITEM = 800			Land Item	SCHEDULE: 1 100						
Description = Abutment Wingwall Replacement			Unit = SF	Takeoff Quan: 108.000			Engr Quan: 108.000			
313100	**Abutment Wingwall Replacement**		**Quan: 108.00 SF**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Includes removal, gravity block wall, backfill										
Throw the old blocks in the the structure excavation offhaul										
LAB4	Foreman + 3 Laborers	8.00 CH	Eff: 100.00	**Prod: 0.3704 MU**	Lab Pcs: 5.00		Eqp Pcs: 2.00			
2PM08	Retaining Wall@108.	108.00 SF		15.000		1,762				1,762
8BHLD426	BHL Cat 426C 1.25C	1.00 8.00 HR		34.500				276		276
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00 8.00 HR		11.828				95		95
LFORMN	Laborer-Foreman	1.00 8.00 MH		29.250	327					327
LPWR	Laborer-Power Tools	3.00 24.00 MH		28.020	948					948
OPEXC3	Op Eng 3- Backhoe to	1.00 8.00 MH		32.390	382					382
$3,788.98	0.3703 MH/SF	40.00 MH		[10.793]	1,657	1,762		371		3,789
2.7000 Unit/M	1.0000 Shifts	13.5000 Units/H			15.34	16.31		3.43		35.08
=====> Item Totals: 800	**- Abutment Wingwall Replacement**									
$3,788.98	0.3703 MH/SF	40.00 MH		[10.793]	1,657	1,762		371		**3,789**
35.083	108 SF				15.34	16.31		3.43		35.08
BID ITEM = 900			Land Item	SCHEDULE: 1 100						
Description = Fire Alarm			Unit = LS	Takeoff Quan: 1.000			Engr Quan: 1.000			
411000	**Fire Alarm**		**Quan: 1.00 LS**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 900			Land Item	SCHEDULE: 1 100						
Description = Fire Alarm			Unit = LS	Takeoff Quan: 1.000				Engr Quan: 1.000		
From Means Alarm, Electric pressure switch (circuit closer), explosion proof, max 20 PSI, Contacts close or open, water motor complete with gong (21 13 13.50 0010) .308 +.308 + 2 = 2.62 MH, say 4 hours										
Materials 73+510+325 = $908, say $1,000										
CARP2	Foreman+1 Carpenter	2.00	CH	Eff: 100.00 **Prod: 4.0000 MU**	Lab Pcs: 2.00				Eqp Pcs: 2.00	
2UWE004	Fire Alarm@108.75%	1.00	EA	1,000.000		1,088				1,088
8GEN010	Generator 10 KW	1.00 2.00	HR	7.010				14		14
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00 2.00	HR	11.828				24		24
CARPFRM	Carpenter Foreman	1.00 2.00	MH	34.720	100					100
CARPJ	Carpenter Journeyma	1.00 2.00	MH	31.920	93					93
$1,317.96	4.0000 MH/LS	4.00	MH	[133.28]	193	1,088		38		1,318
0.2500 Unit/M	0.2500 Shifts	0.5000	Units/H		192.81	1,087.50		37.65		1,317.96
=====> Item Totals: 900 - Fire Alarm										
$1,317.96	4.0000 MH/LS	4.00	MH	[133.28]	193	1,088		38		**1,318**
1,317.960	1 LS				192.81	1,087.50		37.65		1,317.96
BID ITEM = 1000			Land Item	SCHEDULE: 1 100						
Description = Fire Sprinklers			Unit = LF	Takeoff Quan: 210.000				Engr Quan: 210.000		
411100	**2" Fire Sprinkler Pipe/Heads**			**Quan: 210.00 LF Hrs/Shft: 8.00 Cal 508 WC CCISP**						
Use Galvanized Steel Pipe 2" dia From Means Data: Schedule 40, threaded with couplings and clevis hanger assemblies sized for covering at 10' OC										
Pipe 0.286 mh/ft x 210' = 60 manhours (22 11 13.44 5580)										
Tees 1.455 mh/ea x 21ea = 31 manhours (22 11 13.45 5540)										
Heads 0.50 mh/ea x 21ea = 11 manhours (22 11 13.50 3760)										
TOTAL 102 MH										
CARP2	Foreman+1 Carpenter	52.00	CH	Eff: 100.00 **Prod: 0.4952 MU**	Lab Pcs: 2.00				Eqp Pcs: 3.00	
2UWE001	2" Dia Galv St@108.	210.00	LF	25.000		5,709				5,709
2UWE002	2" Galv Steel @108.7	21.00	EA	35.000		799				799
2UWE003	Sprinkler Head@108.	21.00	EA	15.000		343				343
31MATMISC	Misc Material@108.7	210.00	LF	5.000			1,142			1,142
8GEN010	Generator 10 KW	1.00 52.00	HR	7.010				365		365
8MLIFT060	Manlift Grove T60 60	1.00 52.00	HR	28.412				1,477		1,477
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00 52.00	HR	11.828				615		615
CARPFRM	Carpenter Foreman	1.00 52.00	MH	34.720	2,588					2,588
CARPJ	Carpenter Journeyma	1.00 52.00	MH	31.920	2,425					2,425
$15,463.06	0.4952 MH/LF	104.00	MH	[16.501]	5,013	6,851	1,142	2,457		15,463
2.0192 Unit/M	6.5000 Shifts	4.0385	Units/H		23.87	32.63	5.44	11.70		73.63
411088	**Test Water Pipe**			**Quan: 210.00 LF Hrs/Shft: 8.00 Cal 508 WC CCISP**						
CARP2	Foreman+1 Carpenter	4.00	CH	Eff: 100.00 **Prod: 0.0000**	Lab Pcs: 3.00				Eqp Pcs: 3.00	

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 1000			Land Item	SCHEDULE: 1 100						
Description = Fire Sprinklers			Unit = LF	Takeoff Quan: 210.000				Engr Quan: 210.000		
8GEN010	Generator 10 KW	1.00	4.00 HR	7.010				28		28
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	4.00 HR	11.828				47		47
8TRKWTR04	Water Truck 4,000 ga	1.00	4.00 HR	45.330				181		181
CARPFRM	Carpenter Foreman	1.00	4.00 MH	34.720	199					199
CARPJ	Carpenter Journeyma	1.00	4.00 MH	31.920	187					187
TDWT	Water Truck Driver	1.00	4.00 MH	27.020	176					176
$818.70	0.0571 MH/LF		12.00 MH	[1.784]	562			257		819
17.5000 Unit/M	0.5000 Shifts		52.5000 Units/H		2.68			1.22		3.90
=====> Item Totals: 1000 - Fire Sprinklers										
$16,281.76	0.5523 MH/LF		116.00 MH	[18.285]	5,575	6,851	1,142	2,714		**16,282**
77.532	210 LF				26.55	32.63	5.44	12.92		77.53
BID ITEM = 1100			Land Item	SCHEDULE: 1 100						
Description = Water Supply Connection			Unit = LS	Takeoff Quan: 1.000				Engr Quan: 1.000		
411200	**Backflow Preventer**		**Quan: 1.00 LS**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Means 22 11 19.42 1160)										
CARP2	Foreman+1 Carpenter	2.00 CH	Eff: 100.00	**Prod: 4.0000 MU**	Lab Pcs: 2.00		Eqp Pcs: 2.00			
2UWC14	Gate Valve Box@108	1.00 EA	75.000		82					82
2UWE005	Backfilow Prev@108.	1.00 EA	1,500.000		1,631					1,631
31MATMISC	Misc Material@108.7	1.00 LS	500.000			544				544
8GEN010	Generator 10 KW	1.00 2.00 HR	7.010					14		14
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00 2.00 HR	11.828					24		24
CARPFRM	Carpenter Foreman	1.00 2.00 MH	34.720	100						100
CARPJ	Carpenter Journeyma	1.00 2.00 MH	31.920	93						93
$2,487.02	4.0000 MH/LS	4.00 MH	[133.28]	193	1,713	544		38		2,487
0.2500 Unit/M	0.2500 Shifts	0.5000 Units/H		192.81	1,712.81	543.75		37.65		2,487.02
411300	**Connection & Piping to Bridge**		**Quan: 220.00 LF**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Connection from Lonus Street to bridge supply piping is in the $60/lf range										
BACKF4	Backfill 426 BH Loader	20.00 CH	Eff: 100.00	**Prod: 0.3636 MU**	Lab Pcs: 4.00		Eqp Pcs: 6.00			
31MATMISC	Misc Material@108.7	220.00 LF	30.000			7,178				7,178
8BHLD426	BHL Cat 426C 1.25C	1.00 20.00 HR	34.500					690		690
8COMPACA5	Compaction Wheel 46	1.00 20.00 HR	6.704					134		134
8COMPACW	Compactor Hand Ram	1.00 20.00 HR	3.634					73		73
8TRKHW10	Tandem Truck 12 CY	1.00 20.00 HR	59.896					1,198		1,198
8TRKHW30	Lowbed Trailer 60 T	1.00 20.00 HR	19.154					383		383
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00 20.00 HR	11.828					237		237
GF	Grade Foreman	1.00 20.00 MH	31.950	945						945
LGEN	Laborer-General	2.00 40.00 MH	27.520	1,557						1,557

