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DUMBARTON RAIL CORRIDOR STUDY

CORRIDOR REHABILITATION REDWOOD JUNCTION TO NEWARK JUNCTION

CAPITAL INVESTMENTS WORKING PAPER

Prepared for the

San Mateo County Transportation Authority

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1.0 INTRODUCTION

One possibility for extending commuter rail service in the South San Francisco Bay Area is the "Dumbarton Rail Corridor", a former freight line that links the Peninsula and the East Bay, between Redwood City and Newark. This Working Paper by the Parsons Transportation Group (PTG) is part of a San Mateo County Transportation Authority (SMCTA) sponsored study that defines a logical Rail Service Plan for the Dumbarton Corridor, so that this candidate project can be included in the Metropolitan Transportation Commission's *Blueprint for the 21st Century*.

1.1 Purpose

This working paper provides capital cost estimates for track, signal, and structure improvements that would be needed between Redwood City and Newark Junction, to allow reactivating the SMCTA-owned Dumbarton Corridor.

1.2 Scope

Improvements to the Dumbarton Rail Corridor between Redwood Junction and Newark Junction were studied in 1996 and are summarized in a report entitled *Dumbarton Rail Corridor Rehabilitation* prepared by MK Centennial (MKC) and associated subconsultants. Engineering and cost estimating for the current study consisted primarily of reviewing of this previous MKC study. Limited field observations were performed to clarify some of the data in the previous report. Cost savings associated with potential modifications of the previous report's recommendations were identified. Capital investments needed east of the Newark Junction, new stations, and other support facilities for the Dumbarton service are addressed in a separate working paper. This current study does not address potential environmental impacts or possible historic significance of the existing bridges.

1.3 Corridor Description

The Dumbarton Rail Corridor is an 11-mile railroad line that links San Mateo County in Redwood City with Alameda County in Newark. At Redwood Junction the Dumbarton Corridor connects with the Joint Powers Board (JPB) Peninsula Line that has Caltrain service. At Newark Junction the Dumbarton Corridor connects with the Coast Line (the Union Pacific's freight corridor between Oakland and San Jose). The Dumbarton Corridor also connects to the east-west Union Pacific Centerville Line, which continues east from Newark Junction for 5.2 miles to Niles Junction.

The Dumbarton Railroad Corridor was constructed by the Central Pacific Railway in the heyday of railroad activity in the United States. The line opened for service on September 12, 1910 and was constructed to eliminate 22.5 miles of trip length from San Francisco to Tracy. Various events, including the development of the Port of Oakland, the construction of the Benicia Rail Bridge and the general decline of rail transportation after World War II, led to the reduction and eventual suspension of rail traffic over the bridge. Southern Pacific (SP) started a rehabilitation of the bridge in the 1960s, but the decline of traffic from the Port of San Francisco at the same time led to a halt in the rehabilitation work.

In 1994, the San Mateo County Transportation Authority purchased the Dumbarton Rail Corridor right-of-way for future transportation purposes and/or to activate rail service. The SMCTA, with assistance from the California Department of Transportation (Caltrans), paid $6,900,000 for the right-of-way. The agreement between these two agencies designates the San Mateo County Transit District (SamTrans) as the agency to hold title to, manage and maintain the railroad bridge because it is a permanent agency, while the SMCTA will be dissolved when the sales tax expires in 2008.

The Dumbarton Corridor was originally intended to be double track. The corridor includes single track with two tracks at several locations, 11 highway grade crossings (all equipped with flashing lights and gates), the Route 101 underpass, and ten major bridges (the Dumbarton swing bridge, eight approach trestles; and the Newark Slough swing bridge).

1.4 Methodology

The current assessment is based on the assumption that the Dumbarton Corridor will initially operate single-direction westbound trains in the morning and eastbound trains in the afternoon. Rail infrastructure shall comply with the Caltrain design standards, modified by the *Caltrain Rapid Rail Study* of October, 1998.

Track and trackwork engineering consisted of a review of the MKC report plus spot inspections of the track, primarily to determine the year of manufacture of existing rail. In addition, the configuration of the tracks at Newark Junction was observed. Each of the improvements identified in the MKC report was reviewed, and potential cost savings of modifying or eliminating specific improvements were estimated. A few discrepancies were noted between the text and track charts or the conceptual signal diagrams. Two tables in Volume 2 of the report listing turnouts and grade crossings were reviewed. Some inconsistencies between the turnout table and the track chart were observed. One grade crossing, at Thornton Avenue, listed in the table, as an asphalt surface is in fact a rubber panel. In addition, there are some inconsistencies between the text and the turnout tables regarding the size (frog number) of some turnouts.

The cost estimates in the MKC report were reviewed. There is insufficient detail provided to verify unit costs or quantities. This study does not attempt to verify the complete MKC estimate. Rather, this study has estimated potential cost savings of improvements that may be unnecessary. To estimate the potential cost savings of specific projects, unit costs were derived by estimating quantities from the information in the report where possible, and deriving the unit costs from the total cost of the project category listed in the report. Otherwise, unit costs were derived from published data or experience from similar studies.

Signal engineering consisted of a review of the MKC report. No field inspections were made. The condition assessment presented in the report is assumed valid.

There is no detail presented in the signaling cost estimate upon which we can verify the unit costs or quantities. Only the "CTC Office System" is identified as a separate item. We have therefore based our signal cost estimates on the requirements for the proposed service scenario and our in-house experience.

Structural engineering consisted of a review of the MKC report. No field inspections or observations were made. The condition assessment presented in the MKC report was assumed to be valid. PTG's review of the report, therefore, consisted of developing alternatives to the rehabilitation or reconstruction recommended by MKC.

There is insufficient detail provided in the MKC report for verification of unit costs and quantities used in the cost estimate. The report contains an itemized estimate sheet for the swing bridges showing only Lump Sum Items. The report adds mobilization to the estimates for the timber trestle replacement, steel truss rehabilitation and swing span rehabilitation at varying percentages in the cumulative amount of $2,822,167, but does not explain the percentages or for what this number represents. Cost estimates in the current report for alternative construction are therefore based on the PTG's experience and cost information. Potential cost savings are calculated by comparing the costs of the alternatives to cost estimates of comparable elements in the MKC report.

2.0 TRACK

2.1 Review of MKC Report

The MKC report recommends ten categories of track improvements:

1. Lay new 136 RE continuous welded rail (CWR).
2. Replace all timber ties.
3. Remove all non-essential turnouts and upgrade or replace remaining turnouts.
4. Replace all switch timbers.
5. Resurface and ballast the territory.
6. Rebuild/upgrade eleven at-grade crossings.
7. Create a new bypass for Leslie salt brine loadout.
8. Upgrade the siding and connection to the Union Pacific Coast Line.
9. Improve the two connections at Redwood Junction to the Peninsula Corridor Caltrain mainline tracks.
10. Create a 6,600-foot passing siding at Willow Road by connecting two existing sidings.

The MKC report describes upgrading the existing track to a FRA Class 4 track to operate at 79 mph. The 79-mph speed is based on FRA signal standards (49 CFR Part 236) which require a supplemental signal system to operate at speeds of 80 mph or more. The FRA Track Safety Standards (49 CFR Part 213) allow a maximum speed of 80 mph for passenger trains on a Class 4 track. Therefore, a Class 4 track is the minimum needed to run at the 79-mph maximum speed allowed with automatic block signals.

It is important to understand that FRA Track Safety Standards are minimum standards for track maintenance required for defined speed limits. If the track degrades, through lack of maintenance, to a lower class, then the maximum authorized speed must be reduced in accordance the maximum authorized speed for the class of track to which it conforms. FRA Track Safety Standards have no correlation to track economy or preventative maintenance. Improving a track to a minimum FRA class would mean that the track would be designated a lower class upon use, and the speed would have to be reduced. For example, the FRA requires a minimum of 12 good ties per 39-feet length of track for a Class 4 track. This leaves 12 bad ties in the same length. So in principle, if all existing ties are bad, only half of them need to be replaced to obtain a Class 4 track. However, running passenger trains on track with 50% bad ties would not be considered good maintenance or operating practice. In fact, the MKC report recommends replacing all ties. In addition, the replacement of all the rail, with reballasting and resurfacing, would be done to tolerances that are more stringent than FRA Track Safety Standards. So the resulting track will be considerably better than Class 4, which is appropriate.

The ten categories of track improvement recommended in the MKC report are discussed in the following paragraphs. Discussions of additional improvements follow.

2.1.1 New CWR

The report correctly states that the JPB standard (for new track) is 136 LB CWR. Existing rail on the main line is generally second hand bolted rail of 110, 112, 113, 119 and 132 RE sections. Sidings are generally built with 90-lb rail. The report recommends replacing all of the existing rail, and the cost estimate includes a salvage value for the metal.

The necessity of replacing the rail might be re-considered in light of its condition and the proposed service. The table of rail wear shown on page 13 of Volume 2 of the MKC report indicates that just about all the rail conforms to AREMA standards for Class I second hand rail, which is suitable for main line use. About three miles of the existing track consists of 113-, 119- and 132-lb CWR. Based on the track charts and our field observation, this rail was manufactured in 1961. The 112-lb bolted rail sections observed by PTG were manufactured in the period from 1936 to 1939. This is the same period that American steel mills adopted the process of controlled cooling, which prevents the inception of shatter cracks. The rails that we observed did not have "CC" embossed on them, so it is possible that they are not control cooled. However, frequent testing for internal rail flaws, as required by the FRA, would identify any impending fractures even in non-control cooled rail. So the rail could potentially be retained, perhaps on an interim basis.

The 110-lb rail observed by PTG was manufactured in 1929 and is not control-cooled. PTG would concur with replacing this rail due to its lightweight and age.

Based on observations by PTG staff, it is believed that there are two potential options for retaining rail:

1. Retain existing CWR. Savings would be the cost of new 136-lb rail acquired (less any salvage value of the existing rail), plus rail welds not required. PTG's capital cost estimate is based on this option.

2. Retain all 112-lb and heavier main line rail. The rail would be cropped at the ends and welded into CWR strings. Savings would be the cost of new 136-lb CWR not acquired. These savings would be diminished by the salvage value of the existing rail not realized, the costs to crop the rails, and additional rail welds required due to the shorter lengths of the cropped rails as opposed to 78-foot lengths of new rail. PTG does not recommend this option is view of the age of the rail. This option could be considered as a temporary measure if funds are limited.

2.1.2 Replace all timber ties

PTG concurs with this recommendation. This will ensure that a Class 4 track will not degrade due to tie condition for a considerable time

2.1.3 Remove all non-essential turnouts and upgrade or replace remaining turnouts

The MKC report states that "All existing turnouts meet FRA Class 1 standards and would have to be upgraded to meet FRA Class 4 track requirements." The next sentence states that "All remaining turnouts should be retied to upgrade the track classification". Presumably the ones that are to be removed would not be retied. The next sentence states that "The 112 and 113 RE rail turnouts are proposed for replacement, because the age and condition of the rail may lead to rail defects and failures." However, there is no data or documentation to support this statement. Practically all of the track where there are turnouts has 112- or 113-lb rail, so this would imply that all of the existing turnouts are to be replaced. The basis of the cost estimate on page 12 of the MKC report is not clear.

The report identifies 40 turnouts, some existing, some new. PTG concurs with removing the non-essential turnouts, which are generally to industry spurs no longer used. The report states that the existing turnouts meet FRA Class 1 requirements, and need to be upgraded to FRA Class 4. In fact, there is very little difference in FRA Class requirements for turnouts, and the inventory sheets indicate that some of the parts that the FRA standards consider were not measured. Broken switch points and frog points would normally be replaced anyway. The report states that the self-guarded frog on the Dumbarton Bridge at MP 32.5 needs to be replaced to meet FRA Class 4 requirements. It is noted that the FRA Track Safety Standards do not explicitly prohibit a self-guarded frog on a Class 4 track. In actual railroad practice, self-guarded frogs are only used in low speed areas such as yards, so it should be replaced for the increased speed, but not because of FRA standards. In any case, it is not necessary to replace the entire turnout; only the frog needs to be replaced, and guardrails added to the existing turnout. However, the need for this siding should be reviewed. With infrequent need to open the bridge, especially if the opening is coordinated to occur during the middle of the day when there are no trains, the bridge operator's vehicle could remain on the track.

PTG has reviewed the recommendation for each turnout listed in the MKC report. Potential cost savings could be achieved for turnouts and related signals if some of the existing turnouts are retained or not powered. In addition, some of the new turnouts recommended for passing sidings would not be necessary with only single-direction service as proposed in our operating plan. The descriptions and dispositions of the turnouts are summarized in Table 1.

