# Appendix C

## Bridge Memorandum

**GRAVINA ISLAND ACCESS**

***BRIDGE MEMORANDUM***

**AMENDMENT № 23, ACTIVITY 001, TASK 20 – ENGINEERING ESTIMATES**

STATE OF ALASKA
49TH
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7·31·09
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**July 2009**

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# BRIDGE ACTIVITY SUMMARY

Amendment #23 was issued for the purpose of producing a Supplemental Environmental Impact Statement (SEIS). From a bridge engineering perspective, the SEIS is to evaluate the previously identified alignment alternatives and determine if any adjustments are feasible/appropriate with respect to providing a more economical alternative. The SEIS is also to update the costs for the identified alternatives from 4th quarter 2004 to 1st quarter 2008. The specific bridge activities are as follows.

## Task 20-1 - Review of the FEIS Alignments and Structure Types

This task consisted of the review of the Final Environmental Impact Statement (FEIS) alignments (F1, F3, C3a, C3b, C4, and D1) to determine if there were any minor adjustments that could be made to the alignment and span arrangements to improve the economy of the alternatives. It was determined that while minor adjustments could be incorporated, none of the adjustments substantially revised the bridge configurations proposed in the FEIS. As a result it was concluded that adjustments to the alternatives in the FEIS were not warranted as they would not afford any meaningful cost reductions for the proposed facilities.

## Task 20-2 - Review of the FEIS Quantities

This task involved the review of the quantity determinations for the cost estimates in the FEIS. Specifically, the bridge quantities for preferred Alignment F1 were checked for reasonableness based on the proposed structures and available data for similar/comparable structures that have been constructed in the past. The quantities for reinforcing steel and post-tensioning were reduced somewhat as a result of this review. The quantity verification effort for F1 was then pro-rated to the other FEIS alignments (F3, C3a, C3b, C4, and D1) with adjustments as required to accommodate the variations between the respective alternatives and F1 (as was done for the FEIS effort).

The quantities for the single bridge alignments (C3a, C3b, C4 and D1) were also adjusted to address the curvature of the approach spans (and in some cases where the curvature carries onto the main span over the navigational channel). While the curvature was previously recognized, there were no attempts to quantify the cost implications because it was indicated that level of refinement was unwarranted based on the assumption that funding was available for the preferred F1 alignment. Without additional computational effort to advance the level of design (from a conceptual level to a level in excess of a preliminary design effort) it is difficult to quantify the cost implications attributable to the curvature. Let it suffice to say that the conditions are essentially unprecedented in balanced cantilever construction and would result in severe torsional considerations. It is anticipated that the superstructure in the curved sections would have to be strengthened considerably to provide the required capacity for the cantilever condition. For estimating purposes it was assumed that the structural quantities (concrete, reinforcing steel, and post-tensioning) in the curved sections would increase by 50 percent. It was also assumed that the quantities for the main piers (foundations, concrete, reinforcing steel, and post-tensioning) would increase by 100 percent and an additional pier would be required at the back-span. As a result, there is a significant increase in the cost of the single bridge alignments above and beyond the cost escalation considerations from 2004 to 2008.

## Task 20-3 - Update of the FEIS Cost Estimates

This task involved adjusting the cost estimates developed for the FEIS alternatives from the 4th quarter of 2004 to the 1st quarter of 2008. The effort was based on the previously determined quantities adjusted as noted above, and consideration of contractor operations. These additional considerations included the cost of cofferdams and bubbler systems to allow year-round in-water construction, and additional sets of form travelers to facilitate more efficient construction. The cost of fenders at in-water piers was also included.

In summary, there is approximately a 20% and 22% increase in structure cost for the F1 and F3 alignments respectively over the estimates provided in the FEIS, 17% of which is essentially attributable to the cost of inflation (i.e., the quantity adjustments had a relatively minimal impact). The balance of the increase in cost is attributable to provisions for cofferdams, bubbler systems, additional form travelers, and fenders. An increase of 55% to 70% is presented for C3a, C3b, C4 and D1. That increase is similarly due to the cost of inflation, cofferdams, bubbler systems, additional form travelers, and fenders, but was also significantly impacted by the adjustment in quantities to account for the effects of the curvature of the alignments.

**Table 1 -Estimate of Probable Bridge Construction Cost – FEIS Alignments***

| Alignment | Substructure Cost | Superstructure Cost | Total Cost | Cost/SF Deck Area |
|---|---|---|---|---|
| F1 West | $54M | $47M | $101M | $796 |
| F1 East | $75M | $64M | $139M | $796 |
| F3 West | $55M | $47M | $102M | $805 |
| F3 East | $44M | $38M | $82M | $805 |
| C3a | $175M | $160M | $335M | $961 |
| C3b | $139M | $100M | $240M | $1101 |
| C4 | $170M | $141M | $311M | $1216 |
| D1 | $110M | $85M | $195M | $1060 |

* See Supporting Quantity and Cost Information (some rounding will occur).

## Task 20-4 - Consideration of a Steel Structure Alternative at the F3 West Channel Crossing

Steel bridge alternatives were evaluated for the purpose of establishing a cost per square foot basis of comparison to the proposed concrete segmental bridge in the FEIS. The consideration of various steel alternatives was as noted below. A brief summary discussion is provided relative to each of the alternatives. Note that the “per square foot cost” for the alternatives was based on recent similar projects and historical data for similar type bridges. The derived cost is based on those comparable costs adjusted for geographic location, date of construction, and project dissimilarities that would impact cost.

The previous cost estimating exercises associated with this project indicated that the cost of in-water substructure, and in particular deep-water construction in close proximity to the track lines, resulted in the greatest contribution to the overall cost of the bridge (due to deep-water construction considerations and ship impact design considerations). Given that assessment, it was deduced that the avenue to a more economical facility was to minimize deep-water foundations and cruise ship impact considerations, or eliminate in-water construction altogether. Note that in-water construction is also constrained by environmental considerations (work in marine waters may occur July 1st through February 28th.except for blasting, dredging, and pile driving which can occur only between November 1st and February 28th) and would lengthen the number of construction seasons required to complete any alternative requiring in-water construction unless cofferdams and bubbler systems (or other similar mitigation measures) could be successfully implemented.

The following traditional steel bridge alternatives were considered: girder, arch, truss, and cable-stayed. The first three alternatives (girder, arch, and truss type bridges) were dropped from consideration by inspection (based on the physical requirements of the site, physical limitations of the systems, and experience). Specifically, a girder bridge is not an appropriate bridge type given the required span; an arch bridge is not an appropriate bridge type given the physical characteristics of the site and the required span and navigational opening; and, a truss bridge is not an appropriate bridge type given the required span, and initial and life-cycle cost considerations.

While not an ideal site from a topographical perspective, a cable-stayed alternative is an appropriate bridge type for this location. A number of variations were considered before the proposed configuration was deemed the most beneficial. The variations included a shorter main span of 1100 feet that required an in-water pier near Gravina Island along with several approach spans, and a 1600-foot main span alternative (page 7) that resulted in both piers on land with no need for approach piers. It was concluded that the latter configuration is the most beneficial as it simplifies the structure, eliminates in-water construction, and eliminates ship impact considerations on the design of the bridge. Traditionally, longer spans translate into more cost, but we are of the opinion that the above considerations offset the cost effect of the longer span. Also note that a span of 1100 to 1600 feet is well within the economical range of a cable-stayed bridge. (See Plan, Elevation, and Section Sketches.)

As a variation of the concrete segmental box girder bridge proposed in the FEIS, a similar concrete segmental box girder bridge utilizing a steel drop-in span over the navigational channel was also considered. The concrete segmental box girder alternative with a steel drop-in span takes advantage of the economy of concrete segmental construction and the lighter weight of a structural steel section. The reduction in dead load due to the steel drop-in span (page 8) increases span capability over that of a traditional concrete segmental box girder. While the proposed configuration still requires in-water construction, it eliminates the need for a deep-water pier adjacent the navigational opening. Elimination of deep-water construction and the need to design for cruise ship impact offsets the higher unit cost of the steel drop-in section. (See Plan, Elevation, and Section Sketches.)

**Table 2 -Estimate of Probable Bridge Construction Cost – F3 West Channel Alternatives***

| Alternative | Substructure Cost | Superstructure Cost | Total Cost | Cost/SF Deck Area |
|---|---|---|---|---|
| Stayed | $32M | $112M | $144M | $850 |
| Drop-in | $48M | $58M | $106M | $793 |

* See Supporting Quantity and Cost Information.

## Task 20-5 - Consideration of an F3 Variant

This task involved re-assessment of the F3 alignment bridge alternatives assuming that previously imposed constraints could be adjusted. These constraints included the use of approach embankment to water's edge, approach embankment beyond water's edge, and relocation of track lines. The implementation of approach embankment is to take advantage of readily available and easily assessable rock material in the area. The use of embankment allows the length of structure to be reduced considerably taking advantage of the lower unit cost of the embankment. For the configuration where the embankment construction extends beyond water's edge, it was assumed that it was practical and economically feasible to place embankment to a depth of 40 feet. The engineering parameters that were assumed were that embankment material above water's edge could be placed and maintained at a 2:1 slope. Material placed below water was assumed to be placed at 3:1, and on the slope of the bottom at the toe of the embankment at no greater than 10%. It was assumed that the fills that extended beyond water's edge would be constructed from landside out using the advancing embankment as egress, except where the bottom exceeds 10% where it was assumed that the embankment would have to be built from the water on barges and constructed back towards land to buttress the construction. The limits of the embankment were not permitted to encroach into the navigation opening above -40 feet below MLLW.

Such consideration at F3 resulted in two revised bridge configurations. One lends itself to a cable-stayed alternative with a single deep water pylon and symmetric spans of 880 feet (page 10) over West Channel. The other lends itself to a segmental concrete box girder with a main span of 700 feet (page 9). Costs were also developed for a cable-stayed and a segmental concrete box girder structures over East Channel (pages 12 and 11). A plan, elevation and typical section of each configuration are provided herein and the associated construction cost estimates are provided below.

**Table 3 -Estimate of Probable Bridge Construction Cost – F3 Variants***

| Alternative | Substructure Cost | Superstructure Cost | Total Cost | Cost/SF Deck Area |
|---|---|---|---|---|
| West Segmental | $52M | $32M | $84M | $958 |
| East Segmental | $78M | $32M | $110M | $1,261 |
| West Stayed | $42M | $59M | $101M | $1,113 |
| East Stayed | $43M | $57M | $100M | $1,149 |

* See Supporting Quantity and Cost Information (some rounding will occur).

