PRELIMINARY COST ESTIMATE FOR SINGLE SPAN OVERFILLED PRECAST CONCRETE ARCH BRIDGE STRUCTURES

TRINITY COUNTY BRIDGES
CALIFORNIA FOREST HIGHWAY 148:
SHANTY CREEK CROSSING
AND HIGHWAY 149:
VAN HORN GULCH CROSSING
SOUTH FORK MAD RIVER CROSSING

PROJECT NUMBERS:
148-1(1) AND 149-1(3)

SIX RIVERS NATIONAL FOREST
TRINITY COUNTY

Prepared for:
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION
DENVER, COLORADO

Prepared by:
Jacobs Civil Inc.
A/E Consulting Engineering Services
Contract No. DTFH68-04-D-00002
Task Order Nos. T-08-023 and T-08-028
Jacobs developed a bridge selection report for the widening of 5 single-lane bridge structures located on the Six Rivers National Forest Lands within Trinity County, Northern California. Several types of structures were considered including various steel and concrete structures for each site. Within this Bridge Selection Report, there were three bridge sites where single span, prestressed, precast concrete I girders were proposed. During this evaluation, the design team had not considered using precast concrete arch bridges.

Since publishing the preliminary results of the Bridge Selection Report, the design team has been approached by some of the stakeholders of the project, asking if precast concrete arches were applicable at these sites, and if so, should they be considered in lieu of the I girders.

The design team has reviewed the conceptual layouts and costs of these alternative structures, and has found them to be acceptable solutions for three of the five bridge crossings. The purpose of this technical memorandum is to propose the single span overfilled precast concrete arch bridge structures as a new alternative for the following three locations:

- Site No. 2 on Forest Highway 148: Shanty Creek Crossing at MP 7.7,
- Site No. 4 on Forest Highway 149: Van Horn Gulch Crossing at MP 24.9, and
- Site No. 5 on Forest Highway 149: South Fork Mad River Crossing at MP 27.4.

The main reasons for proposing this new alternative is to:

1. Simplify how major structural elements can be transported and erected at the site
2. Reduce construction time
3. Minimize disruption of traffic during transport to the site, as well as reducing delays to local traffic while the structures are erected.

All of the bridges are located in remote locations, hours away from any major city. As a result, these sites have limited availability of man-power, materials, and equipment as well as increasing transportation costs associated with bringing these resources to the site.

<table>
<thead>
<tr>
<th>Bridge Location</th>
<th>Prestressed Precast Concrete I-Girder Bridge</th>
<th>Precast Concrete Arch Bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Span Length</td>
<td>Total Cost</td>
</tr>
<tr>
<td>Shanty Creek Crossing</td>
<td>88 ft</td>
<td>$945,176</td>
</tr>
<tr>
<td>Van Horn Gulch Crossing</td>
<td>68 ft</td>
<td>$730,364</td>
</tr>
<tr>
<td>South Fork Mad River Crossing</td>
<td>68 ft</td>
<td>$730,364</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>$2,405,904</strong></td>
<td></td>
</tr>
</tbody>
</table>

These estimates do not include the cost of removing the existing bridges, and any permanent retaining walls not attached to the bridges. However, these costs would be similar for both bridge types. The total estimated construction cost of the Prestressed Concrete I-Girder Bridges is approximately $2,405,904. The total estimated construction cost for the overfilled precast concrete arch bridges is $2,380,281. *The bridge span lengths have been verified by the hydraulics report.*
ADVANTAGES OF THE OVERFILLED PRECAST CONCRETE ARCH BRIDGE:

The overfilled precast concrete arch bridge structures exhibit a number of advantages over the traditional cast-in-place concrete, precast prestressed concrete, and steel beam bridges, especially for applications requiring spans ranging up to a hundred feet. These advantages are:

1. We are estimating a 1% lower cost over the Prestressed Precast Concrete I Girder Bridge system.
2. The bridge is lighter in weight, resulting in substantial savings in the construction of the footing by minimizing rock excavation and temporary shoring, etc.
3. It will ensure a long life cycle and low life cycle costs, requiring virtually no maintenance during the life of the bridges.
4. It eliminates the need for expansion joints and the costly maintenance associated with them. It also eliminates the maintenance of exposed bridge decks and bridge deck deicing due to the continuity of the pavement over the bridge.
5. Off-site fabrication allows for better quality control of the modular units and tighter adherence to the specifications.
6. The superstructure can be assembled quickly, usually within days compared to weeks and months for cast-in-place construction, therefore, minimizing road closure and detours.
7. It is aesthetically more pleasing and blends well with the natural surroundings due to the use of a continuous, curved soffit, which is considered to be more pleasant than a structure with girders.
8. It reduces the duration of the dewatering and its costs due to smaller footings compared to the conventional bridge.
9. It can accommodate any vertical profile grade in the bridge after the construction by adjusting the overfill height.
10. It performs very well under the design seismic loading due to the large reserve ductility available in the concrete arch section and has the ability to accommodate the deflections imposed by the ground vibrations without failure.

The disadvantages of the concrete arch bridges:

1. It requires more backfill.
2. More difficulty on delivering the larger precast arch pieces.
3. Requires additional headwalls.

BRIDGE DESIGN AND CONSTRUCTION CONSIDERATION:

All bridge components including the precast concrete arch unit, wingwalls and the foundation will be designed in accordance with the 2007 AASHTO Load and Resistance Factor Design (LRFD) Specifications. The bridge sites are located in close proximity of several active and potential active faults. Therefore, the site-specific response spectra will be developed using source to site distances, appropriate attenuation relationships, expected magnitudes, and actual local site conditions and will be obtained from the geotechnical engineer. It is typically assumed that site-specific studies will provide more accurate acceleration spectra than using the codified standard acceleration spectra.

The bridge span length will be determined by the design flood freeboard requirement. Its arched or vertical-curve profile will meet or exceed the freeboard criterion along at least half of its length with 5-ft of freeboard for 50 years flood, and 1-ft for 100 years flood per Federal Lands Highway Project Development and Design Manual 7.4.3.4. Because of the likelihood of
local scour, the footing will be keyed into bedrock. A hydraulic analysis has been performed on the three bridges proposed to use an arch section. The impact of the bridges on the 100-year water surface and the predicted local scour for both the 100-year and 500-year events is presented in the analysis. Based on comparison of the HEC-RAS model for existing and proposed conditions, all the bridges are equal to or longer at the spring line of the arch. For Bridge #2 – Shanty Creek, the bridge abutments do not encroach into the stream flow, including the 500-year event; therefore, there is no local abutment scour. For Bridge #4 – Van Horn Gulch, the left abutment encroaches into the 100-year flow, and both abutments encroach into the 500-year flow. For Bridge #5 - South Fork of Mad River, the right abutment encroaches into the 100-year flow and both abutments encroach into the 500-year flow. The hydraulic performance and predicted scour of each bridge is discussed in the analysis. Attached are the graphics showing the stream cross-sections with the bridges and the HEC-RAS Standard Table #1 output. For Van Horn Gulch and South Fork Mad Rivers, the scour computations have also been included.

As noted in the preliminary bridge selection report, alternative routes and detours are not readily available. Therefore, the traffic will need to be maintained on the existing bridges while the new structures, or a portion of the new structure, is being constructed. In order to achieve this goal, construction on one half of the new bridge must be completed first while traffic is maintained on the existing structure. Once completed, traffic will then be placed on the new half of the new bridge, while the old structure is removed. The remaining balance of the new structure will then be completed. The segmental precast arch units will be installed with temporary precast headwalls and geotextile retaining wall at each stage to meet the staged construction.

RECOMMENDATION

The alternatives proposed herein have been carefully studied to determine the most functional structure and cost effective at the proposed bridge locations and with consideration given to the following factors: Constructability, Maintenance, Cost and Aesthetics.