Table 1
SUMMARY OF TURNOUTS

T.O. No.	MP	MKC Report discussion and recommendation	PTG Review	Comment
1 and 2	26.1	Text and track charts show No. 20 powered turnouts; Table shows No. 24's.	35-mph speed limit shown on MKC track chart does not warrant a No. 24 turnout.	Existing hand throw turnouts can remain for freight with passenger service directed toward the south.
3,4,5 and 6	26.15	Replace No. 12 Crossover with new powered No. 10.	Consider No. 14's as replacements instead of No. 10's if this crossover is needed.	Existing hand throw turnouts can remain for freight with passenger service directed toward the south.
10 and 11	26.8	Existing No. 10 crossover for movement between ML and connection to south at Redwood City.	Report does not indicate disposition. Presumably these turnouts are replaced as they are 112-lb rail. Signal schematic indicates these are power switches.	Powered turnouts, preferably No. 14's needed for passenger service to south. Existing could remain if passenger service runs on south track.
12 and 13	27.0	No. 10 turnouts. Turnout No. 12 is not shown on track chart or signal diagram.	Both this and No. 13 apparently to be replaced based on existing 112-lb rail.	Both could remain if JPB accepts 112-lb rail. Potential savings for turnout.
17	28.4	At end of siding track at Redwood City. Replace w/ new powered No. 14.	Text and track and signal charts show a new No. 24.	This turnout could have a spring switch, eliminating the need for a switch motor. Could be replaced with a RH turnout if south track becomes ML.
19	29.1	No, 10 T.O. Industrial spur.	Presumably being replaced due to 112-lb rail.	Could remain if JPB accepts 112-lb rail.
20	29.5	No. 10 at west end of siding track to be replaced w/ powered No. 14.	Would be one end of passing siding with additional track recommended.	Not required for single-direction passenger service.
21	29.9	At end of existing siding. Report recommends extending the siding track and removing these turnouts.	May need to remain if passing siding is not extended. Could be retained if JPB accepts 112-lb rail, or could be removed if no passing meets occur here.	Not required for single-direction passenger service.
22	30.3	At end of existing siding. Report recommends extending the siding track and removing these turnouts.	Siding serves an industrial spur. Turnout would need to remain if passing siding is not extended. Existing track charts show 119- or 132-lb CWR at this location, so turnout could remain if JPB accepts.	Not required for single-direction passenger service.
23	30.5	No. 9 turnout to an industrial siding that has abandoned rail service.	Presumably will be removed, but is shown as a hand-throw switch with an electric lock on the signal schematic.	Turnout assumed not required.

Table 1
SUMMARY OF TURNOUTS (Continued)

T.O. No.	MP	MKC Report discussion and recommendation	PTG Review	Comment
24	30.6	Exist No. 10 at east end of siding track to be replaced w/ powered No. 14.	Would be one end of passing siding with additional track recommended. Turnout would need to remain even if siding is not extended if industrial service is active.	Could remain if JPB accepts the existing 119- or 132-lb CWR at this location. Not required for single-direction passenger service.
26	32.5	Existing No. 7 T.O. stub-end siding for bridge operator's vehicle. Replace w/ power No. 10	No. 7 turnout hand-throw turnout should be adequate. Only the existing self-guarded frog needs to be replaced.	Turnout can remain (with new frog and guard rails) if JPB accepts 113-lb rail. Need for siding is questionable.
28	35.7	New power switch for Leslie Salt Plant.	Track chart shows a No. 10; Table shows a No. 24. Signal diagram shows a hand-throw switch with an electric lock.	A No. 10 hand-throw switch with an electric lock should be adequate.
29,30,31	36.2	Existing No. 10 turnouts to industrial spurs.	Presumably would be replaced due to existing 112-lb rail.	Turnouts could remain if JPB accepts 112-lb rail.
32	36.2	Existing No. 10 to be replaced with power No. 14.	Would be the west end of a passing siding adjacent to Newark Junction.	Not required for single-direction passenger service. Could remain as is if JPB accepts 112-lb rail.
33	36.25	No. 14 RH T.O.	Not shown in track chart.	May be redundant with No. 32.
34,35	36.8	New power No. 10 crossover between ML and upgraded siding for move to NB Coast Line at Newark.	Turnout on Coast Line north connection has been removed.	Not required for single-direction passenger service.
36,37	36.8	No. 36 connects to the NB Coast Line; No. 37 connects to the upgraded passing siding.	Signal chart shows both powered. Presumably, to be replaced due to existing 112-lb rail.	No. 36 not necessary, as wye track is not connected to the Coast Line. No. 37 could remain if JBP accepts 112-lb rail. Powered switch not necessary.
38	37.3	Power No. 10 turnout.	Not clear where this is from track chart; no RH turnouts shown in the area.	Assumed not required.
39,40	37.4	Power No. 14 turnouts at Newark Junction. No. 39 is currently a No. 10 hand-throw switch. No. 40 would replace a turnout that has been removed.	The configuration shown in the track schematic will not allow both tracks to connect to the Centerville Line. Only one powered turnout needed at Coast Line.	Recommend replacing with a single split switch.

2.1.4 Replace all switch timbers

The MKC report recommends replacing all switch timbers, presumably in conjunction with the replacement of all turnouts. However, PTG recommends that all switch ties should be replaced for turnouts to remain or to be upgraded.

2.1.5 Resurface and ballast the territory

The MKC report recommendation to resurface and ballast the corridor is reasonable. Based on PTG's cursory observation of the line, it is possible that the three-mile section of track with CWR could remain without any resurfacing if the CWR is retained. However, with the replacement of all ties, some resurfacing work will probably be needed. PTG's cost estimate assumes that the entire corridor will be resurfaced.

2.1.6 Rebuild/Upgrade eleven at-grade crossings

PTG concurs that all timber and asphalt concrete crossing surfaces be upgraded as recommended in the MKC report. The report recommends rubber panels. Concrete panels cost about the same, are more durable, and are the recommended new standard contained in the *Caltrain Rapid Rail Study*. Based on the information in the MKC report, it is estimated that there are approximately 1,500 track feet of crossing panels involved in all the crossings shown for replacement. Using the total cost of $705,250 shown in the report, the unit cost comes to $470 per track foot, which appears high in comparison to other recent project costs. Using a unit cost of $350 per track foot would result in a saving of $180,000. In addition, the MKC report lists the crossing of Thornton Avenue as an asphalt crossing. This crossing is now a rubber panel, and is on the unconnected branch of the "wye" to the Coast Line north at Newark Junction. No improvement to this crossing is needed.

2.1.7 Create a new bypass for Leslie salt brine loadout

This recommendation appears necessary, and according to the MKC report a bypass alternative is the most cost-effective among the alternatives studied.

2.1.8 Upgrade the siding and connection to the Union Pacific Coast line

This improvement would not be needed with only single direction service. Potential items that would be saved include the track upgrade, one power No. 10 crossover, two power No. 14 turnouts, one power No. 10 turnout, and one manual No. 14 turnout.

2.1.9 Improve the connection at Redwood Junction to the Caltrain mainline tracks

Caltrain plans to reconfigure the tracks through Redwood City. The MKC report recommended track improvements for movements north along the Peninsula. The MKC report (Page 5-2) recommends upgrading the southbound leg of the Redwood City wye, but states that this is not included in the cost estimate. With passenger service turning south, the two No. 14 powered turnouts recommended by MKC would not be necessary. One additional powered turnout would be needed at the junction of the south leg of the wye and the siding east of Caltrain track MT-1. In addition, the powered No. 10 crossover at MP 26.8 would be needed for passenger service to the south.

If a connection to the north is desired, then (for single-direction service) only the Dumbarton main line needs to be upgraded from the junction at MP 26.2 to the crossover at MP 26.8, and one turnout to the siding track east of Caltrain Track MT-1 replaced with a powered No. 14. One new powered crossover would also be needed from the siding track to MT-1.

An alternative scenario that would accommodate single-direction service to both Caltrain north and south would involve upgrading the existing siding track from MP 26.2 to MP 28.4, and making this track the main line. The alignment at MP 28.4 could be revised, and the existing left hand turnout replaced with an RH turnout. With this configuration, the crossover at MP 26.8 would not need to be powered, and a new crossover to Caltrain MT-1 would not be needed; power could be added to the existing one.

2.1.10 Create a 6,600-foot passing siding at Willow Road by connecting two existing sidings

This improvement is not needed for single direction service. Potential items that would be saved include re-building the existing siding between MP 29.55 and 29.85, two new power No. 14 turnouts, new track and earthwork between MP 29.85 and 30.30, one grade crossing at Willow Road, and upgrading the existing siding from MP 30.3 to 30.6.

2.1.11 Moveable rail joints

The MKC report's track schematic and cost estimate include a turnout and stub-end siding track for the bridge operator's vehicle to pull off the main line. This seems reasonable, but the track continues across the joint between the swing span and the fixed truss on the west side. The plans for the swing span rehabilitation show the control house being located on the end pier on the west side of the swing span. Therefore, some amount of rail and two miter joints are not needed. Similarly, two insulated joints can be eliminated.

2.1.12 Potential additional improvements

At Newark Junction, the existing No. 10 hand-throw switch with electric lock needs to be replaced. The MKC report recommends a No. 14 powered turnout. Based on PTG's field observation, it may be difficult to fit a No. 14 ahead of the switch point of the No. 10 turnout to the Centerville Line. Speed would still be restricted by this No. 10, so there would be little time savings from a No. 14. An alternative solution would involve a No. 10 single slip switch across the Coast Line. This would allow faster movement for Dumbarton trains across the Coast Line. The single slip switch would be in the northeast quadrant and would used by Union Pacific trains that now use the turnout to the Centerville Line. A second slip switch could be added if a connection from the Dumbarton Line to the Coast Line south is needed.

At Redwood City, the existing connection to the south Peninsula JPB main line would need to be upgraded with new track and signalized turnouts. The existing timber grade crossing panel at Middlefield Road should be replaced with concrete.

2.2 Potential Cost Savings

Estimated cost savings for improvements described in the previous section are shown in Table 2. These estimates are before any add-on costs such as contingencies and engineering that are applied as percentages to the cost estimates in the MKC report. The cost savings for turnouts include switch ties as well as hardware.

Table 2
POTENTIAL TRACKWORK COST SAVINGS

Item	Estimated Cost Saving	Note
Retain existing CWR	$598,100	
Re-use existing 112-lb and heavier bolted rail, crop and weld into strings	$526,100	Includes allowance for 5% defective rail
Delete 2 moveable rail joints on bridge operator's spur track	$49,500	
Delete 2 insulated joints on bridge operator's spur track	$1,540	
Reduce unit cost of grade crossing panels	$180,000	
Eliminate grade crossing improvement at Thornton Avenue	$21,000	
Eliminate passing siding from MP 29.5 to 30.6	$968,000	
Eliminate passing siding from MP 36.2 to 37.6	$1,079,400	
Retain existing turnouts instead of replacing	$1,575,000	
Total Potential Savings	$4,998,640	

3.0 SIGNALS

3.1 Review of MKC Report

The MKC study developed concepts and cost estimates for block signaling and highway grade crossing warning systems. The major items and assumptions affecting signals presented in the report are summarized below in italics, followed by PTG's review comments.

3.1.1 Initial and Future Headway and Operating Requirements

Design for 30 minute peak operations; power all switches at sidings that could be used as a passing track; bi-directional CTC; 79 mph maximum for commuter trains; consider express trains; freight train speeds and operations will be limited for optimum commuter train operations.

The 30 minute headway is consistent with the proposed service scenario, though this is not a factor for single-direction service. PTG does not believe that powering all switches that could be used as sidings is cost-effective. We concur with installing CTC for 79 mph maximum authorized speed. We do not believe that express trains (presumably trains in the same direction overtaking slower trains) need to be considered, and are not consistent with the proposed operating scenario. Freight train operation can be limited to non-passenger train operating windows.

3.1.2 CTC for Dumbarton Rail Corridor

CTC controlled by the PCJPB should be planned for this corridor, except that CTC at the Newark interlocking will be controlled by Union Pacific.

PTG concurs with this recommendation.

3.1.3 Redwood Junction Operation

The Redwood Junction interlocking design should only allow movements northbound onto the Peninsula Corridor mainline and southbound from the Peninsula Corridor mainline to the Dumbarton Rail Corridor.

The proposed service scenario is consistent with this recommendation.

3.1.4 Newark Wye Operation

The Newark Wye interlocking design should allow movements to the north or south onto and from the UP/SP mainline (Coast Line).

PTG's site review revealed that the turnout at the Coast Line north has been removed. For the proposed passenger service scenario, connection between the Dumbarton Line and the Coast Line south is not needed, though it is possible with the existing track configuration. To increase train speed across the Coast Line, PTG proposes to replace the two existing turnouts from the Coast Line with a single slip switch (for movements between the Coast Line north and the Centerville Line).

3.1.5 Dumbarton Rail Corridor Passenger Stations

The five historic stations once operated on this corridor should be considered.

It's not clear if this was per JPB direction or just the consultant's assumption. It is not clear what impact this has on the costs. The Dumbarton Station is in the middle of a wildlife area, so it is hard to imagine this becoming a commuter rail stop. The proposed service scenario includes stations at Newark and Chilco.

3.1.6 Electrification

No planned future electrification of this corridor should be considered for this study.

We concur with this recommendation.

3.1.7 Electric Locks

Electric locks and derails with electric locks should be considered for all hand throw switches.

We concur.

3.1.8 Cost Estimates

The signaling cost estimates should break down the costs on a per grade crossing basis and a reasonable breakdown for the block signaling.

There is no breakdown of grade crossing warning device costs or block signaling presented in the report. The Capital Cost Estimate on Page 3-6 shows $3,989,445 for Block Signaling Field Equipment, $250,000 for CTC Office System, and $100,000 for removal and salvage of block signal equipment. Two alternative lump sum figures are presented for grade crossings: $2,071,125 for reuse of existing equipment, and $3,022,965 for new equipment. All other items listed in the table are for design, engineering and contingencies. Costs are tabulated for Engineering Design, Contractor Engineering, and SP Engineering at the Newark interlocking. These costs total $1,491,439 for both the reuse and replacement of the grade crossing warning devices. Contingencies are shown as 15% of estimated construction and engineering.

The total project Capital Cost Estimate on Page 3-8 (with signal summary on Page 3-13) is based on reuse of the existing grade crossing warning device equipment, presumably in accordance with the assessment report which indicates that most of the existing equipment can be reused. However, there is a statement on Page 2-16 of Volume 1 that "A detailed Condition Assessment of the existing Highway Grade Crossing Warning Systems should be performed as part of the preliminary Engineering if re-use of existing equipment is considered".