## Task 20-6 - Consideration of a C3-4 Variant

A refinement of alignment C3a using the Borough's proposed Bypass (or Bench) Road to Signal Road near the Wal-Mart parking lot rather than a large cut to North Tongass Avenue will save the cost of providing a curved structure at the east abutment. In addition, if the track line location is allowed to be adjusted, the main span and back spans of the crossing can be constructed on tangent. The curve at the transition pier and west approach tangent could then be constructed using precast concrete girders. Several variations are possible at the west approach. Chorded precast girders (page 14) or cast-in-place concrete girders built on falsework (page 13) can be used on the curved portion of the alignment. The tangent spans can be comprised of conventional precast girder spans to approximately 150 feet or spliced precast girders can be used to reduce the number of piers. (See Plan, Elevation, and Section Sketches.)

**Table 4 -Estimate of Probable Bridge Construction Cost – C3-4 Variants***

| Alternative | Substructure Cost | Superstructure Cost | Total Cost | Cost/SF Deck Area |
|---|---|---|---|---|
| A: CIP & PC | $104M | $60M | $164M | $765 |
| B: PC | $112M | $53M | $165M | $770 |

* See Supporting Quantity and Cost Information.

## Observations

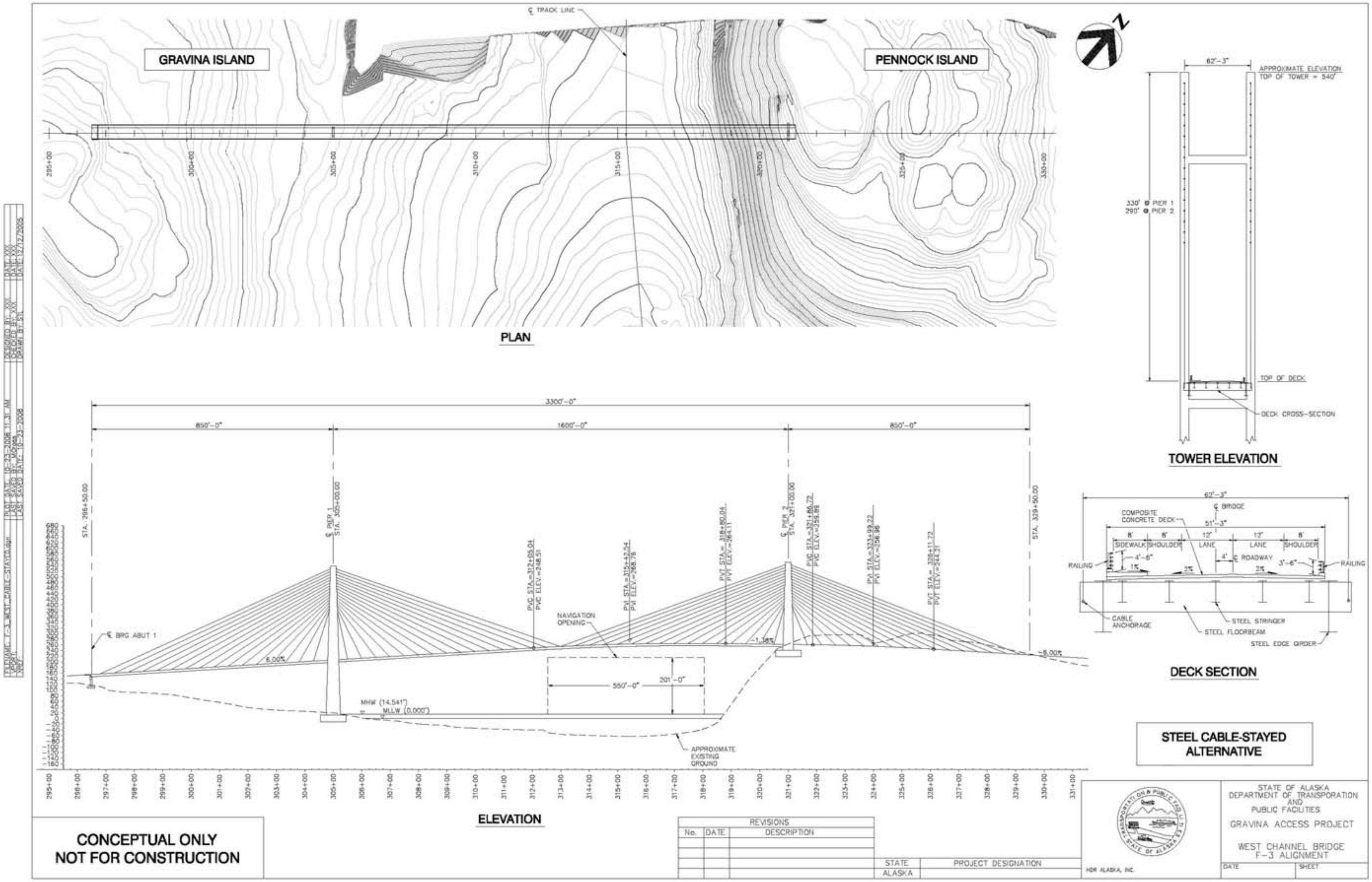
The cost of providing an all-weather hard link from Revilla Island to Gravina Island on any of the previously established FEIS alignments is more costly today than it was in 2004. This is primarily attributable to inflation, although it can be noted that the costs of the structures on the single bridge alignments have also increased substantially due to the attempt to quantify the effects of the curvature of the approaches.

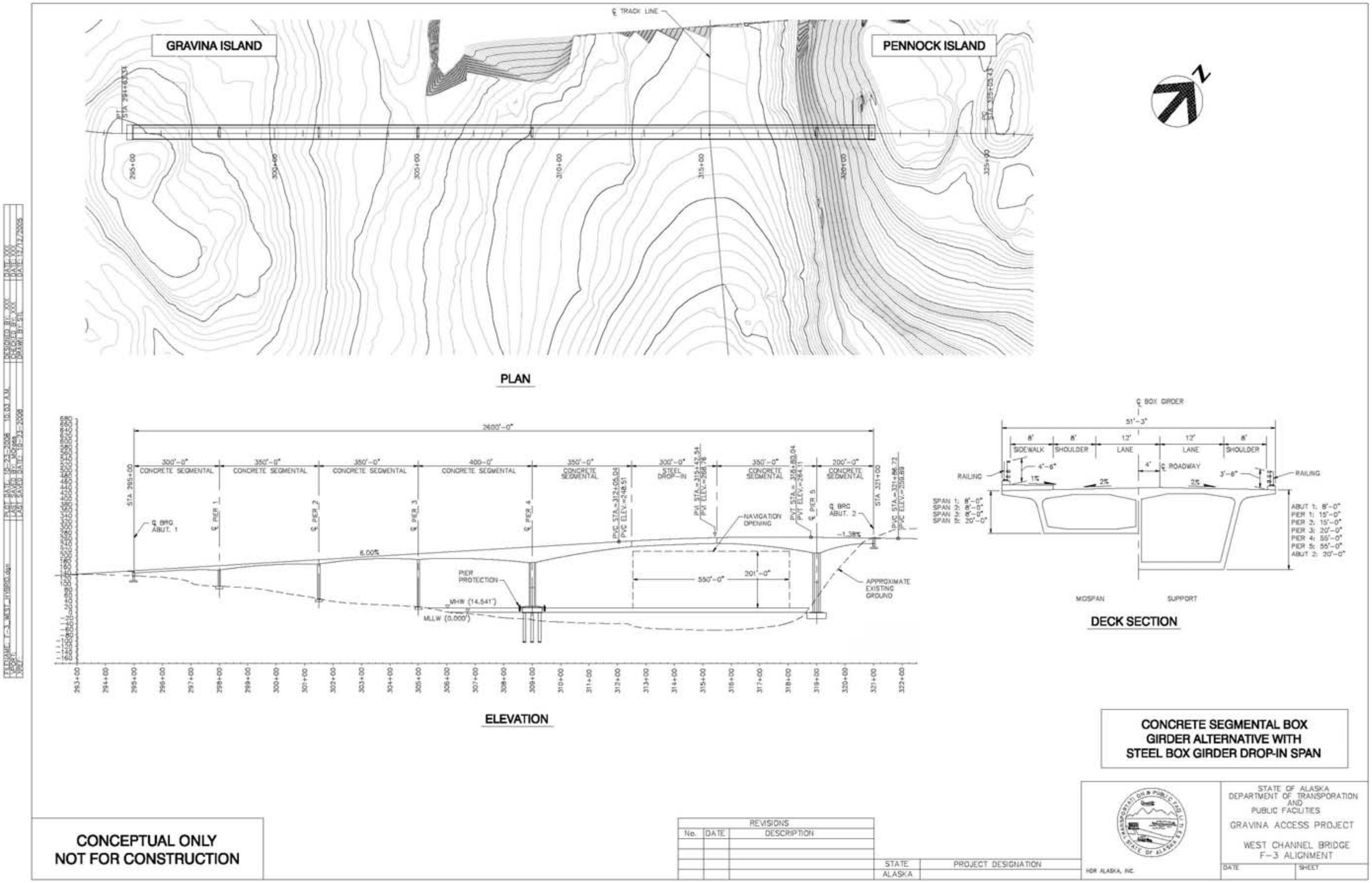
It should also be noted that based on the evaluation of a steel cable-stayed and steel drop-in span alternative for the crossing of the west channel of the F3 alignment, consideration of previously dismissed structure types may provide a more economical solution than the currently proposed concrete segmental box girder structure. It is intuitive that a facility that minimizes/eliminates in-water construction would be a preferred alternative, as long as the configuration did not push the envelope of applicability of the proposed structure type. The reduction/elimination of in-water construction minimizes construction risk, reduces design demands by eliminating cruise ship impact considerations, reduces environmental impacts, and reduces potential construction season restrictions and mitigations measures. The cost estimates provided herein indicate that the steel alternatives are reasonably close in cost to the segmental box girder alternative. Thus, should it be determined that the F3 alignment has merit from a funding perspective, it is recommended that the steel alternatives and segmental concrete box girder alternative be revisited and developed to a level comparable to the segmental concrete box girder alternative on the F1 alignment to insure that structure type selection is based on comparable levels of design development. Note however, even if refinement efforts fail to result in a substantially lower cost estimate for the steel alternatives, the construction risk associated with the steel alternatives would be significantly less than that of the segmental concrete box girder alternative. Less risk generally translates into a lower bid-day price and a lower project close-out cost due to a reduced potential for claims.

