File No. 13926T Task 3.0PB

Technical Memorandum

To: Jay Lyman, DEA

From: Connie Kratovil, PB

Date: October 12, 2001

Subject: Introduction of I-5 Trade Corridor Studies related to the I-205 Glenn Jackson Bridge Modification Technical Memo's to carry Light Rail

As part of the I-5 Trade Corridor Study, specific studies were undertaken to examine the feasibility of accommodating LRT over the Columbia River within the I-205 corridor. Two technical memos were prepared for this study, and attached. The first, "I-5 Trade Corridor Study Phase II, Analysis of Glenn Jackson Bridge Constraints on LRT" evaluated past reports/studies, and developed various scenarios of how to accommodate LRT on the Existing Glenn Jackson Bridge. The second technical memo, "Feasibility of Widening Existing Glenn Jackson Bridge Superstructure" developed an un-engineered concept of how to do the minimal widening possible to the Glenn Jackson Bridge to accommodate LRT and keep four General Purpose lanes with 10-foot inside and outside shoulders.

Construction costs estimates were then developed for three Scenarios of accommodating LRT along the Glenn Jackson Bridge or within the I-205 corridor.

- Scenario 1 (depicted from the past studies (ABAM Engineering Report to RTC, 1980))
- Scenario 2B (Minimal Widening Option, discussed in the Appendix, Section I, and a more in-depth evaluation in the Appendix, Section II); and
- Scenario 3 (Independent LRT Bridge, discussed in the Appendix, Section I).

The assumptions listed, along with the sketches contained within the technical memos, were used to estimate material quantities and labor for the conceptual bridge quantities.

This memorandum includes the following information:

- I-5 Trade Corridor Study Phase II, Analysis of Glenn Jackson Bridge Constraints on LRT
- Feasibility of Widening Existing Glenn Jackson Bridge Superstructure

- Conceptual Cost Estimate for:

  I. Scenario 1 (LRT placed on inside shoulders with 4 GP lanes. Shoulder widths both inside and outside reduced to 3'-6".)

  II. Scenario 2B (Glenn Jackson Bridge widened by 10' to each side with LRT centered between the twin bridges, 4-General Purpose lanes with full (10') Shoulders and Pedestrians on a suspended walkway under the twin bridges)

  III. Scenario 3 (New Independent LRT only Bridge)

The assumptions listed in these this technical memorandum were used to develop conceptual level cost estimates. The estimates with Scenarios 1 and 3 are based on quantifiable project parameters. The estimate for Scenario 2B was based upon broad assumptions and we recommend the need for extensive engineering studies to validate the concept presented.

Results of the cost analysis are as follows:

Scenario	Range of Cost (Structural Only)	Engineering (Structural Only)	Contingency	Total[5] (2001 $)
1–LRT on inside shoulders with four general purpose lanes and reduced shoulder widths of 3'-6"	$18 to $50 Million	$8 Million[1]	$17 Million[4]	$75 Million
2B–Widened Glenn Jackson Bridge	$70 to $150 Million	$38 Million[2]	$75 Million[4]	$263 Million
3–New Independent LRT Only Bridge	$115 to $168 Million	$25 Million[3]	$60 Million[4]	$253 Million

[1] Engineer = 500 for load rating +15% of cost range high end.
[2] Engineering 750 for load rating and widening concept analysis + 25% of Base Cost
[3] Engineer for Scenario 3 – 15%
[4] Contingency for Scenario 2B – 40%, for Scenario 1 and 3 – 30%
[5] Based on highest range cost.

APPENDIX:

I	Analysis of Glenn Jackson Bridge Constraints on LRT
II	Feasibility of Widening Existing Glenn Jackson Bridge Superstructure
III	Cost Estimate for Scenario 2B
IV	Cost Estimate for Scenario 3

File No. ODOT0000-0364

Technical Memorandum

To: Jay Lyman

From: Connie Kratovil

Date: October 12, 2001

Prepared by: Mike Traffalis

Subject: ODOT Contract No. 16902 – I-5 Trade Corridor Study Phase II
Analysis of Glenn Jackson Bridge Constraints on LRT

GLENN JACKSON BRIDGE ASSESSMENT – TECHNICAL MEMORANDUM

Objective: The objective of this technical memorandum is to evaluate past studies related to the structural condition of the Glenn Jackson Bridge, provide any updates, discuss current issues, and conceptualize scenarios to support future Light Rail operations on the Glenn Jackson Bridge. This assessment is being conducted as part of the I-5 Trade Corridor Study for ODOT and WSDOT in corporation with Tri-Met.

1. **BERGER ABAM REPORT, DECEMBER 1990**

   a. Berger ABAM Report: The ABAM report, which reviewed the bridge and its design in December 1990, offered the following summary:

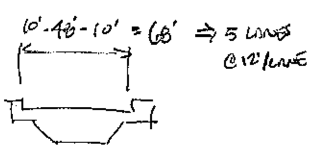
   Conclusion: It is structurally feasible to use the existing I-205 Columbia River Bridges to carry four traffic lanes and LRT operation in each direction (Based upon running 4 lanes of HS20-44 with 1 lane of LRT). Track work will have to be of the direct fixation (DF) type because a ballasted deck would add too much load to the bridge…. The maximum Live Load increases for longitudinal superstructure elements are 8%, which were deemed within acceptable limits.

   Since ABAM performed this analysis, some changes in the Live Load input have happened over the last 10 years.

2. **UPDATES TO LIVE LOADING**

   a. Design Vehicle (2001)

      i. Highway:



REDUCING 5 LANES BY 25% = 3.75 LANES

         1. The highway loading used in the original design was HS20-44. The designer used 5 lanes of this loading in the calculations. AASHTO (Design code in 1980's and 2000's) allowed and allows a 25% reduction of this loading for 4 lanes or more. It is noted in the ABAM report that the designer did not apply this allowable reduction to superstructure members, but did apply it to substructure members; therefore one could conclude that the bridge superstructure was designed for 25% more live load than required by code.
         2. Current DOT (ODOT & WSDOT) standards require new designs to use a live loading of HS25. This loading is approximately 25% larger than HS20-44.

ii. Light Rail
    1. The LRT loading at the time of the original design was assumed equivalent to a lane of HS20-44. PB's past experience with assessing design LRT loading with HS20-44 for these large spans (400' to 600') is that the LRT loading would be more on the order of double a highway traffic loading. Merely designing an extra lane of Live Load (HS20-44) might not accommodate for an equivalent LRT 4 car train at 150kips per car when compared to a single lane loading.
    2. The ABAM report evaluated the increase in Live Load given 4 lanes of Live Loading (HS20-44) and 1990 LRT (vehicle load = 134kips) vehicle load. This is reported in the ABAM report as producing an 8% maximum increase in the longitudinal moment.
    3. The current (2001) LRT vehicle is approximately 10% heavier than the LRT vehicle used in the 1990 report. (LRT vehicle load = 149.2kips)

iii. June 26th I-5 Trade Corridor, Glenn Jackson Meeting with ODOT Region 1, ODOT Structures Department, WSDOT SW Region, and WSDOT Bridge and Structures Group.
    1. At a Glenn Jackson Bridge workshop meeting held on June 26, 2001, ODOT Bridge Engineer, Sam Grossburg, reported that Oregon has been experiencing existing bridge strength issues (fatigue, etc.) associated with overload vehicles. ODOT additionally reported that, in their opinion, any reserve capacity that the Glenn Jackson Bridge might have should be reserved for the great number of undocumented overloads utilizing the freeway system today. Without an in-depth capacity analysis (i.e. Load Rating), the actual amount of Live Load reserve capacity cannot be accurately determined.
    2. WSDOT Bridge and Structures group representative, Mark Anderson, concurred with ODOT's statement.

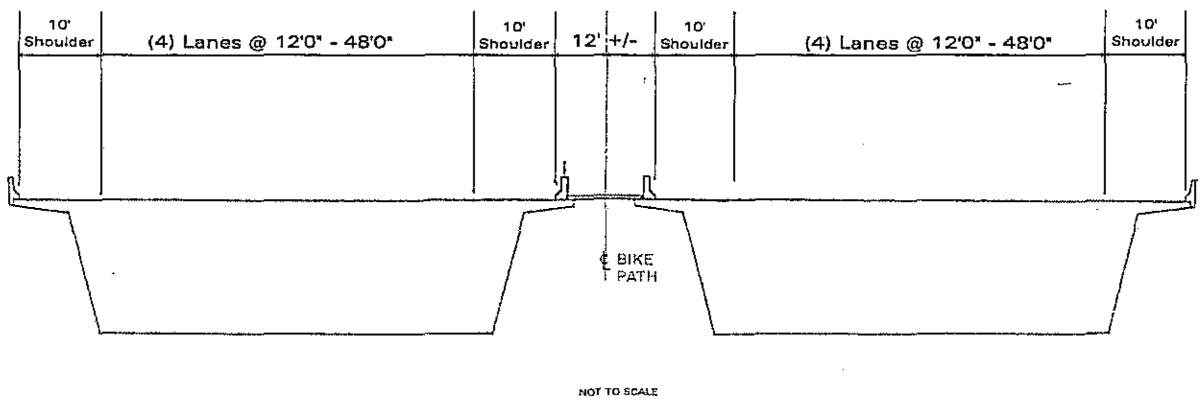
3. **PENDING ISSUES**

a. Capacity of the Bridge
    i. Load Rating: to accurately define the current capacity and reserve Live Load capacities of the bridge, an in-depth load rating analysis should be conducted as follows:
        1. Review existing information and prepare a model, which would include: loss of pre-stress, creep, shrinkage, and general conditions as reported on inspection reports. In addition, the construction sequence should be modeled to obtain the current magnitude and distribution of forces in the existing bridge.
        2. Build transverse (section of deck) and longitudinal (superstructure) models.
        3. Using these models, run a self-weight analysis and various combinations of Live Loads using AASHTO load groups.
        4. Combine the effects of self-weight and Live Loads.
        5. Determine Rating Factors (inventory and operating) with comment and conclusions.

b. Live Loading
    i. The existing bridge superstructure was designed for 25% more HS20-44 than required by code.
    ii. Current standards require use of HS25 loading which is 25% more than HS20-44.
    iii. 5-lanes of HS25 would increase Live Loads by 25%. By replacing one of these lanes with current LRT 4 car train, the % increase would be higher.

4. POSSIBLE SCENARIOS

The Existing Cross Section for the Glenn Jackson Bridge

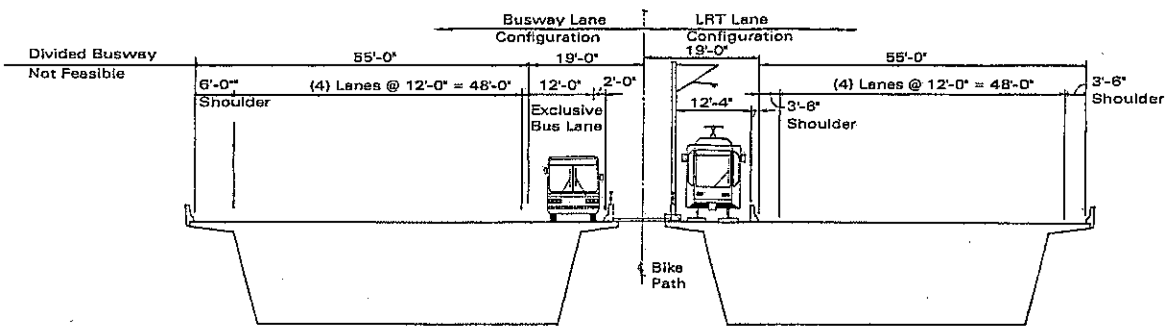


Section – Existing Glen Jackson and South Channel Bridges

The Existing Bridge currently carries a Pedestrian/Bike path between the two bridges. The path is approximately 8' wide and runs the length of the bridge. Inside and outside shoulders are at 10', with both southbound and northbound having (4) 12' general-purpose traffic lanes, producing an overall travel way of 68' per bridge.

SCENARIO 1: (ABAM REPORT ALTERNATIVE)

This scenario was developed in the ABAM report. The LRT is proposed to run in the inside shoulder area of existing bridge (future structural analysis (load rating) to determine the feasibility). In addition, FHWA will need to be contacted at a future date by the I-5 Trade Corridor Management Team to determine if FHWA will allow the proposed inside and outside shoulders to be reduced to 3'6" as depicted below.



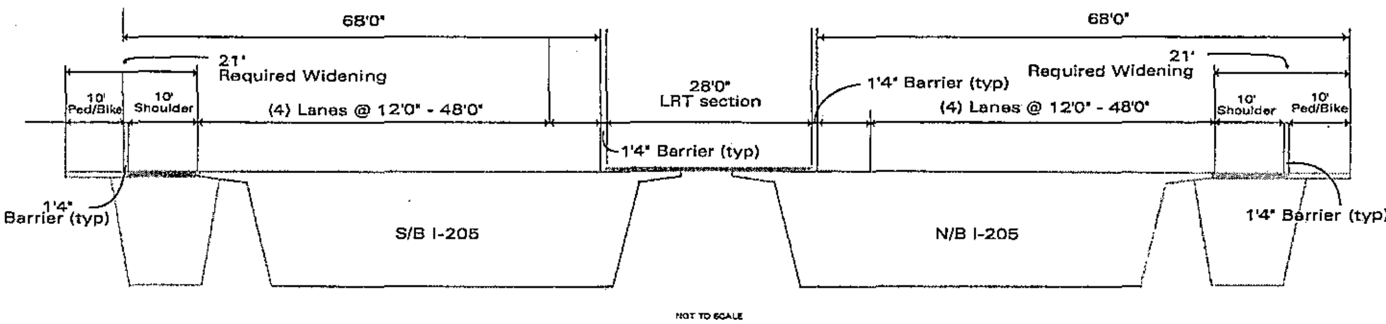
FUNCTIONAL/OPERATIONAL CONSIDERATIONS

Per discussion with ODOT/WSDOT, the resulting 3'-6" shoulder widths are not desirable, and will require detailed discussion with the Federal Highway Administration. Therefore, this scenario will be carried forward, but with the notation that the reduced shoulder width could have the following affects:

- Driver uncertainty, resulting in lower speeds, and less highway capacity;
- Driver safety, with no pullouts for emergencies; and
- Emergency response for auto or LRT activity requires a lane closure.