3.2 Potential Modifications and Cost Savings

PTG generally concurs with MKC's recommendation to install CTC on the Dumbarton Corridor. The cost estimate for the block signal system assumed that none of the existing equipment would be reused. The Assessment Report states that portions of the block signaling equipment could be re-used, but due to limited budget, complete replacement

was assumed. Consequently, there are potential cost savings, which can not be estimated at this time.

Certain cost savings are possible due to the single-direction service that PTG proposes. These savings would involve signals and switch machines for turnouts and sidings not required for the single direction service.

There are potential additional costs (of up to $1 Million based on the estimate presented) if the existing grade crossing warning device equipment needs to be replaced.

4.0 STRUCTURES

4.1 Review of MKC Report

4.1.1 General

Most of the bridge structures within the Dumbarton Rail Corridor span the south end of the San Francisco Bay crossing between MP 31 and MP 35. The steel through girder structure over U.S. 101 (described in the report as a through-truss) was not inspected by MKC. From west to east, the Dumbarton Corridor structures are:

1. West approach timber trestle spans to the Dumbarton Bridge, a total of 1,766 feet with single track on ballasted timber deck. Bents are spaced at 15 feet.

2. West approach pre-cast, pre-stressed (PC/PS) concrete box girder spans to the Dumbarton Bridge, 30 spans @ 30 feet supported on 4-pile bents; total 900 feet long with single track on ballasted deck.

3. West approach PC/PS concrete box girder spans to the Dumbarton Bridge, 52 spans @ 45 feet and one span 34-foot supported on 2-pile bents; total 2,374 feet long with single track on ballasted deck.

4. Dumbarton Bridge steel spans, 6-180 foot truss spans, one 310 foot swing span and 3- short deck girder transition spans; total 1,522 feet long with double tracks on timber bridge deck.

5. East approach PC/PS concrete box girder spans to the Dumbarton Bridge, one 34 foot span and 8-spans @ 45 feet supported on 2-pile bents; total 394 feet long with single track on ballasted deck.

6. East approach timber trestle spans to the Dumbarton Bridge; total 603 feet long with single track on ballasted timber deck.

7. West approach timber trestle spans to the Newark Slough Bridge; total 90 feet long with single track on ballasted timber deck.

8. Newark Slough Bridge steel spans, one 182-foot swing span and 2- 17.5 feet deck girder transition spans; total 217 feet long with double tracks.

9. East approach timber trestle spans to the Newark Slough Bridge; total 150 feet long with single track on ballasted timber deck.

There are essentially four basic structure types of bridge in this rail corridor:

1. timber trestle spans;

2. pre-cast pre-stressed concrete spans;

3. fixed steel truss spans, with some steel deck girder spans;

4. swing steel truss spans.

The MKC team performed a visual inspection of the trestle and bridge superstructures. Their divers also performed a visual inspection of the foundations for the Dumbarton swing span and the adjacent steel truss spans.

MKC's Structural Condition Assessment states that the structural inspection was performed mostly from the deck level; binoculars were used to inspect members that were not accessible. It is, therefore, possible that the top chord members may have more deterioration than the inspectors could observe. Potential top chord replacement costs are presumably part of contingencies.

The condition of the vertical and the diagonal truss members in the 180-foot through truss spans are not reported. The vertical and diagonal truss members of the two swing spans have evidence of rust build up, and rehabilitation was recommended. Therefore, the vertical and diagonal members of the 180-foot through trusses may need repair.

It is understood that the assumed live load is Cooper E-80, though there is one reference to E-72.

4.1.2 Concrete approach spans

Bridge items 2, 3 and 5, the PC/ PS concrete box girders, are part of the total 6,045-foot long approach spans to the Dumbarton Bridge main truss spans. These concrete spans were built in 1968 and 1976 to replace the original timber trestles. They are supported on pre-stressed concrete pile bents, and were designed for Cooper E-72 live load with impact. Totaling 3,274 feet in length, they are in good structural condition, requiring only minor patches at a few locations of concrete.

4.1.3 Timber trestle replacement

Based on the inspection report and field data collected, it is clear that the remaining timber trestle spans (bridge items 1,6, 7 and 9), built in 1908, are in the imminent danger of collapse and need to be replaced. In fact, in January 1998, bridge 1 (west timber trestle) was destroyed in a fire. The MKC report proposes to replace the timber trestle spans with pre-cast, pre-stressed concrete spans supported on concrete pile bents, similar to the existing concrete trestle. PTG concurs with this recommendation as being the most suitable and economical type of structure. This replacement will upgrade this bridge to meet the current AREA code standards, and would allow the structure to meet current seismic design requirements. However, as noted in Section 4.1.7, the costs of seismic upgrade are apparently not included in the MKC cost estimates.

The MKC report estimates the cost for the removal of the timber trestle and replacement with PC/PS concrete girders at $6,530,000. Another $725,579 is added for mobilization. This brings the total (rounded) to $7,255,600 before contingencies and engineering. After adding 25% contingencies, the average per square foot cost is about $205.00. This unit price seems to be sufficient to include the substructure cost as well as the girders.

4.1.4 Steel deck girder replacement

These are the short steel approach spans at each end of the main truss spans and swing spans. The MKC report states that these steel deck girders are generally heavily corroded and in danger of collapse. Total replacement of these spans will ensure a smooth transition between the concrete approach spans and the main truss spans. Welded plate girders are proposed for the replacements. As this bridge is in a marine environment area, and the structure members are so close to salt water, it may be preferable to replace the steel deck girders with PC/PS concrete box girders.

4.1.5 180-Foot through truss rehabilitation

The steel through truss spans of the Dumbarton Bridge need major rehabilitation in order to bring them up to an acceptable level of operational standard.

According to the MKC assessment report, the entire lower portion of the trusses, which is close to the water, is severely corroded and should be replaced. The replacement includes all floor beams, all stringers, all bottom lateral bracings, all chord connections, all bearings, and about 50% of the bottom chord members. Although the report did not mention the condition of the vertical and the diagonal truss members, it is reasonable to assume that some of these members may also have to be replaced. This assumption is based on the report for the Dumbarton and the Newark Slough swing spans where some of the vertical and diagonal members exhibit moderate to severe corrosion and need to be replaced. Also, the end or ends of these members may have experienced section loss which would render them no longer suitable for the connection.

4.1.6 Dumbarton and Newark Slough swing span bridges

4.1.6.1 Structural

According to the MKC report, these two swing spans are severely corroded. The truss members required extensive rehabilitation. The Dumbarton bridge fenders need to be replaced.

There was no under water inspection and no inspection report of Newark Slough bridge's substructures.

4.1.6.2 Electrical and Mechanical

The Dumbarton Bridge electrical and mechanical inspection was a "walk-through" inspection, done in one day by one MKC team member. Mechanical systems were inspected while observing a bridge operation. Therefore it can be concluded that the equipment is operable.

The Newark Slough Bridge, like the Dumbarton, was inspected in one day, with the same limited level of detail. Mechanical observations were limited to a bridge operation.

The Conceptual Engineering section of the MKC report recommends the following work:

- Remove and rehabilitate pivot bearing;
- Rehabilitate existing rack and track, with all new bolts;

- Rehabilitate existing pinions, shafts and bearings and drive with new 30 hp motors with new gearboxes, reduce drive from 4 pinions to 2;
- Rehabilitate the center wedge system, remove existing shafting and direct drive with motor driven gear reducer, add bronze bearing plates to upper and lower castings;
- Rehabilitate the end wedge system, remove existing shafts and direct drive with motor driven gear reducers, add bronze bearing plates to upper and lower castings; and
- Install electrical power and control system, including submarine cables, and engine generator set.

The *MKC Condition Assessment report* and its recommendations are discussed below:

Dumbarton Bridge:

Section 4.1, p18:

> "The general condition of the mechanical equipment is fairly good..."

This phrase strongly suggests that the mechanical equipment could be economically rehabilitated with a minimum of replacement.

Section 4.3 Center Bearing p 19:

> "The only way to determine any possible damage to the bearing would be to jack the bridge up and remove the bearing elements for inspection."

This may not be necessary, depending on the condition of the center wedges. AREMA standards require that the center pivot bearings of all swing bridges be capable of being dismantled for inspection without taking the bridge out of service. Normally, a bridge of this type is designed so that the center wedges can support the dead load as well as the live load. In this situation, the center pivots can be dismantled completely without jacking the bridge.

Section 4.4 Rack and Track p 19:

> "The rack teeth seem to be in good condition..."

This statement agrees with the MKC report's general conclusion that the machinery is in good condition.

Section 5.2 Mechanical and Electrical Recommendations

1. "The enter bearing should be removed to determine the extent of damage...." A more detailed inspection can be done without major disassembly, and a complete inspection is theoretically possible without jacking the bridge, but this cannot be guaranteed without checking out the conditions at the site.

2. "Remove all of the machinery from the control house...." Observations conclude that the mechanical systems are operable. Only extenuating circumstances would make machinery replacement desirable. These could include: desirability of hiring less skilled bridge operators, necessity of remote operability, or desire to reduce maintenance requirements.

3. "Build a control house either on the shore or off the side of the approach span." There seems to be no need for this.

4. "Install ... new ladders and landings.." etc. This is all desirable work, but these items would also be required in a new bridge installation.

5. "Remove and restore all of the wedges. Install bronze plates..." This may have some utility in easing wedge driving and withdrawal efforts, but is not mandatory.

6. "The rack and track should be renovated..." This agrees with the observations, but not with the other recommendations to replace everything. "..all anchor bolts and segment bolts should be replaced..." This is probably not necessary. An in-depth inspection would indicate how many bolts must be replaced to maintain the integrity of the rack and track.

Newark Slough Bridge

Section 9.1 "...general condition of the mechanical equipment is fair..."

"...wedge system damaged...could not be operated..."

"...foot operated brake missing..."

"...clutch not operable..."

All the above suggest that a round of minor repairs would restore the bridge machinery system.

> "...rack teeth seem to be in good condition..."similar to Dumbarton, there appears to be no really heavy wear or deterioration of the machinery. At least the report provides no evidence of it.

Section 9.7

There are many safety violations cited. These are all quite minor, and could be addressed at little cost.

Section 10.2 Mechanical and Electrical Recommendations

1. "The center bearing should be removed to determine the extent of damage..." As indicated above, this is probably not necessary.

2. "Remove all of the machinery from the control house..." As with Dumbarton, this may not be warranted by the evidence for Newark Slough bridge.

3. "Build a control house on the shore." This is not necessary unless remote operation is desired.

4. "Install all new ladders.." This is required.

5. "Remove and restore all of the wedges. Install bronze bearings plates...." As per Dumbarton, this may not be necessary.

6. "The rack and track should be renovated and all anchor and segment bolts.. replaced..." It is probably not necessary to replace all the bolts. An in-depth inspection would indicate the actual extent of work required. This recommendation and response are identical to that for Dumbarton.

7. "The balance wheels should be renovated..." No evidence was presented to indicate that this is necessary.

8. "...Recommend that the USCG be approached to determine the need for a moveable bridge on Newark Slough." This is beyond Electro/mechanical considerations, and appears to be worth investigating. However, based on PTG's discussions with USCG staff, the bridge cannot be left in a permanently closed position.

4.1.7 Seismic considerations

The MKC report does not resolve seismic issues. The Executive Summary states that "placing the control houses at track level will substantially reduce the dead, seismic and wind structural loadings...." In the "Design Criteria" under "Bridge Structural" the report states that "The structure was also reviewed for wind and seismic loading conditions." It is not clear which bridge this refers to. In the section entitled "Conceptual Engineering Study Swing Span Bridges", under the sub heading "Structural Modifications", the last paragraph (p 2-6) states that "A seismic analysis and vulnerability assessment were not performed...." The text further states that "The construction cost estimates for this study do not take into account seismic retrofit strengthening."

In the Design Criteria, Geotechnical section, the text states that the existing subsurface information and as-built plan were not available to the engineer to identify the unstable geological condition. A detailed field inspection of the corridor was conducted by experienced engineers to evaluate whether unstable condition exists. But there is no discussion in the report about this inspection or the subsurface geological conditions.

The MKC text states that "...it is expected that portions of the seismic retrofit strengthening work will be covered within the rehabilitation cost." During a seismic event, the steel trusses will be subject to reverse force cycles. The truss members will undergo tension and compression stress cycles. Based on PTG's experience on seismic retrofit of truss bridges, it is likely that the existing tension members and most of the existing compression members will not meet the current design requirements under seismic loads. To prevent the bridge from collapse, all these members will have to be strengthened. There is also a concern about the potential liquefaction of the bay mud. It is important that the proposed new substructures be designed to maintain a certain level of structural serviceability after the earthquake.

In summary, based on PTG's review of the MKC report, it appears that the proposed bridge rehabilitation, at least for the steel spans, does not include provisions for any degree of seismic upgrade.

4.2 Potential Modifications and Cost Savings

4.2.1 180-Foot through truss spans

4.2.1.1 Provide for Single Track Bridge

The MKC report on page 2-9 states that SCMTA wants to retain a second track over the truss spans. This is not shown in the track chart. It is noted that half of the six spans are on either side of the swing span, which has only the siding track for the bridge operator's vehicle. The report states that this second track would be a siding track, with only a 10 mph speed limit that would allow a low impact factor. The live load would still be E-72. Based on the single-direction service scenario, a single track would be sufficient in this section of the corridor. This is one area where the bridge live loading could potentially be reduced, thus saving on superstructure rehabilitation cost, as well as foundation reconstruction cost. An estimate of cost savings is on the order of $1 million.