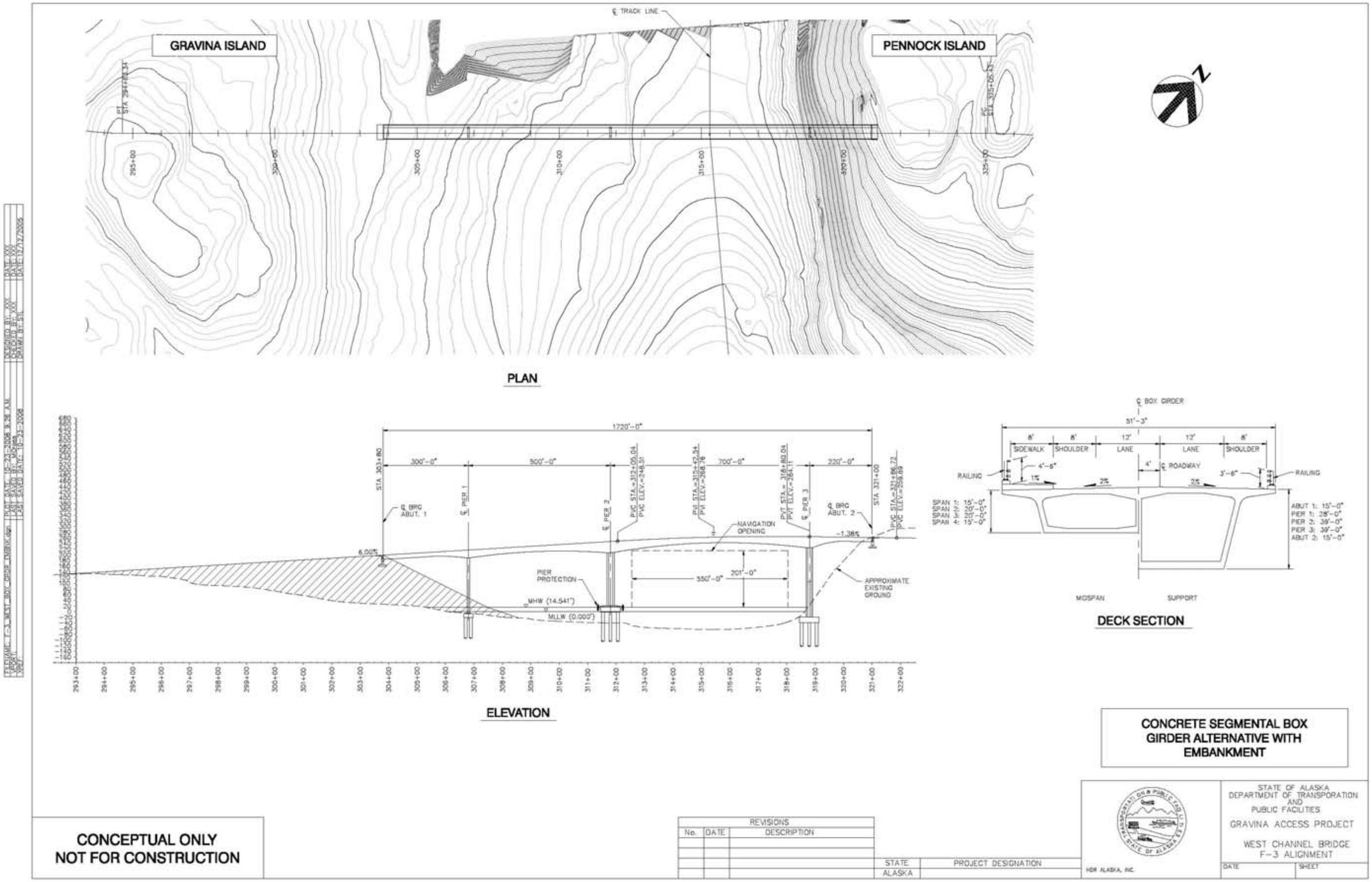
The F3 variant configurations resulted in shorter bridge lengths but higher bridge costs due to additional in-water pier construction required by the revised spans.

Another observation resulting from this exercise is that a single bridge alternative (on an "airport alignment") is economically competitive if certain allowances are made with respect to some of the previously established design criteria (e.g., design speed, track line location, etc.). Such adjustments allow the cost associated with curvature on the back and/or main spans to be eliminated. In addition to resulting in a lower bridge cost, an airport alignment could conceivably be constructed at a lower overall project cost due to a reduction in cost for roadway and other considerations. However, as noted above for the previous tasks addressed herein, it is important to recognize that while the estimated construction costs for all of the alternatives are reasonably comparative, the basis for the costs vary (i.e., some are based on conceptual level engineering and some are based on proration). Given that, it is recommended that any alternatives that are to be advanced for further study (i.e., formal type study) be developed to a comparable level of design to insure that alternative selection is based on a comparable level of cost estimates.

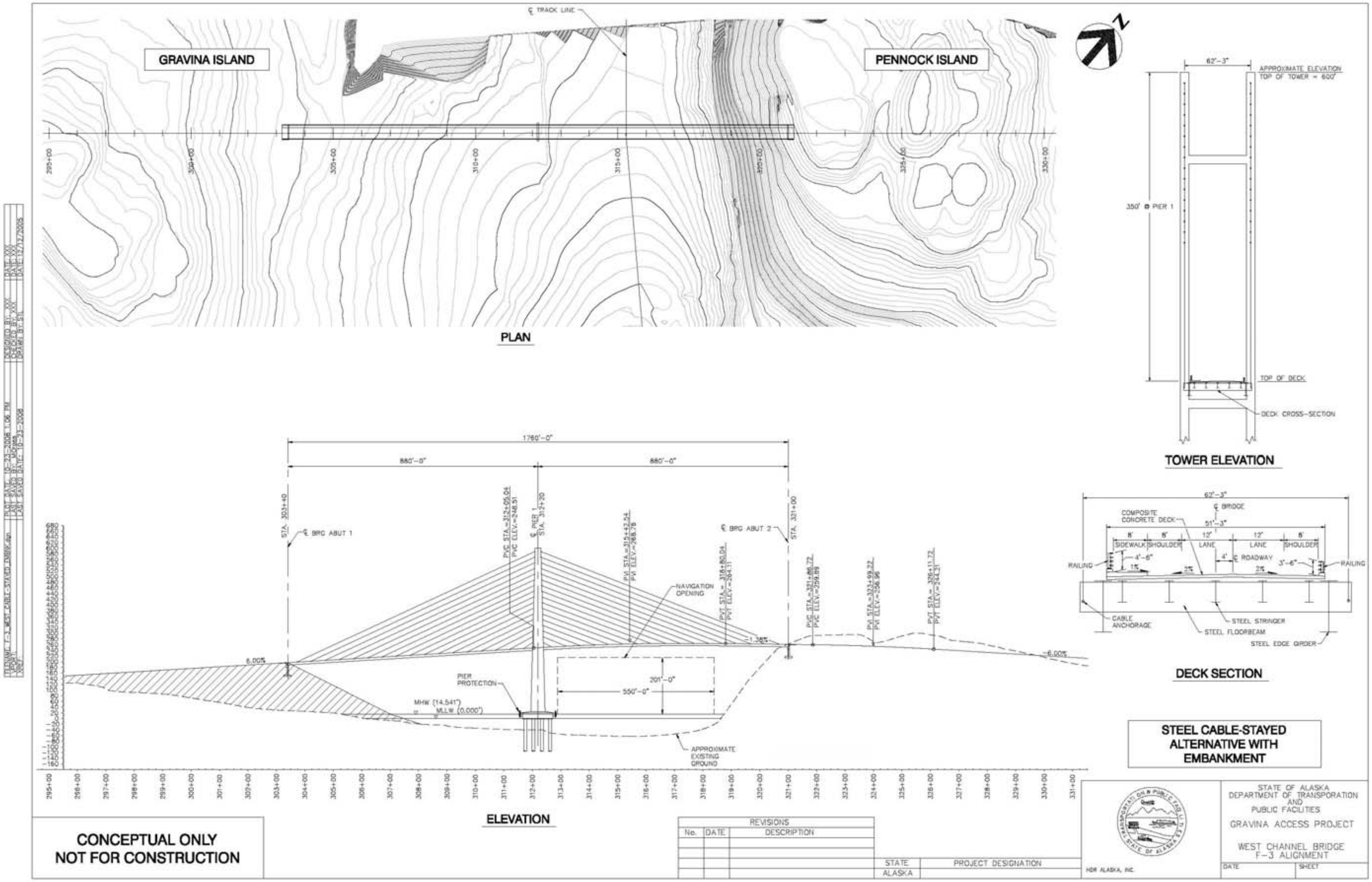
# PLAN, ELEVATION AND SECTION SKETCHES


GRAVINA ISLAND
PENNOCK ISLAND
TRACK LINE
PLAN
TOWER ELEVATION
APPROXIMATE ELEVATION TOP OF TOWER = 540'
62'-3"
330' @ PIER 1
290' @ PIER 2
TOP OF DECK
DECK CROSS-SECTION
3300'-0"
850'-0"
1600'-0"
850'-0"
STA. 296+50.00
PIER 1 STA. 305+00.00
PIER 2 STA. 321+00.00
STA. 329+50.00
NAVIGATION OPENING
550'-0"
201'-0"
BRG ABUT 1
6.00%
-5.00%
MHW (14.541')
MLLW (0.000')
APPROXIMATE EXISTING GROUND
ELEVATION
DECK SECTION
COMPOSITE CONCRETE DECK
BRIDGE
51'-3"
SIDEWALK
SHOULDER
LANE
ROADWAY
RAILING
CABLE ANCHORAGE
STEEL STRINGER
STEEL FLOORBEAM
STEEL EDGE GIRDER
STEEL CABLE-STAYED ALTERNATIVE
CONCEPTUAL ONLY
NOT FOR CONSTRUCTION
REVISIONS
No.
DATE
DESCRIPTION
STATE
ALASKA
PROJECT DESIGNATION
HDR ALASKA, INC.
STATE OF ALASKA
DEPARTMENT OF TRANSPORATION AND PUBLIC FACILITIES
GRAVINA ACCESS PROJECT
WEST CHANNEL BRIDGE
F-3 ALIGNMENT
DATE
SHEET