SCENARIO 2:

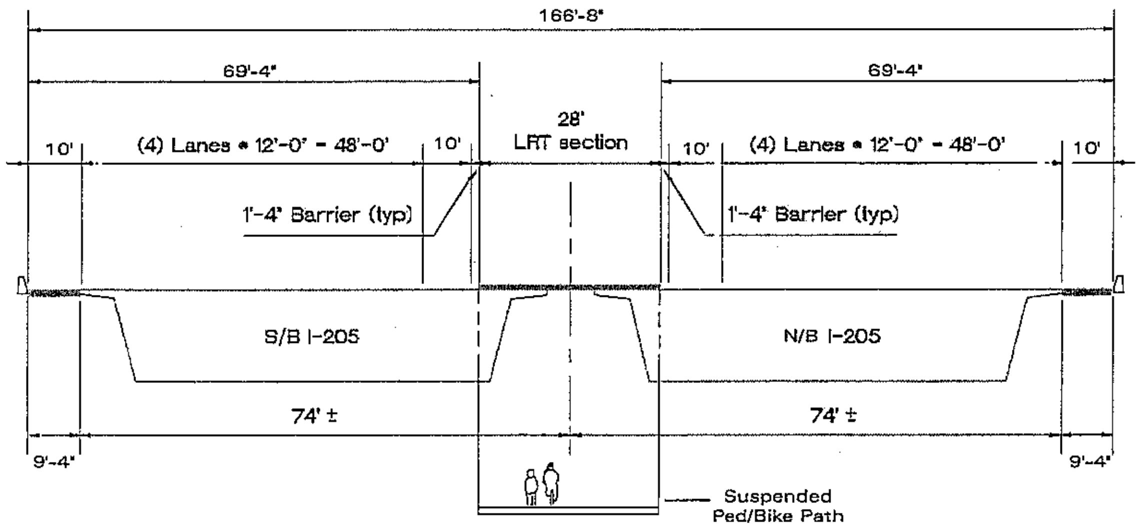
LRT on slab between bridges.



Section 2A – Glen Jackson and South Channel Bridges W/LRT on 28' Slab between bridges, and maintaining full (10') Shoulder w/ 10' Ped/Bike facilities on each side.

This scenario (section 2A) utilizes the minimum LRT clear distance of 28 feet (the 28 feet for LRT width would not accommodate emergency 2'6" egress, this could be accomplished by having openings through the barrier periodically to allow LRT passengers to utilize the inside shoulder for emergency exit), combined first with (4) general purpose 12-foot lanes and (2) 10-foot shoulders, and re-establishing Pedestrian and Bike Facilities. This option requires the widening of approximately 21 feet to each side (for a pedestrian path on both sides).

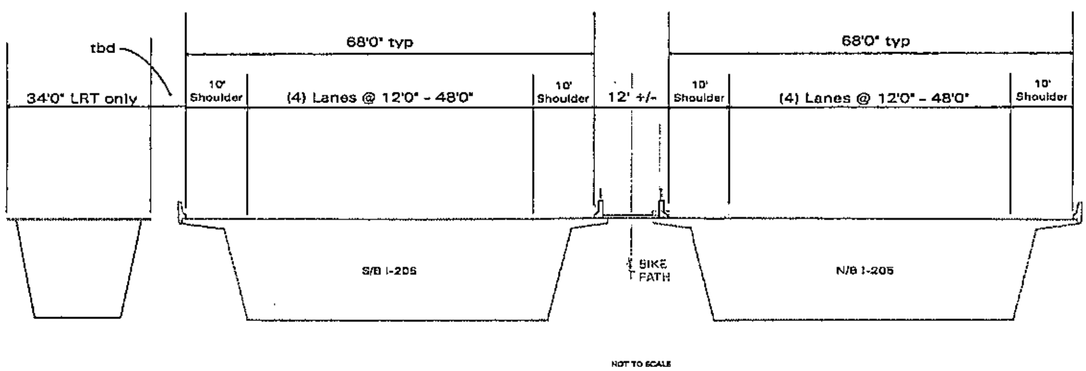
Given the Glenn Jackson Bridge types (cast-in-place balanced cantilever segmental, and precast segmental), this amount of widening is not probable without the addition on new piers and footings. Therefore, a second width configuration could be explored (as shown in Section 2B, page 6). It would increase the out-to-out dimension of the twin bridges by 18'8". This would cause the exterior overhangs of the bridges to extend out an additional 9'4", and the pedestrian path to be re-established via a suspended walkway under the bridge or other configuration. Without a current load rating on file, and with no detailed analysis conducted on this second width configuration no definitive recommendation can be made as to if a potential fatal flaw exists with this scenario. Therefore, further studies would have to take place before an assessment can be made as to the applicability of this scenario, along with navigation clearance assessment of the suspended pedestrian path with Coast Guard and River Users.



Section 2B – Glen Jackson and South Channel Bridges
w/LRT on 28' Slab between bridges,
utilizing shoulder (10' inside, 10' outside)
& Pedestrian Path Suspended Below

Scenario 3:

LRT on independent bridge



Section – Existing Glen Jackson and South Channel Bridges w/Independent LRT Bridge to west

This scenario is simply to build a new independent bridge to the either the downstream (as depicted above) or upstream side. This scenario could be the most costly.

Recommendations

Prepare LRT alignments for traffic modeling using the existing Glenn Jackson Bridge, showing a cost range to capture the low end (scenario 1, reuse of the existing bridge) and the high end (Scenario 3 for the new independent bridge). Cost estimates should also reflect, depending on the scenario being evaluated, the anticipated cost of in-depth load rating, design, construction, and contingencies.

File No. 13926T Task 3.0PB

Technical Memorandum

To: Jay Lyman

From: Connie Kratovil

Date: October 12, 2001

Subject: Feasibility of Widening Existing Glenn Jackson Bridge Superstructure

SUMMARY

A concept was identified that may, after additional engineering analysis, prove to be structurally feasible for widening the existing Glenn Jackson Bridge. This concept was used as a basis for developing order of magnitude construction costs.

The impacts of this scheme on traffic maintenance during construction were not addressed. In addition, the aesthetic impacts of this widening scheme were not addressed.

INTRODUCTION

This memorandum is a qualitative examination of issues associated with installing two tracks of light rail on the existing Glenn Jackson Bridge superstructure. Both the North Channel and South Channel bridges were examined. The scope of this document was limited to determining if there were any obvious fatal flaws in the installation of light rail, and to identify a concept to be used for development of order of magnitude construction costs.

Evaluation of the existing bridge substructure is outside the scope of this memo. Increasing the existing concrete pier section and enlarging the footing with new piles have been assumed and have been quantified in an attempt to capture probable work. It has been assumed that additional dead loads and added live loads would be taken by the added substructure capacity. This assumption would need to be verified by extensive engineering analysis.

This document is preliminary, in that it represents the first step in an extensive study that would need to be undertaken to determine if retrofitting light rail on the existing bridges was technically feasible. While some technical issues are identified, a detailed examination of all relevant technical issues was well beyond the scope of this memorandum. As a result, it cannot be stated with certainty that the concepts discussed could be directly implemented as they are depicted or described. Subsequent analysis and development may indicate that these concepts may not be technically feasible, or they may require extensive additional measures to be implemented to the extent that they are economically not feasible.

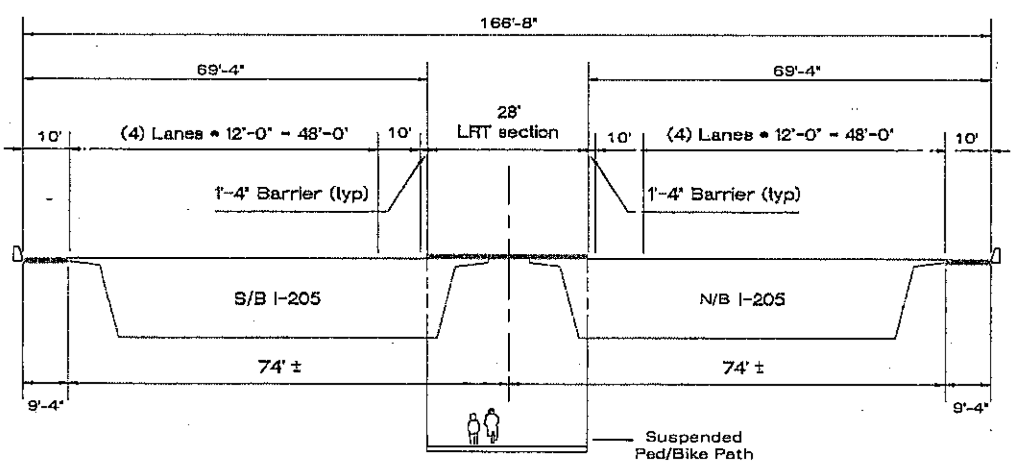
STUDY CROSS SECTION

The cross section that was examined consisted of the following:

- A 28-foot-wide, two-track, light rail corridor located at the centerline of I-205
- Four 12-foot-wide general purpose traffic lanes on each bridge, with 10-foot shoulder on the median and shoulder sides
- 1'-4" traffic barriers on the outside of both shoulders

Drawings of the existing bridges indicate that the out-to-out dimension of the existing deck slabs is on the order of 149'-8". The proposed cross section will be 169'-4" wide. As a result, both existing bridges will need to be widened by approximately 10 feet.

An additional requirement was that any new widening must not require the construction of new substructure.



Proposed Section

(Not to Scale)

SOUTH CHANNEL BRIDGES

EXISTING BRIDGE CONSTRUCTION

The existing 3,120-foot-long South Channel crossing consists of two independent bridges: one bridge for northbound I-205 traffic, and one for southbound I-205 traffic. The bridges are separated by a 7'-4" gap between the edge of their deck slabs. While the deck width varies near Government Island, the typical cross section is 70'-8" wide.

Both bridge superstructures are five-cell, prestressed concrete box girders. The 17 spans are grouped into 6 longitudinally continuous frames. The structure depth varies between 6'-6" and 8 feet, and accommodates a maximum span length of 200 feet. Deck slabs are of reinforced concrete construction and are not transversely prestressed. Longitudinal prestressing necessary to support the superstructure dead load and other applied loads is located in ducts within the webs. Typical bent construction consists of single round columns with integral pier caps, resting on a footing supported by steel H piles.

The design drawings are dated 1978, and depict prestressed concrete box girder construction that is representative of that time. Prestressed concrete box girders are designed with a maximum allowable longitudinal tensile stress to limit, if not eliminate, transverse cracking in the deck slab. In addition, the prestressing must provide the necessary strength required to longitudinally support the bridge and its applied loads. Typical practice is to optimize the use of prestressing steel, due to construction costs and allowable stress design criteria. As a result, this type of construction is relatively sensitive to significant increases in dead loads.

Generally, prestressed concrete box girder construction does not readily accommodate increases in longitudinal prestressing forces. The prestressing steel is located in internal ducts, and typical practice is not to provide additional empty ducts for installation of future prestressing steel. As a result, installation of additional prestressing force is typically done with external tendons (outside of the concrete cross section) that must be anchored to the existing bridge components to develop the required stressing forces.

An examination of the existing drawings indicates a number of features that may limit the installation of additional prestressing steel:

- The integral pier caps are relatively massive. Drawings depict pier diaphragms with a thickness of over 10 feet and a heavily reinforced cross section. Drilling through this thickness of concrete and reinforcing steel to install additional ducts could prove to be a formidable task. It cannot be assumed that the existing reinforcing steel is exactly where the design drawings depict it.

- In addition, the caps are transversely prestressed, with draped tendon profiles. Great care would need to be taken to avoid severing one of these tendons during the drilling process, since this prestressing provides the support of the outer box girder webs at the bents.

Regardless of the difficulties associated with installing additional external prestressing tendons, it is assumed that this will be required regardless of whatever other modifications are done to accommodate LRT on the existing bridge. However, specific details regarding the number of additional tendons and their location are well outside of the scope of this study.

WIDENING TO THE OUTSIDE

The existing bridges have cantilevered deck slabs that extend 7'-10" beyond the face of the exterior box girder webs. Increasing this dimension by ten feet to accommodate the study cross section would result in cantilevers that would far exceed the bending capacity of the existing cantilevered, reinforced concrete slabs.

Two options were examined:

- Construct a series of rectangular transverse stiffening ribs that would transfer the deck widening loads in bending to the interior box girder webs. It was assumed that these ribs would be cast-in-place concrete with a prestressing tendon located in the upper portion of each new rib.
- Construct a precast panel with integral struts to transfer the deck widening loads to the existing exterior web through a simplified truss action. The precast section would resist the cantilever movement through the use of transverse prestressing steel in external ducts, and anchored in cast-in-place blocks to the interior of the box girder.

One of the major constraints on either scheme is the existing longitudinal prestressing steel that is located in each of the existing girder webs. According to the existing drawings, the ducts follow a parabolic longitudinal profile that extends anywhere from 2" above the bottom of the web to 1.5" above the bottom of the deck slab. Any penetration of the box girder webs must not interfere with the existing prestressing ducts, as the tendons supply the support for the bridge superstructure. There is a high probability that transverse tendons, if located in a typical configuration, will conflict with the existing prestressing ducts in the vicinity of the piers. For that reason, there is no "typical" solution of detail that would apply to all portions of the existing bridge.

An additional constraint is the vertical reinforcing steel in the box girder webs. This reinforcement provides a large portion of the box girder shear strength. Any proposed construction scheme must locate the existing reinforcing steel in advance of drilling holes through the webs past the concrete cover. In the event that significant portions of the existing web steel is severed, measures must be taken to restore the girder shear strength.

Finally, both schemes will have a significant visual impact on the existing bridge. An aesthetic analysis was outside of the scope of this memorandum.

For purposes of establishing order of magnitude costs associated with retrofitting, the construction sequence and operations required for the precast concrete strut scheme is described in detail below.

- Place traffic barriers and demolish existing 7'-10" overhang. Expose 2 to 3 feet of the existing transverse reinforcing steel and clean.
- Locate existing longitudinal prestressing ducts. Selectively remove concrete cover to confirm existing duct locations and vertical reinforcing steel locations. Drill through web walls at location necessary for installation of new transverse prestressing tendon.
- Install new strongback at interior web location. Dowel into existing deck slab and soffit slab to anchor strongback. The transverse strength of the existing deck slab reinforcing steel would need to be verified, and strengthening measures, if required, would need to be developed.
- Place new 15-ton concrete slab segments. Install epoxy mortar on exterior face of existing exterior girder web to provide for uniform bearing.
- Install new prestressing bars. Place longitudinal closure concrete.
- Stress and grout prestressing bars.
- After installation of sections of panels, place edge barrier. Place concrete overlay to provide for smooth riding surface.

For estimating purposes, assume that the transverse prestressing force in each rib (at 10-foot o.c.) is on the order of 75 to 100 tons.

From a construction perspective, access to the interior of the box girder could prove to be difficult for the contractor. The drawings do not depict accessibility in any other than the existing center cell. Access hatches were not noted on the existing drawings, nor were access holes in the box girder webs for moving from one girder cell to the adjacent cell. Existing access should be verified in the field.

WIDENING TO THE INSIDE

The proposed cross section has a 28-foot-wide LRT track slab that is centered between the northbound and southbound bridges. The track slab supports the rails, plinths, OCS poles, systems components, and other features. It is assumed that this track slab will be supported over center of each exterior web by elastomeric bearings. For purposes of this study, a 12-inch track slab was assumed. The exact cross section of the track slab was not determined, as it could be solid rectangular, voided, or ribbed.

Aside from the LRT, the track slab is also assumed to support a suspended 20-foot-wide walkway. It was assumed that the walkway would consist of steel framing supporting a 4' concrete slab. Hanger rods were assumed to transfer the walkway dead and live loads to the track slab directly above. In order to obtain a direct load path, and to reduce the dead load on the bridge superstructure, it was assumed that the existing cantilevered overhangs would be removed. Lateral loads on the walkway are assumed to be resisted by stabilizer cables, rods and dampers, or some other similar system that is attached to the adjacent box girder soffit with brackets.