4.2.1.2 Replace with PC/PS Concrete Box Girder Bridge

Based on the good condition of the existing PC/PS concrete approach spans, which were built around 1968 and 1976, replacing these truss spans with PC/PS concrete spans should be considered. The MKC report recommends removing the existing trusses and performing the rehabilitation on land. The spans are effectively being replaced. Concrete box girders would cost less to build and considerably less to maintain. For double-track concrete spans, the total cost including the superstructure and the new substructure is estimated at less than $7 million. It will cost around $9.2 million for refurbishing and re-erecting the existing trusses and their pier/caissons as estimated in the MKC report. Thus, there is potential savings of about $2.2 million. The cost could further be reduced if only a single track was to be provided. For a single track concrete structure replacement, the total construction cost will be around $4 million, a cost savings over the proposed rehabilitation of $5.2 million. The substructure can be concrete pier-supported on concrete piles or large diameter pile bents. The 90-foot span arrangement will allow the new foundations to be staggered around and avoid the existing pier caissons.

In addition, the concrete would less maintenance. Annual maintenance cost savings could be on the order of $450,000.

4.2.2 Steel Deck Girder Replacement

Estimated total saving for replacing the steel deck girders with reinforced concrete box girders for both the Dumbarton and Newark Bridges is about $124,000. Maintenance cost would also be reduced.

4.2.3 Dumbarton Bridge and Newark Slough Swing Bridges

4.2.3.1 Structural

Similar to the 180-foot through trusses, the live loading could be designed for a single track only, instead of the double track. The reduced loading would result in savings of track work, superstructure material, as well as foundation reconstruction cost. Estimated cost savings is about $750,000 for the Dumbarton Bridge and about $500,000 for the Newark Bridge.

4.2.3.2 Electrical and Mechanical

The MKC report estimates the following costs (before mobilization and contingencies) for electrical and mechanical rehabilitation of the two bridges:

Dumbarton	Mechanical Work	$540,000
	Electrical Work	$540,000
	Control House	$50,000
Newark	Mechanical Work	$405,000
	Electrical Work	$472,000
	Control House	$88,000
Total		$2,095,000

MKC and their associates performed a limited inspection and evaluation of the two swing bridges. The MKC report recommends removal and complete replacement of both bridges, based on their structural condition and assumptions about the substructure condition. If the bridges were required for other reasons to be completely replaced, it would be sensible economically to also replace all the electrical and mechanical equipment. If the bridges are not going to be replaced, there may be no apparent need for an extensive electromechanical rehabilitation.

If it is desired to operate the bridges by remote control, which is not required for starter service, then installation of electric bridge power is desirable. If conversion to electric drive is made, an alternative modification to that proposed in the MKC report can be done, with smaller, less expensive gearmotor type units installed less replacement of the existing drives. A simpler control system than that required for remote control can be provided. Installation of electric drive is quite expensive, whether a generator is used for primary power or utility power is supplied.

The electric drive conversion recommended in the MKC report may not be necessary, unless the system is to be operated by remote control. Battery or solar powered navigation lights can be provided and are relatively maintenance free. It appears that with center pivot repair and other relatively minor repairs, the Newark Slough Bridge can be made operable. The Dumbarton Bridge appears to be capable, from a mechanical standpoint, to be serviceable. Other than the center pivot, there appears to be no mechanical components at Dumbarton in immediate need of renovation. For a simple rehabilitation without electric power or remote control, approximately $200,000 worth of mechanical repairs could provide operable bridges; but, an in-depth inspection and analysis would be required to confirm this.

If it proves feasible from a railroad and marine traffic standpoint to have one or both bridges operated by remote control, it would be possible to maintain their present fully mechanical drives and add a remote actuator with a feedback control system. This could be built for less cost than complete replacement of the machinery and providing an electric power supply. However, the complexity of the operation would be substantial, and its long term viability would be in question. An additional estimate $1,000,000 of mechanical rehabilitation costs might provide a radio-electrical-mechanical remote control drive while maintaining the existing engines for prime power.

4.2.4 Potential Additional Costs

If 25% of the vertical and diagonal members of the steel through trusses have to be replaced, it could cost additional $800,000. The report states that the top chord members appear to be mostly in good condition and apparently need only limited replacement. However, as noted in this review of the MKC report, the top chord members were not completely inspected. These costs would not be incurred if the steel trusses are replaced with concrete box girders.

The MKC report indicates that the cost estimates for the rehabilitation of truss spans and swing spans do not include the cost of seismic upgrade. Also the foundations will require

measurement of preventing liquefaction and excessive movement. The actual amount will depend on the seismic retrofit strategy.

4.3 Structures Summary

For comparison purposes, a cost summary for structural modifications has been developed based on the following upgrade program:

1. Replacement of the timber trestle segments with PC/PS concrete box girders as recommended in the MKC report.

2. Replacement of the six 180-foot long steel trusses and related plate girder spans with single track 90-foot long pre-cast, pre-stressed concrete box girder structures.

3. Replacement of the steel deck girder spans with pre-cast, pre-stressed concrete box girders.

4. Rehabilitate the swing span structures based on single track loading. Replace the fenders on the Dumbarton swing span. Repair existing electrical and mechanical systems, instead of replacing them.

5. An allowance for seismic upgrade of the swing span structures. This cost was not included in the MKC cost estimate.

Costs are shown in Table 3. The costs from the MKC report were obtained from the summary sheets on Pages 3-10 through 3-12. The mobilization costs were apportioned to the various structural elements based on the percentages of the direct costs.

Table 3
STRUCTURAL COST ESTIMATE SUMMARY

Item	MKC Report		PTG Review				Savings
	Recommendation	cost w/o contingencies	Recommendation	Costs w/o contingencies			
				Dumbarton Bridge	Newark Slough	Totai	
Timber Trestles	Replace w/ PC/PS Concrete	$7,255,579	Concur w/ MKC report	$6,588,144	$667,435	$7,255,579	$0
Dumbarton Steel Through Trusses	Rehabilitate	$9,587,233	Replace w/ single track PC/PS concrete box girders	$4,000,000		$4,000,000	$5,587,233
Dumbarton Steel Deck Girders	Reconstruct	$551,022	Replace w/ single track PC/PS concrete box girders	$324,000		$324,000	$227,022
Dumbarton Swing Span Structural	Rehabilitate	$5,014,446	Rehabilitate for single track loading	$4,263,000		$4,263,000	$751,446
Dumbarton Swing Span Electrical and Mechanical	Replace mechanical and add new electrical	$1,256,342	Repair mechanical	$100,000		$100,000	$1,156,342
Newark Steel Deck Girders	Reconstruct	$172,085	Replace w/ single track PC/PS concrete box girders		$101,150	$101,150	$70,935
Newark Swing Span Structural	Rehabilitate	$3,312,352	Rehabilitate for single track loading		$2,816,000	$2,816,000	$496,352
Newark Swing Span Electrical and Mechanical	Replace mechanical and add new electrical	$1,072,608	Repair mechanical		$100,000	$100,000	$972,608
Totals		$28,221,667		$15,275,144	$3,684,585	$18,959,729	$9,261,938
Seismic Upgrade of Truss Bridges				$430,000	$280,000	$710,000	($710,000)
Environmental Permitting and Mitigation		$2,000,000	Concur w/ MKC report	$1,816,021	$183,979	$2,000,000	$0
Totals		$30,221,667		$17,521,165	$4,148,564	$21,669,729	$8,551,938

Note: Project development (planning, environmental documentation, and design) costs, administration costs, and construction management costs are not included. Costs are in 1996 dollars.

5.0 SUMMARY

5.1 General

This section summarizes PTG's recommendations for track, signal, and structures capital improvements on the Dumbarton Corridor between Redwood Junction and Newark Junction. The improvements are based on single-direction passenger service in the mornings, with reverse service in the evenings. The improvements do not include layover facilities, stations and parking lots, rolling stock or other improvements on the Caltrain Line north and south of Redwood Junction, or UP tracks east of Newark Junction.

The following paragraphs describe the proposed capital improvements and the basis for the cost estimates in more detail. Costs are summarized in Table 4 (at the end of this working paper).

5.2 Track Improvements

The track configuration from Redwood Junction to Newark Junction is shown schematically in **Figure 1 Service Schematic Track Chart** (page 5-5). Based on the service scenario, only a single track is needed between Redwood Junction and Newark Junction. The existing main line track would be reconstructed, with new 136 LB CWR, and all new timber cross ties, except for a 3-mile segment where existing 113-, 119- and 132-lb continuous welded rail would be retained. Existing turnouts to remain would be replaced with new 136-lb turnouts. Thus, not all the potential savings listed in Table 2 would be realized. Crossovers and turnouts from the Dumbarton Line to the Caltrain Line south would be upgraded.

An alternative improvement shown as Segment 1A involves upgrading track and special trackwork for a connection to the Caltrain line north. A new crossover would be constructed between the siding track and MT-1.

Existing ballast would be cleaned and new ballast added. The existing second track in Redwood City would be retained as is (i.e. not upgraded) for freight traffic. On the east side of the bay, the existing siding track would be retained (not upgraded). A new segment of track would be constructed around the existing track at the Leslie Salt facility. Turnouts from the main line would be replaced with new ones. All existing turnouts and sidings, that are no longer needed, including two sidings on the west side of the Bay, would be removed.

At Newark Junction, a single split switch is proposed to replace the existing two turnouts from the Dumbarton to the Centerville Line. (This configuration would essentially replace the original or earlier configuration as shown on SP track charts.) The slip switch would allow freight traffic between the Coast Line north and the Centerville line. The purpose of this arrangement would be to allow faster speed (25 or 30 mph in place of 15 mph) across Newark Junction for Dumbarton passenger trains. If a connection to the Coast Line South is needed, a second slip switch could be added. The connection from the Dumbarton Branch to the Coast Line to the north is no longer in service; the turnout from the Coast Line has been removed.

All existing AC or timber grade crossing panels would be replaced with concrete panels, both on the main line as well as on existing secondary tracks that are to remain. This will reduce maintenance costs.

5.3 Signals and Grade Crossing Warning Devices

CTC would be installed on the Dumbarton Corridor between Redwood Junction and Newark Junction. Signals for the connection to the Caltrain siding track east of MT-1 main line south at Redwood Junction would be added. The existing crossover from MT-1 to the siding track is presumed to be manually operated; power would be added. It is assumed that a powered and signalized crossover exists south of the junction for SB trains. The crossover from the north track to the south track at MP 26.8, as well as the turnouts from the south track to the Caltrain track would have motorized switches and signals.

For the connection to Caltrain north, the existing turnout to the siding track would be powered and interlocked. A new crossover would be powered and interlocked.

The existing motorized switch and signal at MP 28.4 would be retained. All other siding turnouts to remain would be hand throw with electric locks. The interlocking at Newark Junction would be modified to add approach and home signals to the Dumbarton Corridor. The existing electric lock on the turnout would be effectively replaced with the proposed diamond crossing and single slip switch.

Signals interlocked with the track miter joints will be added at the two swing bridges.

Existing grade crossing warning devices on the Dumbarton Line are to be upgraded or replaced in accordance with MKC's recommendations. The requirements at each crossing are summarized below.

Middlefield Road Wye	Ground and case equipment OK to reuse connection
2nd Street	Replace ground equipment and predictors. Case equipment OK.
5th Street	Replace ground equipment and predictors. Case equipment OK
Marsh Road	Replace all equipment
Chilco Street	Replace predictors
Willow Road	Replace predictors
University Ave.	Replace predictors
Service Road	Assume sign protection or manual gates only
Willow Ave.	Replace predictors
Spruce Street	Replace predictors
Ash Street	Ground and case equipment OK to reuse
Filbert Street/Carter	Ground and case equipment OK to reuse
Thorton Avenue	Crossing protection not needed. Track out of service.

5.4 Structures

Structural improvements to the San Francisco Bay crossing include:

1. Replacement of the timber trestle segments as recommended in the MKC report.
2. Replacement of the six 180-ft long steel trusses and related plate girder spans with single track 90-ft long pre-cast, pre-stressed concrete box girder structures. This is a less costly alternative than proposed by MKC.
3. Rehabilitate the swing span structures based on single track loading. Repair existing electrical and mechanical systems, instead of replacing them.
4. An allowance for seismic upgrade of the swing span structures. This cost was not included in the MKC cost estimate.

5.5 Capital Cost Estimate Summary

The cost estimate is broken into segments. The segments are:

1. At-grade bolted rail from Redwood Junction to the beginning of CWR. This segment includes the connection to the south Caltrain main line.
2. At-grade CWR.
3. Dumbarton bridge, including approach trestles. This segment has existing CWR.
4. At-grade bolted rail between Dumbarton and Newark Slough Bridges
5. Newark Slough Bridge and approach trestles.
6. At-grade from Newark Slough to Newark Junction. The costs of track and signals at Newark Junction are included in this segment.

1A Redwood Junction connection to Caltrain north.

The cost estimates presented herein should be regarded as order of magnitude costs only. Further study, particularly of the Dumbarton and Newark structures, is needed to develop more reliable cost estimates.

The basis for the various items in our cost estimate is described below.

Track and Roadbed Upgrade

New rail consists is 136 LB CWR. All existing cross ties are replaced with new concrete ties in accordance with the Rail infrastructure design standards presented in the *Caltrain Rapid Rail Study*. Ballast and track geometry consists of cleaning existing ballast, adding new ballast equal to 25% of a full section (10% on ballast deck trestles), and resurfacing. Roadbed and drainage work is estimated at $10,000 per mile for at-grade sections.

New Track

This cost is based on 136 LB CWR and concrete ties.