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 1100			Land Item	SCHEDULE: 1 100						
Description = Water Supply Connection			Unit = LS	Takeoff Quan: 1.000				Engr Quan: 1.000		
OPEXC3	Op Eng 3- Backhoe to	1.00	20.00 MH	32.390	955					955
$13,348.59	0.3636 MH/LF		80.00 MH	[10.853]	3,457		7,178	2,714		13,349
2.7500 Unit/M	2.5000 Shifts		11.0000 Units/H		15.71		32.63	12.34		60.68
=====> Item Totals: 1100 - Water Supply Connection										
$15,835.61	84.0000 MH/LS		84.00 MH	[2520.88]	3,650	1,713	7,721	2,752		**15,836**
15,835.610	1 LS				3,649.58	1,712.81	7,721.25	2,751.97		15,835.61
BID ITEM = 1200			Land Item	SCHEDULE: 1 100						
Description = Pressure Wash & Treat			Unit = SF	Takeoff Quan: 2,563.000				Engr Quan: 2,563.000		
389200	**Pressure Wash Timber**			**Quan: 2,563.00 SF Hrs/Shft: 8.00 Cal 508 WC CCISP**						
FIN2	Pressure Washing		8.00 CH	Eff: 100.00 **Prod: 0.0094 MU**			Lab Pcs: 3.00		Eqp Pcs: 4.00	
31MATMISC	Misc Material@108.7		1.00 LS	250.000			272			272
8CONCEQ42	Pressure Washer 3,00	1.00	8.00 HR	4.251				34		34
8MLIFT060	Manlift Grove T60 60	1.00	8.00 HR	28.412				227		227
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	8.00 HR	11.828				95		95
8TRKWTR04	Water Truck 4,000 ga	1.00	8.00 HR	45.330				363		363
LFORMN	Laborer-Foreman	1.00	8.00 MH	29.250	327					327
LPWR	Laborer-Power Tools	1.00	8.00 MH	28.020	316					316
TDWT	Water Truck Driver	1.00	8.00 MH	27.020	353					353
$1,986.20	0.0093 MH/SF		24.00 MH	[0.263]	996		272	719		1,986
106.7917 Unit/M	1.0000 Shifts		320.3750 Units/H		0.39		0.11	0.28		0.77
389210	**Treat Timber**			**Quan: 2,563.00 SF Hrs/Shft: 8.00 Cal 508 WC CCISP**						
Treat after Pressure Wash 09 91 03.14 2900										
LAB2	Foreman + 1 Laborer		16.00 CH	Eff: 100.00 **Prod: 0.0125 MU**			Lab Pcs: 2.00		Eqp Pcs: 2.00	
31MATMISC	Misc Material@108.7		2,563.00 SF	0.500			1,394			1,394
8MLIFT060	Manlift Grove T60 60	1.00	16.00 HR	28.412				455		455
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	16.00 HR	11.828				189		189
LFORMN	Laborer-Foreman	1.00	16.00 MH	29.250	654					654
LPWR	Laborer-Power Tools	1.00	16.00 MH	28.020	632					632
$3,323.24	0.0124 MH/SF		32.00 MH	[0.358]	1,286		1,394	644		3,323
80.0938 Unit/M	2.0000 Shifts		160.1875 Units/H		0.50		0.54	0.25		1.30
=====> Item Totals: 1200 - Pressure Wash & Treat										
$5,309.44	0.0218 MH/SF		56.00 MH	[0.621]	2,282		1,666	1,362		**5,309**
2.072	2563 SF				0.89		0.65	0.53		2.07

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 2000			Land Item	SCHEDULE: 1 100						
Description = Timber Beams			Unit = EA	Takeoff Quan: 14.000			Engr Quan: 14.000			
389030	**Timber Beams (8 x 20 x 30')**		**Quan: 14.00 EA**	**Hrs/Shft: 8.00 Cal 508 WC CCISP**						
Install new 8" x 20" x 30' Beams.										
6,600 BF										
FORM4F	Form Crew 4 Men Forklift	56.00	CH	Eff: 100.00	**Prod: 16.0000 MU**	Lab Pcs: 4.00		Eqp Pcs: 5.00		
2WDLTB	8 x 20 x 30' D@108.7	6,600.00	BF	2.000		14,355				14,355
31MATMISC	Misc Material@108.7	14.00	EA	100.000			1,523			1,523
8COMPR04	Compressor 185 CFM 1.00	56.00	HR	13.278				744		744
8FORK04	Forklift Cat TL1055 1 1.00	56.00	HR	42.914				2,403		2,403
8GEN010	Generator 10 KW 1.00	56.00	HR	7.010				393		393
8MLIFT060	Manlift Grove T60 60 1.00	56.00	HR	28.412				1,591		1,591
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	56.00	HR	11.828				662		662
CARPFRM	Carpenter Foreman 1.00	56.00	MH	34.720	2,787					2,787
CARPJ	Carpenter Journeyma 1.00	56.00	MH	31.920	2,612					2,612
LGEN	Laborer-General 1.00	56.00	MH	27.520	2,180					2,180
OPLDR6	Op Eng 2- Loader <6 1.00	56.00	MH	32.910	2,706					2,706
$31,954.64	16.0000 MH/EA	224.00	MH	[508.28]	10,284	14,355	1,523	5,793		31,955
0.0625 Unit/M	7.0000 Shifts	0.2500	Units/H		734.60	1,025.36	108.75	413.76		2,282.47
=====> Item Totals: 2000 - Timber Beams										
$31,954.64	16.0000 MH/EA	224.00	MH	[508.28]	10,284	14,355	1,523	5,793		**31,955**
2,282.474	14 EA				734.60	1,025.36	108.75	413.76		2,282.47
BID ITEM = 2100			Land Item	SCHEDULE: 1 100						
Description = Timber Deck			Unit = LS	Takeoff Quan: 1.000			Engr Quan: 1.000			
389100	**Timber Deck**		**Quan: 458.00 EA**	**Hrs/Shft: 8.00 Cal 508 WC CCISP**						
Per the IPE Depot 3 x 6 (2-1/2" x 5-1/2" finish dim.) is $22/lf x 12' boards = $264/ea										
Pre-drill 12 holes per board x 458 boards = 5,500 each / 22/mh...250 MH										
8 X 3-1/8" Stainless Steel Screws (Torx Drive) - 1,000 piece contractor packs $235.00 buy 6 each										
Tapered Ipe Plugs 3/8" 1,000 pack @ $130.00, buy 6 each										
Install screws & plugs at 20/hour.....275 MH = 525 MH = 16.4 shifts, say 17 shifts										
FORM4F	Form Crew 4 Men Forklift	136.00	CH	Eff: 100.00	**Prod: 1.1878 MU**	Lab Pcs: 4.00		Eqp Pcs: 4.00		
2WDLIPE	IPE Decking 3 x 6 x 1	458.00	EA	264.000		120,912				120,912
31MATMISC	Misc Material@108.7	458.00	EA	5.000			2,490			2,490
8COMPR04	Compressor 185 CFM 1.00	136.00	HR	13.278				1,806		1,806
8FORK04	Forklift Cat TL1055 1 1.00	136.00	HR	42.914				5,836		5,836
8GEN010	Generator 10 KW 1.00	136.00	HR	7.010				953		953