It is assumed that the LRT slab and track would have expansion joints at the same locations as the existing superstructure expansion joints.

From a construction point of view, the widening to the inside appears to be less complex than widening to the outside. One feature that needs to be considered is the required work zone necessary to accommodate these modifications. If 11'-8" is removed from the inside face of the deck and 7'-10" + 2'-0" for barriers from the outside face, this results in a maximum remaining deck width of 49'-2". This does not account for additional space necessary for erection equipment (such as cranes). As a result, **it is anticipated that the number of existing traffic lanes would be reduced during construction,** with the associated inconveniences to the public and restrictions on contractor operations. It is unknown if this is acceptable to the Oregon and Washington DOTs. Work on the outside widening could utilize barge-mounted cranes to ease congestion. However, access on the inside of the existing girders is greatly complicated by the close proximity of the two parallel decks. It appears that the contractor will require a median construction zone for working on the inside of the existing girders.

NORTH CHANNEL BRIDGES

EXISTING BRIDGE CONSTRUCTION

The existing 7,167-foot long North Channel crossing consists of two independent bridges: one bridge for northbound I-205 traffic and one for southbound I-205 traffic. The bridges are structurally separated by a 7'-4" gap between the edge of their deck slabs. While the deck width varies near the north side of the river, the typical cross section is 70'-8" wide.

Drawings were not available for the 1,967-foot-long Washington approach bridge (north of Pier 10). It is assumed that, since these spans were constructed over land, they are of similar construction to the South Channel spans. The Washington approach bridge superstructures are assumed be five-cell, prestressed concrete box girders. The discussion regarding the South Channel bridges would also apply to these structures.

The remainder of the North Channel bridge structure consists of 18 spans grouped into 6 longitudinally continuous frames. There are also two different types of construction in this portion of the bridge:

- A 1,882-foot-long, cast-in-place, segmental concrete cantilever construction for Spans 10 through 13. This portion includes the span over the navigation channel. In this area, the structure depth varies between 17 and 30 feet, and the span lengths vary from 360 feet to 600 feet. The drawings depict a two-cell cross section with 10'-2" cantilever deck slabs.

- A 3,318-foot-long, precast segmental concrete cantilever construction for Spans 14 through 26, the approach spans extending to the north shore of Government Island. The structure depths vary from 12 to 17 feet, and the span lengths from 242 feet to 360 feet. The drawings depict a two-cell cross section with 10'-2" cantilever deck slabs.

The design drawings depict a number of features that influence the ability of these structures to accommodate LRT installation:

- Unlike the South Channel bridge, the deck slabs of the segmentally constructed girders are transversely prestressed. This prestressing force provides the required transverse bending resistance in the relatively thin deck slab. Stressing anchors are located at the edge of the existing deck slabs. The drawings depict cast in dead-end anchors that develop the prestressing force through bond. Disturbing or removal of these anchorages must be avoided.

- Similar to the details of the falsework construction of the South Channel and Washington approach spans, a portion of the tendons in the precast segmental bridge spans is located in ducts within the webs. However, the majority of the prestressing in the precast segmental portion is located in ducts within the deck slab. This prestressing cannot be disturbed, as it literally supports the bridge superstructure. Typically these ducts are relatively closely spaced. As a result, extreme care must be taken in locating deck penetrations.

- The drawings suggest that all of the longitudinal prestressing for the cast-in-place segmental portion is located within the deck slab.
- The drawings also depict vertical prestressing tendons in the precast segmental concrete girder webs. These tendons are located adjacent to the piers, and provide resistance to shear and web cracking.
- Similar to the South Channel and Washington approach bridges, no provisions have been made in the construction of the segmental bridge spans to accommodate installation of additional longitudinal prestressing steel. Provisions for adding additional post-tensioning after construction have been required by the AASHTO segmental bridge design code since 1989. However, the Glenn Jackson Bridge design precedes this date.
- The design of segmental bridges has typically been optimized to result in least-weight designs for achieving long spans. As a result, there is typically little reserve capacity in these structures for loads in excess of the design loads. Accompanying this is a relatively high degree of congestion of embedded items, such as reinforcing steel and prestressing ducts.

WIDENING CONCEPTS

The existing bridges have cantilevered deck slabs that extend 10'-2" beyond the face of the exterior box girder webs. Increasing this dimension by ten feet to accommodate the study cross section would result in cantilevers that would far exceed the bending capacity of the existing cantilevered transversely prestressed concrete slabs.

Similar to the South Channel concept described above, two options were examined. The concept using precast concrete struts to transfer the deck widening loads to the existing exterior web through a simplified truss action was identified as being the least-weight option.

The precast section would resist the cantilever movement through the use of transverse prestressing steel in external ducts. Unlike the South Channel, internal anchor blocks are not likely not to be feasible due to the existing longitudinal and transverse ducts in the deck slab. A "balanced" bracket scheme appears to be reasonable to minimize dead load torsional movements on the superstructure. An internal strut will likely be needed in each cell at each new tendon to minimize transverse web bending movements.

On the precast concrete segments, care will need to be taken to avoid interfering with the existing inclined tendons in the webs.

As with the South Channel spans, the vertical reinforcing steel in the box girder webs provides a large portion of the box girder shear strength. Any proposed construction scheme must locate the existing reinforcing steel in advance of drilling holes through the webs past the concrete cover. In the event that significant portions of the existing web steel is severed, measures must be taken to restore the girder shear strength.

As with the South Channel Bridge, the proposed cross section has a 28-foot-wide LRT track slab that is centered between the northbound and southbound bridges. It is assumed that this track slab will be supported adjacent to the existing exterior webs by elastomeric bearings. In addition to the LRT loads, the existing girder must also support a suspended 20-foot-wide walkway. In order to obtain a direct load path, and to reduce the dead load torsional imbalance it was assumed that the walkway would be suspended from concrete struts similar to those used on the exterior girder face.

It is assumed that the LRT slab and track would have expansion joints at the same locations as the existing superstructure expansion joints.

For purposes of establishing potential costs associated with retrofitting, the construction sequence and operations required for the precast concrete strut scheme is described in detail below.

- Locate existing longitudinal prestressing ducts within girder webs. Selectively remove concrete cover to confirm existing duct locations and vertical reinforcing steel locations. Drill through web walls at location necessary for installation of new transverse prestressing tendons.
- Install new struts between existing girder webs.
- Install epoxy mortar on exterior and interior faces of existing exterior girder to provide for uniform bearing. Place new 25-ton concrete slab segments on outside of girder. Then install new bracket on inside face of existing girder.
- Install new prestressing bars. Place longitudinal closure in concrete.
- Stress and grout prestressing bars.
- After installation of sections of panels, place edge barrier. Place concrete overlay to provide for smooth riding surface.

For estimating purposes, assume that the transverse prestressing force in each rib (at 12 feet o.c.) is on the order of 75 to 100 tons.

As with the South Channel Bridge, it was assumed that the increased dead load and live loads would require additional longitudinal post-tensioning to be installed. The installation of this prestressing would be subject to similar constraints that were previously noted for the South Channel Bridge.

ADDITIONAL ENGINEERING STUDIES REQUIRED FOR CONCEPT VERIFICATION

The following are required to validate the above-described concepts:

- Definition of highway, rail, and pedestrian design loadings
- Transverse analysis of existing superstructure cross sections with proposed modifications
- Longitudinal girder analysis, including shear capacity of the webs and bending capacity under service and ultimate loads. Analysis must be based on current state of stress in the segmental portions of the existing bridge.
- A detailed constructibility analysis

BASIS OF ESTIMATE

The following is a brief description of the development of the order of magnitude capital cost estimate for the widening of the existing Glen Jackson Bridge (I-205) over the Columbia River. The purpose of this estimate is to aid in the evaluation of the feasibility of retrofitting the existing bridge to accommodate a new LRT guideway and relocating pedestrian walkways below this new guideway.

The existing bridge consists of two distinct superstructure types as well as a portion of embanked section. These sections have been described as follows:

• North Channel	5,700 LF
• South Channel and Washington Approach	4,887 LF
• Government Island (Embankment)	1,170 LF

The scope of work and approximate quantities that were used to prepare the order of magnitude estimates are based on the written concepts and cross section sketches contained in a draft memo from Joe Showers to Mike Trafallis and dated September 5, 2001, as well as a Glen Jackson Bridge Widening Scope of Work received by e-mail on August 28, 2001.

The following major construction activities have been included in the cost estimate.

- Maintenance of Traffic
- Pier Footing Modifications, including cofferdams, additional steel piling, and additional reinforced concrete footings.
- Pier Modifications, including doweling tie-bars to the existing pier and adding a full height reinforced concrete collar.
- Superstructure Modifications, including selective demolition of existing structure, addition of new precast widening slab and struts, concrete closure and surfacing, additional transverse and longitudinal post tensioning, LRT reinforced concrete track slab, new concrete traffic barrier and modifications to the bridge deck drainage system.
- Pedestrian Walkway, including a suspended steel frame deck system, precast concrete walkway slab, stabilizing rods, chain link fencing, and paved walkway on the embankment section.

All construction cost are in 2001 dollars and a contingency of 30% has been added to the totals due to the conceptual nature of the design concepts.

These estimates represent an opinion of probable construction cost in 2001 dollars, based on our professional experience and qualifications. There are any number of factors which can influence a probable contractors actual bid, therefore we cannot guarantee that actual bids or final construction costs will not vary from this opinion of probable cost.

PROJE AME: I-5 TRADE CORRIDOR STUDY
PROJECT NO.: 13926
DATE: 10/12/2001
ESTIMATOR: R. HARBUCK

CONCEPTUAL COST ESTIMATE

Summary of Alternative - Glen Jackson Bridge Retrofit for LRT
(2nd Qtr. 2001 Dollars in Millions)

Major Construction Item	Glen Jackson Bridge			
	North Channel	South Channel	Government Island	Total
GENERAL REQUIREMENTS	$1.3	$1.0		$2.3
PIER FOOTINGS - MODIFICATIONS	$27.2	$44.2		$71.3
PIERS - MODIFICATIONS	$3.5	$5.7		$9.2
SUPERSTRUCTURE - MODIFICATIONS	$30.5	$21.4		$52.0
PEDESTRIAN WALKWAY	$6.7	$5.7	$0.4	$12.7
SUBTOTAL CONSTRUCTION COST - 2001 $	$69.1	$78.0	$0.4	$147.5
CONTINGENCIES: 30%	$20.7	$23.4	$0.1	$44.3
TOTAL CONSTRUCTION COST - 2001 $	$89.9	$101.4	$0.5	$191.8
LENGTH OF ALIGNMENT - LF	5,700	4,887	1,170	11,757

Parsons Brinckerhoff Construction Services

PROJECT NAME: I-5 TRADE CORRIDOR STUDY
PROJECT NO.: 13926
DATE: 10/12/2001
ESTIMATOR: R. HARBUCK

GLEN JACKSON BRIDGE RETROFIT
North Channel Structure

ITEM NO.	ITEM DESCRIPTION	EST. QTY.	UNIT	UNIT COST	TOTAL COST
	General Requirements				
1	Precast barrier wall, temp.	18,400	lf	$35.00	$644,000
2	Warning panels	4	ea	$3,000.00	$12,000
3	Plastic drums	550	ea	$100.00	$55,000
4	Signing and stripping	4.3	lm	$15,000	$64,500
5	Maintenance of Traffic	24	mo	$20,000	$480,000
	Subtotal General Requirements				**$1,255,500**
	Pier Footings - Modified				
6	Cofferdam, temporary	163,200	sf	$50.00	$8,160,000
7	Structural excavation	16,864	cy	$35.00	$590,240
8	Furnish and install steel pipe piling	76,800	lf	$60.00	$4,608,000
9	Concrete, seal slab	16,864	cy	$350.00	$5,902,400
10	Concrete, footing	16,416	cy	$482.00	$7,912,512
	Subtotal Pier Footings - Modified				**$27,173,152**
	Piers - Modified				
11	Doweling to existing pier	22,080	ea	$50.00	$1,104,000
12	Concrete, footing	3,264	cy	$733.00	$2,392,512
	Subtotal Piers - Modified				**$3,496,512**
	Superstructure - Modifications				
13	Demolish existing traffic barrier	22,800	lf	$10.00	$228,000
14	Precast deck slab and strut, 12' segments, outside	950	ea	$10,000	$9,500,000
15	Precast struts, 12' segments, inside	950	ea	$4,000	$3,800,000
16	Precast struts, 12' spacing, internal	950	ea	$2,000	$1,900,000
17	Post-tensioning	600	tn	$6,500	$3,900,000
18	Concrete clouser pours	845	cy	$350.00	$295,750
19	Concrete overlay, 2" thick	12,667	sy	$40.00	$506,667
20	Concrete traffic barrier	22,800	lf	$35.00	$798,000
21	Concrete track slab	35,467	sy	$190.00	$6,738,667
22	Elastometric bearings	2,850	ea	$800.00	$2,280,000
23	Bridge deck drainage piping	1	ls	$600,000	$600,000
	Subtotal Superstructure - Modifications				**$30,547,083**
	Pedestrian Walkway				
24	Chain link fence	136,800	sf	$8.00	$1,094,400
25	Steel framing	1,995	tn	$2,000.00	$3,990,000
26	Precast concrete slab, 4"	114,000	sf	$10.00	$1,140,000
27	Stabilizer rods	1,425	ea	$300.00	$427,500
	Subtotal Pedestrian Walkway				**$6,651,900**
Total Structure					**$69,124,147**

Parsons Brinckerhoff Construction Services

PROJECT NAME:	I-5 TRADE CORRIDOR STUDY
PROJECT NO.:	13926
DATE:	10/12/2001
ESTIMATOR:	R. HARBUCK

GLEN JACKSON BRIDGE RETROFIT
South Channel and Washington Approach Structure

ITEM NO.	ITEM DESCRIPTION	EST. QTY.	UNIT	UNIT COST	TOTAL COST
	General Requirements				
1	Precast barrier wall, temp.	16,000	lf	$35.00	$560,000
2	Warning panels	4	ea	$3,000.00	$12,000
3	Plastic drums	444	ea	$100.00	$44,400
4	Signing and stripping	3.7	lm	$15,000	$55,500
5	Maintenance of Traffic	18	mo	$20,000	$360,000
	Subtotal General Requirements				**$1,031,900**
	Pier Footings - Modified				
6	Cofferdam, temporary	265,200	sf	$50.00	$13,260,000
7	Structural excavation	27,404	cy	$35.00	$959,140
8	Furnish and install steel pipe piling	124,800	lf	$60.00	$7,488,000
9	Concrete, seal slab	27,404	cy	$350.00	$9,591,400
10	Concrete, footing	26,676	cy	$482.00	$12,857,832
	Subtotal Pier Footings - Modified				**$44,156,372**
	Piers - Modified				
11	Doweling to existing pier	35,880	ea	$50.00	$1,794,000
12	Concrete, footing	5,304	cy	$733.00	$3,887,832
	Subtotal Piers - Modified				**$5,681,832**
	Superstructure - Modifications				
13	Demolish existing traffic barrier	19,548	lf	$10.00	$195,480
14	Demolish existing deck slab	141,723	sf	$6.00	$850,338
15	Precast deck slab and strut, 10' segments	978	ea	$6,500	$6,357,000
16	Post-tensioning	500	tn	$6,500	$3,250,000
17	Concrete clouser pours	724	cy	$350.00	$253,400
18	Concrete strongbacks	870	sf	$950.00	$826,500
19	Concrete overlay, 2" thick	19,548	sy	$40.00	$781,920
20	Concrete traffic barrier	19,548	lf	$35.00	$684,180
21	Concrete track slab	30,408	sy	$190.00	$5,777,520
22	Elastometric bearings	2,444	ea	$800.00	$1,955,200
23	Bridge deck drainage piping	1	ls	$500,000	$500,000
	Subtotal Superstructure - Modifications				**$21,431,538**
	Pedestrian Walkway				
24	Chain link fence	117,288	sf	$8.00	$938,304
25	Steel framing	1,710	tn	$2,000.00	$3,420,900
26	Precast concrete slab, 4"	97,740	sf	$10.00	$977,400
27	Stabilizer rods	1,222	ea	$300.00	$366,525
	Subtotal Pedestrian Walkway				**$5,703,129**
Total Structure					**$78,004,771**