The overfilled precast concrete arch bridge structure is preferred because it minimizes the duration of construction and it meets the staged construction requirements. It is also the most cost effective solution; it will require minimal maintenance throughout the life of the structure. Finally, this type of structure will be aesthetically pleasing and blend in well with natural surroundings.
### LUMP SUM STRUCTURE ITEMS

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>UNIT COST</th>
<th>QUANTITY</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CONTECH (Arch, Headwalls, Wingwalls, and Footing)</td>
<td>L.SUM</td>
<td></td>
<td>1</td>
<td>$340,000</td>
</tr>
<tr>
<td></td>
<td>DEWATERING</td>
<td>L.SUM</td>
<td></td>
<td>1</td>
<td>$20,000</td>
</tr>
<tr>
<td></td>
<td>INSTALLATION OF CONTECH</td>
<td>L.SUM</td>
<td></td>
<td>1</td>
<td>$20,000</td>
</tr>
<tr>
<td></td>
<td>STRUCTURAL EXCAVATION</td>
<td>CU. YD.</td>
<td>$50.00</td>
<td>1,000</td>
<td>$50,000</td>
</tr>
<tr>
<td></td>
<td>STRUCTURE BACKFILL</td>
<td>CU. YD.</td>
<td>$100.00</td>
<td>1,500</td>
<td>$150,000</td>
</tr>
<tr>
<td></td>
<td>CONCRETE PAVEMENT SECTION</td>
<td>SQ. YD.</td>
<td>$100.00</td>
<td>206</td>
<td>$20,622</td>
</tr>
<tr>
<td></td>
<td>STRUCTURAL CONCRETE (FOOTING)(F'c = 4,000)</td>
<td>CU. YD.</td>
<td>$800.00</td>
<td>350</td>
<td>$280,000</td>
</tr>
<tr>
<td></td>
<td>TRAFFIC BARRIER</td>
<td>L. FT.</td>
<td>$75.00</td>
<td>110</td>
<td>$8,250</td>
</tr>
<tr>
<td></td>
<td><strong>SUBTOTAL:</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$888,872</strong></td>
</tr>
</tbody>
</table>

Deduct due to shorter time of construction

(When compare to the bridge option)

STAGING CONTRUCTION: -10% $ (88,887)

### TOTAL ALTERNATIVE COST FOR COMPARISON

<table>
<thead>
<tr>
<th>SUBTOTAL:</th>
<th>$ 799,985</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smaller contingency due to the type of construction and duration</td>
<td>CONTINGENCY: 20% $ 159,997</td>
</tr>
<tr>
<td></td>
<td>TOTAL COST: $ 959,982</td>
</tr>
<tr>
<td></td>
<td>TOTAL COST/SF: $ 517.23</td>
</tr>
</tbody>
</table>

Superstructure Type: **Precast Concrete Arch**
Substructure Type: **Parapet walls**
Foundation Type: **Spread Footings**
Number of Spans: 1
Span Lengths (feet): 56
Skew (degrees): 0
Total Length (feet): 58
Out-to-Out Width (feet): 32.0
Area (square feet): 1,856
### LUMP SUM STRUCTURE ITEMS

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>UNIT COST</th>
<th>QUANTITY</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CONTECH (Arch, Headwalls, Wingwalls, and Footing)</td>
<td>L.SUM</td>
<td></td>
<td>1</td>
<td>$330,000</td>
</tr>
<tr>
<td></td>
<td>DEWATERING</td>
<td>L.SUM</td>
<td></td>
<td>1</td>
<td>$20,000</td>
</tr>
<tr>
<td></td>
<td>INSTALLATION OF CONTECH</td>
<td>L.SUM</td>
<td></td>
<td>1</td>
<td>$20,000</td>
</tr>
<tr>
<td></td>
<td>STRUCTURAL EXCAVATION</td>
<td>CU. YD.</td>
<td>$50.00</td>
<td>700</td>
<td>$35,000</td>
</tr>
<tr>
<td></td>
<td>STRUCTURE BACKFILL</td>
<td>CU. YD.</td>
<td>$100.00</td>
<td>1,000</td>
<td>$100,000</td>
</tr>
<tr>
<td></td>
<td>CONCRETE PAVEMENT SECTION</td>
<td>SQ. YD.</td>
<td>$100.00</td>
<td>220</td>
<td>$22,044</td>
</tr>
<tr>
<td></td>
<td>STRUCTURAL CONCRETE (FOOTING) (F’C = 4,000)</td>
<td>CU. YD.</td>
<td>$800.00</td>
<td>166</td>
<td>$132,800</td>
</tr>
<tr>
<td></td>
<td>TRAFFIC BARRIER</td>
<td>L. FT.</td>
<td>$75.00</td>
<td>125</td>
<td>$9,375</td>
</tr>
</tbody>
</table>