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 2100			Land Item	SCHEDULE: 1 100						
Description = Timber Deck			Unit = LS	Takeoff Quan: 1.000				Engr Quan: 1.000		
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	136.00 HR	11.828				1,609		1,609
CARPFRM	Carpenter Foreman	1.00	136.00 MH	34.720	6,768					6,768
CARPJ	Carpenter Journeyma	1.00	136.00 MH	31.920	6,342					6,342
LGEN	Laborer-General	1.00	136.00 MH	27.520	5,295					5,295
OPLDR6	Op Eng 2- Loader <6	1.00	136.00 MH	32.910	6,571					6,571
$158,582.90	1.1877 MH/EA		544.00 MH	[37.733]	24,976	120,912	2,490	10,204		158,583
0.8419 Unit/M	17.0000 Shifts		3.3676 Units/H		54.53	264.00	5.44	22.28		346.25
=====> Item Totals: 2100 - Timber Deck										
$158,582.90	544.0000 MH/LS		544.00 MH	[17281.52]	24,976	120,912	2,490	10,204		**158,583**
158,582.900	1 LS				24,976.47	120,912.00	2,490.38	10,204.05		158,582.90
BID ITEM = 2200			Land Item	SCHEDULE: 1 100						
Description = Fire Proof Coating			Unit = SF	Takeoff Quan: 11,075.000				Engr Quan: 11,075.000		
845000	**Fire Proof Coating**		**Quan: 11,075.00 SF**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Material-Contego Intumescent Latex 130sf per gallon per coat, 2 coats required 11,075sf / 130sf/gal x 2 coats = 170 gallons, say 180 gallons (097 97 10.10 7000) (Labor 097 97 13.23 6830) 0.005mh/sf x 11,075sf x 2 coats = 111 mh										
LAB2	Foreman + 1 Laborer		56.00 CH	Eff: 100.00	**Prod: 0.0101 MU**		Lab Pcs: 2.00		Eqp Pcs: 3.00	
2COAT5	Intumescent La@108.		180.00 GAL	50.000		9,788				9,788
31MATMISC	Misc Material@108.7		11,075.00 SF	0.100			1,204			1,204
8GEN010	Generator 10 KW	1.00	56.00 HR	7.010				393		393
8MLIFT060	Manlift Grove T60 60	1.00	56.00 HR	28.412				1,591		1,591
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	56.00 HR	11.828				662		662
LFORMN	Laborer-Foreman	1.00	56.00 MH	29.250	2,289					2,289
LPWR	Laborer-Power Tools	1.00	56.00 MH	28.020	2,212					2,212
$18,138.16	0.0101 MH/SF		112.00 MH	[0.29]	4,500	9,788	1,204	2,646		18,138
98.8840 Unit/M	7.0000 Shifts		197.7679 Units/H		0.41	0.88	0.11	0.24		1.64
=====> Item Totals: 2200 - Fire Proof Coating										
$18,138.16	0.0101 MH/SF		112.00 MH	[0.29]	4,500	9,788	1,204	2,646		**18,138**
1.638	11075 SF				0.41	0.88	0.11	0.24		1.64
BID ITEM = 2300			Land Item	SCHEDULE: 1 100						
Description = Metal Railing			Unit = LF	Takeoff Quan: 420.000				Engr Quan: 420.000		
387000	**Install Steel Railing**		**Quan: 420.00 LF**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 2300			Land Item	SCHEDULE: 1 100						
Description = Metal Railing			Unit = LF	Takeoff Quan: 420.000				Engr Quan: 420.000		
1 shift each side										
FORM3	Form Crew 3 Man	16.00	CH	Eff: 100.00 **Prod: 0.1143 MU**	Lab Pcs: 3.00			Eqp Pcs: 4.00		
2SR05	Steel Bridge R@108.	420.00	LF	100.000		45,675				45,675
8COMPR04	Compressor 185 CFM 1.00	16.00	HR	13.278				212		212
8GEN010	Generator 10 KW 1.00	16.00	HR	7.010				112		112
8MLIFT060	Manlift Grove T60 60 1.00	16.00	HR	28.412				455		455
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	16.00	HR	11.828				189		189
CARPFRM	Carpenter Foreman 1.00	16.00	MH	34.720	796					796
CARPJ	Carpenter Journeyma 1.00	16.00	MH	31.920	746					746
LGEN	Laborer-General 1.00	16.00	MH	27.520	623					623
$48,808.79	0.1142 MH/LF	48.00	MH	[3.587]	2,165	45,675		968		48,809
8.7500 Unit/M	2.0000 Shifts	26.2500	Units/H		5.16	108.75		2.31		116.21
387100	**Install Railing Anchor Bolts**			**Quan: 144.00 EA Hrs/Shft: 8.00 Cal 508 WC CCISP**						
Figure bolts at 6' oc, 210' = 36 x 2 bolts x 2 sides = 144 ea @ 1 mh each										
Drill & Install										
CARP4	Foreman + 3 Carpenters	36.00	CH	Eff: 100.00 **Prod: 1.0000 MU**	Lab Pcs: 4.00			Eqp Pcs: 3.00		
8GEN010	Generator 10 KW 1.00	36.00	HR	7.010				252		252
8MLIFT060	Manlift Grove T60 60 1.00	36.00	HR	28.412				1,023		1,023
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	36.00	HR	11.828				426		426
CARPFRM	Carpenter Foreman 1.00	36.00	MH	34.720	1,792					1,792
CARPJ	Carpenter Journeyma 3.00	108.00	MH	31.920	5,037					5,037
$8,529.25	1.0000 MH/EA	144.00	MH	[32.62]	6,828			1,701		8,529
1.0000 Unit/M	4.5000 Shifts	4.0000	Units/H		47.42			11.81		59.23
======> Item Totals: 2300 - Metal Railing										
$57,338.04	0.4571 MH/LF	192.00	MH	[14.771]	8,994	45,675		2,669		**57,338**
136.519	420 LF				21.41	108.75		6.36		136.52
BID ITEM = 3000			Land Item	SCHEDULE: 1 100						
Description = Structural Concrete Bridge			Unit = CY	Takeoff Quan: 67.000				Engr Quan: 67.000		
210.5'L x 12' W										
325035	**Falsework Beams**			**Quan: 56.00 EA Hrs/Shft: 8.00 Cal 508 WC CCISP**						
Use 14 x 120 or 12's x 16' on exterior two beams per span per side										
2 beams x 2 sides x 14 spans x 16' x 120# = 107,520#										
Trucking: Three loads in, three out. Figure 4 hours / load = 24 hours										
CARP4C	Foreman+3 Carpenters w/Crane	56.00	CH	Eff: 100.00 **Prod: 5.0000 MU**	Lab Pcs: 5.00			Eqp Pcs: 3.00		
2SS02	Steel Beams (?size)	107,520.00	LB	0.100		10,752				10,752
5EQML	Equipment Move, Lar	2.00	EA	750.000			1,500			1,500
5TRKFB	Trucking - Flat Bed	24.00	HR	100.000			2,400			2,400

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 3000			Land Item	SCHEDULE: 1 100						
Description = Structural Concrete Bridge				Unit = CY	Takeoff Quan: 67.000			Engr Quan: 67.000		
8CRANERT7	Crane Grove RT700E	1.00	56.00 HR	106.929				5,988		5,988
8GEN010	Generator 10 KW	1.00	56.00 HR	7.010				393		393
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	56.00 HR	11.828				662		662
CARPFRM	Carpenter Foreman	1.00	56.00 MH	34.720	2,787					2,787
CARPJ	Carpenter Journeyma	3.00	168.00 MH	31.920	7,835					7,835
OPCR70	Op Eng 1- Crane 45-9	1.00	56.00 MH	32.910	2,706					2,706
$35,022.25	5.0000 MH/EA		280.00 MH	[163.39]	13,327	10,752	3,900	7,043		35,022
0.2000 Unit/M	7.0000 Shifts		1.0000 Units/H		237.99	192.00	69.64	125.77		625.40

325040 Soffit F&S **Quan: 2,170.00 SF Hrs/Shft: 8.00 Cal 508 WC CCISP**

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Width is 12' - the existing timber beams center section is 2'-4" and is formed like
a closure pour, ledger attached to existing timber beams, horses at 4' OC and 2 x 4
joists at 12" OC max.
The outside section 2'-2" wide and is supported on 2 x 4's @ 12" OC with a 2' for
walkway for a width of about 4'.
Therefore the soffit area is 210 x 10.333 = 2,170 SF
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FORM4F	Form Crew 4 Men Forklift	32.00 CH	Eff: 100.00	**Prod: 0.0590 MU**	Lab Pcs: 4.00		Eqp Pcs: 5.00		
31FMAALL	Oil/Nails/Ties@108.7	2,170.00 SF		0.350			826		826
3FBF1	Form - Bottom @108.	2,170.00 SF		2.000			4,720		4,720
8COMPR04	Compressor 185 CFM	1.00	32.00 HR	13.278				425	425
8FORK04	Forklift Cat TL1055 1	1.00	32.00 HR	42.914				1,373	1,373
8GEN010	Generator 10 KW	1.00	32.00 HR	7.010				224	224
8MLIFT060	Manlift Grove T60 60	1.00	32.00 HR	28.412				909	909
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	32.00 HR	11.828				378	378
CARPFRM	Carpenter Foreman	1.00	32.00 MH	34.720	1,593				1,593
CARPJ	Carpenter Journeyma	1.00	32.00 MH	31.920	1,492				1,492
LGEN	Laborer-General	1.00	32.00 MH	27.520	1,246				1,246
OPLDR6	Op Eng 2- Loader <6	1.00	32.00 MH	32.910	1,546				1,546
$14,732.61	0.0589 MH/SF		128.00 MH	[1.874]	5,877		5,546	3,310	14,733
16.9531 Unit/M	4.0000 Shifts		67.8125 Units/H		2.71		2.56	1.53	6.79

323025 Edge & End of Deck F&S **Quan: 334.00 SF Hrs/Shft: 8.00 Cal 508 WC CCISP**

CARP3	Foreman+2 Carpenters	20.00 CH	Eff: 100.00	**Prod: 0.1796 MU**	Lab Pcs: 3.00		Eqp Pcs: 2.00		
31FMAALL	Oil/Nails/Ties@108.7	334.00 SF		0.350			127		127
3EOD	EOD Deck Forms@1	334.00 SF		2.000			726		726
8GEN010	Generator 10 KW	1.00	20.00 HR	7.010				140	140
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	20.00 HR	11.828				237	237
CARPFRM	Carpenter Foreman	1.00	20.00 MH	34.720	995				995
CARPJ	Carpenter Journeyma	2.00	40.00 MH	31.920	1,865				1,865
$4,091.12	0.1796 MH/SF		60.00 MH	[5.902]	2,861		854	377	4,091
5.5667 Unit/M	2.5000 Shifts		16.7000 Units/H		8.57		2.56	1.13	12.25