Parsons Brinckerhoff Construction Services

PROJECT NAME:	I-5 TRADE CORRIDOR STUDY
PROJECT NO.:	13926
DATE:	10/12/2001
ESTIMATOR:	R. HARBUCK

GLEN JACKSON BRIDGE RETROFIT
Government Island Pedestrian Walkway

ITEM NO.	ITEM DESCRIPTION	EST. QTY.	UNIT	UNIT COST	TOTAL COST
	Pedestrian Walkway				
1	Clearing and Grubbing	3,120	sy	$1.00	$3,120
2	Rough Grading	28,080	sf	$0.40	$11,120
3	Finish Grading	23,400	sf	$0.60	$14,040
4	Geotextile Fabric	2,600	sy	$1.50	$3,900
5	Erosion Control	2,340	lf	$22.00	$51,480
6	Underdrains	2,340	lf	$18.00	$42,120
7	Walkway Drainage	2,340	lf	$40.00	$93,600
8	Walkway Paving	23,400	sf	$5.00	$117,000
9	Walkway Signage	23,400	lf	$2.00	$46,800
	Subtotal Pedestrian Walkway				**$383,180**

Airport Jct to Van Mall TC & P/R (Via New CRC Bridge)

I-205

CAPITAL COST ESTIMATE

dated July 2001 in Second Quarter 2001 Dollars.

	Summary of Conceptual Engineering Estimated Costs.			Segment 1	Segment 2	Segment 3	Segment 4	Segment 5		
				Airport Jct to State Line	Wash St Line to SE 10th	SE 10th - Mill Plain Area	Mill Plain to Van Mall TC	Van Mall TC to NE 83rd	Systems	Totals
				12,950 LF	5,960 LF	6,700 LF	13,446 LF	9,900 LF	48,956 LF	48,956 LF TOTAL
1	CIVIL CONSTRUCTION		$305,057,827	$129,547,159	$63,954,846	$28,630,087	$47,767,360	$35,158,374		$305,057,827
2	INSURANCE		$0							$0
3	TRACK MATERIALS		$0							$0
4	TRANSIT VEHICLES (19 LRV's)		$57,274,711						$57,274,711	$57,274,711
5	OPERATIONS FACILITIES (Prorated for Rocky Butte)		$11,724,361						$11,724,361	$11,724,361
6	TRACTION ELECTRIFICATION SYSTEM (TES)		$16,465,297	$4,874,215	$2,220,687	$2,167,290	$4,190,550	$3,012,557		$16,465,297
7	SIGNALS		$15,997,063	$4,384,545	$1,676,908	$1,885,114	$4,524,100	$3,526,396		$15,997,063
8	COMMUNICATIONS		$5,167,020	$1,366,797	$629,043	$707,146	$1,419,147	$1,044,887		$5,167,020
9	FARE COLLECTION		$1,321,846	$0	$0	$248,001	$744,003	$329,842		$1,321,846
10	RIGHT OF WAY / REAL ESTATE		$22,519,469	$3,600	$3,727,006	$4,189,755	$8,408,276	$6,190,832		$22,519,469
11	ENGINEERING AND ADMINISTRATION		$119,820,191	$46,674,645	$22,835,675	$11,043,563	$19,063,279	$13,783,006	$6,420,023	$119,820,191
12	CONTINGENCIES		$118,001,527	$46,525,662	$22,861,217	$10,536,612	$17,607,957	$12,059,968	$8,409,911	$118,001,527
	TOTAL (2001 $)		$673,349,313	$233,376,823	$117,905,381	$59,407,568	$103,724,672	$75,105,862	$83,829,007	$673,349,313
	YOE (mid - 2010 $)	145.6%	$987,137,612	$342,133,028	$172,850,606	$87,092,158	$152,061,528	$110,106,032	$122,894,261	$987,137,612
	Miles			2.45	1.13	1.27	2.55	1.88	9.27	9.27
	Cost per mile calculation in millions		$106 M per mile	$139 M per mile	$153 M per mile	$69 M per mile	$60 M per mile	$59 M per mile	$13 M per mile	$106 M per mile

:lark County Light Rail Cost Estimate

heet: Segment 1 — Airport Jct to Van Mall TC & P/R (via I-205 - New CRC Br) — Date: 8/28/01

ngineer: B Dethlefs — Airport Jct to Wash State Line (I-205 Alignment) — Estimator: David Chiara

25+50 255+00 — Oregon Side

ategory	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	25% E&A	Total
OM	COMBIN	COMMUNICATION	125+50	255+00	12,950	0	0	1.00	12,950	RF	$105.54	$1,366,797	$273,359	$410,039	$2,050,195
RS	STREET	Street And Track @ Intersections	125+50	255+00	-	0	0	1.00	0	EA	$158,859.97	$0	$0	$0	$0
RS	SIGNAL	Modify Existing Traffic Signals	125+50	255+00	-	0	0	0.67	0	EA	$160,984.93	$0	$0	$0	$0
RS	SIGNAL	New Traffic Signal	125+50	255+00	-	0	0	1.00	0	EA	$160,984.93	$0	$0	$0	$0
RS	GATE1	1 Gate With Flashers	125+50	255+00	-	0	0	1.00	0	EA	$122,500.32	$0	$0	$0	$0
LC	CAT	Double Track Catenary System	125+50	137+60	1,210	0	0	1.00	1,210	RF	$301.08	$364,309	$72,862	$109,293	$546,464
LC	CATBR	Double Track Catenary On Bridge	137+60	140+95	335	0	0	1.00	335	RF	$423.56	$141,894	$28,379	$42,568	$212,841
LC	CAT	Double Track Catenary System	140+95	158+10	1,715	0	0	1.00	1,715	RF	$301.08	$516,356	$103,271	$154,907	$774,533
LC	CATBR	Double Track Catenary On Bridge	158+10	162+10	400	0	0	1.00	400	RF	$423.56	$169,426	$33,885	$50,828	$254,139
LC	CAT	Double Track Catenary System	162+10	168+63	653	0	0	1.00	653	RF	$301.08	$196,607	$39,321	$58,982	$294,910
LC	CATBR	Double Track Catenary On Bridge	168+63	200+20	3,157	0	0	1.00	3,157	RF	$423.56	$1,337,192	$267,438	$401,158	$2,005,788
LC	CAT	Double Track Catenary System	200+20	214+30	1,410	0	0	1.00	1,410	RF	$301.08	$424,526	$84,905	$127,358	$636,788
LC	CATBR	Double Track Catenary On Bridge	214+30	255+00	4,070	0	0	1.00	4,070	RF	$423.56	$1,723,906	$344,781	$517,172	$2,585,859
CL	NA	None	125+50	255+00	-	0	0	1.00	0	RF	$0.00	$0	$0	$0	$0
RD	D	LRT Grade Construction-50 Ft Row	125+50	137+60	1,210	0	0	1.00	1,210	RF	$756.32	$915,149	$320,302	$308,863	$1,544,315
RD	D	LRT Grade Construction-50 Ft Row	140+95	158+10	1,715	0	0	1.00	1,715	RF	$756.32	$1,297,092	$453,982	$437,769	$2,188,843
RD	D	LRT Grade Construction-50 Ft Row	200+20	214+30	1,410	0	0	1.00	1,410	RF	$756.32	$1,066,414	$373,245	$359,915	$1,799,573
RD	AERIALD	Aerial Double, Ductbanks	125+50	255+00	7,962	0	0	1.00	7,962	RF	$102.54	$816,406	$285,742	$275,537	$1,377,685
RD	EXC-MAJ	Allowance for Cut	125+50	214+20	4,988	40.00	2	1.00	14,779	CY	$14.82	$219,008	$76,653	$73,915	$369,575
RD	FILL-MIN	Allowance for Fill	125+50	214+20	4,988	-	0	1.00	0	CY	$6.17	$0	$0	$0	$0
RD	UNIQUE	Allowance for tree removal (replacement in SPC)	200+20	214+30	10,000	0	0	1.00	10,000	LS	$1.00	$10,000	$3,500	$3,375	$16,875
RD	FENCE	Fencing	200+20	214+30	1,410	0	0	2.00	1,410	LF	$18.52	$52,235	$18,282	$17,629	$88,147
RD	UNIQUE	Chain & bollard (I-MAX style)	125+50	255+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
RK	NA	No Park & Ride Facilities On This Sheet	125+50	255+00	-	0	0	1.00	0	RF	$0.00	$0	$0	$0	$0
IG	SIGALL	Combined Signal System	125+50	255+00	12,950	0	0	1.00	12,950	RF	$281.36	$3,643,617	$728,723	$1,093,085	$5,465,425
IG	INTER	Interlock	125+50		1	0	0	1.00	1	EA	$740,928.57	$740,929	$148,186	$222,279	$1,111,393
PC	UNIQUE	HAZ MAT Testing & Remediation	125+50	255+00	453,250	0	0	1.00	453,250	LS	$1.00	$453,250	$158,638	$152,972	$764,859
PC	UNIQUE	Landscaping & hydroseeding	125+50	255+00	175,000	0	0	1.00	175,000	LS	$1.00	$175,000	$61,250	$59,063	$295,313
TA	NA	No Station On This Sheet	125+50	255+00	-	0	0	1.00	0	RF	$0.00	$0	$0	$0	$0
TA	UNIQUE	Signs & Graphics for this alignment	125+50	255+00	361,978	0	0	1.00	361,978	LS	$1.00	$361,978	$108,593	$117,643	$588,213
TA	UNIQUE	Signs & Graphics for existing lines	125+50	255+00	208,475	0	0	1.00	208,475	LS	$1.00	$208,475	$62,543	$67,754	$338,772
TR	UNIQUE	Temporary Traffic Control on I-205	125+50	255+00	465,000	0	0	1.00	465,000	LS	$1.00	$465,000	$162,750	$156,937	$784,687
TR	UNIQUE	Adjust ODOT drainage (off structure)	125+50	255+00	650,000	0	0	1.00	650,000	LS	$1.00	$650,000	$227,500	$219,375	$1,096,875
TR	DEMO	Allowance for bike path removal	161+00	172+00	1,100	12	0	1.00	1,467	SY	$6.17	$9,056	$3,170	$3,056	$15,282
TR	PAV-STD	Allowance for lane adjustments SB & NB	120+00	140+00	2,000	8	0	2.00	1,778	SY	$43.22	$153,674	$53,786	$51,865	$259,325
TR	DEMO10	Allowance for lane adjustments SB & NB	120+00	140+00	2,000	8	0	2.00	1,778	SY	$12.35	$43,907	$15,367	$14,819	$74,093
TR	UNIQUE	Relocate ODOT sign bridge (NB - full lane width)	142+50		125,000	0	0	1.00	125,000	LS	$1.00	$125,000	$43,750	$42,188	$210,938
TU	UNIQUE	Relocate existing ODOT J-barriers (2-sides) -Demo	125+00	135+00	20,000	-	0	2.00	20,000	LS	$1.00	$40,000	$14,000	$13,500	$67,500
TU	JBARRIER	Relocate existing ODOT J-barriers (2-sides)	125+00	135+00	1,000	-	0	2.00	1,000	LF	$44.70	$89,395	$31,288	$30,171	$150,854
TU	AERIAL	LRT Double Track Aerial Structure	137+60	140+95	335	-	0	1.00	335	RF	$5,099.27	$1,708,254	$597,889	$576,536	$2,882,679
TU	AERIAL	LRT Double Track Aerial Structure	158+10	162+10	400	-	0	1.00	400	RF	$5,099.27	$2,039,706	$713,897	$688,401	$3,442,005
TU	JBARRIER	Jersey Barrier (Per Side) - off structure	135+00	169+00	4,988	-	0	2.00	4,988	LF	$44.70	$445,903	$156,066	$150,492	$752,462
TU	UNIQUE	Construct new spiral bike ramp connection to I-205 structure (15VF)	172+00		120,000	-	0	1.00	120,000	LS	$1.00	$120,000	$42,000	$40,500	$202,500
TU	RETFIL20	Retained Fill - 20' Avg. Hgt.	162+10	168+63	653	-	0	1.00	653	RF	$5,053.74	$3,300,090	$1,155,031	$1,113,780	$5,568,901
TU	COLCONC	Col River Conc Segmental - 40' width required	168+63	200+20	3,157	-	0	1.20	3,157	RF	$11,627.83	$44,197,699	$15,469,195	$14,916,723	$74,583,617
TU	COLCONC	Col River Conc Segmental - 40' width required	214+30	255+00	4,070	-	0	1.29	4,070	RF	$11,627.83	$61,049,584	$21,367,355	$20,604,235	$103,021,174
RK	STD	Tie & Ballast Double Track	125+50	137+60	1,210	-	0	1.00	1,210	RF	$299.50	$362,395	$72,479	$108,718	$543,592
RK	TO16	#20 Turnouts	125+60		2	-	0	1.00	2	EA	$174,195.57	$348,391	$69,678	$104,517	$522,587
RK	DF	Double Track Direct Fixation	137+60	140+95	335	-	0	1.00	335	RF	$640.87	$214,691	$42,938	$64,407	$322,036
RK	STD	Tie & Ballast Double Track	140+95	158+10	1,715	-	0	1.00	1,715	RF	$299.50	$513,642	$102,728	$154,093	$770,463
RK	DF	Double Track Direct Fixation	158+10	162+10	400	-	0	1.00	400	RF	$640.87	$256,347	$51,269	$76,904	$384,521
RK	STD	Tie & Ballast Double Track	162+10	168+63	653	-	0	1.00	653	RF	$299.50	$195,573	$39,115	$58,672	$293,360
RK	DF	Double Track Direct Fixation on I-205 Glenn Jackson Br	168+63	200+20	3,157	-	0	1.00	3,157	RF	$640.87	$2,023,219	$404,644	$606,966	$3,034,828
RK	STD	Tie & Ballast Double Track - Govt Island	200+20	214+30	1,410	-	0	1.00	1,410	RF	$299.50	$422,295	$84,459	$126,688	$633,442

lark County Light Rail Cost Estimate

heet:	Segment 1	Airport Jct to Van Mall TC & P/R (via I-205 - New CRC Br)				Date:	8/28/01										
ngineer:	B Dethlefts	Airport Jct to Wash State Line (I-205 Alignment)				Estimator:	David Chiara										
25+50	255+00	Oregon Side													25%		
ategory	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	E&A	Total		
RK	DF	Double Track Direct Fixation on I-205 Glenn Jackson Br	214+30	255+00	4,070	-	0	1.00	4,070	RF	$640.87	$2,608,331	$521,666	$782,499	$3,912,496		
TL	UNIQUE	Utilities - private ROW - minor - on bridges	125+50	255+00	647,500	-	0	1.00	647,500	LS	$1.00	$647,500	$259,000	$226,625	$1,133,125		
TL	UNIQUE	Utilities - public ROW - ODOT ROW	125+50	255+00	1,942,500	-	0	1.00	1,942,500	LS	$1.00	$1,942,500	$777,000	$679,875	$3,399,375		
											Totals	$140,172,716	$46,525,862	$46,674,645	$233,373,223		