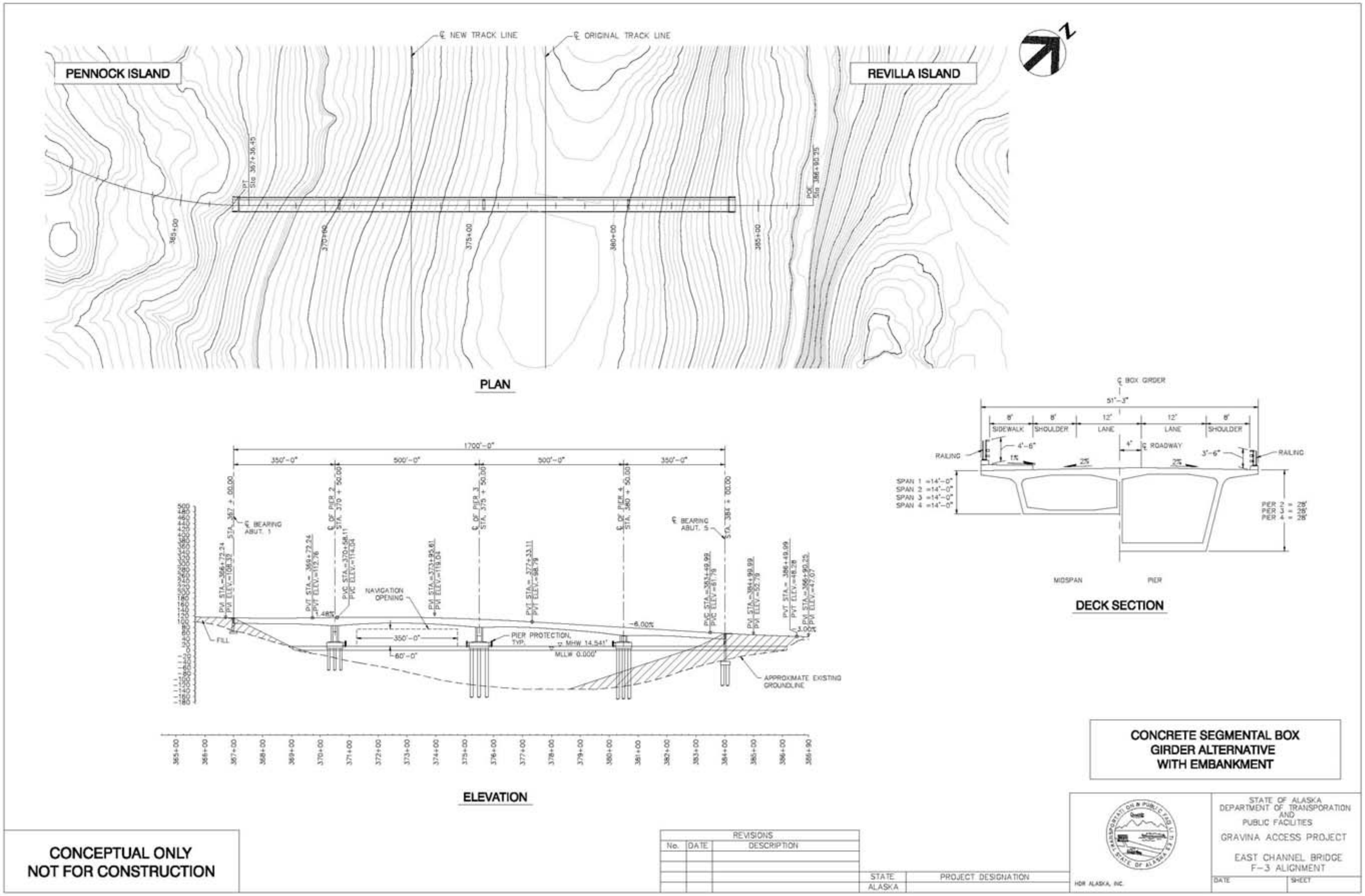

GRAVINA ISLAND
PENNOCK ISLAND
PLAN
ELEVATION
DECK SECTION
CONCRETE SEGMENTAL BOX GIRDER ALTERNATIVE WITH STEEL BOX GIRDER DROP-IN SPAN
CONCEPTUAL ONLY
NOT FOR CONSTRUCTION
STATE OF ALASKA
DEPARTMENT OF TRANSPORATION AND PUBLIC FACILITIES
GRAVINA ACCESS PROJECT
WEST CHANNEL BRIDGE
F-3 ALIGNMENT



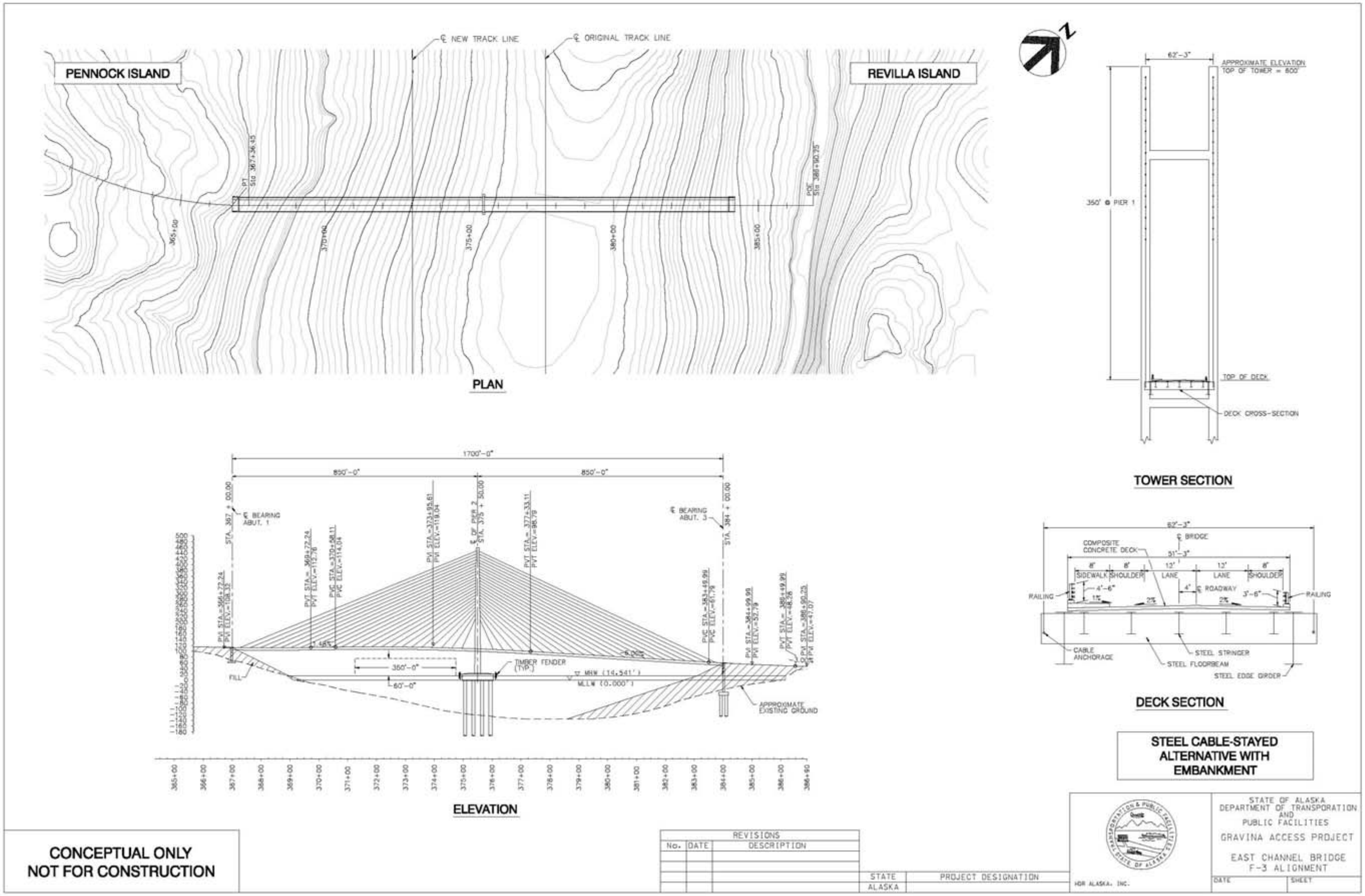
GRAVINA ISLAND
PENNOCK ISLAND
PLAN
ELEVATION
1720'-0"
300'-0"
500'-0"
700'-0"
220'-0"
NAVIGATION OPENING
550'-0"
201'-0"
PIER PROTECTION
MHW (14.541')
MLLW (0.000')
APPROXIMATE EXISTING GROUND
DECK SECTION
SIDEWALK
SHOULDER
LANE
LANE
SHOULDER
RAILING
RAILING
MIDSPAN
SUPPORT
CONCRETE SEGMENTAL BOX GIRDER ALTERNATIVE WITH EMBANKMENT
CONCEPTUAL ONLY
NOT FOR CONSTRUCTION
REVISIONS
No.
DATE
DESCRIPTION
STATE
ALASKA
PROJECT DESIGNATION
STATE OF ALASKA
DEPARTMENT OF TRANSPORATION AND PUBLIC FACILITIES
GRAVINA ACCESS PROJECT
WEST CHANNEL BRIDGE
F-3 ALIGNMENT
DATE
SHEET