**Subtotal:** $669,219

Deduct due to shorter time of construction

STAGED CONSTRUCTION: -10% $(66,922)

**Total Alternative Cost for Comparison**

<table>
<thead>
<tr>
<th></th>
<th>SUBTOTAL:</th>
<th>CONTINGENCY:</th>
<th>TOTAL COST:</th>
<th>TOTAL COST/SF:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smaller contingency due to the type of construction and duration</td>
<td>$602,298</td>
<td>20% $120,460</td>
<td>$722,757</td>
<td>$364.29</td>
</tr>
</tbody>
</table>

**Total cost per square foot:** $364.29

Superstructure Type: **Precast Concrete Arch**
Substructure Type: **Parapet walls**
Foundation Type: **Spread Footings**
Number of Spans: 1
Span Lengths (feet): 60
Skew (degrees): 0
Total Length (feet): 62
Out-to-Out Width (feet): 32.0
Area (square feet): 1,984
### SIX RIVERS NATIONAL FOREST, TRINITY COUNTY

**SOUTH FORK MAD RIVER BRIDGE - OVERFILLED PRECAST CONCRETE ARCH BRIDGE**

<table>
<thead>
<tr>
<th>ITEM NUMBER</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>UNIT COST</th>
<th>QUANTITY</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CONTECH (Arch, Headwalls, Wingwalls, and Footing)</td>
<td>L.SUM</td>
<td></td>
<td>1</td>
<td>$305,000</td>
</tr>
<tr>
<td></td>
<td>DEWATERING</td>
<td>L.SUM</td>
<td></td>
<td>1</td>
<td>$20,000</td>
</tr>
<tr>
<td></td>
<td>INSTALLATION OF CONTECH</td>
<td>L.SUM</td>
<td></td>
<td>1</td>
<td>$20,000</td>
</tr>
<tr>
<td></td>
<td>STRUCTURAL EXCAVATION</td>
<td>CU. YD.</td>
<td>$50.00</td>
<td>1,000</td>
<td>$50,000</td>
</tr>
<tr>
<td></td>
<td>STRUCTURE BACKFILL</td>
<td>CU. YD.</td>
<td>$100.00</td>
<td>1,500</td>
<td>$150,000</td>
</tr>
<tr>
<td></td>
<td>CONCRETE PAVEMENT SECTION</td>
<td>SQ. YD.</td>
<td>$100.00</td>
<td>206</td>
<td>$20,622</td>
</tr>
<tr>
<td></td>
<td>STRUCTURAL CONCRETE (FOOTING)(F'C = 4,000)</td>
<td>CU. YD.</td>
<td>$800.00</td>
<td>90</td>
<td>$72,000</td>
</tr>
<tr>
<td></td>
<td>TRAFFIC BARRIER</td>
<td>L. FT.</td>
<td>$75.00</td>
<td>110</td>
<td>$8,250</td>
</tr>
</tbody>
</table>

**SUBTOTAL:** $645,872

Deduct due to shorter time of construction

STAGED CONTRUCTION: -10% $ (64,587)

<table>
<thead>
<tr>
<th>TOTAL ALTERNATIVE COST FOR COMPARISON</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBTOTAL: $ 581,285</td>
</tr>
<tr>
<td>CONTINGENCY: 20% $ 116,257</td>
</tr>
<tr>
<td>TOTAL COST: $ 697,542</td>
</tr>
<tr>
<td>TOTAL COST/SF: $ 375.83</td>
</tr>
</tbody>
</table>