323020 Overhang Safety Rail **Quan: 424.00 LF Hrs/Shft: 8.00 Cal 508 WC CCISP**

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 3000				Land Item	SCHEDULE: 1 100						
Description = Structural Concrete Bridge				Unit = CY	Takeoff Quan: 67.000			Engr Quan: 67.000			
CARP2	Foreman+1 Carpenter	16.00	CH	Eff: 100.00	**Prod: 0.0755 MU**			Lab Pcs: 2.00		Eqp Pcs: 2.00	
3SR	Safety Rail@108.75%	424.00	LF	1.500				692			692
8GEN010	Generator 10 KW 1.00	16.00	HR	7.010					112		112
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	16.00	HR	11.828					189		189
CARPFRM	Carpenter Foreman 1.00	16.00	MH	34.720		796					796
CARPJ	Carpenter Journeyma 1.00	16.00	MH	31.920		746					746
$2,535.49	0.0754 MH/LF	32.00	MH	[2.515]		1,542		692	301		2,535
13.2500 Unit/M	2.0000 Shifts	26.5000	Units/H			3.64		1.63	0.71		5.98
322000	**Screed&Rail Setup/Grd/Rmv**			**Quan: 240.00 LF**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
CARP2C	Foreman+1 Carpenter w/Crane	8.00	CH	Eff: 100.00	**Prod: 0.1000 MU**			Lab Pcs: 3.00		Eqp Pcs: 3.00	
31MATFMR	Finish Machine@108.	240.00	LF	5.000				1,305			1,305
8CRANERT7	Crane Grove RT700E 1.00	8.00	HR	106.929					855		855
8GEN010	Generator 10 KW 1.00	8.00	HR	7.010					56		56
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	8.00	HR	11.828					95		95
CARPFRM	Carpenter Foreman 1.00	8.00	MH	34.720		398					398
CARPJ	Carpenter Journeyma 1.00	8.00	MH	31.920		373					373
OPCR70	Op Eng 1- Crane 45-9 1.00	8.00	MH	32.910		387					387
$3,468.84	0.1000 MH/LF	24.00	MH	[3.318]		1,158		1,305	1,006		3,469
10.0000 Unit/M	1.0000 Shifts	30.0000	Units/H			4.82		5.44	4.19		14.45
322005	**Fin Mach Setup/Grd/Rmv**			**Quan: 1.00 EA**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
POUR1	Bidwell Set-up	8.00	CH	Eff: 100.00	**Prod: 48.0000 MU**			Lab Pcs: 6.00		Eqp Pcs: 3.00	
8CONCEQ48	Bid-well 4800 Deck F 1.00	8.00	HR	27.786					222		222
8CRANERT7	Crane Grove RT700E 1.00	8.00	HR	106.929					855		855
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	8.00	HR	11.828					95		95
CARPFRM	Carpenter Foreman 1.00	8.00	MH	34.720		398					398
CARPJ	Carpenter Journeyma 1.00	8.00	MH	31.920		373					373
GF	Grade Foreman 1.00	8.00	MH	31.950		378					378
LGEN	Laborer-General 1.00	8.00	MH	27.520		311					311
OPBIDW	Op Eng 2- Bidwell 1.00	8.00	MH	32.390		382					382
OPCR70	Op Eng 1- Crane 45-9 1.00	8.00	MH	32.910		387					387
$3,401.28	48.0000 MH/EA	48.00	MH	[1531.28]		2,229			1,172		3,401
0.0208 Unit/M	1.0000 Shifts	0.1250	Units/H			2,228.99			1,172.29		3,401.28
322025	**Slab Deck - Plc Conc**			**Quan: 67.00 CY**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
10% Waste											
POUR7	Pour Conc 7 man	8.00	CH	Eff: 100.00	**Prod: 0.8358 MU**			Lab Pcs: 7.00		Eqp Pcs: 5.00	
2CONC01	4,000 psi Read@108. 1.10	73.70	CY	100.000			8,015				8,015
5CONCP52M	Concrete Pump 52m	8.00	HR	250.000				2,000			2,000
5CONCPCY	Cubic Yard Charge	67.00	CY	2.250				151			151
8COMPR04	Compressor 185 CFM 1.00	8.00	HR	13.278					106		106
8CONCEQ28	Conc Vib 2.0" Elec. 2.00	16.00	HR	0.777					12		12

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity	Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 3000				Land Item	SCHEDULE: 1 100						
Description = Structural Concrete Bridge					Unit = CY	Takeoff Quan: 67.000			Engr Quan: 67.000		
8GEN010	Generator 10 KW	1.00	8.00	HR	7.010				56		56
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	8.00	HR	11.828				95		95
CARPJ	Carpenter Journeyma	1.00	8.00	MH	31.920	373					373
FINISHJ	Cement Mason Journe	2.00	16.00	MH	32.280	762					762
LFORMN	Laborer-Foreman	1.00	8.00	MH	29.250	327					327
LPWR	Laborer-Power Tools	3.00	24.00	MH	28.020	948					948
$12,844.87	0.8358 MH/CY		56.00	MH	[25.05]	2,410	8,015	2,151	269		12,845
1.1964 Unit/M	1.0000 Shifts		8.3750	Units/H		35.97	119.63	32.10	4.02		191.71
322072	**Wet Cure Deck**				**Quan: 2,860.00 SF Hrs/Shft: 8.00 Cal 508 WC CCISP**						
LAB3	Foreman + 2 Laborers		8.00	CH	Eff: 100.00 **Prod: 0.0112 MU** Lab Pcs: 4.00 Eqp Pcs: 2.00						
31FCUREBL	Curing Blankets		2,860.00	SF	0.500			1,430			1,430
3CRC	Concrete Resin@108.		2,860.00	SF	0.070			218			218
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	8.00	HR	11.828				95		95
8TRKWTR04	Water Truck 4,000 ga	1.00	8.00	HR	45.330				363		363
LFORMN	Laborer-Foreman	1.00	8.00	MH	29.250	327					327
LPWR	Laborer-Power Tools	2.00	16.00	MH	28.020	632					632
TDWT	Water Truck Driver	1.00	8.00	MH	27.020	353					353
$3,416.72	0.0111 MH/SF		32.00	MH	[0.314]	1,312		1,648	457		3,417
89.3750 Unit/M	1.0000 Shifts		357.5000	Units/H		0.46		0.58	0.16		1.19
315000	**Misc Form & Rental Hardware**				**Quan: 63.00 CY Hrs/Shft: 8.00 Cal 508 WC CCISP**						
3FH	Form Hardware@108.		63.00	CY	2.000			137			137
3MB	Misc Bridge It@108.7		63.00	CY	17.000			1,165			1,165
$1,301.74					[ ]			1,302			1,302
								20.66			20.66
======> Item Totals: 3000 - Structural Concrete Bridge											
$80,814.92	9.8507 MH/CY		660.00	MH	[315.791]	30,716	18,767	17,396	13,936		**80,815**
1,206.193	67 CY					458.44	280.10	259.64	208.00		1,206.19
BID ITEM = 3100				Land Item	SCHEDULE: 1 100						
Description = Bar Reinforcing, Bridge					Unit = LB	Takeoff Quan: 32,000.000			Engr Quan: 32,000.000		
380010	**Superstructure Rebar**				**Quan: 32,000.00 LB Hrs/Shft: 8.00 Cal 508 WC CCISP**						
IRON3C	Foreman+2 Ironworker+Crane		32.00	CH	Eff: 100.00 **Prod: 0.0040 MU** Lab Pcs: 4.00 Eqp Pcs: 2.00						
2REBAR1	Rebar Accessor@108.		32,000.00	LB	0.025		870				870
2REBAR31	Rebar - Supers@108.		32,000.00	LB	0.700		24,360				24,360
8CRANERT7	Crane Grove RT700E	1.00	32.00	HR	106.929				3,422		3,422
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	32.00	HR	11.828				378		378

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 3100			Land Item	SCHEDULE: 1 100						
Description = Bar Reinforcing, Bridge			Unit = LB	Takeoff Quan: 32,000.000				Engr Quan: 32,000.000		
IW	Ironworker	2.00	64.00 MH	33.980	3,322					3,322
IWFR	Ironworker Foreman	1.00	32.00 MH	34.360	1,674					1,674
OPCR70	Op Eng 1- Crane 45-9	1.00	32.00 MH	32.910	1,546					1,546
$35,572.22	0.0040 MH/LB		128.00 MH	[0.135]	6,542	25,230		3,800		35,572
250.0000 Unit/M	4.0000 Shifts		1,000.0000 Units/H		0.20	0.79		0.12		1.11
=====> Item Totals: 3100 - Bar Reinforcing, Bridge										
$35,572.22	0.0040 MH/LB		128.00 MH	[0.135]	6,542	25,230		3,800		**35,572**
1.112	32000 LB				0.20	0.79		0.12		1.11
BID ITEM = 3200			Land Item	SCHEDULE: 1 100						
Description = Miscellaneous Metal, Bridge			Unit = LB	Takeoff Quan: 825.000				Engr Quan: 825.000		
385100	**Miscellaneous Metal, Bridge**		**Quan: 825.00 LB**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
L6 x 6 x 1/2" x 3" Angles Drilled and hot dipped galvanized										
3/4" dia x 7" L Lag Bolts.....336 each, buy 350 x $3.62										
Washers 25 per pack at $7.82 ($0.31 each)										
3/4" dia x 6" L Anchor Bolts...336 each, buy 350 x $4.23										
Washers 25 per pack at $7.82 ($0.31 each)										
Bolts 25 per pack at $11.86 ($0.47 each)										
Prices from McMaster-Carr 115										
FORM3	Form Crew 3 Man		24.00 CH	Eff: 100.00	**Prod: 0.0873 MU**		Lab Pcs: 3.00		Eqp Pcs: 4.00	
2MM002	Angle@108.75%		825.00 LB	1.500		1,346				1,346
2SA01	Lag Bolt 3/4" @108.7		350.00 EA	4.000		1,523				1,523
2SA02	Anchor Bolt 3/@108.		350.00 EA	5.000		1,903				1,903
8COMPR04	Compressor 185 CFM	1.00	24.00 HR	13.278				319		319
8GEN010	Generator 10 KW	1.00	24.00 HR	7.010				168		168
8MLIFT060	Manlift Grove T60 60	1.00	24.00 HR	28.412				682		682
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	24.00 HR	11.828				284		284
CARPFRM	Carpenter Foreman	1.00	24.00 MH	34.720	1,194					1,194
CARPJ	Carpenter Journeyma	1.00	24.00 MH	31.920	1,119					1,119
LGEN	Laborer-General	1.00	24.00 MH	27.520	934					934
$9,472.13	0.0872 MH/LB		72.00 MH	[2.739]	3,248	4,771		1,453		9,472
11.4583 Unit/M	3.0000 Shifts		34.3750 Units/H		3.94	5.78		1.76		11.48
=====> Item Totals: 3200 - Miscellaneous Metal, Bridge										
$9,472.13	0.0872 MH/LB		72.00 MH	[2.739]	3,248	4,771		1,453		**9,472**
11.481	825 LB				3.94	5.78		1.76		11.48