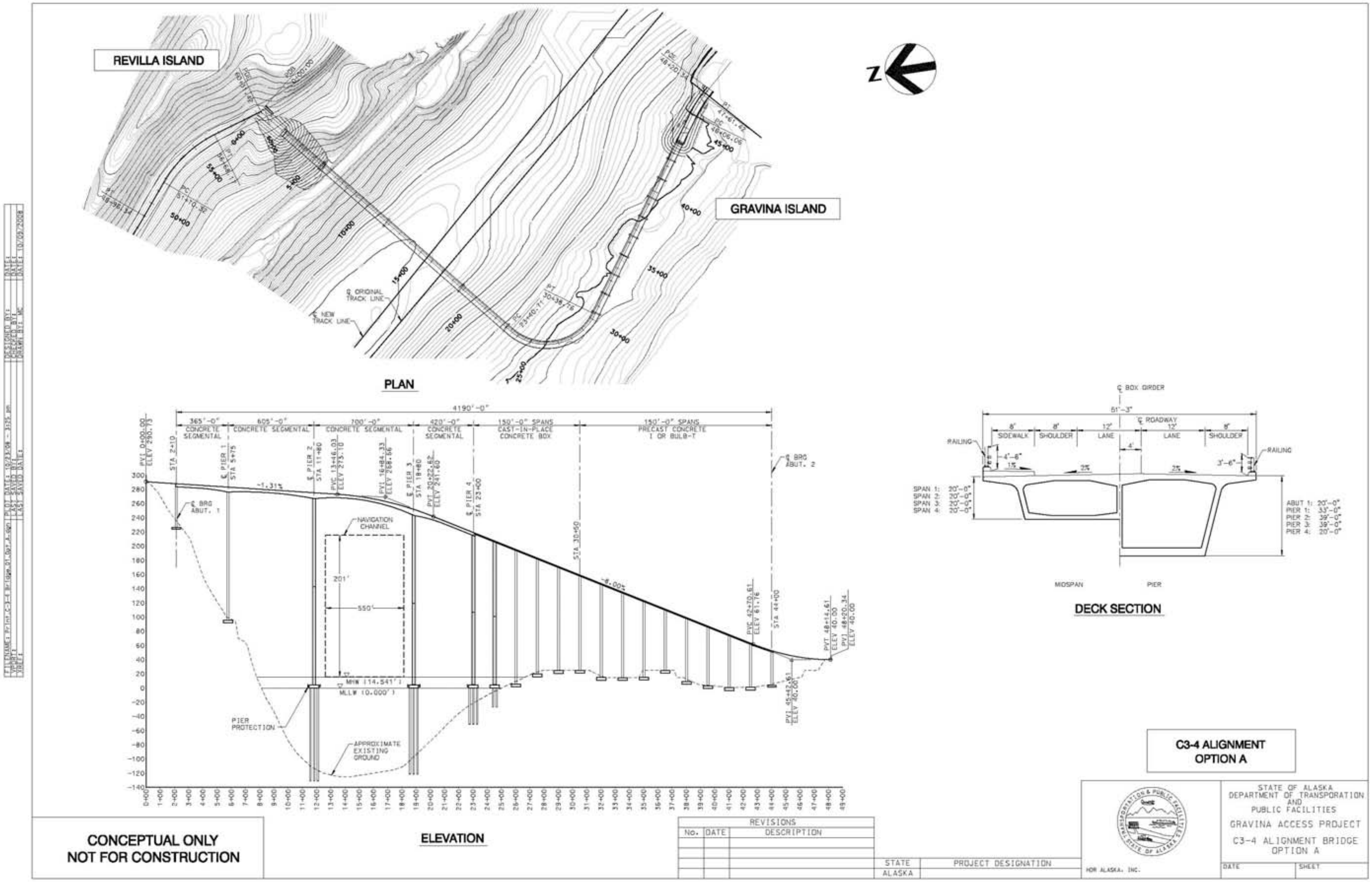


GRAVINA ISLAND
PENNOCK ISLAND
PLAN
TOWER ELEVATION
DECK SECTION
ELEVATION
STEEL CABLE-STAYED ALTERNATIVE WITH EMBANKMENT
CONCEPTUAL ONLY NOT FOR CONSTRUCTION
STATE OF ALASKA DEPARTMENT OF TRANSPORATION AND PUBLIC FACILITIES
GRAVINA ACCESS PROJECT
WEST CHANNEL BRIDGE F-3 ALIGNMENT

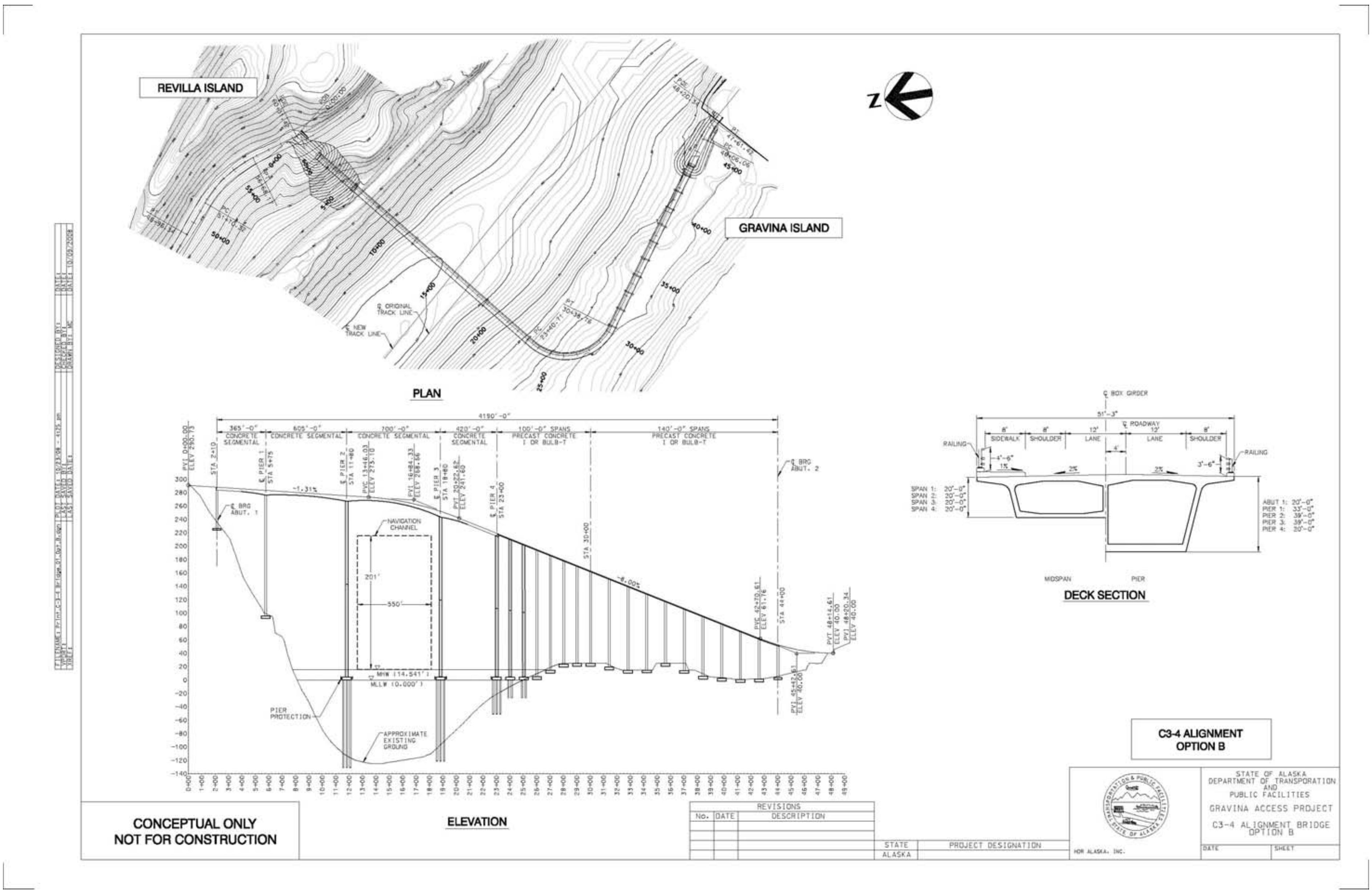


PENNOCK ISLAND
REVILLA ISLAND
℄ NEW TRACK LINE
℄ ORIGINAL TRACK LINE
PLAN
ELEVATION
DECK SECTION
NAVIGATION OPENING
PIER PROTECTION TYP.
APPROXIMATE EXISTING GROUNDLINE
FILL
CONCRETE SEGMENTAL BOX GIRDER ALTERNATIVE WITH EMBANKMENT
CONCEPTUAL ONLY NOT FOR CONSTRUCTION
REVISIONS
STATE OF ALASKA DEPARTMENT OF TRANSPORATION AND PUBLIC FACILITIES
GRAVINA ACCESS PROJECT
EAST CHANNEL BRIDGE F-3 ALIGNMENT
HDR ALASKA, INC.


PENNOCK ISLAND
REVILLA ISLAND
℄ NEW TRACK LINE
℄ ORIGINAL TRACK LINE
PLAN
ELEVATION
TOWER SECTION
DECK SECTION
STEEL CABLE-STAYED ALTERNATIVE WITH EMBANKMENT
CONCEPTUAL ONLY
NOT FOR CONSTRUCTION
REVISIONS
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
GRAVINA ACCESS PROJECT
EAST CHANNEL BRIDGE
F-3 ALIGNMENT
HDR ALASKA, INC.



REVILLA ISLAND
GRAVINA ISLAND
PLAN
℄ ORIGINAL TRACK LINE
℄ NEW TRACK LINE
4190'-0"
365'-0" CONCRETE SEGMENTAL
605'-0" CONCRETE SEGMENTAL
700'-0" CONCRETE SEGMENTAL
420'-0" CONCRETE SEGMENTAL
150'-0" SPANS CAST-IN-PLACE CONCRETE BOX
150'-0" SPANS PRECAST CONCRETE I OR BULB-T
-1.31%
-8.00%
NAVIGATION CHANNEL
201'
550'
MHW (14.541')
MLLW (0.000')
PIER PROTECTION
APPROXIMATE EXISTING GROUND
ELEVATION
℄ BOX GIRDER
61'-3"
℄ ROADWAY
SIDEWALK
SHOULDER
LANE
RAILING
MIDSPAN
PIER
DECK SECTION
C3-4 ALIGNMENT
OPTION A
CONCEPTUAL ONLY
NOT FOR CONSTRUCTION
REVISIONS
No. DATE DESCRIPTION
STATE
ALASKA
PROJECT DESIGNATION
HDR ALASKA, INC.
STATE OF ALASKA
DEPARTMENT OF TRANSPORATION
AND
PUBLIC FACILITIES
GRAVINA ACCESS PROJECT
C3-4 ALIGNMENT BRIDGE
OPTION A
DATE
SHEET


REVILLA ISLAND
GRAVINA ISLAND
PLAN
ELEVATION
DECK SECTION
MIDSPAN
PIER
C3-4 ALIGNMENT
OPTION B
CONCEPTUAL ONLY
NOT FOR CONSTRUCTION
STATE OF ALASKA
DEPARTMENT OF TRANSPORATION
AND
PUBLIC FACILITIES
GRAVINA ACCESS PROJECT
C3-4 ALIGNMENT BRIDGE
OPTION B
HDR ALASKA, INC.