Structures

The basis for the cost of upgrading the existing structures on the SF Bay crossing is shown in Table 3 Structural Cost Estimate Summary.

Train Signals

The cost estimate for CTC train signals is based on Electrocode type devices for track circuits and signal lighting. A per-mile cost for CTC was developed based on a conceptual layout. Lump sum costs for CTC Office System and salvage of the existing equipment were apportioned into the per-mile unit cost for the new installation. Interlocking at Redwood City consists of 2 crossovers and 5 signals. The interlocking at Newark Junction consists of 1 slip switch and 4 signals. Electric locks are all new and include pre-wired case, hand-throw switch, electric lock and cables.

Signaling for the Dumbarton and Newark Slough swing bridges includes pre-wired hut with Local Control Panel, supervisory for remote control, 2 signals, circuit controller boxes, an electric lock and electric switch machine controlled derails.

Grade Crossings

Costs of warning devices on the Redwood City to Newark Junction segments are based on crossings with no insulated joints. Nineteen (19) conductor #14 cable is assumed throughout the length of the line. Complete new warning device installation includes pre-wired 6x8 bungalows, gates, flashers, cantilevers, and cables.

Contingencies

Contingencies are added to cost estimates to account for unknowns and items that can change as the project progresses.

Based on the conceptual nature of this project, contingencies have calculated at 30% of the estimated construction costs and 40% of the estimated right-of-way costs.

Project Implementation Costs

These associated with right of way acquisition. Other items are calculated, as percentages are costs over and above construction and right of way acquisition costs that are part of the project. The various items are shown in the cost summary sheet. The percentages reflect general experience for similar projects. Planning, engineering and administration costs are calculated as percentages of construction plus right-of-way costs, to account for engineering, negotiation and legal costs of construction only. Pre-operating expenses include testing and commissioning, pre-revenue service operations, permits and similar items.

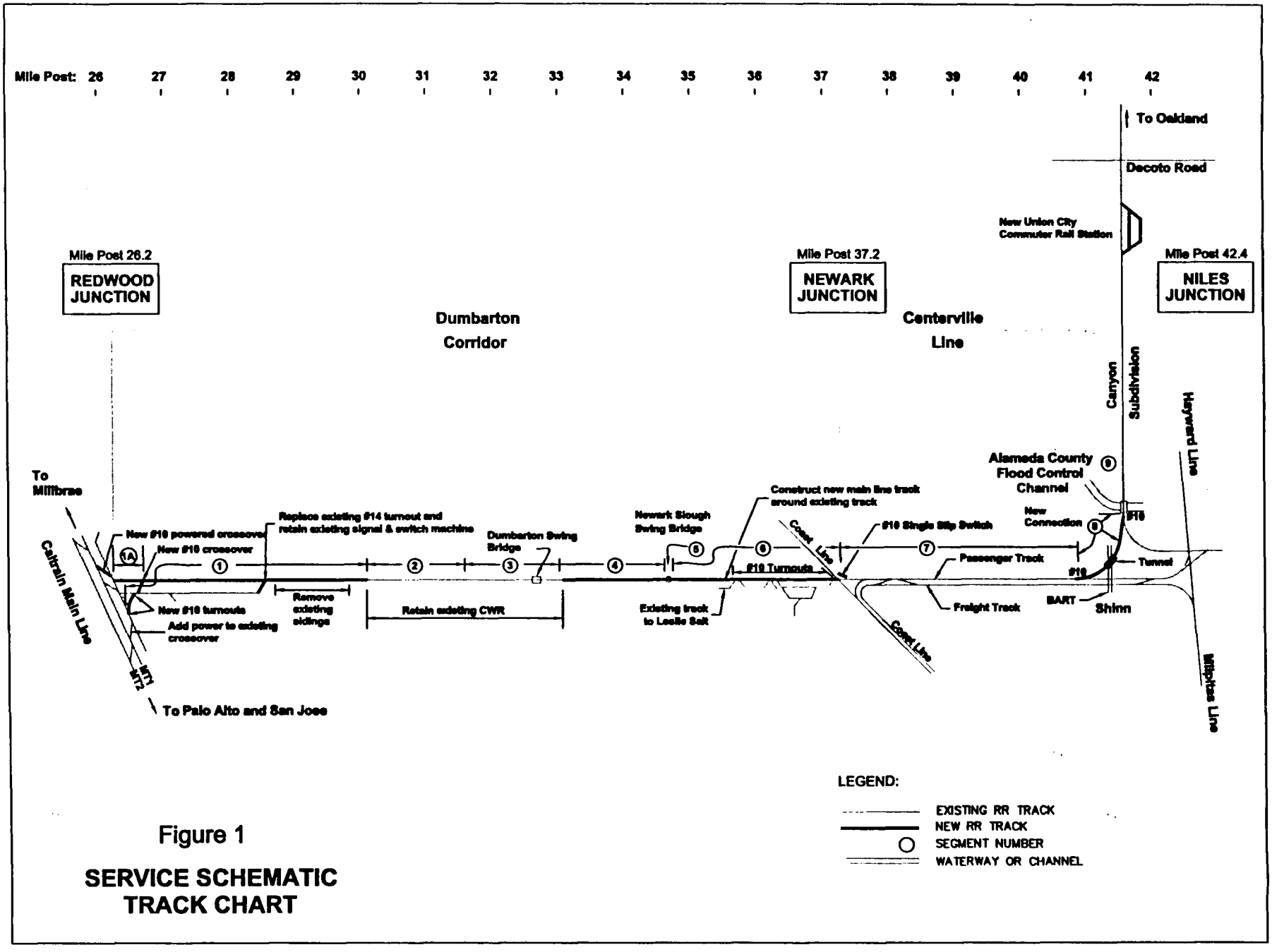

Figure 1

SERVICE SCHEMATIC TRACK CHART

Table 4
CAPITAL COST ESTIMATE SUMMARY

Estimated Costs, $Millions

ITEM	Segment							TOTAL	TOTAL
Segment Number	1	2	3	4	5	6	1A	Segments	All Segments
Railroad	Dumbarton	Dumbarton	Dumbarton	Dumbarton	Dumbarton	Dumbarton	Dumbarton	1,2,3,4,5,6	
From	Redwood Jct	Henderson	Revenswood	Dumbarton	Newark Slough	Newark Slough	Redwood Jct	Redwood City	Redwood City
To	Henderson	Ravenswood	Dumbarton	Newark Slough	Newark Slough	Newark JCT	Redwood City	Newark Jct	Newark Jct
Length Miles	3.9	1.5	1.4	1.6	0.1	2.6	0.6	11.0	11.6
Track and Roadbed Upgrade									
Rail and hardware	$1.11	$0.09	$0.09	$0.46	$0.03	$0.66	$0.15	$2.44	$2.60
Cross Ties	$1.02	$0.39	$0.38	$0.42	$0.02	$0.68	$0.16	$2.90	$3.06
Ballast and Track Geometry	$0.42	$0.13	$0.13	$0.17	$0.01	$0.28	$0.06	$1.14	$1.20
Roadbed and Drainage	$0.04	$0.01		$0.02		$0.02	$0.01	$0.09	$0.10
Track Upgrade Total	$2.58	$0.63	$0.60	$1.06	$0.06	$1.65	$0.38	$6.58	$6.96
New Track									
Construction	$0.46		$0.10			$0.90	$0.25	$1.45	$1.70
Right of Way									
New Track Total	$0.46		$0.10			$0.90	$0.25	$1.45	$1.70
Structures			$17.52		$4.15			$21.67	$21.67
Train Signals	$0.89	$0.21	$0.41	$0.23	$0.21	$0.89	$0.25	$2.84	$3.09
Grade Crossings									
Warning devices	$0.74	$0.09				$0.18	$0.04	$1.01	$1.05
Crossing Surfaces	$0.26	$0.03				$0.18		$0.47	$0.47
Steet and traffic signal work									
Grade Crossing Total	$1.00	$0.12				$0.36	$0.04	$1.48	$1.52
Stations									
Construction	$0.20					$0.61		$0.81	$0.81
Right of Way	$0.05					$1.30		$1.35	$1.35
Stations Total	$0.25					$1.91		$2.16	$2.16

Table 4
CAPITAL COST ESTIMATE SUMMARY (Continued)

Estimated Costs, $Millions

ITEM		Segment							TOTAL	TOTAL
Segment Number		1	2	3	4	5	6	1A	Segments	All Segments
Railroad		Dumbarton	Dumbarton	Dumbarton	Dumbarton	Dumbarton	Dumbarton	Dumbarton	1,2,3,4,5,6	
From		Redwood Jct	Henderson	Revenswood	Dumbarton	Newark Slough	Newark Slough	Redwood Jct	Redwood City	Redwood City
To		Henderson	Ravenswood	Dumbarton	Newark Slough	Newark Slough	Newark JCT	Redwood City	Newark Jct	Newark Jct
Length	Miles	3.9	1.5	1.4	1.6	0.1	2.6	0.6	11.0	11.6
Support Facilities										
Construction										
Right of Way										
Total Support Facilities										
Construction Total		$5.13	$0.96	$18.63	$1.29	$4.42	$4.40	$0.92	$34.84	$35.76
Right of Way Total		$0.05					$1.30		$1.35	$1.35
Project Total		$5.18	$0.96	$18.63	$1.29	$4.42	$5.70	$0.92	$36.19	$37.11
Contingencies		$1.50	$0.29	$5.59	$0.39	$1.33	$1.84	$0.28	$10.99	$11.27
TOTAL FACILITIES		$6.74	$1.25	$24.22	$1.68	$5.75	$7.54	$1.20	$47.18	$48.38
Implementation Costs										
Planning and Engineering	14%	$0.94	$0.17	$3.39	$0.23	$0.80	$1.06	$0.17	$6.60	$6.77
Administration	4%	$0.27	$0.05	$0.97	$0.07	$0.23	$0.30	$0.05	$1.89	$1.94
Construction Management	6%	$0.40	$0.07	$1.45	$0.10	$0.34	$0.34	$0.07	$2.72	$2.79
Pre-Operating Expenses	2%	$0.13	$0.02	$0.48	$0.03	$0.11	$0.11	$0.02	$0.91	$0.93
Total Add-on Costs		$1.75	$0.32	$6.30	$0.44	$1.49	$1.81	$0.31	$12.12	$12.43
TOTAL PROJECT COSTS		$8.49	$1.57	$30.52	$2.11	$7.24	$9.35	$1.51	$59.29	$60.80

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DUMBARTON RAIL CORRIDOR STUDY

IMPROVEMENTS EAST OF NEWARK JUNCTION, STATIONS AND SUPPORTING FACILITIES

CAPITAL INVESTMENTS WORKING PAPER

Prepared for the

San Mateo County Transportation Authority

Prepared by

Parsons Transportation Group
Barton-Aschman De Leuw, Cather Steinman

July 13, 1999

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1.0 INTRODUCTION

One possibility for extending commuter rail service in the South San Francisco Bay Area is the "Dumbarton Rail Corridor", a former freight line that links the Peninsula and the East Bay, between Redwood City and Newark. This Working Paper by the Parsons Transportation Group (PTG) is part of a San Mateo County Transportation Authority (SMCTA) sponsored study that defines a logical Rail Service Plan for the Dumbarton Corridor, so that this candidate project can be included in the Metropolitan Transportation Commission's *Blueprint for the 21st Century*. In particular, this working paper identifies the track improvements, stations and supporting facilities needed to provide new commuter rail service using a reactivated Dumbarton Corridor, in conjunction with three other existing active rail corridors. The estimated costs of these improvements are also presented.

1.1 Background Information

The Dumbarton rail crossing was formerly part of the 16.2-mile long Centerville Line, which accommodated Trans-Bay freight train movements between Redwood Junction and Niles Junction, via Newark Junction. Through-rail operations between Redwood Junction and Newark Junction stopped about two decades ago. However, the Centerville Line is still very active in the five-mile stretch between Newark and Niles as it accommodates Altamont Commuter Express (ACE) service, Capitol Route Amtrak trains and UP freight moves. In this working paper the eleven-mile rail right-of-way between Redwood Junction and Newark Junction is referred to as the Dumbarton Rail Corridor (or Dumbarton Corridor). Reference to the Centerville Line should be read as the Centerville Line, east of Newark Junction.

The San Mateo County Transit District (SamTrans) purchased the Dumbarton Corridor from the Southern Pacific Transportation Company in 1994 as an investment for future transportation purposes. The Dumbarton Corridor is inactive, except within two miles of Redwood Junction, and within a mile west of Newark Junction.

1.2 Overview of Proposed Dumbarton Rail Service

July 1999, *Service Plan Evaluations* by PTG have indicated that the Dumbarton Corridor can best be used by providing rail service between a new commuter rail station in Union City in the East Bay, and existing Caltrain stations on the JPB Peninsula Line. It is proposed to run train service on two routes:

- Between Union City and Millbrae (30.0 revenue miles, approximately a 60-minute run), and
- Between Union City and San Jose Diridon (37.8 revenue miles, approximately a 75-minute run).

There will be twelve Dumbarton train runs each non-holiday weekday, as described below:

- In the morning peak commuter hours, three two-to-three-car trains will provide service between Union City and Millbrae, and layover in Millbrae. In the evening peak commuter hours, the three trains will provide the reciprocal service between Millbrae and Union City.

- In the morning peak commuter hours, three two-to-three-car trains will run between Union City and downtown San Jose (Diridon), and layover in San Jose. In the evening peak commuter hours, the three trains will provide the reciprocal service between San Jose and Union City.