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 3300				Land Item	SCHEDULE: 1 100					
Description = Concrete Stain				Unit = SF	Takeoff Quan: 2,520.000			Engr Quan: 2,520.000		
3400	**Concrete Stain**			**Quan: 2,520.00 SF**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**				
4COAT	Coating Sub	2,520.00	SF	3.500					8,820	8,820
BID ITEM = 3400				Land Item	SCHEDULE: 1 100					
Description = Metal Railing				Unit = LF	Takeoff Quan: 420.000			Engr Quan: 420.000		
387000	**Install Steel Railing**			**Quan: 420.00 LF**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**				
1 shift each side										
FORM3	Form Crew 3 Man	16.00	CH	Eff: 100.00	**Prod: 0.1143 MU**	Lab Pcs: 3.00			Eqp Pcs: 3.00	
2SR05	Steel Bridge R@108.	420.00	LF	100.000		45,675				45,675
8COMPR04	Compressor 185 CFM 1.00	16.00	HR	13.278				212		212
8GEN010	Generator 10 KW 1.00	16.00	HR	7.010				112		112
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	16.00	HR	11.828				189		189
CARPFRM	Carpenter Foreman 1.00	16.00	MH	34.720	796					796
CARPJ	Carpenter Journeyma 1.00	16.00	MH	31.920	746					746
LGEN	Laborer-General 1.00	16.00	MH	27.520	623					623
$48,354.22	0.1142 MH/LF	48.00	MH	[3.587]	2,165	45,675		514		48,354
8.7500 Unit/M	2.0000 Shifts	26.2500	Units/H		5.16	108.75		1.22		115.13
387100	**Install Railing Anchor Bolts**			**Quan: 144.00 EA**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**				
Figure bolts at 6' oc, 210' = 36 x 2 bolts x 2 sides = 144 ea @ 0.5 mh each Layout, set, strip in concrete										
CARP4	Foreman + 3 Carpenters	18.00	CH	Eff: 100.00	**Prod: 0.5000 MU**	Lab Pcs: 4.00			Eqp Pcs: 2.00	
8GEN010	Generator 10 KW 1.00	18.00	HR	7.010				126		126
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	18.00	HR	11.828				213		213
CARPFRM	Carpenter Foreman 1.00	18.00	MH	34.720	896					896
CARPJ	Carpenter Journeyma 3.00	54.00	MH	31.920	2,518					2,518
$3,753.21	0.5000 MH/EA	72.00	MH	[16.31]	3,414			339		3,753
2.0000 Unit/M	2.2500 Shifts	8.0000	Units/H		23.71			2.35		26.06
======> Item Totals: 3400 - Metal Railing										
$52,107.43	0.2857 MH/LF	120.00	MH	[9.179]	5,580	45,675		853		**52,107**
124.065	420 LF				13.28	108.75		2.03		124.07
BID ITEM = 3500				Land Item	SCHEDULE: 1 100					
Description = Fire Proof Coating				Unit = SF	Takeoff Quan: 9,480.000			Engr Quan: 9,480.000		

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total

BID ITEM = 3500 Land Item SCHEDULE: 1 100
Description = Fire Proof Coating Unit = SF Takeoff Quan: 9,480.000 Engr Quan: 9,480.000

845000 Fire Proof Coating **Quan: 9,480.00 SF Hrs/Shft: 8.00 Cal 508 WC CCISP**

```
Material-Contego Intumescent Latex 130sf per gallon per coat, 2 coats required
9,480sf / 130sf/gal x 2 coats = 146 gallons, say 154 gallons (097 97 10.10 7000)
(Labor 097 97 13.23 6830) 0.005mh/sf x 9,480sf x 2 coats = 95 mh
```

LAB2	Foreman + 1 Laborer		48.00	CH	Eff: 100.00	**Prod: 0.0101 MU**		Lab Pcs: 2.00		Eqp Pcs: 3.00
2COAT5	Intumescent La@108.		154.00	GAL	50.000		8,374			8,374
31MATMISC	Misc Material@108.7		9,480.00	SF	0.100			1,031		1,031
8GEN010	Generator 10 KW	1.00	48.00	HR	7.010				336	336
8MLIFT060	Manlift Grove T60 60	1.00	48.00	HR	28.412				1,364	1,364
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	48.00	HR	11.828				568	568
LFORMN	Laborer-Foreman	1.00	48.00	MH	29.250	1,962				1,962
LPWR	Laborer-Power Tools	1.00	48.00	MH	28.020	1,896				1,896
$15,530.04	0.0101 MH/SF		96.00	MH	[0.29]	3,857	8,374	1,031	2,268	15,530
98.7500 Unit/M	6.0000 Shifts		197.5000	Units/H		0.41	0.88	0.11	0.24	1.64

=====> Item Totals: 3500 - Fire Proof Coating

$15,530.04	0.0101 MH/SF		96.00	MH	[0.29]	3,857	8,374	1,031	2,268	**15,530**
1.638	9480 SF					0.41	0.88	0.11	0.24	1.64

BID ITEM = 4000 Land Item SCHEDULE: 1 100
Description = Complete Bridge Removal Unit = LF Takeoff Quan: 210.000 Engr Quan: 210.000

```
All replacement structural lumber (does not include IPE) shall be stress-grade
Douglas Fir (Larch) and shall conform to AREMA specifications see, Part 1, Material
Specifications for Lumber, Timber, Engineered Wood Products, Timber Piles,
Fasteners, Timber Bridge Ties and Recommendations for Fire-Retardant Coating for
Creosoted Wood. All lumber and piles, except IPE timber, should be pressure treated
in accordance with AREMA Chapter 30.

Trucking included in Demolition/Removals item #300
```

133014 Remove Timber Deck **Quan: 2,520.00 SF Hrs/Shft: 8.00 Cal 508 WC CCISP**

```
Remove Grating & Flat Bar  - 210 LF x 2 = 420 LF = 1 Shift
Remove Timbers = 214 Each @ .75 MH/Ea           = 4 Shifts
Remove Posts/Cable/Fence Panels                 = 1 Shift
Main Ties are   10' x 8" x 8" = 53 BF x 171 each = 9,063 BF x 4.5#/BF = 40,784#
Handrail Ties are 18' x 4" x 8" = 48 BF x 43 each = 2,064 BF x 4.5#/BF = 9,288#
Disposal At $60/ton                                                Total...50,072#
(25.0 tons)
```

DEMO22	Timber Deck Demo		64.00	CH	Eff: 100.00	**Prod: 8.0000 S**		Lab Pcs: 5.00		Eqp Pcs: 6.00
31DFTIMTN	Timber Dump Fe@10		25.00	TN	60.000			1,631		1,631
8COMPR04	Compressor 185 CFM	1.00	64.00	HR	13.278				850	850

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 4000			Land Item	SCHEDULE: 1 100						
Description = Complete Bridge Removal				Unit = LF	Takeoff Quan: 210.000			Engr Quan: 210.000		
8DEMO02	Jackhammer 35#	2.00	128.00 HR	2.600				333		333
8EXC315	Excavator Cat 315D L	1.00	64.00 HR	53.312				3,412		3,412
8FORK04	Forklift Cat TL1055 1	1.00	64.00 HR	42.914				2,746		2,746
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	64.00 HR	11.828				757		757
LFORMN	Laborer-Foreman	1.00	64.00 MH	29.250	2,616					2,616
LPWR	Laborer-Power Tools	2.00	128.00 MH	28.020	5,055					5,055
OPEXC3	Op Eng 3- Backhoe to	1.00	64.00 MH	32.390	3,055					3,055
OPLDR6	Op Eng 2- Loader <6	1.00	64.00 MH	32.910	3,092					3,092
$23,546.83	0.1269 MH/SF		320.00 MH	[3.825]	13,818		1,631	8,098		23,547
7.8750 Unit/M	8.0000 Shifts		* 39.3750 Units/H		5.48		0.65	3.21		9.34