# SUPPORTING QUANTITY AND COST INFORMATION

**GRAVINA COSTS**
**ADJUSTED BASE**
**ALTERNATES**
**COST ESCALATED TO 1st QTR. 2008**

| | SHIP IMPACT | UofM | | C-3A QUANTITY | C-3A UNIT | C-3A AMOUNT | | C-3B QUANTITY | C-3B UNIT | C-3B AMOUNT | | C-4 QUANTITY | C-4 UNIT | C-4 AMOUNT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASE SUB-STRUCTURE | | SF | | 348,500.00 | $ 413.61 | $ 144,143,085 | | 217,813.00 | $ 413.61 | $ 90,089,635 | | 256,250.00 | $ 413.61 | $ 105,987,563 |
| BASE SUPERSTRUCTURE | | SF | | 348,500.00 | $ 364.18 | $ 126,916,730 | | 217,813.00 | $ 364.18 | $ 79,323,138 | | 256,250.00 | $ 364.18 | $ 93,321,125 |
| ADD FOR CURVED DECK | | SF | premium | 174,250.00 | $ 182.09 | $ 31,729,183 | premium | 108,906.50 | $ 182.09 | $ 19,830,785 | premium | 256,250.00 | $ 182.09 | $ 46,660,563 |
| ADD PIER 120 FOOT WATER | YES | EACH | | - | $ 24,178,372.00 | $ - | | | $ 24,178,372.00 | $ - | premium | 1.00 | $ 24,178,372.00 | $ 24,178,372 |
| ADD PIER 80 FOOT WATER | YES | EACH | | | $ 21,558,053.00 | $ - | premium | 1.00 | $ 21,558,053.00 | $ 21,558,053 | | | $ 21,558,053.00 | $ - |
| ADD PIER 50 FOOT WATER | YES | EACH | premium | 1.00 | $ 18,894,543.00 | $ 18,894,543 | new | 1.00 | $ 18,894,543.00 | $ 18,894,543 | premium | 1.00 | $ 18,894,543.00 | $ 18,894,543 |
| ADD PIER 20 FOOT WATER | NO | EACH | new | 1.00 | $ 6,223,205.00 | $ 6,223,205 | | | $ 6,223,205.00 | $ - | new | 2.00 | $ 6,223,205.00 | $ 12,446,410 |
| BASE TOTAL | | SF | | | | | | | | | | | | |
| BASE EAST CHANNEL | | SF | | | | | | | | | | | | |
| BASE WEST CHANNEL | | SF | | | | | | | | | | | | |
| COFFERDAM AND BUBBLER | | | | | | $ 5,474,122 | 4 piers | | | $ 8,415,232 | 4 piers | | | $ 8,415,232 |
| FENDER | | | | | | $ 470,760 | | | | $ 470,760 | | | | $ 470,760 |
| EXTRA FORM TRAVELERS | | | | | | $ 1,176,900 | | | | $ 1,176,900 | | | | $ 1,176,900 |
| | | SF | | 348,500.00 | $ 961.34 | $ 335,028,528 | | 217,813.00 | $ 1,100.76 | $ 239,759,046 | | 256,250.00 | $ 1,215.81 | $ 311,551,467 |
| SUBSTRUCTURE | | | | | $ 502.74 | $ 175,205,715 | | | $ 640.13 | $ 139,428,223 | | | $ 664.95 | $ 170,392,880 |
| SUPERSTRUCTURE | | | | | $ 458.60 | $ 159,822,813 | | | $ 460.63 | $ 100,330,823 | | | $ 550.86 | $ 141,158,588 |
| TOTALS | | | | | | $ 335,028,528 | | | | $ 239,759,046 | | | | $ 311,551,467 |

| | | F-1 ESCALATED & UPDATED QUANTITY | F-1 UNIT | F-1 AMOUNT | | F-3 ESCALATED QUANTITY | F-3 UNIT | F-3 AMOUNT | | D-1 ESCALATED QUANTITY | D-1 UNIT | D-1 AMOUNT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASE SUB-STRUCTURE | **W**<br>**E** | 126,331.00<br>174,250.00<br>300,581.00 | $ 413.61<br>$ 413.61 | $ 52,251,765<br>$ 72,071,543 | **W**<br>**E** | 126,639.00<br>101,731.00<br>228,370.00 | $ 413.61<br>$ 413.61 | $ 52,379,157<br>$ 42,076,959 | | 184,500.00 | $ 430.23 | $ 79,377,435 |
| BASE SUPERSTRUCTURE | **W**<br>**E** | 126,331.00<br>174,250.00<br>300,581.00 | $ 364.18<br>$ 364.18 | $ 46,007,224<br>$ 63,458,365 | **W**<br>**E** | 126,639<br>101,731<br>228,370 | $ 364.18<br>$ 364.18 | $ 46,119,391<br>$ 37,048,396 | | 184,500.00 | $ 364.18 | $ 67,191,210 |
| ADD FOR CURVED DECK | | | | | | | | | premium | 92,250.00 | $ 182.09 | $ 16,797,803 |
| ADD PIER 120 FOOT WATER | | | | | | | | | | | | |
| ADD PIER 80 FOOT WATER | | | | | | | | | | | | |
| ADD PIER 50 FOOT WATER | | | | | | | | | new | 1.00 | $ 18,894,543.00 | $ 18,894,543 |
| ADD PIER 20 FOOT WATER | | | | | | | | | new | 1.00 | $ 6,223,205.00 | $ 6,223,205 |
| BASE TOTAL | | | | | | | | | | | | |
| BASE EAST CHANNEL | | 174,250.00 | | | | | | | | | | |
| BASE WEST CHANNEL | | 126,331.00 | | | | | | | | | | |
| COFFERDAM AND BUBBLER | | | 2 piers | $ 4,207,616 | | 2 piers | | $ 4,207,616 | | 3 piers | | $ 5,474,122 |
| FENDER | | | | INC | | | | $ 823,830 | | | | $ 470,760 |
| EXTRA FORM TRAVELERS | | | | $ 1,176,900 | | | | $ 1,176,900 | | | | $ 1,176,900 |
| | | 300,581.00 | $ 795.70 | $ 239,173,412 | | 228,370.00 | $ 804.98 | $ 183,832,248 | | 184,500.00 | $ 1,060.20 | $ 195,605,978 |
| SUBSTRUCTURE | **W**<br>**E** | 126,331.00<br>174,250.00 | $ 427.61<br>$ 427.61 | $ 54,020,181<br>$ 74,510,742 | **W**<br>**E** | 126,639<br>101,731 | $ 435.64<br>$ 435.64 | $ 55,169,266<br>$ 44,318,295 | | | $ 598.59 | $ 110,440,065 |
| SUPERSTRUCTURE | **W**<br>**E** | 126,331.00<br>174,250.00 | $ 368.10<br>$ 368.10 | $ 46,501,862<br>$ 64,140,626 | **W**<br>**E** | 126,639<br>101,731 | $ 369.33<br>$ 369.33 | $ 46,772,022<br>$ 37,572,664 | | | $ 461.60 | $ 85,165,913 |
| TOTALS | **W**<br>**E** | 126,331.00<br>174,250.00 | $ 795.70<br>$ 795.70 | $ 100,522,043<br>$ 138,651,369<br>$ 239,173,412 | **W**<br>**E** | 126,639.00<br>101,731.00 | $ 804.98<br>$ 804.98 | $ 101,941,289<br>$ 81,890,960<br>$ 183,832,248 | | | $ 1,060.20 | $ 195,605,978 |

**COMMENTS**

| | |
|---|---|
| **C3A** | Adjusted quantities and unit costs to that of revised F-1 and added pier and deck costs for curvature at ends |
| **C3B** | Did not have original pricing, so developed based on quantities and F-1 pricing with adds for curvature at ends |
| **C4** | Adjusted quantities and unit costs to that of revised F-1 and added pier and deck costs for curvature at ends |
| **F1** | Escalated quantified unit pricing and adjusted reinforcing and PT quantities |
| **D1** | Adjusted quantities and unit costs to that of revised F-1 and added pier and deck costs for curvature at ends |
| **ALL** | All costs include 20% contingency |

## GRAVINA COSTS
## VARIANT ALTERNATES
## COST ESCALATED TO 2008

| | | | | C3 - 4 ALIGNMENT OPTION A | | | | C3 - 4 ALIGNMENT OPTION B | | | | F-3 WEST CHANNEL CONCRETE SEGMENTAL BOX WITH EMBANKMENT | | | F-3 WEST CHANNEL STEEL CABLE -STAYED | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **UofM** | | **QUANTITY** | **UNIT** | **AMOUNT** | | **QUANTITY** | **UNIT** | **AMOUNT** | **QUANTITY** | **UNIT** | **AMOUNT** | **QUANTITY** | **UNIT** | **AMOUNT** |
| BRIDGE LENGTH | | | **LF** | | 4,190.00 | | | | 4,190.00 | | | 1,720.00 | | | 3,300.00 | | |
| BASE SUB-STRUCTURE | | | **SF** | | 214,738.00 | $ 435.62 | $ 93,544,168 | | 214,738.00 | $ 468.51 | $ 100,606,900 | 88,150.00 | $ 540.95 | $ 47,684,743 | 169,125.00 | $ 181.98 | $ 30,777,368 |
| | | | | | | | | | | | | | | | - | | $ - |
| BASE SUPERSTRUCTURE | | | **SF** | | 214,738.00 | | $ - | | 214,738.00 | | $ - | 88,150.00 | $ 364.18 | $ 32,102,467 | 169,125.00 | $ 660.33 | $ 111,678,311 |
| | | | | **SEG** | 107,113.00 | $ 364.18 | $ 39,008,412 | **SEG** | 107,113.00 | $ 364.18 | $ 39,008,412 | | | | | | |
| | | | | **CIP** | 38,437.00 | $ 322.00 | $ 12,376,714 | **CIP** | | | $ - | | | | | | |
| | | | | **BT** | 69,188.00 | $ 130.00 | $ 8,994,440 | **BT** | 107,625.00 | $ 130.00 | $ 13,991,250 | | | | | | |
| COFFERDAM AND BUBBLER | DEEP WATER | $ 2,941,110 | | | 2.00 | PIER | $ 5,882,220 | | 2.00 | PIER | $ 5,882,220 | 1.00 | PIER | $ 2,941,110 | - | PIER | $ - |
| | SHALLOW WATER | $ 1,266,506 | | | 2.00 | PIER | $ 2,533,012 | | 3.00 | PIER | $ 3,799,518 | 1.00 | PIER | $ 1,266,506 | 1.00 | PIER | $ 1,266,506 |
| FENDER | | $ 470,760 | | | 4.00 | PIER | $ 1,883,040 | | 4.50 | PIER | $ 2,118,420 | 1.00 | PIER | $ 470,760 | - | PIER | $ - |
| | | | | | | | | | | | | | | | | | $ - |
| | | | **SF** | | 214,738.00 | $ 764.76 | $ 164,222,006 | | 214,738.00 | $ 770.27 | $ 165,406,721 | 88,150.00 | $ 958.20 | $ 84,465,586 | 169,125.00 | $ 849.80 | $ 143,722,185 |
| SUBSTRUCTURE | | | | | 214,738.00 | $ 483.58 | $ 103,842,440 | | 214,738.00 | $ 523.46 | $ 112,407,058 | 88,150.00 | $ 594.02 | $ 52,363,119 | 169,125.00 | $ 189.47 | $ 32,043,874 |
| | | | | | | | | | | | | | | | | | $ - |
| SUPERSTRUCTURE | | | | | 214,738.00 | $ 281.18 | $ 60,379,566 | | 214,738.00 | $ 246.81 | $ 52,999,662 | 88,150.00 | $ 364.18 | $ 32,102,467 | 169,125.00 | $ 660.33 | $ 111,678,311 |
| TOTALS | | | | | 214,738.00 | $ 764.76 | $ 164,222,006 | | 214,738.00 | $ 770.27 | $ 165,406,721 | 88,150.00 | $ 958.20 | $ 84,465,586 | 169,125.00 | $ 849.80 | $ 143,722,185 |