Superstructure Type: **Precast Concrete Arch**

Substructure Type: **Parapet walls**

Foundation Type: **Spread Footings**

Number of Spans: 1

Span Lengths (feet): 56

Skew (degrees): 0

Total Length (feet): 58

Out-to-Out Width (feet): 32.0

Area (square feet): 1,856
<table>
<thead>
<tr>
<th>SIX RIVERS NATIONAL FOREST, TRINITY COUNTY</th>
<th>OVERFILLED PRECAST CONCRETE ARCH BRIDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHANTY CREEK BRIDGE: $ 959,982</td>
<td></td>
</tr>
<tr>
<td>VAN HORN GULCH CREEK BRIDGE: $ 722,757</td>
<td></td>
</tr>
<tr>
<td>SOUTH FORK MAD RIVER BRIDGE: $ 697,542</td>
<td></td>
</tr>
<tr>
<td><strong>Summary Total:</strong> $ 2,380,281</td>
<td></td>
</tr>
</tbody>
</table>
MEMORANDUM

TO: CHRIS LONGLEY
FROM: OSCAR OLIDEN
SUBJECT: SIX RIVERS NATIONAL FOREST, TRINITY COUNTY: FHWA PROJECT- 148-1(1) & 149-1(3)
DATE: 1/3/2009
CC: BERWYN WILBRINK

This memo is in response to the comments brought forth by Chris Longley of the FHWA regarding the technical memo for the Trinity County Bridges, project numbers 148-1(1) and 149-1(3). In order to address each remark, a bulleted format will be used for each comment.

- Add paragraph of how we can reduce the span lengths by up to 34' with the arch bridge. Will the vertical profile still remain the same?

  Answer: A hydraulic analysis has been performed on the three bridges proposed to use an arch section. The impact of the bridges on the 100-year water surface and the predicted local scour for both the 100-year and 500-year events is presented in the attached analysis.

- Revise cost estimates for both the girder and arch bridges to include more recent cost data. Specifically increase the cost of structural concrete, structure excavation, backfill, and barrier. Contact Karl Eikermann for assistance with recent CFL cost data.

  Answer: The cost estimate has been revised to represent the values provided by Karl. We believe the cost per cubic yard of concrete for the substructure is excessive at $1,200/cubic. We have obtained different values from similar projects in the area and we think the values for substructure ought to be close to $800/cubic yard. The substructures for these footings are rectangular in shape using very little forming, making it less expensive.

- List disadvantages as well as advantages for these structures. Memo appears biased towards these structures. Will structure need to be wider? Will slope protection be more difficult? More backfill required, do we have a material source? Smaller opening, will this be more difficult with construction or hydraulics?

  Answer: Actually there are not many disadvantages for this particular case. Some may be the need for more backfill, more difficulty on delivering the larger precast arch pieces and additional headwalls are required.

  Answer: The precast concrete arch bridge will have similar width as the precast prestressed concrete I girder bridges.
Answer: Slope protection may not be required at all for either the precast concrete I girder bridges or the precast concrete arch bridge, all the substructures are going to be founded on bedrock.

Answer: More backfill is required but the volume is not excessive. We have not researched the availability of backfill source or are not aware of any local backfill in the area. Though, the backfill material could be hauled from outside sources.

Answer: The size of the opening does not affect the constructability of the precast arch option and hydraulically it has been engineered not to affect the hydraulics of the river.

- Advantage # 1 - revise "other concrete systems" to "Prestressed Precast Concrete I - Girder Bridge" if this is the intent.

Answer: Yes, it was the intent. This has been updated.

- Advantage # 4 – Does this apply to this project?

Answer: Yes it does. Normally we would have expected to place an expansion joint; therefore, by not doing so, these maintenance costs are eliminated. Also, since the bridge is buried, no deicing system is required.

- Advantage # 6 – Are we saying it can be constructed within a couple of days? This seems misleading.

Answer: Normally the superstructure can be constructed in 24 hours. We were actually conservative providing 2 days for the time frame to erect the superstructure. Note this applies only to the bridge superstructure and not the time frame for completion of the entire project. Another consideration is the need for stage construction with either option which will increase the construction time for both options.

- Advantage # 7 - Whose judgment is it that this structure is aesthetically more pleasing and blends with the natural environment? It is a concrete structure, how does that blend?