133020 Remove Timber Cap (14 x 14 x 18') Quan: 14.00 EA Hrs/Shft: 8.00 Cal 508 WC CCISP

```
Remove existing 14" x 14" x 18' cap, figure 0.5 mh/ea
294BF x 14ea x 4.5#/BF = 18,522# (9.3tons)
Disposal At $60/ton
```

DEMO22	Timber Deck Demo	2.00 CH	Eff: 100.00	**Prod: 0.5714 MU**	Lab Pcs: 4.00		Eqp Pcs: 6.00	
31DFTIMTN	Timber Dump Fe@10	9.30 TN	60.000		607			607
8COMPR04	Compressor 185 CFM	1.00	2.00 HR	13.278			27	27
8DEMO02	Jackhammer 35#	2.00	4.00 HR	2.600			10	10
8EXC315	Excavator Cat 315D L	1.00	2.00 HR	53.312			107	107
8FORK04	Forklift Cat TL1055 1	1.00	2.00 HR	42.914			86	86
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	2.00 HR	11.828			24	24
LFORMN	Laborer-Foreman	1.00	2.00 MH	29.250	82			82
LPWR	Laborer-Power Tools	1.00	2.00 MH	28.020	79			79
OPEXC3	Op Eng 3- Backhoe to	1.00	2.00 MH	32.390	95			95
OPLDR6	Op Eng 2- Loader <6	1.00	2.00 MH	32.910	97			97
$1,212.65	0.5714 MH/EA		8.00 MH	[17.51]	353	607	253	1,213
1.7500 Unit/M	0.2500 Shifts		7.0000 Units/H		25.20	43.35	18.07	86.62

133045 Remove Timber Piles (14" dia x 40') Quan: 81.00 EA Hrs/Shft: 8.00 Cal 508 WC CCISP

```
Remove existing 14" dia x 40' pile, figure 1.0 mh/ea
1.069 CF x 12BF/CF x 40' x 81ea x 4.5#/BF = 187,032 (93.5tons)
Disposal At $60/ton
```

DEMO22	Timber Deck Demo	20.00 CH	Eff: 100.00	**Prod: 0.9877 MU**	Lab Pcs: 4.00		Eqp Pcs: 6.00	
31DFTIMTN	Timber Dump Fe@10	93.50 TN	60.000		6,101			6,101
8COMPR04	Compressor 185 CFM	1.00	20.00 HR	13.278			266	266
8DEMO02	Jackhammer 35#	2.00	40.00 HR	2.600			104	104
8EXC315	Excavator Cat 315D L	1.00	20.00 HR	53.312			1,066	1,066
8FORK04	Forklift Cat TL1055 1	1.00	20.00 HR	42.914			858	858
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	20.00 HR	11.828			237	237
LFORMN	Laborer-Foreman	1.00	20.00 MH	29.250	817			817
LPWR	Laborer-Power Tools	1.00	20.00 MH	28.020	790			790
OPEXC3	Op Eng 3- Backhoe to	1.00	20.00 MH	32.390	955			955
OPLDR6	Op Eng 2- Loader <6	1.00	20.00 MH	32.910	966			966

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity / Pcs	Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 4000			Land Item	SCHEDULE: 1 100						
Description = Complete Bridge Removal			Unit = LF	Takeoff Quan: 210.000			Engr Quan: 210.000			
$12,159.66	0.9876 MH/EA	80.00	MH	[30.264]	3,528		6,101	2,531		12,160
1.0125 Unit/M	2.5000 Shifts	4.0500	Units/H		43.56		75.32	31.24		150.12
133025	**Remove Sway Brace (4 x 10 x 20')**	**Quan: 44.00 EA**		**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Remove existing 4" x 10" x 20' sway brace at 0.5mh/ea										
66.7BF x 44ea x 4.5#/BF = 13,200#(6.6 tons)										
Disposal At $60/ton										
DEMO22	Timber Deck Demo	6.00	CH	Eff: 100.00 **Prod: 0.5455 MU**	Lab Pcs: 4.00			Eqp Pcs: 6.00		
31DFTIMTN	Timber Dump Fe@10	6.60	TN	60.000			431			431
8COMPR04	Compressor 185 CFM 1.00	6.00	HR	13.278				80		80
8DEMO02	Jackhammer 35# 2.00	12.00	HR	2.600				31		31
8EXC315	Excavator Cat 315D L 1.00	6.00	HR	53.312				320		320
8FORK04	Forklift Cat TL1055 1 1.00	6.00	HR	42.914				257		257
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	6.00	HR	11.828				71		71
LFORMN	Laborer-Foreman 1.00	6.00	MH	29.250	245					245
LPWR	Laborer-Power Tools 1.00	6.00	MH	28.020	237					237
OPEXC3	Op Eng 3- Backhoe to 1.00	6.00	MH	32.390	286					286
OPLDR6	Op Eng 2- Loader <6 1.00	6.00	MH	32.910	290					290
$2,248.23	0.5454 MH/EA	24.00	MH	[16.714]	1,058		431	759		2,248
1.8333 Unit/M	0.7500 Shifts	7.3333	Units/H		24.06		9.79	17.25		51.10
133500	**Dispose of Timber (Haz)**	**Quan: 1.00 LS**		**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Timber Deck.....25.0 tons										
Timber Cap.....9.3 Tons										
Sway Brace.....6.6 Tons										
Sash Brace.....5.4 Tons										
Timber Abut 1.....3.8 Tons										
Timber Abut 15....1.6 Tons										
Timber Piles.....93.5 Tons										
TOTAL...145.2 Tons / 24 Tons/Load = 6 loads										
2 hours to load, 2 hours travel each way, 2 hour unload = 8 x 6 loads = 48 hours										
5TRKFB	Trucking - Flat Bed	48.00	HR	100.000			4,800			4,800
133030	**Remove Sash Brace (8 x 10 x 18')**	**Quan: 20.00 EA**		**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Remove existing 8" x 10" x 18' sash brace @ 0.5 MH/EA										
120BF x 20EA x 4.5#/BF = 10,800# (5.4 tons)										
Disposal At $60/ton										
DEMO22	Timber Deck Demo	3.00	CH	Eff: 100.00 **Prod: 0.6000 MU**	Lab Pcs: 4.00			Eqp Pcs: 6.00		
31DFTIMTN	Timber Dump Fe@10	5.40	TN	60.000			352			352
8COMPR04	Compressor 185 CFM 1.00	3.00	HR	13.278				40		40
8DEMO02	Jackhammer 35# 2.00	6.00	HR	2.600				16		16
8EXC315	Excavator Cat 315D L 1.00	3.00	HR	53.312				160		160
8FORK04	Forklift Cat TL1055 1 1.00	3.00	HR	42.914				129		129
8TRKPU7	Leased 4x2, 3/4 T Pic 1.00	3.00	HR	11.828				35		35

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 4000			Land Item	SCHEDULE: 1 100						
Description = Complete Bridge Removal			Unit = LF	Takeoff Quan: 210.000			Engr Quan: 210.000			
LFORMN	Laborer-Foreman	1.00	3.00 MH	29.250	123					123
LPWR	Laborer-Power Tools	1.00	3.00 MH	28.020	118					118
OPEXC3	Op Eng 3- Backhoe to	1.00	3.00 MH	32.390	143					143
OPLDR6	Op Eng 2- Loader <6	1.00	3.00 MH	32.910	145					145
$1,261.10		0.6000 MH/EA	12.00 MH	[18.386]	529		352	380		1,261
1.6667 Unit/M		0.3750 Shifts	6.6667 Units/H		26.46		17.62	18.98		63.06
133035	**Remove Abut 1 Backwall 8 x 20 x 25'**		**Quan: 5.00 EA**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Remove existing 8" x 20" x 25' Timber Beams @ 0.5mh/ea										
333.3 BF x 5ea x 4.5#/BF = 7,500# (3.75tons)										
Disposal At $60/ton										
FORM4F	Form Crew 4 Men Forklift	10.00 CH	Eff: 100.00	**Prod: 8.0000 MU**	Lab Pcs: 4.00			Eqp Pcs: 4.00		
31DFTIMTN	Timber Dump Fe@10	3.75 TN	60.000		245					245
8COMPR04	Compressor 185 CFM	1.00	10.00 HR	13.278				133		133
8FORK04	Forklift Cat TL1055 1	1.00	10.00 HR	42.914				429		429
8GEN010	Generator 10 KW	1.00	10.00 HR	7.010				70		70
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	10.00 HR	11.828				118		118
CARPFRM	Carpenter Foreman	1.00	10.00 MH	34.720	498					498
CARPJ	Carpenter Journeyma	1.00	10.00 MH	31.920	466					466
LGEN	Laborer-General	1.00	10.00 MH	27.520	389					389
OPLDR6	Op Eng 2- Loader <6	1.00	10.00 MH	32.910	483					483
$2,831.50		8.0000 MH/EA	40.00 MH	[254.14]	1,837		245	750		2,832
0.1250 Unit/M		1.2500 Shifts	0.5000 Units/H		367.30		48.94	150.06		566.30
133040	**Remove Abut 15 Backwall 8 x 20 x 18'**		**Quan: 3.00 EA**	**Hrs/Shft: 8.00**	**Cal 508 WC CCISP**					
Remove existing 8" x 20" x 18' Timber Beams @ 0.5mh/ea										
240 BF x 3ea x 4.5#/BF = 3,240# (1.6tons)										
Disposal At $60/ton										
FORM4F	Form Crew 4 Men Forklift	0.50 CH	Eff: 100.00	**Prod: 0.6667 MU**	Lab Pcs: 4.00			Eqp Pcs: 4.00		
31DFTIMTN	Timber Dump Fe@10	1.60 TN	60.000		104					104
8COMPR04	Compressor 185 CFM	1.00	0.50 HR	13.278				7		7
8FORK04	Forklift Cat TL1055 1	1.00	0.50 HR	42.914				21		21
8GEN010	Generator 10 KW	1.00	0.50 HR	7.010				3		3
8TRKPU7	Leased 4x2, 3/4 T Pic	1.00	0.50 HR	11.828				6		6
CARPFRM	Carpenter Foreman	1.00	0.50 MH	34.720	25					25
CARPJ	Carpenter Journeyma	1.00	0.50 MH	31.920	23					23
LGEN	Laborer-General	1.00	0.50 MH	27.520	19					19
OPLDR6	Op Eng 2- Loader <6	1.00	0.50 MH	32.910	24					24
$233.68		0.6666 MH/EA	2.00 MH	[21.18]	92		104	37		234
1.5000 Unit/M		0.0625 Shifts	6.0000 Units/H		30.61		34.80	12.48		77.89
=====> Item Totals: 4000 - Complete Bridge Removal										
$48,293.65		2.3142 MH/LF	486.00 MH	[70.341]	21,215		14,271	12,808		**48,294**
229.970		210 LF			101.02		67.96	60.99		229.97