**All costs include 20% Contingency**

**GRAVINA COSTS**
**VARIANT ALTERNATES**
**COST ESCALATED TO 2008**

| | | | F-3 WEST CHANNEL STEEL CABLE -STAYED WITH EMBANKMENT | | | F-3 WEST CHANNEL CONCRETE SEGMENTAL BOX WITH STEEL DROP-IN-SPAN | | | F-3 EAST CHANNEL CONCRETE SEGMENTAL BOX WITH EMBANKMENT | | | F-3 EAST CHANNEL STEEL CABLE -STAYED WITH EMBANKMENT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **UofM** | **QUANTITY** | **UNIT** | **AMOUNT** | **QUANTITY** | **UNIT** | **AMOUNT** | **QUANTITY** | **UNIT** | **AMOUNT** | **QUANTITY** | **UNIT** | **AMOUNT** |
| BRIDGE LENGTH | | **LF** | 1,760.00 | | | 2,600.00 | | | 1,700.00 | | | 1,700.00 | | |
| BASE SUB-STRUCTURE | | **SF** | 90,200.00 | $ 423.79 | $ 38,225,858 | 133,250.00 | $ 323.59 | $ 43,118,368 | 87,125.00 | $ 789.68 | $ 68,800,870 | 87,125.00 | $ 438.76 | $ 38,226,965 |
| | | | | | $ - | | | | | | | | | |
| BASE SUPERSTRUCTURE | | **SF** | 90,200.00 | $ 651.50 | $ 58,765,300 | 133,250.00 | $ 433.56 | $ 57,771,870 | 87,125.00 | $ 364.18 | $ 31,729,183 | 87,125.00 | $ 656.18 | $ 57,169,683 |
| COFFERDAM AND BUBBLER | DEEP WATER | $ 2,941,110 | 1.00 | PIER | $ 2,941,110 | 1.00 | PIER | $ 2,941,110 | 2.00 | PIER | $ 5,882,220 | 1.00 | PIER | $ 2,941,110 |
| | SHALLOW WATER | $ 1,266,506 | - | PIER | $ - | 1.00 | PIER | $ 1,266,506 | 2.00 | PIER | $ 2,533,012 | 1.00 | PIER | $ 1,266,506 |
| FENDER | | $ 470,760 | 1.00 | PIER | $ 470,760 | 1.00 | PIER | $ 470,760 | 2.00 | PIER | $ 941,520 | 1.00 | PIER | $ 470,760 |
| | | **SF** | 90,200.00 | $ 1,113.12 | $ 100,403,028 | 133,250.00 | $ 792.26 | $ 105,568,614 | 87,125.00 | $ 1,261.25 | $ 109,886,805 | 87,125.00 | $ 1,148.64 | $ 100,075,024 |
| SUBSTRUCTURE | | | 90,200 | $ 461.62 | $ 41,637,728 | 133,250.00 | $ 358.70 | $ 47,796,744 | 87,125.00 | $ 897.07 | $ 78,157,622 | 87,125.00 | $ 492.46 | $ 42,905,341 |
| | | | | | $ - | | | $ - | | | $ - | | | $ - |
| SUPERSTRUCTURE | | | 90,200 | $ 651.50 | $ 58,765,300 | 133,250.00 | $ 433.56 | $ 57,771,870 | 87,125.00 | $ 364.18 | $ 31,729,183 | 87,125.00 | $ 656.18 | $ 57,169,683 |
| TOTALS | | | 90,200.00 | $ 1,113.12 | $ 100,403,028 | 133,250.00 | $ 792.26 | $ 105,568,614 | 87,125.00 | $ 1,261.25 | $ 109,886,805 | 87,125.00 | $ 1,148.64 | $ 100,075,024 |

**All costs include 20% Contingency**

| GRAVINA PROBABLE COST |
|---|
| Cable-Stay F-3 |
| WEST CHANNEL |

| | | | | |
|---|---|---|---|---|
| Total Length | 3,300.0 | Feet | 169,125 | SF |
| Main Span Length | 1,600.0 | | | |
| Width | 51.25 | | | |
| Pylon Piers on Land | | | | |

| | | QTY | UOM | | UNIT COST | | AMOUNT |
|---|---|---|---|---|---|---|---|
| Pylon Pier Below Deck | | 2.00 | EA | $ | 9,530,000.00 | $ | 19,060,000.00 |
| Deduct Pier 2 Short Land | | | | | | $ | (1,050,000.00) |
| 12 DS Each | | | | | | | |
| Pylon Above Deck | Pier 1 | | | | | | |
| **Concrete | | 1,737.00 | CY | $ | 963.89 | $ | 1,674,269.98 |
| **Reinforcing (300LB/CY) | | 521,100.00 | LB | $ | 1.96 | $ | 1,021,356.00 |
| Pylon Above Deck | Pier 2 | | | | | | |
| **Concrete | | 1,737.00 | CY | $ | 963.89 | $ | 1,674,269.98 |
| **Reinforcing (300LB/CY) | | 521,100.00 | LB | $ | 1.96 | $ | 1,021,356.00 |
| End Piers/Abutment | | 2.00 | | | | | |
| **Concrete | | 1,760.00 | CY | $ | 688.49 | $ | 1,211,742.40 |
| **Reinforcing (300LB/CY) | | 528,000.00 | LB | $ | 1.96 | $ | 1,034,880.00 |
| Superstructure (Deck less Stays) | | 169,125.00 | SF | $ | 432.61 | $ | 73,165,166.25 |
| **Cable-Stay System | | 2.00 | LS | $ | 9,950,000.00 | $ | 19,900,000.00 |
| Contingency | Sub | 20% | | $ | 25,647,874.36 | $ | 5,129,574.87 |
| | Super | 20% | | $ | 93,065,166.25 | $ | 18,613,033.25 |
| **TOTAL COST BRIDGE** | | | | | | **$** | **142,455,648.74** |
| | | | | (does not include costs for cofferdams and bubblers) | | | |
| **Total Unit Cost** | | **169,125.00** | **SF** | | | **$** | **842.31** |
| **Superstructure** | | **169,125.00** | | **$** | **111,678,199.50** | **$** | **660.33** |
| **Substructure** | | **169,125.00** | | **$** | **30,777,449.24** | **$** | **181.98** |

pylon factor 1.40

**GRAVINA PROBABLE COST**
**CIP BOX AND DROP-IN-STEEL BOX F-3**
**WEST CHANNEL**

| | | |
|---|---|---|
| **Total Length** | **2,600.0** | **Feet** |
| | **300.0** | |
| **CIP Concrete Box Length** | **2,300.0** | |
| **Width** | **51.25** | |
| Pylon Piers on Land | | |

| | | QTY | UOM | UNIT COST | AMOUNT | |
|---|---|---|---|---|---|---|
| Superstructure CIP Box (from F-1) | | 117,875.00 | SF | $ 364.18 | $ 42,927,717.50 | |
| Drop-in-Box (15,375 SF @ 150lb/sf) | | 2,306,250.00 | LB | $ 5.00 | $ 11,531,250.00 | |
| Deck Concrete on Steel (12") | | 570.00 | CY | $ 688.49 | $ 392,439.30 | |
| **Reinforcement | | 228,000.00 | LB | $ 1.96 | $ 446,880.00 | |
| **Superstructure Total** | | | | | | $ 55,298,286.80 |
| **Abutments ( 2 each )** | Concrete | 1,000.00 | CY | $ 688.49 | $ 688,490.00 | |
| | Reinforcement | 300,000.00 | LB | $ 1.96 | $ 588,000.00 | |
| | | | | | | $ 1,276,490.00 |
| **Pier 1** | Concrete | 1,143.00 | CY | $ 688.49 | $ 786,944.07 | |
| | Reinforcement | 342,900.00 | LB | $ 1.96 | $ 672,084.00 | |
| | | | | | | $ 1,459,028.07 |
| **Pier 2** | Concrete | 2,683.00 | CY | $ 688.49 | $ 1,847,218.67 | |
| | Reinforcement | 858,822.00 | LB | $ 1.96 | $ 1,683,291.12 | |
| | | | | | | $ 3,530,509.79 |
| **Pier 3** | Concrete | 2,683.00 | CY | $ 688.49 | $ 1,847,218.67 | |
| | Reinforcement | 858,822.00 | LB | $ 1.96 | $ 1,683,291.12 | |
| | | | | | | $ 3,530,509.79 |
| **Pier 4** | Concrete | 10,127.00 | CY | $ 688.49 | $ 6,972,338.23 | |
| | Reinforcement | 3,037,983.00 | LB | $ 1.96 | $ 5,954,446.68 | |
| Drilled Shaft 16 Each | DS Rock Exc | 1,396.00 | CY | $ 2,059.58 | $ 2,875,173.68 | |
| | DS Concrete | 3,721.00 | CY | $ 582.57 | $ 2,167,742.97 | |
| | DS Reinforcement | 1,488,593.00 | LB | $ 1.52 | $ 2,262,661.36 | |
| | DS Casing | 1,024,896.00 | LB | $ 0.98 | $ 1,004,398.08 | |
| | DS Instrumentation | 16.00 | EA | $ 2,500.00 | $ 40,000.00 | |
| | Pier Protection | 1.00 | EA | $ 235,380.00 | $ 235,380.00 | |
| | | | | | | $ 21,512,141.00 |
| **Pier 5** | Concrete | 3,622.00 | CY | $ 688.49 | $ 2,493,710.78 | |
| | Reinforcement | 1,086,556.00 | LB | $ 1.96 | $ 2,129,649.76 | |
| | | | | | | $ 4,623,360.54 |
| Contingency on Super less F1 Unit | | 20% | | $ 12,370,569.30 | $ 2,474,113.86 | |
| Contingency on Substructure | | 20% | | $ 35,932,039.19 | $ 7,186,407.84 | |
| | | | | | | $ 9,660,521.70 |
| **TOTAL COST BRIDGE** | | | | | | **$ 100,890,848** |
| | | | | (does not include costs for cofferdams, bubblers, and fenders) | | |
| **Total Unit Cost** | | **133,250.00** | **SF** | | | **$ 757.15** |
| **Superstructure** | | **133,250.00** | **SF** | | **$ 57,772,401** | **$ 433.56** |
| **Substructure** | | **133,250.00** | **SF** | | **$ 43,118,447** | **$ 323.59** |