Each run will use four existing rail corridors:

- The JPB Peninsula Line and its stations, between Redwood Junction and Millbrae or San Jose,
- A rehabilitated Dumbarton Corridor between Redwood Junction and Newark Junction, including new stations at Chilco Street and in western Newark,
- The Union Pacific Centerville Line trackage within approximately 3.9 miles east of Newark Junction, including the existing Fremont Centerville Station now serving the Altamont Commuter Express (ACE) and Amtrak Capitol Route trains, and
- The Union Pacific's Canyon Subdivision, within approximately 2.2 miles north of the Alameda County Flood Control Channel to a new commuter rail station, functionally integrated with the existing Union City BART Station, about a third of a mile south of Decoto Road.

The Dumbarton project would include constructing a new 0.3-mile long track connection between the Centerville Line and Canyon Subdivision, about a mile west of Newark Junction, just west of what the UP refers to as the Shinn Yard. Thus, the new connection is being called the Shinn Connection. It is assumed that this connection would be given to the UP, as part of negotiations in exchange for trackage rights for the Dumbarton service.

1.3 Study Approach and Purpose

For purposes of this study it is assumed that the Dumbarton Corridor commuter train service would be an extension of the JPB's Caltrain service, which uses conventional commuter rail equipment. This study does not identify funding sources or how cost sharing among agencies can be accomplished. The purpose of this working paper is to determine, at a planning level, the estimated capital costs associated with making physical improvements for the new Dumbarton rail service. Unit costs applied reflect local cost experience on similar studies; no vendor quotes were obtained. Although items are discussed in detail, the primary objective is to make a reliable assessment of the total capital costs.

The Parsons Transportation Group has also prepared the following documents that complement this working paper:

- *Corridor Rehabilitation, Redwood Junction to Newark Junction; Capital Investments Working Paper*, July 1999.
- *Operating Costs Working Paper*, July 1999.

The first working paper listed discusses in detail the minimum renovation that would be needed to Dumbarton Corridor physical facilities to allow basic line-haul operation of trains, regardless of the service plan (i.e., stations, parking lots, numbers of trains). The technical studies and cost estimates presented in all working papers are based on having a single main track in the Dumbarton Corridor. This current working paper extends the previous evaluations by defining the cost of stations, supporting facilities and basic track improvements needed east of Newark Junction.

2.0 SUMMARY OF IMPROVEMENTS

2.1 Track

Figure 1 Service Schematic Track Chart (at end of this working paper) shows needed track improvements and the portions of the existing railroad network that will be used to provide the proposed commuter rail service. **Table 2-1 Basic Track Improvements** describes the required trackwork and new facilities. For cost accounting purposes, the Dumbarton Corridor and trackage to the east have been broken into nine segments, as shown on Figure 1. This working paper focuses primarily on the track improvements needed east of Newark Junction, in segments 7, 8 and 9.

Table 2-1
BASIC TRACK IMPROVEMENTS

Segment Limits	Description	Length in Miles
JPB Corridor: Redwood Junction north to the Millbrae BART Station and south to San Jose (Diridon Station)	Run on existing JPB trackage. It is assumed that the Dumbarton fleet will be part of the added train runs that are being planned, and adequate layover facilities will be provided by others at Millbrae and San Jose.	12.50 (Millbrae) 20.35 (San Jose)
Dumbarton Corridor: Redwood Junction to Newark Junction	Renovate the Dumbarton Rail Corridor physical facilities to provide one-track mainline operation. Maintain existing Dumbarton Corridor freight service.	11.00 (Millbrae) 10.88 (San Jose)
Centerville Line: Newark Junction to west of Shinn	Acquire track rights on the existing Centerville Line. It is assumed that a third main will not be needed.	3.93
New Shinn Connection	South of the existing Alameda County Flood Control Channel bridge, construct a one-track connection running under BART, between the Centerville Line and Canyon Subdivision.	0.24
Canyon Subdivision	Acquire track rights on the existing Canyon Subdivision trackage, between south of the Alameda County Flood Control Channel to about a quarter mile south of Decoto Road. It is assumed that a second main track will not be needed.	2.17

The JPB Peninsula Line, the Centerville Branch, and the Canyon Subdivision are all assumed to have adequate capacity for the proposed service. Thus, no additional passing sidings or running tracks have been proposed. Basic track improvements in the Dumbarton Corridor are discussed in *Corridor Rehabilitation, Redwood Junction to Newark Junction; Capital Investments Working Paper*, July 1999, by the Parsons Transportation Group.

No improvements to the Centerville Branch tracks are needed. Dumbarton passenger service will normally run on the north track between Newark Junction and west of Shinn. At that location, west of Shinn, the new connection will be constructed between the Centerville north track and the Canyon Subdivision track just south of the Alameda County Flood Control Channel Bridge. The proposed connection will require the construction of a tunnel underneath the BART tracks, which are on an embankment. The tunnel under BART would be about 66 ft long, with wing walls at each portal. Based on cursory visual observations, this concept appears feasible, but a layout based on topographic mapping would be required to confirm this. The connection would require property acquisition from parcels on either side of BART, and would create landlocked portions of each. Acquisition of the entire landlocked portions has been assumed in the cost estimate.

During the course of the current study, it was noted that the area west of BART and north of the Centerville Line (through which the connection proposed) is planned for residential development. In the event that such development precludes the proposed connection, an alternative alignment is possible on the east side of BART. That alternative would not require a new tunnel, but would involve smaller-radii curves with consequent slower speeds, a new grade crossing, and possible realignment of the Canyon Subdivision main line track.

At its north end, the connection to the Canyon Subdivision requires a new turnout at a location where a turnout exists. This existing turnout is constructed partially on a curve, with the main line track partially superelevated opposite the direction of the new connection. Some modification of the existing configuration will be needed to introduce the new connection. If this is not feasible, the new turnout could be constructed north of the existing one, but that would require reconstruction of at least one span of the bridge over the flood control channel. No specific allowance has been made for this possibility in the cost estimate because it is considered to be included in the contingencies.

The connection to the Canyon Subdivision track will cross the flood channel maintenance access road, which is also used by bicyclists to access the bike path that parallels the channel. For costing purposes, an at-grade crossing has been assumed; however, an underpass may be warranted. The cost of such potential construction is included in the contingencies.

The existing Canyon Subdivision track would be used from Shinn to the new Union City station, a distance of about 2.2 miles. This station would be located directly adjacent to the BART Union City station to facilitate passenger transfers. Based on our observation, no improvement to the Canyon Subdivision track would be required. The current speed limit on the track is 60 mph. Due to the short length of this segment, an increase in maximum authorized speed is not warranted.

2.2 Signals

New interlocking signals will be added as part of the Shinn Connection. Although the connecting track is short (about ¼ mile), it is proposed to create an intermediate signal block on the track. This will allow commuter trains to pull off either the Centerville or the Canyon Subdivision without needing the other to be clear.

A new pedestrian at-grade crossing of the Canyon Subdivision main would be constructed at the Union City Station, to allow travelers to walk between the commuter rail platform and a new entrance to the BART Station.

2.3 Structures

A new structure will be required to grade separate the existing BART tracks and facilities over the Shinn Connection. BART could be carried on a structure or a short tunnel could be built through the existing embankment. The crown of the tunnel would need to be below the tracks as well as the 34.5 kv power and the communications duct banks that run beneath the subgrade on either side of BART tracks.

2.4 Stations

Table 2-2 Proposed Dumbarton Corridor Station Facilities lists new or expanded station complexes that will be needed to support the recommended Dumbarton Corridor rail service. The table describes concepts for restructuring current transit service and adding employer shuttles to induce commuter rail patronage. Parking requirements are also shown in the table.

In the East Bay, Dumbarton train runs will commence and end revenue service on the Canyon Subdivision at a new commuter rail station to be built either as an independent commuter rail station development, or as a component of a contemplated Union City Intermodal Center. Under either scenario, the Union City Station will be functionally the most important East Bay stop associated with the Dumbarton Corridor commuter rail service. A new access road, with a signalized intersection at Decoto Road, would need to be built, leading south from Decoto Road for approximately a third of a mile to the station. Cost estimates discussed in Section 3.0 are based on an independent station development located adjacent to and connected with the existing Union City BART Station complex, as described in Table 2-2.

In Fremont, the proposed rail service will use existing station facilities and infrastructure (i.e., the Fremont Centerville ACE/Amtrak Station). However, it is assumed additional parking will be constructed. Preliminary evaluations indicate that the single platform now on the north side of the passenger main will be adequate for handling the patronage that is expected to transfer between ACE and the Dumbarton trains.

Parking lots would be at constructed at Union City and Newark. At Fremont, there is no vacant space available near the station for a new parking lot. For purposes of this study, construction of new parking has been assumed at an undefined location. Alternatively, required parking spaces could be acquired from an existing shopping center located about one block north of the station. Chilco is considered to be a work destination station, so no parking would be provided. Bus bays and drop-off areas for autos would be provided for employer shuttles.

Table 2-2
PROPOSED DUMBARTON CORRIDOR STATION FACILITIES

Ref.	Station Name	Station Development Scenario	Number of Added Parking Spaces Required
B	Union City Station *(BART)*	It is assumed that the new commuter rail station will come first, and a larger intermodal complex developed by others in phases. The initial station complex would include a platform and walkway to connect with the existing BART station complex. Decoto Road would be improved to provide a signalized intersection for a new access road leading south to the new station parking lots and bus transit facilities. Train storage and support facilities will be developed at this location. AC Transit and SamTrans Trans-Bay bus service will be modified to serve the east side of the BART station complex.	370
C	Fremont Centerville *(ACE/ Amtrak)*	The existing station handles six Amtrak trains and four ACE trains, with two (or four) more expected. Three AC Transit routes already serve this station. The Dumbarton train service will use the existing station complex and construct additional parking for the expected patronage.	200
D	Newark *(Area Two)*	This station should be developed in consort with the Area Two Plan, which calls for additional streets and other infrastructure. Because this is a new area for businesses, there is no AC Transit service. Added AC Transit is anticipated to serve primarily the Area Two developments. It is assumed that the Dumbarton rail service project will construct a station and parking area, but not be involved in constructing new arterial streets.	250
E	Chilco Street	This will be a new station, tailored primarily to serve East Bay residents employed in the area surrounding the station. Local SamTrans service could be expanded to serve this station. Employee shuttles should be promoted. The station will be constructed and Chilco Street improved to include bus and shuttle turnouts and added sidewalk leading to the improved street system immediately to the north.	None

Note: In subsequent capital cost estimates it has been assumed that right-of-way will be acquired initially for the number of parking spaces shown. However, initially only one-half of the indicated number of spaces will be constructed.

The Newark Station will be as proposed by the City of Newark's Area Two Plan, for the land use planning district located about a mile west of Newark Junction. Cost estimates presented in Section 3.0 assume the Dumbarton rail service project will build a station and parking lot, but not be involved in constructing new arterial streets.

North and south of Redwood Junction the added Dumbarton trains will stop at selected Caltrain Stations, similar to existing Caltrain service. In line with the market assessment, if the overall scheduling constraints allow, new trains between the East Bay and Millbrae should stop in Redwood City and San Carlos at a minimum, and the San Jose-bound trains should stop at Atherton, Menlo Park, Palo Alto and California Avenue.

The existing Caltrain stations along the Peninsula Line are assumed to be adequate for handling the added patronage associated with Trans-Bay Dumbarton trips. The Dumbarton trains are expected to generate new patronage associated with passengers traveling between points on the Peninsula. This will offset in part the operating expenditures associated with the recommended Dumbarton service. It is unlikely that additional patronage on the Peninsula can be generated without adding parking at existing Caltrain stations. Station parking needs and layover of additional trains on the Peninsula Line are being addressed separately as part of overall Caltrain service improvements throughout the JPB Corridor from San Francisco to Gilroy. Consequently, this Dumbarton Rail Corridor Study did not investigate the details of where and how parking should be added to existing Caltrain stations, or exactly where Dumbarton trains will layover during mid-day periods. The capital cost estimates discussed in Section 3.0 do not include any allowance for added parking on the Peninsula.

2.5 Layover Facilities

It is assumed that the Dumbarton rolling stock (six locomotives and 15 coach cars) will return nightly to Union City. The new station complex would include storage tracks, lighting and facilities for car cleaning and inspection. Figure 1 conceptually shows one possible arrangement for combining storage needs with the loading platform needed at Union City (i.e., a center platform between two station tracks, outside the existing Canyon Subdivision right-of-way).

It is expected that washing and fleet maintenance will occur in San Jose, in conjunction with Caltrain operations. Existing or planned layover facilities at San Jose and Millbrae are assumed to have capacity for the proposed Dumbarton Service, so no allowance for these items is included in the following cost estimates.

3.0 CAPITAL COST ESTIMATES

3.1 Basis for Cost Estimates

The following assumptions were made as part of preparing cost estimates:

- **New Track:** This cost is based on 136 LB CWR and concrete ties.
- **Structures:** The estimate for the tunnel under BART for the connection from the Centerville Line to the Canyon Subdivision is based on a method of micro-tunneling by installing steel pipes around the horse-shoe profile of the tunnel as a pre-support system before excavating.
- **Train Signals:** The cost estimate for centralized traffic control (CTC) train signals is based on Electrocode type device for track circuits and signal lighting. A per-mile cost for CTC was developed based on a conceptual layout.
- **Stations:** No platform is needed at Fremont. The cost of street work at stations is included in the auto and bus facility costs. The cost of new stations is based in part on a prototype that includes the following features:
  - 600-ft long platform and 60-ft long canopy.
  - Handicapped lift, benches and information kiosks.
  - Parking lot for initial number of cars at each station. Lighting and fencing are included.
  - 3 bus bays at a minimum.
  - 6 auto drop-off and loading spots.
  - Landscaping and irrigation in the parking lot, based on the number of cars.
- **Property Acquisition:** Property is estimated at $500,000 per acre, excluding the "property acquisition reserve" discussed in Section 3.2.
- **Layover Facility:** The layover facility would have two tracks, each long enough for three four-car trains, plus site work, auxiliary power and lighting. There would be a single turnout from the main line. Property acquisition is included in the right-of-way cost of the Union City Station.
- **Contingencies:** Contingencies are added to cost estimates to account for unknowns and items that can change as the project progresses.
- **Project Implementation Costs:** These are costs over and above construction and right of way acquisition costs that are part of the project. The various items are shown in the cost summary sheet. The percentages reflect general experience for similar projects. Planning, engineering and administration costs are calculated as percentages of construction plus right-of-way costs, to account for engineering, negotiation and legal costs associated with right-of-way acquisition. Other items are calculated as percentages of construction only. Pre-operating expenses include testing and commissioning, pre-revenue service operations, permits and similar items.