DETAILED ESTIMATE

Activity / Resource	Desc	Quantity Pcs	Quantity Unit	Unit Cost	Labor	Perm Materi	Constr Matl/Ex	Equip Ment	Sub-Contrac	Total
BID ITEM = 4000				Land Item	SCHEDULE: 1 100					
Description = Complete Bridge Removal				Unit =	LF	Takeoff Quan: 210.000		Engr Quan: 210.000		
$**688,772.86**	*** **Report Totals** ***	3,866.50	MH		175,231	355,817	66,314	82,591	8,820	**688,773**

>>> indicates Non Additive Activity

------Report Notes:------

The estimate was prepared with TAKEOFF Quantities.

This report shows TAKEOFF Quantities with the resources.

Bid Date: 08/02/12 Owner: Engineering Firm:

Estimator-In-Charge: RHU

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* on units of MH indicate average labor unit cost was used rather than base rate.

[ ] in the Unit Cost Column = Labor Unit Cost Without Labor Burdens

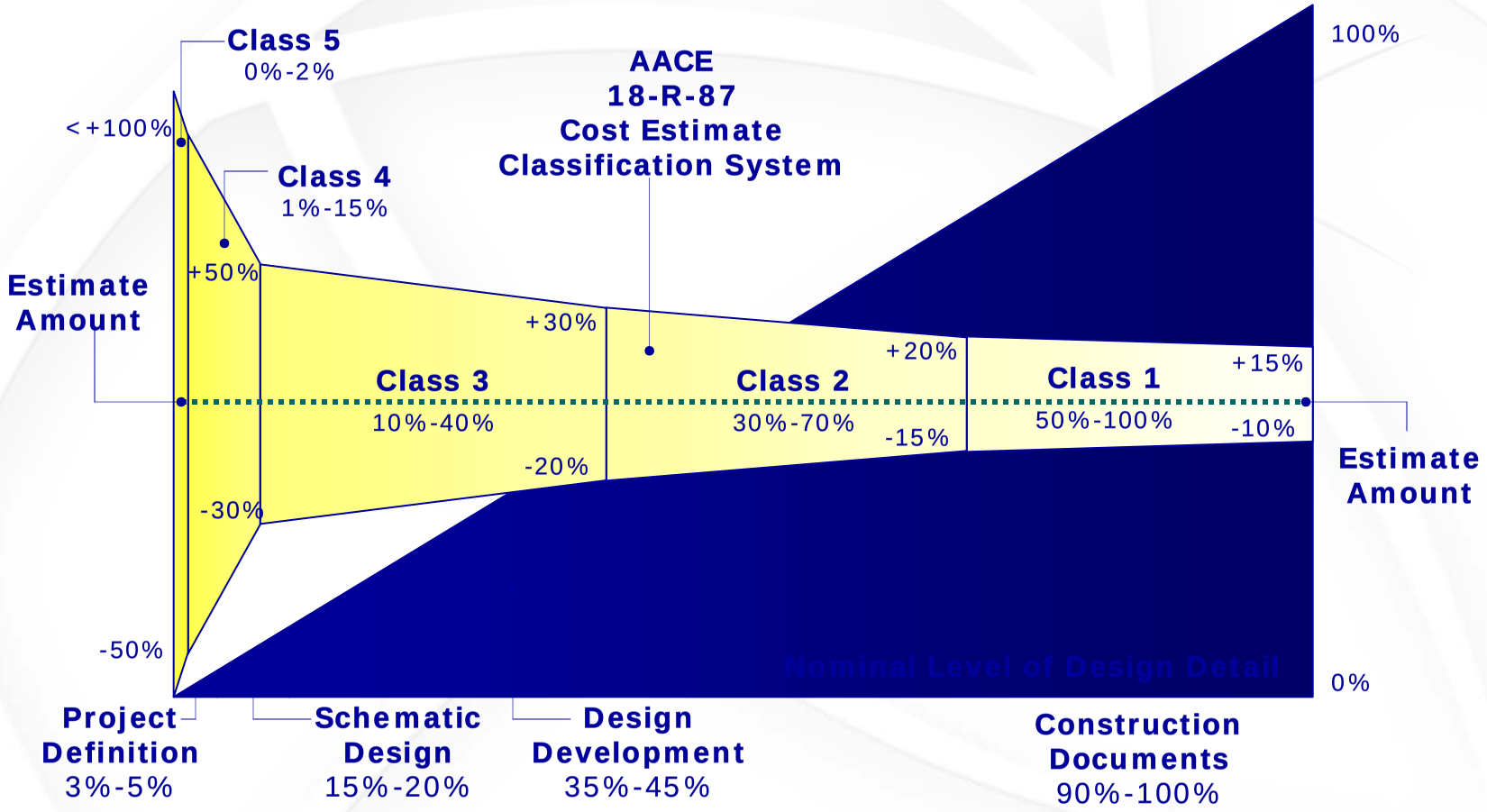
In equipment resources, rent % and EOE % not = 100% are represented as XXX%YYY where XXX=Rent% and YYY=EOE%

------Calendar Codes------

410	4 Nights @ 10 hrs/night
508	**5 days @ 8hrs/day (Default Calendar)**
509	5 days @ 9 hrs/day
510	5 days @ 10hrs/day
608	6 Days @ 8 hrs/day
610	6 Days @ 10 hrs/day