**GRAVINA BRIDGE UPDATED COST ESTIMATE, ALIGNMENT F1**
**MARCH 3, 2008**

| ITEM NO. | PAY ITEM | | EAST QUANTITY | WEST QUANTITY | TOTAL QUANTITY | | TYPICAL UNIT COST | UP ESCALATED 2004 TO 2008 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1.1769 | | |
| 203(2) | Rock Excavation for Structures | sub | 5,301 | 2,519 | 7,820 | CY | $50 | $ 58.85 | $ 460,196.23 | |
| 205(1) | Excavation for Structures (above water) | sub | 2,150 | 400 | 2,550 | CY | $20 | $ 23.54 | $ 60,021.90 | |
| 501(1) | Class A Concrete (Footing) | sub | 19,889 | 8,673 | 28,562 | CY | $585 | $ 688.49 | $ 19,664,474.91 | |
| 501(1) | Class A Concrete (pier) | sub | 11,918 | 5,467 | 17,385 | CY | $585 | $ 688.49 | $ 11,969,558.38 | |
| 501(2) | Class A-A Concrete (sidewalk and approach slab) | sup | 1,266 | 944 | 2,210 | CY | $675 | $ 794.41 | $ 1,755,655.29 | |
| 501(2) | Class A-A Concrete (Segmental box) | sup | 26,593 | 15,441 | 42,034 | CY | $855 | $ 1,006.25 | $ 42,296,457.54 | |
| 501(20) | Class DS Concrete (drilled shaft concrete) | sub | 14,195 | 3,694 | 17,889 | CY | $495 | $ 582.57 | $ 10,421,714.97 | |
| 501(21) | DS Grout (drilled shaft grout) | sub | 0 | 0 | 0 | | $700 | $ 823.83 | $ - | |
| 502(1) | Post-Tensioning (box girder bridge) | sup | 4,520,770 | 2,624,970 | 7,145,740 | LB | $2.75 | $ 3.00 | $ 21,437,220.00 | REVISED PRICING |
| 502(1) | High Strength Bars | sup | 151,845 | 88,167 | 240,012 | LB | $4.00 | $ 13.08 | $ 3,139,356.96 | REVISED PRICING |
| 503(1) | Reinforcing Steel - Superstr | sup | 5,318,554 | 3,088,200 | 8,406,754 | LB | $1.43 | $ 1.52 | $ 12,778,266.08 | REVISED PRICING |
| 503(1) | Reinforcing Steel - Substr | sub | 6,572,445 | 1,710,452 | 8,282,897 | LB | $1.43 | $ 1.52 | $ 12,590,002.74 | REVISED PRICING |
| 503(2) | Epoxy Coated Reinforcing Steel - Superstr | sup | 1,329,638 | 772,050 | 2,101,688 | LB | $1.66 | $ 1.96 | $ 4,112,154.86 | |
| 503(2) | Epoxy Coated Reinforcing Steel - Substr | sub | 10,733,995 | 4,788,700 | 15,522,695 | LB | $1.66 | $ 1.96 | $ 30,371,646.83 | |
| | Bearings | sup | 10 | 4 | 14 | EACH | $25,000 | $ 40,000.00 | $ 560,000.00 | REVISED PRICING |
| | Modular Joints | sup | 154 | 102.50 | 256 | LF | $1,500 | $ 1,765.35 | $ 452,370.94 | |
| 507(2) | Pedestrian Railing (3 Tube incl curb) | sup | 6,800 | 4,930 | 11,730 | LF | $150 | $ 176.54 | $ 2,070,755.55 | |
| 508(1) | Waterproofing Membrane | sup | 174,250 | 126,331 | 300,581 | SF | $1.25 | $ 1.47 | $ 442,192.22 | |
| 516(1) | Drilled Shaft (equipment) | sub | 10,222,642 | 3,492,471 | 13,715,113 | | 0% | $ - | $ - | |
| 516(2) | Unclassified Shaft Excavation | sub | 1,629 | 204 | 1,833 | CY | $500 | $ 588.45 | $ 1,078,613.53 | |
| 516(3) | Rock Shaft Excavation | sub | 3,723 | 1,542 | 5,265 | CY | $1,750 | $ 2,059.58 | $ 10,844,422.50 | |
| 516(4) | Casing (permanent steel) | sub | 4,105,014 | 936,419 | 5,041,433 | LB | $0.65 | $ 0.98 | $ 4,940,604.73 | REVISED PRICING |
| 516(5) | Instrumentation and Data Collection | sub | 128 | 48 | 176 | EACH | $1,750 | $ 2,059.58 | $ 362,485.20 | |
| 606(12) | Guardrail / Bridge Rail Connection | sub | 4 | 4 | 8 | EACH | $1,500 | $ 1,765.35 | $ 14,122.80 | |
| SP | Superstructure - Traveler Large | sup | 1 | 1 | 2 | EACH | $500,000 | $ 588,450.00 | $ 1,176,900.00 | |
| SP | Superstructure - Rent Traveler | sup | 2 | 1 | 3 | EACH | $150,000 | $ 176,535.00 | $ 529,605.00 | |
| SP | Pier Protection | sub | 2 | 1.50 | 4 | EACH | $200,000 | $ 235,380.00 | $ 823,830.00 | |
| | Lighting / Navigation Lighting | sup | 1 | 1 | 2 | LS | $200,000 | $ 235,380.00 | $ 470,760.00 | |

| | | | |
|---|---|---|---|
| Total Bridge Cost= | | $ | 194,823,389.18 |
| Total SF Cost= | | | |
| Superstructure= | | $ | 91,221,694.44 |
| Substructure= | | $ | 103,601,694.74 |
| Total SF Cost= | | | 648.155496 |
| Area= | 300,581 | | 300,581 |
| Contigency= | | | 20% |
| Contigency= | | $ | 38,964,677.84 |
| Rounding | | $ | 828.98 |

(does not include costs for cofferdams, bubblers, and form travelers)

| | | | |
|---|---|---|---|
| Total= | | $ | 233,788,896.00 |
| Total SF Cost= | | $ | 777.79 |
| Superstructure= | | $ | 364.18 |
| Substructure= | | $ | 413.61 |

Size/Loc of Project Factor (Concr unit cost)= 0.9
Size/Loc of Project Factor (Rebar unit cost)= 0.95

| | | East | West | Total |
|---|---|---|---|---|
| 26,031,137 | Length | 3,400 | 2,465 | 5,865 |
| | Width | | | 51.25 |
| | Area-SF | 174,250 | 126,331 | 300,581 |

| COFFERDAM FOR PIERS GRAVINA AND BUBBLER SYSTEM | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | # | L | W | H | SHEETPILE SF | WALES | SPUD | WEIGHT PZ-27 | LABOR | EQUIP | MATERIALS | LABOR | EQUIP | MATERIALS |
| PIER | 3 | | 56 | 56 | 60 | | | | | | | | | | |
| | 4 | | 76 | 68 | 110 | | | | | | | | | | |
| | | 4 | 60 | | 60 | 14,400 | | | 583,200 | | | | | | |
| | | 2 | 80 | | 110 | 17,600 | | | 712,800 | | | | | | |
| | | 2 | 72 | | 110 | 15,840 | | | 641,520 | | | | | | |
| WALE | | 4 | 60 | | 150 | | 36,000 | | | | | | | | |
| | | 4 | 80 | | 150 | | 48,000 | | | | | | | | |
| | | 4 | 72 | | 150 | | 43,200 | | | | | | | | |
| SPUDS | | 12 | 80 | | 128 | | | 122,880 | | | | | | | |
| | | 12 | 120 | | 128 | | | | | | | | | | |
| | | | | | | 47,840 | 127,200 | 122,880 | 1,937,520 | | | | | | |
| SPUDS | | UNIT | LF | 16.00 | MH/EA | 24 | 384 | | | $ 100.00 | $ 200.00 | $ 0.60 | $ 38,400 | $ 76,800 | $ 73,728 |
| WALE | | UNIT | TON | 12.00 | MH/UNIT | 64 | 763 | | | $ 800.00 | $ 400.00 | $ 2,000.00 | $ 610,560 | $ 305,280 | $ 127,200 |
| PILE | | UNIT | SF | 0.20 | MH/UNIT | 47,840 | 9,568 | | | $ 100.00 | $ 100.00 | $ 0.40 | $ 956,800 | $ 956,800 | $ 775,008 |
| MISC EXP | | | SF | $ 1.00 | | | | | | | | | | | $ 47,840 |
| BUBBLE CURTAIN | | | | $ 5.00 | | 47,840 | | | | | | | | | $ 239,200 |
| | | | | | | | | | | | | | $ 1,605,760 | $ 1,338,880 | $ 1,262,976 |
| | | | | | | | | | | | | | | | $ 4,207,616 |
| | | | | | | | | "DEEP WATER" PIER (~110') | | | 14,400 | | | | $ 1,266,506 |
| | | | | | | | | "SHALLOW WATER" PIER (~60') | | | 33,440 | | | | $ 2,941,110 |