OTAL BY COST CATEGORY

LG	Building	$0	$0	$0	$0
OM	Communications	$1,366,797	$273,359	$410,039	$2,050,195
RS	Crossings	$0	$0	$0	$0
LC	Traction Electrification	$4,874,215	$974,843	$1,462,264	$7,311,322
QU	Equipment	$0	$0	$0	$0
CL	Fare Collection	$0	$0	$0	$0
RD	Track Grade Construction	$4,376,304	$1,531,706	$1,477,002	$7,385,012
RK	Park & Ride	$0	$0	$0	$0
IG	Signal System	$4,384,545	$876,909	$1,315,364	$6,576,818
IT	Sitework	$0	$0	$0	$0
PC	Special Conditions	$628,250	$219,888	$212,034	$1,060,172
TA	Stations	$570,453	$171,136	$185,397	$926,986
TR	Street Reconstruction	$1,446,636	$506,323	$488,240	$2,441,199
TU	Structures	$112,990,632	$39,546,721	$38,134,338	$190,671,692
RK	Trackwork	$6,944,884	$1,388,977	$2,083,465	$10,417,326
TL	Utilities	$2,590,000	$1,036,000	$906,500	$4,532,500
	Totals	$140,172,716	$46,525,862	$46,674,645	$233,373,223

Civil Construction				
Crossings	$0	$0	$0	$0
Track Grade Construction	$4,376,304	$1,531,706	$1,477,002	$7,385,012
Park & Ride	$0	$0	$0	$0
Special Conditions	$628,250	$219,888	$212,034	$1,060,172
Stations	$570,453	$171,136	$185,397	$926,986
Street Reconstruction	$1,446,636	$506,323	$488,240	$2,441,199
Structures	$112,990,632	$39,546,721	$38,134,338	$190,671,692
Trackwork	$6,944,884	$1,388,977	$2,083,465	$10,417,326
Utilities	$2,590,000	$1,036,000	$906,500	$4,532,500
Total - Civil Construction	$129,547,159	$44,400,751	$43,486,978	$217,434,888
TES	$4,874,215	$974,843	$1,462,264	$7,311,322
Signals	$4,384,545	$876,909	$1,315,364	$6,576,818
Communications	$1,366,797	$273,359	$410,039	$2,050,195
Fare Collection	$0	$0	$0	$0
Total - Systems	$10,625,557	$2,125,111	$3,187,667	$15,938,335
	$140,172,716	$46,525,862	$46,674,645	$233,373,223

lark County Light Rail Cost Estimate

ieet: Segment 2 Airport Jct to Van Mall TC & P/R (via I-205) Date: 8/29/01
igineer: B Dethlefts Wash State Line to SE 10th (I-205 Alignment) Estimator: David Chiara
i5+00 288+60 Bk Washington Side 25%
i0+00 Ahd 326+00

itegory	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	E&A	Total
OM	COMBIN	COMMUNICATION	255+00	326+00	5,960	0	0	1.00	5,960	RF	$105.54	$629,043	$125,809	$188,713	$943,565
RS	STREET	Street And Track @ Intersections	255+00	326+00	-	0	0	1.00	0.0	EA	$158,859.97	$0	$0	$0	$0
RS	SIGNAL	Modify Existing Traffic Signals	255+00	326+00	-	0	0	0.67	0	EA	$160,984.93	$0	$0	$0	$0
RS	SIGNAL	New Traffic Signal	255+00	326+00	-	0	0	1.00	0	EA	$160,984.93	$0	$0	$0	$0
RS	GATE1	1 Gate With Flashers	255+00	326+00	-	0	0	1.00	0	EA	$122,500.32	$0	$0	$0	$0
.C	CATBR	Double Track Catenary On Bridge	255+00	288+60	3,360	0	0	1.00	3,360	RF	$423.56	$1,423,176	$284,635	$426,953	$2,134,763
.C	CATBR	Double Track Catenary On Bridge	300+00	301+20	120	0	0	1.00	120	RF	$423.56	$50,828	$10,166	$15,248	$76,242
.C	CAT	Double Track Catenary System	301+20	326+00	2,480	0	0	1.00	2,480	RF	$301.08	$746,683	$149,337	$224,005	$1,120,025
:L	NA	None	255+00	326+00	-	0	0	1.00	0	RF	$0.00	$0	$0	$0	$0
RD	D	LRT Grade Construction-50 Ft Row	307+20	326+00	1,880	0	0	1.00	1,880	RF	$756.32	$1,421,885	$497,660	$479,886	$2,399,431
RD	AERIALD	Aerial Double, Ductbanks	255+00	288+60	3,360	0	0	1.00	3,360	RF	$102.54	$344,527	$120,584	$116,278	$581,389
RD	AERIALD	Aerial Double, Ductbanks	300+00	301+20	120	0	0	1.00	120	RF	$102.54	$12,305	$4,307	$4,153	$20,764
RD	EXC-MAJ	Allowance for Cut	307+20	326+00	1,880	40.00	2	1.00	5,570	CY	$14.82	$82,545	$28,891	$27,859	$139,295
RD	FILL-MIN	Allowance for Fill	307+20	326+00	1,880	-	0	1.00	0	CY	$6.17	$0	$0	$0	$0
RD	UNIQUE	Allowance for tree removal (replacement in SPC)	300+00	326+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
RD	FENCE	Fencing	300+00	326+00	-	0	0	2.00	0	LF	$18.52	$0	$0	$0	$0
RD	UNIQUE	Chain & bollard (I-MAX style)	300+00	326+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
RK	NA	No Park & Ride Facilities On This Sheet	255+00	326+00	-	0	0	1.00	0	RF	$0.00	$0	$0	$0	$0
G	SIGALL	Combined Signal System	255+00	326+00	5,960	0	0	1.00	5,960	RF	$281.36	$1,676,908	$335,382	$503,072	$2,515,362
PC	UNIQUE	HAZ MAT Testing & Remediation	255+00	326+00	208,600	0	0	1.00	208,600	LS	$1.00	$208,600	$73,010	$70,403	$352,013
PC	UNIQUE	Landscaping & hydroseeding	300+00	326+00	78,000	0	0	1.00	78,000	LS	$1.00	$78,000	$27,300	$26,325	$131,625
PC	UNIQUE	Washington State Sales Tax on Materials	255+00	326+00	1,820,000	0	0	1.00	1,820,000	LS	$1.00	$1,820,000	$637,000	$614,250	$3,071,250
'A	NA	No Station On This Sheet	255+00	326+00	-	0	0	1.00	0	RF	$0.00	$0	$0	$0	$0
'A	UNIQUE	Signs & Graphics for this alignment	255+00	326+00	166,594	0	0	1.00	166,594	LS	$1.00	$166,594	$49,978	$54,143	$270,714
'A	UNIQUE	Signs & Graphics for existing lines	255+00	326+00	95,947	0	0	1.00	95,947	LS	$1.00	$95,947	$28,784	$31,183	$155,914
'R	UNIQUE	Temporary Traffic Control on I-205	255+00	326+00	250,000	0	0	1.00	250,000	LS	$1.00	$250,000	$87,500	$84,375	$421,876
'R	UNIQUE	Adjust WSDOT drainage (off structure)	300+00	326+00	323,600	0	0	1.00	323,600	LS	$1.00	$323,600	$113,260	$109,215	$546,075
'R	PAV-STD	Allowance for lane adjustments SB & NB	300+00	315+00	1,500	8	0	2.00	1,333	SY	$43.22	$115,256	$40,339	$38,899	$194,494
'R	DEMO10	Allowance for lane adjustments SB & NB	289+00	315+00	2,600	8	0	2.00	2,311	SY	$12.35	$57,079	$19,978	$19,264	$96,321
'R	UNIQUE	Relocate WSDOT sign bridge (- full lane width)	+00		-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
'U	JBARRIER	Jersey Barrier (Per Side) - off structure	300+00	326+00	2,600	-	0	2.00	2,600	LF	$44.70	$232,428	$81,350	$78,444	$392,222
'U	COLCONC	Col River Conc Segmental - 40' width required	255+00	288+60	3,360	-	0	1.29	3,360	RF	$11,627.83	$50,399,657	$17,639,880	$17,009,884	$85,049,421
'U	COLCONC	Col River Conc Segmental - 40' width required	300+00	301+20	120	-	0	1.29	120	RF	$11,627.83	$1,799,988	$629,996	$607,496	$3,037,479
'U	RETFIL20	Retained Fill - 20' Avg. Hgt.	301+20	307+20	600	-	0	1.00	600	RF	$5,053.74	$3,032,242	$1,061,285	$1,023,382	$5,116,908
:K	DF		255+00	288+95	3,395	-	0	1.00	3,395	RF	$640.87	$2,175,745	$435,149	$652,724	$3,263,618
:K	STD	Tie & Ballast Double Track	300+00	326+00	2,600	-	0	1.00	2,600	RF	$299.50	$778,700	$155,740	$233,610	$1,168,050
'L	UNIQUE	Utilities - private ROW - minor - on bridges	255+00	288+95	169,750	-	0	1.00	169,750	LS	$1.00	$169,750	$67,900	$59,413	$297,063
'L	UNIQUE	Utilities - public ROW - WSDOT ROW	300+00	326+00	390,000	-	0	1.00	390,000	LS	$1.00	$390,000	$156,000	$136,500	$682,500
											Totals	$68,481,483	$22,861,217	$22,835,675	$114,178,375

ITAL BY COST CATEGORY

		Line Cost	Contingency	E&A	Total
G	Building	$0	$0	$0	$0
OM	Communications	$629,043	$125,809	$188,713	$943,565
RS	Crossings	$0	$0	$0	$0
C	Traction Electrification	$2,220,687	$444,137	$666,206	$3,331,030
QU	Equipment	$0	$0	$0	$0
:L	Fare Collection	$0	$0	$0	$0
RD	Track Grade Construction	$1,861,261	$651,441	$628,176	$3,140,879
RK	Park & Ride	$0	$0	$0	$0

:lark County Light Rail Cost Estimate

;heet:	Segment 2	Airport Jct to Van Mall TC & P/R (via I-205)	Date:	8/29/01		
:ngineer:	B Dethlefts	Wash State Line to SE 10th (I-205 Alignment)	Estimator:	David Chiara		
55+00	288+60 Bk	Washington Side				25%
00+00 Ahd 326+00						

:ategory	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	E&A	Total
;IG		Signal System										$1,676,908	$335,382	$503,072	$2,515,362
;IT		Sitework										$0	$0	$0	$0
;PC		Special Conditions										$2,106,600	$737,310	$710,978	$3,554,888
;TA		Stations										$262,540	$78,762	$85,326	$426,628
;TR		Street Reconstruction										$745,935	$261,077	$251,753	$1,258,765
;TU		Structures										$55,464,314	$19,412,510	$18,719,206	$93,596,030
'RK		Trackwork										$2,954,445	$590,889	$886,334	$4,431,668
ITL		Utilities										$559,750	$223,900	$195,913	$979,563
											Totals	$68,481,483	$22,861,217	$22,835,675	$114,178,375

Description	Line Cost	Contingency	E&A	Total
Civil Construction				
Crossings	$0	$0	$0	$0
Track Grade Construction	$1,861,261	$651,441	$628,176	$3,140,879
Park & Ride	$0	$0	$0	$0
Special Conditions	$2,106,600	$737,310	$710,978	$3,554,888
Stations	$262,540	$78,762	$85,326	$426,628
Street Reconstruction	$745,935	$261,077	$251,753	$1,258,765
Structures	$55,464,314	$19,412,510	$18,719,206	$93,596,030
Trackwork	$2,954,445	$590,889	$886,334	$4,431,668
Utilities	$559,750	$223,900	$195,913	$979,563
Total - Civil Construction	$63,954,846	$21,955,890	$21,477,684	$107,388,419
TES	$2,220,687	$444,137	$666,206	$3,331,030
Signals	$1,676,908	$335,382	$503,072	$2,515,362
Communications	$629,043	$125,809	$188,713	$943,565
Fare Collection	$0	$0	$0	$0
Total - Systems	$4,526,637	$905,327	$1,357,991	$6,789,956
	$68,481,483	$22,861,217	$22,835,675	$114,178,375

:lark County Light Rail Cost Estimate

;heet:	Segment 3	Airport Jct to Van Mall TC & P/R (via I-205)	Date:	7/17/01			
:ngineer:	B Dethlefts	SE 10th to north of Mill Plain (I-205/Chkalov Dr Alignment)	Estimator:	David Chiara			
26+00	393+00	Washington Side	Note: alignment changed from I-205 Thru to SE Chkalov Dr as base option (equation between Seg 3 & 4)				