All costs are expressed in 1999 dollars. The contingencies do not include any allowances for possible cost escalation.

3.2 Summary of Cost Estimates

The Parsons Transportation Group document *Dumbarton Corridor Rehabilitation, Redwood Junction to Newark Junction; Capital Investments Working Paper*, July 1999 provides details on the estimated costs for improvements needed within the SamTrans-owned Dumbarton Corridor. **Table 3-1 Capital Cost Estimate Summary For Improvements East Of Newark Junction** provides a similar summary for capital investments that need to be made east of Newark Junction, within or near existing Union Pacific-owned corridors. The cost estimate is broken into segments, as follows:

7. Centerville Branch from Newark Junction to Shinn.
8. New connection from Centerville Line to Canyon Subdivision.
9. Canyon Subdivision from new connection to Union City Station.

Segments 1 through 6 are on the Dumbarton Corridor (Redwood Junction to Newark Junction).

Initial property acquisition costs estimates by the Parsons Transportation Group (PTG) were based on approximately $500,000 per acre ($11.48 per square foot). Most proposed stations are in areas experiencing commercial development. Potential for rapidly escalating real estate values warrants that a "property acquisition reserve" be established.

Table 3-2 Estimated Capital Costs summarizes all the capital improvements required to provide the physical facilities that will allow implementing the recommended rail service plan for reactivating the Dumbarton Rail Corridor. The total estimate of $86.24 million (1999 dollars) consists of $62.15 million for improvements for the Dumbarton Corridor, and $24.09 million in improvements east of Newark Junction.

Table 3-1
CAPITAL COST ESTIMATE SUMMARY FOR IMPROVEMENTS EAST OF NEWARK JUNCTION

Item		Estimated Cost in $Millions				
						Total
Segment Number		7	8	9		All Segments
Railroad Line:		Centerville:	Shinn	Canyon Sub:		
From		Newark Jct.	Connect.	Flood Channel		
To		Shinn		Union City		
Track & Roadbed Upgrade						
Rail and hardware						
Cross Ties						
Ballast & Track Geometry						
Roadbed and Drainage						
Track Upgrade Total						
New Track						
Construction			$0.38			$0.38
Right-of-Way			$1.16			$1.16
New Track Total			$1.53			$1.53
Structures			$2.37			$2.37
Train Signals			$0.36			$0.36
Grade Crossings						
Warning devices				$0.21		$0.21
Crossing Surfaces				$0.01		$0.01
Street and traffic signal work						
Grade Crossing Total				$0.21		$0.21
Stations						
Construction		$0.32		$1.00		$1.32
Right-of-Way		$1.00		$1.90		$2.90
Stations Total		$1.32		$2.90		$4.22
Support Facilities						
Construction				$1.00		$1.00
Right-of-Way				$0.63		$0.63
Total Support Facilities				$1.63		$1.63
Construction Total		$0.32	$3.11	$2.21		$5.64
Right-of-Way Total		$1.00	$1.16	$2.53		$4.68
Project Total		$1.32	$4.26	$4.74		$10.32
Contingencies		$0.48	$1.24	$1.56		$3.28
TOTAL FACILITIES		**$1.80**	**$5.50**	**$6.30**		**$13.61**
Add-on Costs						
Planning & Engineering	14%	$0.25	$0.77	$0.88		$1.91
Administration	4%	$0.07	$0.22	$0.25		$0.54
Construction Management	6%	$0.02	$0.23	$0.17		$0.42
Pre-Operating Expenses	2%	$0.01	$0.08	$0.06		$0.14
Total Add-on Costs		$0.36	$1.30	$1.36		$3.01
TOTAL COSTS		**$2.16**	**$6.80**	**$7.66**		**$16.62**

Table 3-2
ESTIMATED CAPITAL COSTS

Category and Work Item	Estimated Costs, in millions, by Corridor			
	JPB Peninsula Line	Dumbarton Corridor	East of Newark Junction	Total
Track and Roadway				
• Track Upgrade		6.96		6.96
• New Track		1.70	0.38	2.08
Signals				
• Train Signals		3.09	0.36	3.45
At-Grade Crossings				
• Warning Devices		1.05	0.21	1.26
• Crossing Panels		0.47	0.01	0.48
Structures				
• Structures		21.67	2.37	24.04
Stations				
• Stations, Parking and Facilities		0.81	1.32	2.13
Supporting Facilities				
• Train Storage Area	See Note		1.00	1.00
Construction Total		**35.75**	**5.65**	**41.40**
Right-of-Way Acquisition				
• New Track Connection			1.16	1.16
• Station Areas		1.35	2.89	4.24
• Train Storage Area	See Note		0.63	0.63
Right-of-Way Total		**1.35**	**4.68**	**6.03**
• Contingencies		11.27	3.28	14.55
• Project Engineering, Administration; and Implementation		12.43	3.01	15.44
• Property Acquisition Reserve		1.35	7.47	8.82
Total Project Cost	See Note	**62.15**	**24.09**	**86.24**

Note: It is assumed that any supporting facilities needed in the JPB Corridor (i.e., mid-day layover facilities in Millbrae and San Jose) will be constructed as part of other programmed or planned improvements.

Costs are based on current year 1999 dollars.

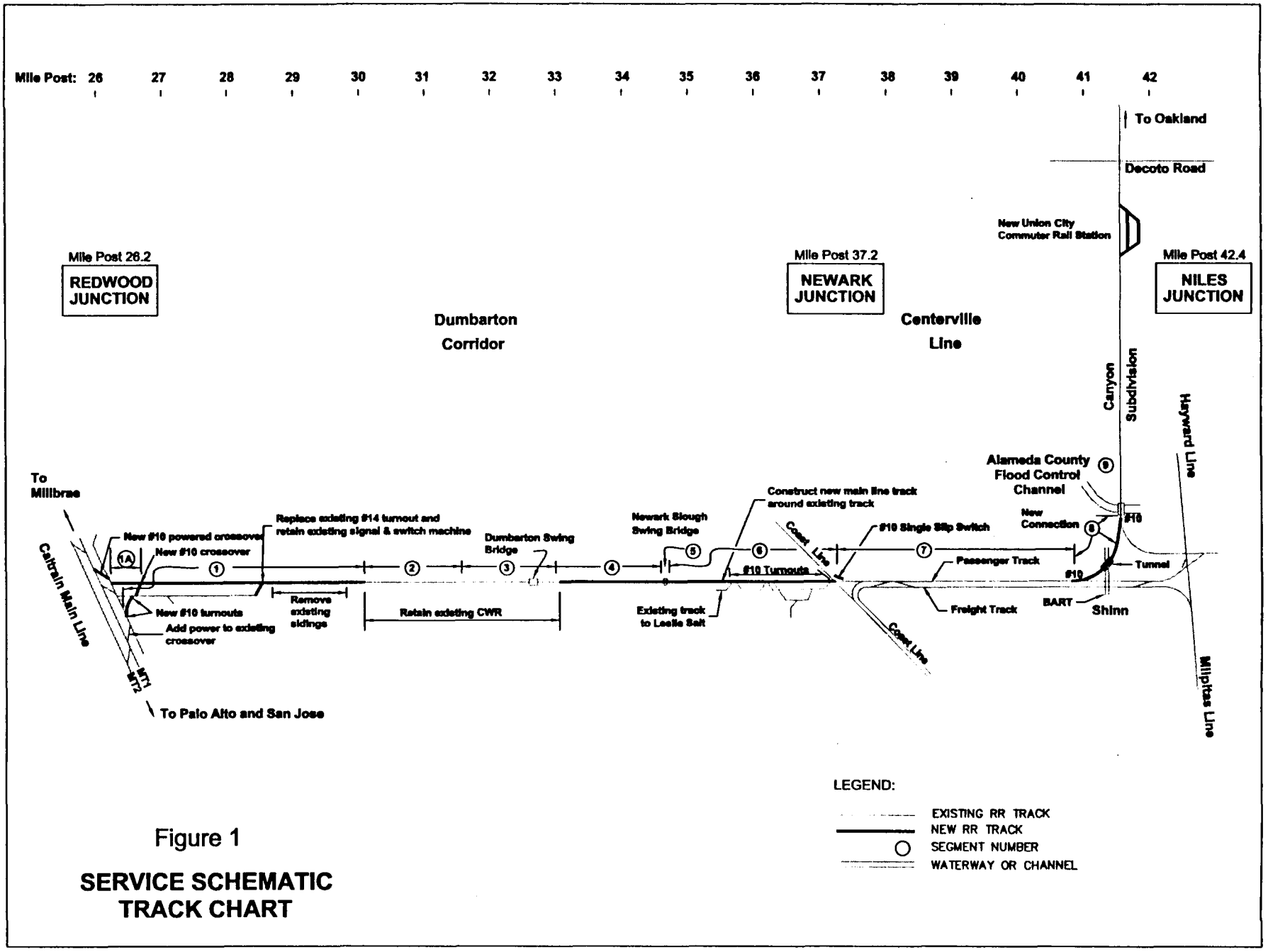

Figure 1

SERVICE SCHEMATIC TRACK CHART

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DUMBARTON RAIL CORRIDOR STUDY

OPERATING COSTS
WORKING PAPER

Prepared for the

San Mateo County
Transportation Authority

Prepared by

Parsons Transportation Group
Barton-Aschman De Leuw, Cather Steinman

July 13, 1999

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1.0 INTRODUCTION

One possibility for extending commuter rail service in the South San Francisco Bay Area is the "Dumbarton Rail Corridor", a former freight line that links the Peninsula and the East Bay, between Redwood City and Newark. This Working Paper is part of a San Mateo County Transportation Authority (SMCTA) sponsored study that defines a logical Rail Service Plan for the Dumbarton Corridor, so that this candidate project can be included in the Metropolitan Transportation Commission's *Blueprint for the 21st Century.*

1.1 Background Information

The Dumbarton rail crossing was formerly part of the 16.2-mile long Centerville Line, which accommodated Trans-Bay freight train movements between Redwood Junction and Niles Junction, via Newark Junction. Although the Centerville Line is still very active in the five-mile stretch between Newark and Niles, through-rail operations between Redwood Junction and Newark Junction stopped about two decades ago. In this working paper the eleven-mile rail right-of-way between Redwood Junction and Newark Junction is referred to as the Dumbarton Rail Corridor (or Dumbarton Corridor). Reference to the Centerville Line should be read as the Centerville Line, east of Newark Junction.

The San Mateo County Transit District (SamTrans) purchased the Dumbarton Corridor from the Southern Pacific Transportation Company in 1994 as an investment for future transportation purposes. The Dumbarton Corridor is inactive, with the following exceptions:

- Within approximately two miles east of the main Joint Powers Board (JPB) Peninsula Corridor, Union Pacific Railroad Company (UP) freight service is provided to some small customers.
- Within about a mile west of the Coast Line at Newark Junction, four medium-sized industries use rail freight service.

When SamTrans purchased the Dumbarton Corridor, the UP was given trackage rights to continue the local freight service described above.

In the last decade, a number of investigations have evaluated how the Dumbarton Corridor facilities would need to be renovated. Various potential service routes have also been identified and analyzed. On March 25, 1999, SMCTA gave notice to the Parsons Transportation Group (PTG) to conduct a comprehensive study aimed at defining the best strategy for implementing the added commuter rail service. In particular, the current Dumbarton Rail Corridor Study has evaluated initial and long-range service options, in terms of initial capital costs, operating costs and forecasted patronage revenue, before identifying the most practical service scenario.

1.2 Overview of Proposed Dumbarton Rail Service

As part of this study, a separate document and the main report *Service Plan Evaluations*, by Parsons Transportation Group has indicated that the Dumbarton Corridor can best be used, initially, by

providing rail service between a new commuter rail station in Union City in the East Bay, and existing Caltrain stations on the JPB Peninsula Line. Trains would be stored and have interiors cleaned at the new Union City Station. It is proposed to run Dumbarton train service on two routes:

- Between Union City and Millbrae (30.0 revenue miles, approximately a 60-minute run), and
- Between Union City and San Jose Diridon (37.8 revenue miles, approximately a 75-minute run).

In the last decade, the potential for commuter rail service in the Dumbarton Corridor was recognized in a number of studies. These investigations of service alternatives culminated in the *Dumbarton Corridor Transit Concept Plan*, as prepared by the SMCTA in November of 1998. The Concept Plan provides general guidelines for the contemplated commuter rail service, including hours of service. In line with these guidelines and current Parsons Transportation Group patronage forecasts, it is proposed to operate twelve Dumbarton train runs each non-holiday weekday, as described below:

- In the morning peak commuter hours, three two-to-three-car trains will provide service between Union City and Millbrae, and layover in Millbrae. In the evening peak commuter hours, the three trains will provide the reciprocal service between Millbrae and Union City.
- In the morning peak commuter hours, three two-to-three-car trains will run between Union City and downtown San Jose (Diridon), and layover in San Jose. In the evening peak commuter hours, the three trains will provide the reciprocal service between San Jose and Union City.