APPENDIX C– AACE Estimate Definitions

AACE – Classification System



Construction Cost Estimate Accuracy Ranges

CH2MHILL

Estimate Class	Class 5		Class 4		Class 3		Class 2		Class 1	
LEVEL OF PROJECT DEFINITION Expressed as a % of complete definition	**0% to 2%**		**1% to 15%**		**10% to 40%**		**30% to 70%**		**50% to 100%**	
END USAGE Typical Purpose of Estimate	**Concept Screening**		**Study or Feasibility**		**Budget Authorization, or Control**		**Control or Bid / Tender**		**Check Estimate or Bid / Tender**	
METHODOLOGY Typical estimating method	**Capacity Factored, Parametric Models, Judgment, or Analogy**		**Equipment Factored or Parametric Models**		**Semi-Detailed Unit Costs with Assembly Level Line Items**		**Detailed Unit Cost with Forced Detailed Take-Off**		**Detailed Unit Cost with Detailed Take-Off**	
EXPECTED ACCURACY RANGE Typical variation in low and high ranges [a]	**L: -20% to -50%**	**H: +30% to +100%**	**L: -15% to -30%**	**H: +20% to +50%**	**L: -10% to -20%**	**H: +10% to +30%**	**L: -5% to -15%**	**H: +5% to +20%**	**L: -3% to -10%**	**H: +3% to +15%**
PREPARATION EFFORT Typical degree of effort relative to least cost index of 1 [b]	**1**		**2 to 4**		**3 to 10**		**4 to 20**		**5 to 100**	
REFINED CLASS DEFINITION	Class 5 estimates are generally prepared based on very limited information, and subsequently have very wide accuracy ranges. As such, some companies and organizations have elected to determine that due to the inherent inaccuracies, such estimates cannot be classified in a conventional and systematic manner. Class 5 estimates, due to the requirements of end use, may be prepared within a very limited amount of time and with very little effort expended - sometimes requiring less than 1 hour to prepare. Often, little more than proposed plant type, location, and capacity are known at the time of estimate preparation.		Class 4 estimates are generally prepared based on very limited information, and subsequently have very wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1% to 5% complete, and would comprise at a minimum the following: plant capacity, block schematics, indicated layout, process flow diagrams (PFDs) for main process systems and preliminary engineered process and utility equipment lists. Level of Project Definition Required: 1% to 15% of full project definition.		Class 3 estimates are generally prepared to form the basis for budget authorization, appropriation, and/or funding. As such, they typically form the initial control estimate against which all actual costs and resources will be monitored. Typically, engineering is from 10% to 40% complete, and would comprise at a minimum the following: process flow diagrams, utility flow diagrams, preliminary piping and instrument diagrams, utility flow diagrams, preliminary piping and instrument diagrams, plot plan, developed layout drawings, and essentially complete engineering process and utility equipment lists. Level Of Project Definition Required: 10% to 40% of full project definition.		Class 2 estimates are generally prepared to form a detailed control baseline against which all project work is monitored in terms of cost and progress control. For contractors, this class of estimate is often used as the "bid" estimate to establish contract value. Typically, engineering is from 30% to 70% complete, and would comprise at a minimum the following: Process flow diagrams, utility flow diagrams, piping and instrument flow diagrams, heat and material balances, final plot plan, final layout drawings, complete engineered process and utility equipment lists, single line diagrams for electrical, electrical equipment and motor schedules, vendor quotations, detailed project execution plans, resourcing and work force plans, etc.		Class 1 estimates are generally prepared for discrete parts or sections of the total project rather than generating this level of detail for the entire project. The parts of the project estimated at this level of detail will typically be used by subcontractors for bids, or by owners for check estimates. The updated estimate is often referred to as the current control estimate and becomes the new baseline for cost/schedule control of the project. Class 1 estimates may be prepared for parts of the project to comprise a fair price estimate or bid check estimate to compare against a contractor's bid estimate, or to evaluate/dispute claims. Typically, engineering is from 50% to 100% complete, and would comprise virtually all engineering and design documentation of the project, and complete project execution and commissioning plans. Level for Project Definition Required: 50% to 100% of full project definition.	
END USAGE DEFINED	Class 5 estimates are prepared for any number of strategic business planning purposes, such as but not limited to market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, long-range capital planning, etc.		Class 4 estimates are prepared for a number of purposes, such as but not limited to, detailed strategic planning, business development, project screening at more developed stages, alternative scheme analysis, confirmation of economic and/or technical feasibility, and preliminary budget approval or approval to proceed to next stage.		Class 3 estimates are typically prepared to support full project funding requests, and become the first of the project phase "control estimate" against which all actual costs and resources will be monitored for variations to the budget. They are used as the project budget until replaced by more detailed estimates. In many owner organizations, a Class 3 estimate may be the last estimate required and could well form the only basis for cost/schedule control.		Class 2 estimates are typically prepared as the detailed control baseline against which all actual costs an resources will now be monitored for variation to the budget, and form a part of the change/variation control program.		Class 1 estimates are typically prepared to form a current control estimate to be used as the final control baseline against which all actual coasts and resources will now be monitored for variations to the budget, and form a part of the change/variation control program. They may be used to evaluate bid checking, to support vendor/contractor negotiations, or for claim evaluations and dispute resolution.	
ESTIMATING METHODS USED	Class 5 estimates virtually always use stochastic estimating methods such as cost/capacity curves and factors, scale of operations factors, Lang factors, Handy-Whitman factors, Chilton factors, Peters-Timmerhaus factors, Guthrie factors, and other parametric and modeling techniques.		Class 4 estimates virtually always use stochastic estimating methods such as cost/capacity curves and factors, scale of operations factors, Lang factors, Hand factors, Chilton factors, Peters-Timmerhaus factors, Guthrie factors, the Miller method, gross unit costs/ratios, and other parametric and modeling techniques.		Class 3 estimates usually involve more deterministic estimating methods that stochastic methods. They usually involve a high degree of unit cost line items, although these may be at an assembly level of detail rather than individual components. Factoring and other stochastic methods may be used to estimate less-significant areas of the project.		Class 2 estimates always involve a high degree of deterministic estimating methods. Class 2 estimates are prepared in great detail, and often involve tens of thousands of unit cost line items. For those areas of the project still undefined, an assumed level of detailed takeoff (forced detail) may be developed to use as line items in the estimate instead of relying on factoring methods.		Class 1 estimates involve the highest degree of deterministic estimating methods, and require a great amount of effort. Class 1 estimates are prepared in great detail, and thus are usually performed on only the most important or critical areas of the project. All items in the estimate are usually unit cost line items based on actual design quantities.	
EXPECTED ACCURACY RANGE	Typical accuracy ranges for Class 5 estimates are -20% to 50% on the low side, and +30% to +100% on the high side, depending on the technological complexity of the project, appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.		Typical accuracy ranges for Class 4 estimates are -15% to -30% on the low side, and +20% to +50% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.		Typical accuracy ranges for Class 3 estimates are -10% to -20% on the low side, and +10% to +30% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.		Typical accuracy ranges for Class 2 estimates are -5% to -15% on the low side, and +5% to +20% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.		Typical accuracy ranges for Class 1 estimates are -3% to -10% on the low side, and +3% to +15% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.	
EFFORT TO PREPARE (for US$20MM project):	As little as 1 hour or less to prepare to perhaps more than 200 hours, depending on the project and the estimating methodology used.		Typically, as little as 20 hours or less to perhaps more than 300 hours, depending on the project and the estimating methodology used.		Typically, as little as 150 hours or less to perhaps more than 1500 hours, depending on the project and the estimating methodology used.		Typically, as little as 300 hours or less to perhaps more than 3000 hours, depending on the project and the estimating methodology used. Bid Estimates typically require more effort than estimates used for funding or control purposes		Class 1 estimates require the most effort to create, and as such are generally developed for only selected areas of the project, or for bidding purposes. A complete Class 1 estimate may involve as little as 600 hours or less, to perhaps more than 6,000 hours, depending on the project and the estimating methodology used. Bid estimate typically require more effort than estimates used for funding or control purposes.	
ANSI Standard Reference Z94.2-1989 name; Alternate Estimate Names, Terms, Expressions, Synonyms:	Order of Magnitude Estimate; Ratio, ballpark, blue sky, seat-of-pants, ROM, idea study, prospect estimate, concession license estimate, guesstimate, rule-of thumb.		Budget Estimate; Screening, top-down, feasibility, authorization, factored, pre-design, pre-study.		Budget Estimate; Budget, scope, sanction, semi-detailed, authorization, preliminary control, concept study, development, basic engineering phase estimate, target estimate.		Definitive Estimate; Detailed Control, forced detail, execution phase, master control, engineering, bid, tender, change order estimate.		Definitive Estimate; Full detail, release, fall-out, tender, firm price, bottoms-up, final, detailed control, forced detail, execution phase, master control, fair price, definitive, change order estimate.	

Estimate Class	Class 5	Class 4	Class 3	Class 2	Class 1
Estimate Input Checklist and Maturity Index	Class 5	Class 4	Class 3	Class 2	Class 1
GENERAL PROJECT DATA					
Project Scope Description	General	Preliminary	Defined	Defined	Defined
Plant Production / Facility Capacity	Assumed	Preliminary	Defined	Defined	Defined
Plant Location	General	Approximate	Specific	Specific	Specific
Soils & Hydrology	None	Preliminary	Defined	Defined	Defined
Integrated Project Plan	None	Preliminary	Defined	Defined	Defined
Project Master Schedule	None	Preliminary	Defined	Defined	Defined
Escalation Strategy	None	Preliminary	Defined	Defined	Defined
Work Breakdown Structure	None	Preliminary	Defined	Defined	Defined
Project Code of Accounts	None	Preliminary	Defined	Defined	Defined
Contracting Strategy	Assumed	Assumed	Preliminary	Defined	Defined
ENGINEERING DELIVERABLES:	**Class 5**	**Class 4**	**Class 3**	**Class 2**	**Class 1**
Block Flow Diagrams	Started / Preliminary	Preliminary / Complete	Complete	Complete	Complete
Plot Plans		Started	Preliminary / Complete	Complete	Complete
Process Flow Diagrams (PFDs)		Started / Preliminary	Preliminary / Complete	Complete	Complete
Utility Flow Diagrams (UFDs)		Started / Preliminary	Preliminary / Complete	Complete	Complete
Piping & Instrument Diagrams (P&IDS)		Started	Preliminary / Complete	Complete	Complete
Heat and Material Balances		Started	Preliminary / Complete	Complete	Complete
Process Equipment List		Started / Preliminary	Preliminary / Complete	Complete	Complete
Utility Equipment List		Started / Preliminary	Preliminary / Complete	Complete	Complete
Electrical One Line Drawings		Started / Preliminary	Preliminary / Complete	Complete	Complete
Specifications and Datasheets		Started	Preliminary / Complete	Complete	Complete
General Equipment Arrangement Drawings		Started	Preliminary / Complete	Complete	Complete
Spare Parts Lists			Started / Preliminary	Preliminary	Complete
Architectural Details / Schedules		Started	Preliminary / Complete	Complete	Complete
Structural Details		Started	Preliminary / Complete	Complete	Complete
Mechanical Discipline Drawings			Started	Preliminary	Preliminary / Complete
Electrical Discipline Drawings			Started	Preliminary	Preliminary / Complete
System Discipline Drawings			Started	Preliminary	Preliminary / Complete
Civil/Site Discipline Drawings			Started	Preliminary	Preliminary / Complete
Demolition Details		Started	Preliminary / Complete	Complete	Complete