:ategory	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	25% E&A	Total
:OM	COMBIN	COMMUNICATION	326+00	393+00	6,700	0	0	1.00	6,700	RF	$105.54	$707,146	$141,429	$212,144	$1,060,719
:RS	STREET	Street And Track @ Intersections	326+00	393+00	5	0	0	1.70	5.0	EA	$158,859.97	$1,350,310	$405,093	$438,851	$2,194,253
;RS	SIGNAL	Modify Existing Traffic Signals	326+00	393+00	-	0	0	0.67	0	EA	$160,984.93	$0	$0	$0	$0
;RS	SIGNAL	New Traffic Signals (SW 10th, Mill Plain + 3)	326+00	393+00	5	0	0	1.00	5	EA	$160,984.93	$804,925	$241,477	$261,601	$1,308,003
:RS	GATE1	1 Gate With Flashers	326+00	393+00	-	0	0	1.00	0	EA	$122,500.32	$0	$0	$0	$0
LC	CAT	Double Track Catenary System - bridges	326+00	393+00	5,475	0	0	1.00	5,475	RF	$301.08	$1,648,424	$329,685	$494,527	$2,472,635
LC	CATBR	Double Track Catenary On Bridge	326+00	393+00	1,225	0	0	1.00	1,225	RF	$423.56	$518,866	$103,773	$155,660	$778,299
CL	TOTEA	Station @ SE Chkalov Dr - Split Platforms	353+75	355+75	2	0	0	1.00	2	EA	$124,000.57	$248,001	$37,200	$71,300	$356,502
;RD	AERIALD	Aerial Double, Ductbanks	332+50	338+00	550	0	0	1.00	550	RF	$102.54	$56,396	$19,739	$19,034	$95,168
;RD	D	LRT Grade Construction-50 Ft Row	338+00	377+80	3,980	0	0	1.00	3,980	RF	$756.32	$3,010,161	$1,053,556	$1,015,929	$5,079,646
;RD	AERIALD	Aerial Double, Ductbanks	380+25	387+00	675	0	0	1.00	675	RF	$102.54	$69,213	$24,225	$23,359	$116,797
;RD	EXC-MAJ	Allowance for Cut	326+00	393+00	-	40.00	2	1.00	0	CY	$14.82	$0	$0	$0	$0
;RD	FILL-MAJ	Allowance for Fill	373+00	377+80	480	52.00	10	1.00	9,244	CY	$14.82	$136,989	$47,946	$46,234	$231,170
RD	UNIQUE	Allowance for tree removal (replacement in SPC)	326+00	393+00	40,000	0	0	1.00	40,000	LS	$1.00	$40,000	$14,000	$13,500	$67,500
RD	FENCE	Fencing	373+00	377+80	480	0	0	2.00	480	LF	$18.52	$17,782	$6,224	$6,002	$30,008
RD	UNIQUE	Chain & bollard (I-MAX style)	338+00	373+00	2,990	0	0	1.00	2,990	LS	$1.00	$2,990	$1,047	$1,009	$5,046
RK	NA	No Park & Ride Facilities On This Sheet	326+00	393+00	-	0	0	1.00	0	RF	$0.00	$0	$0	$0	$0
IG	SIGALL	Combined Signal System	326+00	393+00	6,700	0	0	1.00	6,700	RF	$281.36	$1,885,114	$377,023	$565,534	$2,827,672
PC	UNIQUE	HAZ MAT Testing & Remediation	326+00	393+00	234,500	0	0	1.00	234,500	LS	$1.00	$234,500	$82,075	$79,144	$395,719
PC	UNIQUE	Landscaping allowance	326+00	393+00	335,000	0	0	1.00	335,000	LS	$1.00	$335,000	$117,250	$113,063	$565,313
PC	UNIQUE	Tree replacement allowance	326+00	393+00	50,000	0	0	1.00	50,000	LS	$1.00	$50,000	$17,500	$16,875	$84,375
PC	WET-MIT	Wetland Mitigation (acres)	326+00	393+00	-	0	0	1.00	0	EA	$150,000.00	$0	$0	$0	$0
PC	UNIQUE	Operator's Building	326+00	393+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
PC	UNIQUE	Washington State Sales Tax on Materials	326+00	393+00	900,000	0	0	1.00	900,000	LS	$1.00	$900,000	$315,000	$303,750	$1,518,750
TA	PRIV	Station @ SE Chkalov Dr - Split Platforms	353+75	355+75	1	0	0	1.00	1	EA	$871,250.50	$871,250	$261,375	$283,156	$1,415,782
TA	UNIQUE	Signs & Graphics for this alignment	326+00	393+00	187,278	0	0	1.00	187,278	LS	$1.00	$187,278	$56,183	$60,865	$304,327
TA	UNIQUE	Signs & Graphics for existing lines	326+00	393+00	107,860	0	0	1.00	107,860	LS	$1.00	$107,860	$32,358	$35,054	$175,272
TR	UNIQUE	Temporary Traffic Control on I-205 & SE Chkalov Dr	326+00	393+00	215,000	0	0	1.00	215,000	LS	$1.00	$215,000	$75,250	$72,563	$362,813
TR	UNIQUE	Adjust WSDOT drainage (off structure)	326+00	332+50	81,000	0	0	1.00	81,000	LS	$1.00	$81,000	$28,350	$27,338	$136,688
TR	UNIQUE	Adjust WSDOT drainage (off structure)	387+00	393+00	74,800	0	0	1.00	74,800	LS	$1.00	$74,800	$26,180	$25,245	$126,225
TR	UNIQUE	Allowance for bike path adjustments	326+00	393+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
TR	DEMO10	Allowance for demo of western side of SE Chkalov Dr	338+85	361+70	2,285	65	0	1.00	16,503	SY	$12.35	$203,790	$71,326	$68,779	$343,895
TR	CURB	Allowance for new curbs (both sides of SE Chkalov Dr)	338+85	361+70	2,285	0	0	2.00	2,285	LF	$23.74	$108,511	$37,979	$36,623	$183,113
TR	WALKS	Allowance for new walk (west side of SE Chkalov Dr)	338+85	361+70	2,285	10	0	1.00	2,539	SY	$33.34	$84,651	$29,628	$28,570	$142,849
TR	PAV-STD	Allowance for new pavement (western side - full)	338+85	361+70	2,285	28	0	1.00	7,109	SY	$43.22	$307,252	$107,538	$103,698	$518,488
TR	PAV-MIN	Allowance for lane overlay - east side of Chkalov Dr	338+85	361+70	2,285	8	0	2.00	2,031	SY	$30.87	$125,409	$43,893	$42,326	$211,628
TR	DEMO10	Allowance for demo of both sides of SE Chkalov Dr	361+70	373+00	1,130	100	0	1.00	12,556	SY	$12.35	$155,046	$54,266	$52,328	$261,640
TR	CURB	Allowance for new curbs (both sides of SE Chkalov Dr)	361+70	373+00	1,130	0	0	2.00	1,130	LF	$23.74	$53,662	$18,782	$18,111	$90,555
TR	PAV-STD	Allowance for new pavement (both sides - full)	361+70	373+00	1,130	28	0	2.00	3,516	SY	$43.22	$303,890	$106,362	$102,563	$512,815
TR	WALKS	Allowance for new walks (both sides of SE Chkalov Dr)	361+70	373+00	1,130	10	0	2.00	1,256	SY	$33.34	$83,725	$29,304	$28,257	$141,286
TU	RETFIL15	Retained fill	326+00	332+50	650	-	0	1.00	650	RF	$4,753.74	$3,089,928	$1,081,475	$1,042,851	$5,214,254
TU	AERIAL	Aerial LRT structure over NB lanes of I-205	332+50	338+00	550	-	0	1.00	550	RF	$5,099.27	$2,804,596	$981,609	$946,551	$4,732,756
TU	RETWAL10	Retaining wall Right side	373+30	377+80	450	10.00	0	1.00	4,500	SF	$35.81	$161,152	$56,403	$54,389	$271,944
TU	RETFIL20	Retained fill	377+80	380+25	245	-	0	1.00	245	RF	$5,053.74	$1,238,165	$433,358	$417,881	$2,089,404
TU	AERIAL	Aerial LRT structure over NB lanes of I-205	380+25	387+00	675	-	0	1.00	675	RF	$5,099.27	$3,442,005	$1,204,702	$1,161,677	$5,808,383
TU	RETFIL15	Retained fill	387+00	393+00	600	-	0	1.00	600	RF	$4,753.74	$2,852,242	$998,285	$962,632	$4,813,158
TU	JBARRIER	Jersey Barrier (Per Side) - off structure	387+30	393+00	570	-	0	2.00	570	LF	$44.70	$50,955	$17,834	$17,197	$85,987
RK	STD	Tie & Ballast Double Track	326+00	332+50	650	-	0	1.00	650	RF	$299.50	$194,675	$38,935	$58,402	$292,012
RK	DF	Double Track Direct Fixation	332+50	338+00	550	-	0	1.00	550	RF	$640.87	$352,477	$70,495	$105,743	$528,716
RK	PAVVAN	Paved track - minus intersections	338+00	373+00	2,990	-	0	1.00	2,990	RF	$750.00	$2,242,500	$448,500	$672,750	$3,363,750
TL	UNIQUE	Utilities - public ROW - WSDOT ROW	326+00	338+00	180,000	-	0	1.00	180,000	LS	$1.00	$180,000	$72,000	$63,000	$315,000
TL	UNIQUE	Utilities - public ROW	338+00	373+00	1,750,000	-	0	1.00	1,750,000	LS	$1.00	$1,750,000	$700,000	$612,500	$3,062,500
TL	UNIQUE	Utilities - public ROW - WSDOT ROW	373+00	393+00	300,000	-	0	1.00	300,000	LS	$1.00	$300,000	$120,000	$105,000	$525,000

lark County Light Rail Cost Estimate

ieet: Segment 3 — Airport Jct to Van Mall TC & P/R (via I-205) — Date: 7/17/01
igineer: B Dethlefls — SE 10th to north of Mill Plain (I-205/Chkalov Dr Alignment) — Estimator: David Chiara
:6+00 393+00 — Washington Side — Note: alignment changed from I-205 Thru to SE Chkalov Dr as base option (equation between Seg 3 & 4)

ategory	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	25% E&A	Total
											Totals	$33,637,638	$10,536,612	$11,043,563	$55,217,813

Seg 3 SE Chkalov Dr 393+00 = 390+54 Seg 3 for I-205 Thru version

)TAL BY COST CATEGORY

	Description	Line Cost	Contingency	E&A	Total
.G	Building	$0	$0	$0	$0
)M	Communications	$707,146	$141,429	$212,144	$1,060,719
RS	Crossings	$2,155,234	$646,570	$700,451	$3,502,256
.C	Traction Electrification	$2,167,290	$433,458	$650,187	$3,250,935
)U	Equipment	$0	$0	$0	$0
:L	Fare Collection	$248,001	$37,200	$71,300	$356,502
RD	Track Grade Construction	$3,333,531	$1,166,736	$1,125,067	$5,625,334
RK	Park & Ride	$0	$0	$0	$0
G	Signal System	$1,885,114	$377,023	$565,534	$2,827,672
T	Sitework	$0	$0	$0	$0
PC	Special Conditions	$1,519,500	$531,825	$512,831	$2,564,156
'A	Stations	$1,166,388	$349,916	$379,076	$1,895,381
'R	Street Reconstruction	$1,796,737	$628,858	$606,399	$3,031,995
'U	Structures	$13,639,044	$4,773,665	$4,603,177	$23,015,886
RK	Trackwork	$2,789,652	$557,930	$836,896	$4,184,478
'L	Utilities	$2,230,000	$892,000	$780,500	$3,902,500
	Totals	$33,637,638	$10,536,612	$11,043,563	$55,217,813

Description	Line Cost	Contingency	E&A	Total
Civil Construction				
Crossings	$2,155,234	$646,570	$700,451	$3,502,256
Track Grade Construction	$3,333,531	$1,166,736	$1,125,067	$5,625,334
Park & Ride	$0	$0	$0	$0
Special Conditions	$1,519,500	$531,825	$512,831	$2,564,156
Stations	$1,166,388	$349,916	$379,076	$1,895,381
Street Reconstruction	$1,796,737	$628,858	$606,399	$3,031,995
Structures	$13,639,044	$4,773,665	$4,603,177	$23,015,886
Trackwork	$2,789,652	$557,930	$836,896	$4,184,478
Utilities	$2,230,000	$892,000	$780,500	$3,902,500
Total - Civil Construction	$28,630,087	$9,547,502	$9,544,397	$47,721,986
TES	$2,167,290	$433,458	$650,187	$3,250,935
Signals	$1,885,114	$377,023	$565,534	$2,827,672
Communications	$707,146	$141,429	$212,144	$1,060,719
Fare Collection	$248,001	$37,200	$71,300	$356,502
Total - Systems	$5,007,551	$989,110	$1,499,165	$7,495,827
	$33,637,638	$10,536,612	$11,043,563	$55,217,813

lark County Light Rail Cost Estimate

ieet: Segment 4 — Airport Jct to Van Mall TC & P/R (via I-205) — Date: 7/17/01
igineer: B Dethlefts — Mill Plain to Vancouver Mall TC (I-205 Alignment) — Estimator: David Chiara
i0+54 525+00 — Washington Side — Note: alignment changed from I-205 Thru to SE Chkalov Dr as base option (equation between Seg 3 & 4)