Answer: Bridge speaking it is customarily to say that a structure with a continuous soffit is considered to be more pleasant than a structure with girders. Additionally, the soffit will be curved providing further aesthetic appeal rather than straight lines.

- Two of the proposed structures are shorter than existing. May need to reconsider their lengths to at least match existing. Has the backwater elevations and potential increased scour concerns been looked into by hydraulics?

Answer: A hydraulic analysis has been performed on the three bridges proposed to use an arch section. The impact of the bridges on the 100-year water surface and the predicted local scour for both the 100-year and 500-year events is presented in the analysis. Based on comparison of the HEC-RAS model for
existing and proposed conditions, all the bridges are equal to or longer at the spring line of the arch. For Bridge #2 – Shanty Creek, the bridge abutments do not encroach into the stream flow, including the 500-year event; therefore, there is no local abutment scour. For Bridge #4 – Van Horn Gulch, the left abutment encroaches into the 100-year flow, and both abutments encroach into the 500-year flow. For Bridge #5 – South Fork of Mad River, the right abutment encroaches into the 100-year flow and both abutments encroach into the 500-year flow. The hydraulic performance and predicted scour of each bridge is discussed in the analysis. Attached are the graphics showing the stream cross-sections with the bridges and the HEC-RAS Standard Table #1 output. For Van Horn Gulch and South Fork Mad Rivers, the scour computations have also been included.
MEMORANDUM

TO: KARL EIKERMANN
FROM: OSCAR OLIDEN
SUBJECT: SIX RIVERS NATIONAL FOREST, TRINITY COUNTY: FHWA PROJECT- 148-1(1) & 149-1(3)
DATE: 1/3/2009
CC: BERWYN WILBRINK

This memo is in response to the comments from Karl Eikermann with FHWA regarding the cost for some of the items for the Trinity County Bridges, project numbers 148-1(1) and 149-1(3). In order to address each remark, a bulleted format will be used for each comment.

- I think your cost for the p/s girder bridge should be increased if you still plan on having the deep vertical abutment walls on spread footings to account for all the extra excavation and concrete quantities. With bridges like this it is pretty hard to estimate a halfway accurate sq. ft. cost. I suggest you estimate the main bridge quantities based on your TSLs then do an itemized estimate. I think this will give you a truer comparison with the itemized Contech alternative you already did.

  Answer: One of the main reasons why the precast concrete arch bridge was brought for discussion was primarily due to the shorter construction time it will take to erect these structures. We believe this feature adds more benefit than cost itself. The preliminary cost estimate for the precast concrete arch bridge structure is an extension of the original Type Selection Report submitted in 2005 to FHWA, showing the estimated costs based on cost per square foot rather than an itemized estimate. To extrapolate the 2005 costs to today’s costs, we have added a conservative 8.8% increase in cost (we believe it could be much higher) to the preliminary estimate done as cost per square foot.

- I think Regarding the Contech structure I would revise your unit costs as follows: structure excavation $50/CY (this could be more if you anticipate a lot of rock); structure backfill $100/CY (this could be cheaper if you are able to use the material that is being excavated); structural concrete $1200/CY; traffic barrier $75/ft; concrete pavement section $100/SY (is this part of the structure?) These figures are based on FLH bridge data in California we have compiled (with CALTRANS cost data considerations). The last two figures are more roadway related that I used our historical cost data to estimate. Anita may have better info on these. If you revise your Contech estimate with the figures I am giving you it looks like the bridge may be a more economical alternative, so this would be another reason to itemize the bridge estimate. You can use those figures for doing your itemized bridge estimate, and I can help you with other items if you need it.
Answer: We are accepting the revised unit costs as described above except for the structural concrete. We have done some research ourselves and have found costs much lower than $1200/CY of concrete for substructure work. The $1200/CY is typical of superstructure costs. The structural concrete in this case is for substructure concrete where small trench footings are required and forming of the footing is minimal; falsework is not required. Simple reinforcing steel cages will be required and concrete delivery could be provided from the truck. We are attaching concrete costs from similar jobs showing lower costs. We think a cost of $800/CY is more reasonable.