ategory	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	25% E&A	Total
OM	COMBIN	COMMUNICATION	390+54	525+00	13,446	0	0	1.00	13,446	RF	$105.54	$1,419,147	$283,829	$425,744	$2,128,720
RS	STREET	Street And Track @ Intersections	390+54	525+00	1.5	0	0	1.00	1.5	EA	$158,859.97	$238,290	$71,487	$77,444	$387,221
RS	SIGNAL	Modify Existing Traffic Signals	390+54	525+00	-	0	0	0.67	0	EA	$160,984.93	$0	$0	$0	$0
RS	SIGNAL	New Traffic Signal (Van Mall TC)	390+54	525+00	1	0	0	1.00	1	EA	$160,984.93	$160,985	$48,295	$52,320	$261,601
RS	GATE	Add gated crossing protection for emergency vehicle turn-around	446+50		1	0	0	1.00	1	EA	$183,750.48	$183,750	$55,125	$59,719	$298,595
RS	UNIQUE	Ped crossing (lighted crosswalk) @ Burton Rd Station	443+50		60,000	0	0	1.00	60,000	LS	$1.00	$60,000	$18,000	$19,500	$97,500
LC	CAT	Double Track Catenary System - bridges	390+54	525+00	12,285	0	0	1.00	12,285	RF	$301.08	$3,698,792	$739,758	$1,109,637	$5,548,187
LC	CATBR	Double Track Catenary On Bridge	390+54	525+00	1,161	0	0	1.00	1,161	RF	$423.56	$491,758	$98,352	$147,527	$737,637
CL	TOTEA	Station @ NE 18th Overpass - Island (wider/longer)	415+45	417+45	2	0	0	1.00	2	EA	$124,000.57	$248,001	$37,200	$71,300	$356,502
CL	TOTEA	Station @ Burton Rd Underpass - Island	444+20	446+20	2	0	0	1.00	2	EA	$124,000.57	$248,001	$37,200	$71,300	$356,502
CL	TOTEA	Station @ Vancouver Mall TC - side platforms	518+80	520+80	2	0	0	1.00	2	EA	$124,000.57	$248,001	$37,200	$71,300	$356,502
RD	D	LRT Grade Construction-50 Ft Row	390+54	442+15	5,161	0	0	1.00	5,161	RF	$756.32	$3,903,377	$1,366,182	$1,317,390	$6,586,949
RD	AERIALD	Aerial Double, Ductbanks	442+15	443+90	175	0	0	1.00	175	RF	$102.54	$17,944	$6,280	$6,056	$30,281
RD	D	LRT Grade Construction-50 Ft Row	443+90	485+75	4,185	0	0	1.00	4,185	RF	$756.32	$3,165,207	$1,107,822	$1,068,257	$5,341,286
RD	AERIALD	Aerial Double, Ductbanks	485+75	490+55	480	0	0	1.00	480	RF	$102.54	$49,218	$17,226	$16,611	$83,056
RD	AERIALD	Aerial Double, Ductbanks	505+00	510+06	506	0	0	1.00	506	RF	$102.54	$51,884	$18,159	$17,511	$87,554
RD	D	LRT Grade Construction-50 Ft Row	518+30	525+00	670	0	0	1.00	670	RF	$756.32	$506,736	$177,357	$171,023	$855,116
RD	EXC-MAJ	Allowance for Cut	390+54	525+00	13,446	40.00	2	1.00	39,840	CY	$14.82	$590,372	$206,630	$199,251	$996,253
RD	FILL-MIN	Allowance for Fill	390+54	525+00	13,446	40.00	4	1.00	79,680	CY	$6.17	$491,977	$172,192	$166,042	$830,210
RD	UNIQUE	Allowance for tree removal (replacement in SPC)	390+54	525+00	100,000	0	0	1.00	100,000	LS	$1.00	$100,000	$35,000	$33,750	$168,750
RD	FENCE	Fencing	390+54	525+00	-	0	0	2.00	0	LF	$18.52	$0	$0	$0	$0
RD	UNIQUE	Chain & bollard (I-MAX style)	390+54	525+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
RK	LOT-STAL	Park and ride facilities - West side of I-205	415+45		550	0	0	1.00	550	EA	$3,316.15	$1,823,884	$364,777	$547,165	$2,735,826
RK	UNIQUE	Allowance for tree removal (replacement in SPC) west lot	415+45		14,000	0	0	1.00	14,000	LS	$1.00	$14,000	$2,800	$4,200	$21,000
RK	LOT-STAL	Park and ride facilities - East side of I-205	415+45		280	0	0	1.00	280	EA	$3,316.15	$928,523	$185,705	$278,557	$1,392,784
RK	UNIQUE	Allowance for tree removal (replacement in SPC) east lot	415+45		7,000	0	0	1.00	7,000	LS	$1.00	$7,000	$1,400	$2,100	$10,500
G	SIGALL	Combined Signal System	390+54	525+00	13,446	0	0	1.00	13,446	RF	$281.36	$3,783,171	$756,634	$1,134,951	$5,674,757
G	INTER	Interlock	524+80		1	0	0	1.00	1	EA	$740,928.57	$740,929	$148,186	$222,279	$1,111,393
PC	UNIQUE	HAZ MAT Testing & Remediation	390+54	525+00	470,610	0	0	1.00	470,610	LS	$1.00	$470,610	$164,714	$158,831	$794,154
PC	UNIQUE	Landscaping allowance	390+54	525+00	672,300	0	0	1.00	672,300	LS	$1.00	$672,300	$235,305	$226,901	$1,134,506
PC	UNIQUE	Tree replacement allowance	390+54	525+00	25,000	0	0	1.00	25,000	LS	$1.00	$25,000	$8,750	$8,438	$42,188
PC	WET-MIT	Wetland Mitigation (acres) (in median)	470+00	486+00	1.8	0	0	1.00	1.8	EA	$150,000.00	$275,482	$96,419	$92,975	$464,876
PC	WET-MIT	Wetland Mitigation (acres) (adjacent to SB on-ramp)	491+00	497+00	0.7	0	0	1.00	0.7	EA	$150,000.00	$103,306	$36,157	$34,866	$174,329
PC	UNIQUE	Operator's Building	390+54	525+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
PC	UNIQUE	Washington State Sales Tax on Materials	390+54	525+00	1,600,000	0	0	1.00	1,600,000	LS	$1.00	$1,600,000	$560,000	$540,000	$2,700,000
TA	PRIVISL	Station @ NE 18th Overpass - Island (wider/longer)	415+45	417+45	1	0	0	1.33	1	EA	$563,750.32	$749,788	$224,936	$243,681	$1,218,405
TA	ELEVATOR	Station @ NE 18th Overpass - Island (wider/longer)	415+45		1	0	0	1.00	1	EA	$216,656.02	$216,656	$64,997	$70,413	$352,066
TA	PRIVISL	Station @ Burton Rd Underpass - Island	444+20	446+20	1	0	0	1.33	1	EA	$563,750.32	$749,788	$224,936	$243,681	$1,218,405
TA	PRIVISL	Station @ Vancouver Mall TC - side platforms	518+80	520+80	1	0	0	1.00	1	EA	$563,750.32	$563,750	$169,125	$183,219	$916,094
TA	UNIQUE	Signs & Graphics for this alignment	390+54	525+00	375,842	0	0	1.00	375,842	LS	$1.00	$375,842	$112,753	$122,149	$610,743
TA	UNIQUE	Signs & Graphics for existing lines	390+54	525+00	216,460	0	0	1.00	216,460	LS	$1.00	$216,460	$64,938	$70,350	$351,748
TR	UNIQUE	Temporary Traffic Control on I-205	390+54	525+00	500,000	0	0	1.00	500,000	LS	$1.00	$500,000	$175,000	$168,750	$843,749
TR	UNIQUE	Adjust WSDOT drainage (off structure)	390+54	525+00	1,667,304	0	0	1.00	1,667,304	LS	$1.00	$1,667,304	$583,556	$562,715	$2,813,576
TR	UNIQUE	Allowance for bike path adjustments	390+54	525+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
TR	PAV-STD	Allowance for lane adjustments SB & NB	390+54	525+00	-	0	0	2.00	0	SY	$43.22	$0	$0	$0	$0
TR	DEMO10	Allowance for lane adjustments SB & NB	390+54	525+00	-	0	0	2.00	0	SY	$12.35	$0	$0	$0	$0
TR	UNIQUE	Relocate WSDOT sign bridge (- full lane width)	390+54	525+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
TR	WALK32	ADA ramp at Burton Rd Station	444+20	446+20	300	12	0	1.00	400	SY	$39.52	$15,806	$5,532	$5,335	$26,673
TR	CURB	ADA ramp curbs at Burton Rd Station	444+20	446+20	300	0	0	2.00	300	LF	$23.74	$14,247	$4,986	$4,808	$24,041
TR	PAV-STD	Burton Rd Station bus pull-outs (2-sides)	443+50		200	12	0	2.00	267	SY	$43.22	$23,051	$8,068	$7,780	$38,899
TR	CURB	Burton Rd Station bus pull-outs (2-sides)	443+50		200	0	0	2.00	200	LF	$23.74	$9,498	$3,324	$3,205	$16,027
TR	UNIQUE	Add drainage - Burton Rd bus pull-outs (2-sides)	443+50		37,200	0	0	1.00	37,200	LS	$1.00	$37,200	$13,020	$12,555	$62,775
TR	CLOSE	Close cul-de-sac	515+00		400	30	0	1.00	1,333	SY	$18.52	$24,698	$8,644	$8,335	$41,677

Clark County Light Rail Cost Estimate

Sheet:	Segment 4	Airport Jct to Van Mall TC & P/R (via I-205)	Date:	7/17/01
Engineer:	B Dethlefls	Mill Plain to Vancouver Mall TC (I-205 Alignment)	Estimator:	David Chiara
390+54	525+00	Washington Side	Note: alignment changed from I-205 Thru to SE Chkalov Dr as base option (equation between Seg 3 & 4)	

Category	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	25% E&A	Total
STR	CLOSE	Close cul-de-sac	515+00		71	71	0	1.00	560	SY	$18.52	$10,375	$3,631	$3,502	$17,508
STU	AERIAL	LRT Double Track Aerial Structure	442+15	443+90	175	-	0	1.00	175	RF	$5,099.27	$892,372	$312,330	$301,175	$1,505,877
STU	JBARRIER	Jersey Barrier (Per Side) - off structure	390+54	482+00	9,146	-	0	2.00	9,146	LF	$44.70	$817,609	$286,163	$275,943	$1,379,715
STU	STAIR	Stairway @ NE 18th Station	415+45		25	-	0	1.00	25	LF	$1,481.86	$37,046	$12,966	$12,503	$62,516
STU	STAIR	Stairway @ Burton Rd Station	444+20		25	-	0	1.00	25	LF	$1,481.86	$37,046	$12,966	$12,503	$62,516
STU	RETFIL15	Retained Fill - 15' Avg. Hgt.	480+75	485+75	500	-	0	1.00	500	RF	$4,753.74	$2,376,868	$831,904	$802,193	$4,010,965
STU	AERIAL	LRT Double Track Aerial Structure	485+75	490+55	480	-	0	1.00	480	RF	$5,099.27	$2,447,648	$856,677	$826,081	$4,130,406
STU	RETFIL15	Retained Fill - 15' Avg. Hgt.	490+55	498+00	745	-	0	1.00	745	RF	$4,753.74	$3,541,533	$1,239,537	$1,195,267	$5,976,337
STU	RETFIL15	Retained Fill - 15' Avg. Hgt.	498+00	505+00	700	-	0	1.00	700	RF	$4,753.74	$3,327,615	$1,164,665	$1,123,070	$5,615,351
STU	AERIAL	LRT Double Track Aerial Structure	505+00	510+06	506	-	0	1.10	506	RF	$5,099.27	$2,838,252	$993,388	$957,910	$4,789,549
STU	RETFIL20	Retained Fill - 20' Avg. Hgt.	510+06	517+60	754	-	0	1.00	754	RF	$5,053.74	$3,810,517	$1,333,681	$1,286,049	$6,430,247
TRK	STD	Tie & Ballast Double Track	390+54	442+15	5,161	-	0	1.00	5,161	RF	$299.50	$1,545,719	$309,144	$463,716	$2,318,578
TRK	DF	Double Track Direct Fixation	442+15	443+90	175	-	0	1.00	175	RF	$640.87	$112,152	$22,430	$33,646	$168,228
TRK	STD	Tie & Ballast Double Track	443+90	485+75	4,185	-	0	1.00	4,185	RF	$299.50	$1,253,407	$250,681	$376,022	$1,880,111
TRK	DF	Double Track Direct Fixation	485+75	490+55	480	-	0	1.00	480	RF	$640.87	$307,616	$61,523	$92,285	$461,425
TRK	STD	Tie & Ballast Double Track	490+55	505+00	1,445	-	0	1.00	1,445	RF	$299.50	$432,777	$86,555	$129,833	$649,166
TRK	DF	Double Track Direct Fixation	505+00	510+06	506	-	0	1.00	506	RF	$640.87	$324,279	$64,856	$97,284	$486,418
TRK	STD	Tie & Ballast Double Track	510+06	517+60	754	-	0	1.00	754	RF	$299.50	$225,823	$45,165	$67,747	$338,734
TRK	STD	Tie & Ballast Double Track	518+30	525+00	670	-	0	1.00	670	RF	$299.50	$200,665	$40,133	$60,199	$300,997
TRK	CO6	#6 Double Cross Over - Tee Rail	522+00		1	-	0	1.00	1	EA	$291,818.39	$291,818	$58,364	$87,546	$437,728
TRK	TO16	#20 Turnouts	524+80		2	-	0	1.00	2	EA	$174,195.57	$348,391	$69,678	$104,517	$522,587
UTL	UNIQUE	Utilities - private ROW - minor - on bridges	390+54	525+00	58,050	-	0	1.00	58,050	LS	$1.00	$58,050	$23,220	$20,318	$101,588
UTL	UNIQUE	Utilities - public ROW - WSDOT ROW	390+54	525+00	1,925,850	-	0	1.00	1,925,850	LS	$1.00	$1,925,850	$770,340	$674,048	$3,370,238
											Totals	$58,645,160	$17,607,957	$19,063,279	$95,316,397

TOTAL BY COST CATEGORY

		Line Cost	Contingency	E&A	Total
BLG	Building	$0	$0	$0	$0
COM	Communications	$1,419,147	$283,829	$425,744	$2,128,720
CRS	Crossings	$643,025	$192,908	$208,983	$1,044,916
ELC	Traction Electrification	$4,190,550	$838,110	$1,257,165	$6,285,824
EQU	Equipment	$0	$0	$0	$0
FCL	Fare Collection	$744,003	$111,601	$213,901	$1,069,505
GRD	Track Grade Construction	$8,876,714	$3,106,850	$2,995,891	$14,979,455
PRK	Park & Ride	$2,773,407	$554,681	$832,022	$4,160,110
SIG	Signal System	$4,524,100	$904,820	$1,357,230	$6,786,150
SIT	Sitework	$0	$0	$0	$0
SPC	Special Conditions	$3,146,698	$1,101,344	$1,062,011	$5,310,053
STA	Stations	$2,872,284	$861,685	$933,492	$4,667,462
STR	Street Reconstruction	$2,302,178	$805,762	$776,985	$3,884,926
STU	Structures	$20,126,506	$7,044,277	$6,792,696	$33,963,479
TRK	Trackwork	$5,042,648	$1,008,530	$1,512,794	$7,563,972
UTL	Utilities	$1,983,900	$793,560	$694,365	$3,471,825
	Totals	$58,645,160	$17,607,957	$19,063,279	$95,316,397

Civil Construction				
Crossings	$643,025	$192,908	$208,983	$1,044,916
Track Grade Construction	$8,876,714	$3,106,850	$2,995,891	$14,979,455
Park & Ride	$2,773,407	$554,681	$832,022	$4,160,110
Special Conditions	$3,146,698	$1,101,344	$1,062,011	$5,310,053
Stations	$2,872,284	$861,685	$933,492	$4,667,462
Street Reconstruction	$2,302,178	$805,762	$776,985	$3,884,926
Structures	$20,126,506	$7,044,277	$6,792,696	$33,963,479
Trackwork	$5,042,648	$1,008,530	$1,512,794	$7,563,972

lark County Light Rail Cost Estimate

ieet: Segment 4 — Airport Jct to Van Mall TC & P/R (via I-205) — Date: 7/17/01
igineer: B Dethlefls — Mill Plain to Vancouver Mall TC (I-205 Alignment) — Estimator: David Chiara
)0+54 525+00 — Washington Side — Note: alignment changed from I-205 Thru to SE Chkalov Dr as base option (equation between Seg 3 & 4)

ategory	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	25% E&A	Total
		Utilities										$1,983,900	$793,560	$694,365	$3,471,825
		Total - Civil Construction										$47,767,360	$15,469,597	$15,809,239	$79,046,197
		TES										$4,190,550	$838,110	$1,257,165	$6,285,824
		Signals										$4,524,100	$904,820	$1,357,230	$6,786,150
		Communications										$1,419,147	$283,829	$425,744	$2,128,720
		Fare Collection										$744,003	$111,601	$213,901	$1,069,505
		Total - Systems										$10,877,800	$2,138,360	$3,254,040	$16,270,200
												$58,645,160	$17,607,957	$19,063,279	$95,316,397

:lark County Light Rail Cost Estimate

heet: Segment 5 — Airport Jct to Van Mall TC & P/R (via I-205) — Date: 7/17/01
ngineer: B Dethlefts — Vancouver Mall TC to NE 83rd Terminous (I-205 Alignment) — Estimator: David Chiara
25+00 624+00 — Washington Side

ategory	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	25% E&A	Total
OM	COMBIN	COMMUNICATION	525+00	624+00	9,900	0	0	1.00	9,900	RF	$105.54	$1,044,887	$208,977	$313,466	$1,567,331
RS	STREET	Street And Track @ Intersections	525+00	624+00	4.0	0	0	1.00	4.0	EA	$158,859.97	$635,440	$190,632	$206,518	$1,032,590
RS	SIGNAL	Modify Existing Traffic Signals	385+00	525+00	-	0	0	0.67	0	EA	$160,984.93	$0	$0	$0	$0
RS	SIGNAL	New Traffic Signal (Van Mall P&R)	385+00	525+00	2	0	0	1.00	2	EA	$160,984.93	$321,970	$96,591	$104,640	$523,201
RS	GATE	Add gated crossing protection for emergency vehicle turn-around	525+00	624+00	-	0	0	1.00	0	EA	$183,750.48	$0	$0	$0	$0
RS	UNIQUE	Ped crossing (lighted crosswalk) @ Burton Rd Station	525+00	624+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
LC	CAT	Double Track Catenary System - bridges	525+00	624+00	9,640	0	0	1.00	9,640	RF	$301.08	$2,902,430	$580,486	$870,729	$4,353,645
LC	CATBR	Double Track Catenary On Bridge	525+00	624+00	260	0	0	1.00	260	RF	$423.56	$110,127	$22,025	$33,036	$165,190
CL	TOTEA	Station @ NE Padden Expressway (83rd) Overpass - Island (wider/longer)	615+00	617+00	2	0	0	1.33	2	EA	$124,000.57	$329,842	$49,476	$94,829	$474,147
RD	D	LRT Grade Construction-50 Ft Row	525+00	533+30	830	0	0	1.00	830	RF	$756.32	$627,747	$219,711	$211,865	$1,059,323
RD	AERIALD	Aerial Double, Ductbanks	533+30	535+90	260	0	0	1.00	260	RF	$102.54	$26,660	$9,331	$8,998	$44,988
RD	D	LRT Grade Construction-50 Ft Row	541+00	620+97	7,997	0	0	1.00	7,997	RF	$756.32	$6,048,306	$2,116,907	$2,041,303	$10,206,516
RD	D	LRT Grade Construction-50 Ft Row	620+97	624+00	303	0	0	0.75	303	RF	$756.32	$171,874	$60,156	$58,008	$290,038
RD	EXC-MAJ	Allowance for Cut	541+00	624+00	8,300	40.00	2	1.00	24,593	CY	$14.82	$364,427	$127,549	$122,994	$614,971
RD	FILL-MIN	Allowance for Fill	541+00	620+00	7,900	40.00	2	1.00	23,407	CY	$6.17	$144,527	$50,584	$48,778	$243,889
RD	FILL-MAJ	Allowance for Fill	620+00	624+00	400	40.00	4	1.00	2,370	CY	$14.82	$35,126	$12,294	$11,855	$59,274
RD	UNIQUE	Allowance for tree removal (replacement in SPC)	525+00	624+00	40,000	0	0	1.00	40,000	LS	$1.00	$40,000	$14,000	$13,500	$67,500
RD	FENCE	Fencing	525+00	624+00	-	0	0	2.00	0	LF	$18.52	$0	$0	$0	$0
RD	UNIQUE	Chain & bollard (i-MAX style)	525+00	624+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
RK	LOT-STAL	Park and ride facilities - West side of I-205	615+00		1,200	0	0	1.00	1,200	EA	$3,316.15	$3,979,383	$795,877	$1,193,815	$5,969,075
RK	UNIQUE	Allowance for tree removal (replacement in SPC) west lot	615+00		3,000	0	0	1.00	3,000	LS	$1.00	$3,000	$600	$900	$4,500
RK	LOT-STAL	Park and ride facilities - East side of I-205	615+00		1,330	0	0	1.00	1,330	EA	$3,316.15	$4,410,483	$882,097	$1,323,145	$6,615,725
RK	UNIQUE	Allowance for tree removal (replacement in SPC) east lot	615+00		33,000	0	0	1.00	33,000	LS	$1.00	$33,000	$6,600	$9,900	$49,500
IG	SIGALL	Combined Signal System	525+00	624+00	9,900	0	0	1.00	9,900	RF	$281.36	$2,785,468	$557,094	$835,640	$4,178,201
IG	INTER	Interlock	608+00		1	0	0	1.00	1	EA	$740,928.57	$740,929	$148,186	$222,279	$1,111,393
PC	UNIQUE	HAZ MAT Testing & Remediation	525+00	624+00	346,500	0	0	1.00	346,500	LS	$1.00	$346,500	$121,275	$116,944	$584,719
PC	UNIQUE	HAZ MAT Testing & Remediation (Park & Ride lots)	615+00	+00	50,000	0	0	1.00	50,000	LS	$1.00	$50,000	$17,500	$16,875	$84,375
PC	UNIQUE	Landscaping allowance	525+00	624+00	500,000	0	0	1.00	500,000	LS	$1.00	$500,000	$175,000	$168,750	$843,750
PC	UNIQUE	Tree replacement allowance - in median	525+00	624+00	50,000	0	0	1.00	50,000	LS	$1.00	$50,000	$17,500	$16,875	$84,375
PC	UNIQUE	Tree replacement allowance - P&R's	615+00		200,000	0	0	1.00	200,000	LS	$1.00	$200,000	$70,000	$67,500	$337,500
PC	WET-MIT	Wetland Mitigation (acres) (in median)	525+00	624+00	1.1	0	0	1.00	1.1	EA	$150,000.00	$170,455	$59,659	$57,528	$287,642
PC	WET-MIT	Wetland Mitigation (acres) (P&R's)	615+00		1.6	0	0	1.00	1.6	EA	$150,000.00	$241,047	$84,366	$81,353	$406,767
PC	UNIQUE	Operator's Building	624+00		175,000	0	0	1.00	175,000	LS	$1.00	$175,000	$61,250	$59,063	$295,313
PC	UNIQUE	Washington State Sales Tax on Materials	525+00	624+00	1,200,000	0	0	1.00	1,200,000	LS	$1.00	$1,200,000	$420,000	$405,000	$2,025,000
TA	PRIVISL	Station @ NE Padden Expressway Overpass - Island (wider/longer)	615+00	617+00	1	0	0	1.33	1	EA	$563,750.32	$749,788	$224,936	$243,681	$1,218,405
TA	ELEVATOR	Station @ NE Padden Expressway Overpass - Island (wider/longer)	615+00		1	0	0	1.00	1	EA	$216,656.02	$216,656	$64,997	$70,413	$352,066
TA	UNIQUE	Signs & Graphics for this alignment	525+00	624+00	276,724	0	0	1.00	276,724	LS	$1.00	$276,724	$83,017	$89,935	$449,677
TA	UNIQUE	Signs & Graphics for existing lines	525+00	624+00	159,375	0	0	1.00	159,375	LS	$1.00	$159,375	$47,813	$51,797	$258,984
TR	UNIQUE	Temporary Traffic Control on I-205	530+00	630+00	360,000	0	0	1.00	360,000	LS	$1.00	$360,000	$126,000	$121,500	$607,500
TR	UNIQUE	Adjust WSDOT drainage (off structure)	525+00	624+00	1,227,600	0	0	1.00	1,227,600	LS	$1.00	$1,227,600	$429,660	$414,315	$2,071,575
TR	UNIQUE	Allowance for bike path adjustments	525+00	624+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
TR	PAV-STD	Allowance for lane adjustments SB & NB	525+00	624+00	-	0	0	2.00	0	SY	$43.22	$0	$0	$0	$0
TR	DEMO10	Allowance for lane adjustments SB & NB	525+00	624+00	-	0	0	2.00	0	SY	$12.35	$0	$0	$0	$0
TR	UNIQUE	Relocate WSDOT sign bridge (- full lane width)	525+00	624+00	-	0	0	1.00	0	LS	$1.00	$0	$0	$0	$0
TR	DEMO10	Remove parking lot paving	527+50	530+50	300	40	0	1.00	1,333	SY	$12.35	$16,465	$5,763	$5,557	$27,785
TR	CURB	Curbs for new roadway to P&R	526+15		400	0	0	2.00	400	LF	$23.74	$18,995	$6,648	$6,411	$32,055
TR	PAV-STD	AC for new roadway to P&R	526+15		400	28	0	1.00	1,244	SY	$43.22	$53,786	$18,825	$18,153	$90,764
TR	WALKS	Walkways for new roadway to P&R	526+15		400	10	0	2.00	444	SY	$33.34	$29,637	$10,373	$10,003	$50,013
TR	UNIQUE	Add drainage - for new roadway to P&R	526+15		24,800	0	0	1.00	24,800	LS	$1.00	$24,800	$8,680	$8,370	$41,850
TR	UNIQUE	Add lighting - for new roadway to P&R	526+15		28,000	0	0	1.00	28,000	LS	$1.00	$28,000	$9,800	$9,450	$47,250
TU	RETFIL12	Retained Fill 12' Hgt. 2 Walls	532+40	533+30	90	-	0	1.00	90	RF	$3,638.77	$327,489	$114,621	$110,528	$552,638
TU	AERIAL	LRT Double Track Aerial Structure	533+30	535+90	260	-	0	1.00	260	RF	$5,099.27	$1,325,809	$464,033	$447,461	$2,237,303
TU	RETFIL15	Retained Fill - 15' Avg. Hgt.	535+90	541+00	510	-	0	1.00	510	RF	$4,753.74	$2,424,405	$848,542	$818,237	$4,091,184
TU	JBARRIER	Jersey Barrier (Per Side) - off structure	541+00	624+00	8,300	-	0	2.00	8,300	LF	$44.70	$741,980	$259,693	$250,418	$1,252,092
TU	STAIR	Stairway @ NE Padden Expressway Station Pedestrian Bridge (3-ea)	615+00		25	-	0	3.00	25	LF	$1,481.86	$111,139	$38,899	$37,510	$187,548
TU	UNIQUE	Ped Bridge from station to P&R's east & west of I-205	615+00		1,630,000	-	0	1.00	1,630,000	LS	$1.00	$1,630,000	$570,500	$550,125	$2,750,626
TU	PEDRAMP	Pedestrian ramps @ either end of Ped Bridge	615+00		550	-	0	2.00	550	LF	$617.44	$679,185	$237,715	$229,225	$1,146,124
RK	STD	Tie & Ballast Double Track	525+00	533+30	830	-	0	1.00	830	RF	$299.50	$248,585	$49,717	$74,575	$372,877
RK	DF	Double Track Direct Fixation	533+30	535+90	260	-	0	1.00	260	RF	$640.87	$166,626	$33,325	$49,988	$249,938
RK	STD	Tie & Ballast Double Track	535+90	620+97	8,507	-	0	1.00	8,507	RF	$299.50	$2,547,846	$509,569	$764,354	$3,821,768

:lark County Light Rail Cost Estimate

:heet:	Segment 5	Airport Jct to Van Mall TC & P/R (via I-205)	Date:	7/17/01
:ngineer:	B Dethlefts	Vancouver Mall TC to NE 83rd Terminous (I-205 Alignment)	Estimator:	David Chiara
25+00	624+00	Washington Side		

:ategory	Cost Code	Description	BegSTA	EndSTA	Length	Width	Height	Factor	Quantity	Unit	UnitCost	Line Cost	Contingency	25% E&A	Total
RK	STD	Tie & Ballast Single Track	620+97	624+00	303	-	0	0.50	303	RF	$299.50	$45,374	$9,075	$13,612	$68,061
RK	TOB	#8 Turnout-Tee Rail	620+97		1	-	0	1.00	1	EA	$76,235.41	$76,235	$15,247	$22,871	$114,353
RK	COS8	#8 Single Cross Over	608+50	614+20	2	-	0	1.00	2	EA	$143,666.11	$287,332	$57,466	$86,200	$430,998
RK	BP	Bumping Post	624+00		1	-	0	1.00	1	EA	$22,547.57	$22,548	$4,510	$6,764	$33,821
ITL	UNIQUE	Utilities - public ROW - WSDOT ROW	525+00	533+30	207,500	-	0	1.00	207,500	LS	$1.00	$207,500	$83,000	$72,625	$363,125
ITL	UNIQUE	Utilities - private ROW - minor - on bridges	533+30	535+90	58,050	-	0	1.00	58,050	LS	$1.00	$58,050	$23,220	$20,318	$101,588
ITL	UNIQUE	Utilities - public ROW - WSDOT ROW	535+90	624+00	1,321,500	-	0	1.00	1,321,500	LS	$1.00	$1,321,500	$528,600	$462,525	$2,312,625
											Totals	$43,072,055	$12,059,968	$13,783,006	$68,915,030

OTAL BY COST CATEGORY

LG	Building	$0	$0	$0	$0
OM	Communications	$1,044,887	$208,977	$313,466	$1,567,331
RS	Crossings	$957,410	$287,223	$311,158	$1,555,791
LC	Traction Electrification	$3,012,557	$602,511	$903,767	$4,518,835
QU	Equipment	$0	$0	$0	$0
CL	Fare Collection	$329,842	$49,476	$94,829	$474,147
RD	Track Grade Construction	$7,458,666	$2,610,533	$2,517,300	$12,586,499
RK	Park & Ride	$8,425,866	$1,685,173	$2,527,760	$12,638,799
IG	Signal System	$3,526,396	$705,279	$1,057,919	$5,289,594
IT	Sitework	$0	$0	$0	$0
PC	Special Conditions	$2,933,001	$1,026,550	$989,888	$4,949,440
TA	Stations	$1,402,543	$420,763	$455,827	$2,279,133
TR	Street Reconstruction	$1,759,284	$615,749	$593,758	$2,968,791
TU	Structures	$7,240,008	$2,534,003	$2,443,503	$12,217,514
RK	Trackwork	$3,394,546	$678,909	$1,018,364	$5,091,818
TL	Utilities	$1,587,050	$634,820	$555,468	$2,777,338
	Totals	$43,072,055	$12,059,968	$13,783,006	$68,915,030

Civil Construction				
Crossings	$957,410	$287,223	$311,158	$1,555,791
Track Grade Construction	$7,458,666	$2,610,533	$2,517,300	$12,586,499
Park & Ride	$8,425,866	$1,685,173	$2,527,760	$12,638,799
Special Conditions	$2,933,001	$1,026,550	$989,888	$4,949,440
Stations	$1,402,543	$420,763	$455,827	$2,279,133
Street Reconstruction	$1,759,284	$615,749	$593,758	$2,968,791
Structures	$7,240,008	$2,534,003	$2,443,503	$12,217,514
Trackwork	$3,394,546	$678,909	$1,018,364	$5,091,818
Utilities	$1,587,050	$634,820	$555,468	$2,777,338
Total - Civil Construction	$35,158,374	$10,493,724	$11,413,024	$57,065,122
TES	$3,012,557	$602,511	$903,767	$4,518,835
Signals	$3,526,396	$705,279	$1,057,919	$5,289,594
Communications	$1,044,887	$208,977	$313,466	$1,567,331
Fare Collection	$329,842	$49,476	$94,829	$474,147
Total - Systems	$7,913,681	$1,566,244	$2,369,981	$11,849,907
	$43,072,055	$12,059,968	$13,783,006	$68,915,030