Each run will use four existing rail corridors:

- The JPB Peninsula Line and its stations, between Redwood Junction and Millbrae or San Jose;
- A rehabilitated Dumbarton Corridor between Redwood Junction and Newark Junction, including new stations at Chilco Street and in western Newark;
- The Union Pacific Centerville Line trackage within approximately 3.9 miles east of Newark Junction, including the existing Fremont Centerville Station now serving the Altamont Commuter Express (ACE) and Amtrak Capitol Route trains; and
- The Union Pacific's Canyon Subdivision, within approximately 2.2 miles north of Alameda Creek to a new commuter rail station, functionally integrated with the existing Union City BART Station, about a third of a mile south of Decoto Road.

The Dumbarton project would include constructing a new 0.3-mile long track connection between the Centerville Line and Canyon Subdivision in the vicinity of Nunes Lane (west of Shinn), north of Horner, and immediately south of the Alameda County Flood Control Channel. It is assumed that this connection would be given to the UP with trackage fees, as part of JPB/UP negotiations, in exchange for trackage rights for the Dumbarton service.

An accompanying Working Paper titled: *Improvements East of Newark Junction, Stations and Supporting Facilities; Capital Investments Working Paper*, July 1999 provides a fuller description of proposed stations and supporting facilities, and related operations. Another PTG Working Paper: *Corridor Rehabilitation, Redwood Junction to Newark Junction; Capital Investments Working Paper*, July 1999, has defined the capital improvements that will be needed to reactivate the Dumbarton Corridor.

1.3 Objective of Working Paper

The purpose of this Working Paper is to determine, at planning level, the estimated annual costs associated with operating the new Dumbarton rail service and maintaining the associated railroad facilities. Although items are discussed in detail, the primary objective is to make a reliable assessment of the total annual cost that will be associated with operating and maintaining the Dumbarton commuter rail service, between Union City and Millbrae and between Union City and San Jose.

For purposes of this study it is assumed that the Dumbarton Corridor commuter train service would be an extension of the JPB's Caltrain service using conventional commuter rail equipment. This study does not identify funding sources, or how cost sharing among agencies can be accomplished.

2.0 OPERATION COST DATA BASE

This section reviews the current operating cost experience of Caltrain and other carriers. Except as noted in Section 2.1, this information was used as a baseline for estimating the annual costs that will be associated Dumbarton train service.

2.1 Recent Caltrain Operating Cost Experience

The following table summarizes operating costs associated with the current Amtrak/JPB contract and expresses the various items in terms of per-train mile rates for the total Caltrain system.

Table 2-1
CURRENT CALTRAIN OPERATING COSTS

Category	Operating Cost Item	Total Cost	Cost Per Train Mile
Train Operations	• Train Operations (Crew)	$ 12,600,000	$ 12.49
	• Fuel	3,000,000	2.98
	• Train Dispatching	900,000	0.89
Equipment and Facilities	• Equipment Maintenance	7,700,000	7.63
	• Track/Facilities Maintenance Exterior Cleaning	5,500,000	5.45
	• Revenue Collection (Station)	2,000,000	1.98
	• Station Maintenance	900,000	0.89
Other Items	• General Manager Staff	1,600,000	1.59
	• Police	1,100,000	1.09
	• Revenue Accounting	400,000	0.40
	• Materials Control, Leases, Insurance, Marketing	400,000	0.40
	• Budget and Finance	400,000	0.40
	Totals without Agency Overhead	**$36,500,000**	**$ 36.19**
Agency Overhead	Approximately 31.5% of above items	11,500,000	11.40
	Total Agency Cost	**$48,000,000**	**$ 47.59**

Per train mile rates are based on 1,008,654 train miles.
Source: Woodside Consultants, July 1999

2.2 Typical Caltrain Station Operations

As part of the duties listed above, Amtrak is responsible for maintenance of stations, including typically janitorial services inside station buildings, landscaping and exterior trash removal, parking lot maintenance and revenue collection. In certain cases cities also provide assistance in operating and maintaining station complexes. Although Amtrak also provides some security services, this is usually reinforced indirectly by the local municipal police as part of other routine duties. JPB Real Estate staff have suggested to the Parsons Transportation Group staff that it would be reasonable to assume that annual station maintenance costs will average approximately $40,000 per station.

3.0 COST ESTIMATING LOGIC

This section reviews the Caltrain unit cost data presented in Section 2.0 and verifies if the per train mile rate for each cost item is applicable for the proposed Dumbarton service. If not applicable, an alternative strategy is suggested for deriving an appropriate annual operating cost estimate.

3.1 Overview Evaluation of Operations

The Caltrain "Train Operations" per train mile rate indirectly reflects economies of scale associated with using a large labor pool and existing facilities to operate and service a large number of trains. The Dumbarton service will create six additional train crews that possibly could be used for other runs in a mid-day six-hour period on weekdays, and possibly cars could be cleaned midday in San Jose and Millbrae. However, to more clearly show the costs associated with the Dumbarton Service, labor costs for crews are calculated independently in Section 4.0, without making use of the Caltrain average per-train mile rate.

The Dumbarton Corridor contains a number of bridges that are atypical relative to the existing Caltrain system. Consequently, special operating and maintenance costs for the Dumbarton Corridor are evaluated and estimated in Section 5.0.

On average, the four new stations (Chilco Street, Newark, Fremont Centerville, and Union City) associated with Dumbarton rail service will serve fewer commuter trains than existing stations. Thus, using the per-train-mile rate indicated in Section 2.0 would under-state annual station maintenance costs. Use of the $40,000 per station annual rate would be more appropriate. However, each new station will be unique and probably involve either a higher or lower annual cost than average. In particular:

- Chilco Street Station is assumed to have no parking facilities, station building or off-street transit circulation roads. Thus, maintenance costs will be less. However, due to its isolated location, special arrangements should be made with Menlo Park police to keep a watchful eye on the station, especially during night time hours.
- The Newark Station operating environment will be similar to Chilco Street Station , with the exception that parking will be provided.
- The Amtrak Centerville Station complex will be shared with ACE and the Amtrak Capitol Route service. Consequently, the annual station cost contribution for Dumbarton service would be less than average.
- The proposed Union City commuter rail station may eventually act as a catalyst for a larger multi-modal center. However, it is assumed that the facilities for a rail commuter operation (new access road, bus turnouts, parking lots, platform, train storage/cleaning area) will come first, and that these must be operated and maintained independently. A higher level of security is also appropriate at the Union City terminal. Thus, station operating costs in Union City would be greater than average.

Although each station will involve a different operating and maintenance situation, for cost estimating purposes it has been assumed that each new station will involve an annual maintenance expenditure of $40,000, excluding agency overhead. Assuming a 31.5% agency overhead, the burdened rate would be approximately $53,000 per year per station.

3.2 Adjusted Per-Train Rates

The table below indicates the resulting "net per-train mile rates", if crew labor costs and the following are removed:

- Dumbarton stations' operating and maintenance costs, east of Redwood Junction.
- Bridge and maintenance-of-way costs in the Dumbarton Corridor (Redwood Junction to Newark Junction).

The October 1, 1998 *Caltrain Rapid Rail Study* discussed trackage rights for the Dumbarton service and, based on an industry comparison, assumed trackage rights would cost approximately $5.76 per train mile. It is understood that ACE pays UP $6.00 per train mile for their trackage fees. For this study, it is assumed that $7.00 per train mile is a reasonable trackage fee to account for cost escalation. The actual rate will need to be negotiated with the UP.

Table 3-1
ADJUSTED TRAIN OPERATING COSTS PER TRAIN MILE

Category	Operating Cost Item	Net Cost Per Train Mile		
		In JPB Corridor	In Dumbarton Corridor	Over UP Trackage
Train Operations	• Train Operations (Crew)	Excluded[1]	Excluded[1]	Excluded[1]
	• Fuel	$ 2.98	$ 2.98	$ 2.98
	• Train Dispatching	0.89	0.89	Excluded[2]
Equipment and Facilities	• Equipment Maintenance	7.63	7.63	7.63
	• Track/Facilities Maintenance	5.45	Excluded[3]	Excluded[4]
	• Revenue Collection (Station)	1.98	Excluded[3]	Excluded[3]
	• Station Maintenance	0.89	Excluded[3]	Excluded[3]
Other Items	• See discussion in Section 2.1	3.88	3.88	3.88
	Totals without Agency Overhead	**$ 23.70**	**$ 15.38**	**$ 14.49**
Agency Overhead	Approximately 31.5% of above items	7.47	4.84	4.56
Track Use Charge		-	-	7.00
	Total Agency Cost, per train mile	**$ 31.17**	**$ 20.22**	**$ 26.05**

[1] Per-Train labor costs are not dependent on corridor, per-train labor costs are calculated in Section 4.0

[2] Dispatching would be provided by UP with costs covered under trackage fees.

[3] Dumbarton Corridor bridge and track operating and maintenance costs are calculated in Section 5.0 Station operating and maintenance costs are identified on a per station basis in Section 3.1.

[4] UP would perform maintenance with costs covered under trackage fee.

The travel distances for each train in miles, by corridor, will be as indicated below:

	In JPB Corridor	In Dumbarton Corridor	Over UP Trackage
• Between Union City and Millbrae	13.0	11.0	6.8
• Between Union City and San Jose	21.9	10.9	6.8

The revenue mileage on the JPB line is 12.5 and 20.4 miles for the runs to Millbrae and San Jose respectively. It is estimated that the mid-day layovers will involve 0.5 and 1.5 miles of non-revenue service, per train run.

Over UP trackage, the revenue run will be 6.5 miles; distances to/from storage in Union City are estimated to be 0.3 mile per train run.

If the net per-train-mile rates by corridor are multiplied by the associated distances, and totaled, the result is the following per-train cost, for the items included in the per-train-mile rates:

- Between Union City and Millbrae = approximately $ 805 per train trip
- Between Union City and San Jose = approximately $1.080 per train trip

4.0 PER-TRAIN LABOR COSTS

This section provides the unit cost information needed to estimate the crew labor costs that would be associated with each new train operated as part of the Dumbarton Corridor Service.

4.1 Per-Train Crew Costs

It is assumed that the Dumbarton trains will be cleaned each night at the storage facility in Union City. Based on discussions with ACE staff, cleaning of ACE trains in Stockton during the overnight layover has been costing approximately $57 per car day, excluding cleaning supplies. Assuming cleaning supplies average approximately $7 per car day, the total unit cost including labor is $64 per car day.

In Tables 2-1 and 3-1, the $7.63 per-train-mile rate for Equipment Maintenance includes interior car cleaning and exterior washing costs, as well as spot and heavy maintenance. However, it could not be determined what part of the $7.63 relates exclusively to car cleaning. Thus, the potential added cost for interior cleaning of Dumbarton cars has been omitted in the following calculations because the $7.63 rate is applied.

All Caltrain crews are at least three persons, typically including the following:

- An engineer paid at approximately $37.50 per hour (including fringe benefits).
- One conductor at $30.00 per hour.
- An assistant conductor paid approximately $22.50 to $30.00 per hour.

If the average rate is used for the assistant conductor, the result is a crew cost of about $94 per hour.

For Caltrain crews, break time (the time off between daily service periods) is paid at half the above rate, or $47 per hour per crew. Active time includes preparatory time before the start of a run, the train run, and the final tie-up and coach walk-through (cursory car cleaning) at the end of a run. It has been assumed the preparatory and closing times will together take about 60 minutes. Although the train running times will be slightly less going to and from Millbrae, for preliminary costing purposes it has been assumed that each of the six crews will work a 12.5-hour day, with two 2.5-hour duty periods separated by a 7.5-hour break. This equates to 8.75 hours of compensation, or about 4.4 crew hours per train run. That results in a per-train-crew cost of 4.4 hours times $94 per hour, or $414 per train run.

The crew costs, including the 31.5% agency overhead, are then as follows:

- Trains to/from Millbrae: 414 x 1.315 = approximately $544 per train run.
- Trains to/from San Jose: 414 x 1.315 = approximately $544 per train run.

4.2 Potential Other Labor Costs

It is assumed that the Dumbarton fleet will be stored in what is today a relatively undeveloped part of Union City. For costing purposes it has been assumed that arrangements would be made to wash Dumbarton cars elsewhere on the Caltrain system, and that the associated cost is reflected in the "Equipment Maintenance" component of the per train miles costs. Further study may indicate the need or desirability to wash the Dumbarton fleet at a new facility in Union City. Under that approach, the per-car washing cost and associated labor expenses would probably be higher than the current average Caltrain experience. However, this would not significantly increase the total estimated annual operating costs for Dumbarton commuter rail service.

5.0 MAINTENANCE COSTS FOR DUMBARTON CORRIDOR

The Dumbarton Corridor has unique bridges and other facilities that are different than similar elements in the existing JPB Corridor. This section estimates the annual costs that would be associated with operating and maintaining the unique railroad facilities of the Dumbarton Corridor.

5.1 Bridge Improvements

The bridge facilities that will require maintenance are identified in this section. The Dumbarton Corridor now includes eight bridges, as follows, from west to east:

- U.S. 101 Underpass; steel through truss.
- West Timber Trestle on San Francisco Bay.
- West Concrete Trestle on San Francisco Bay.
- West Approach to Dumbarton Bridge; Concrete Trestle on San Francisco Bay.
- Dumbarton Bridge: six truss spans, three short deck girder transition spans, and one steel swing span. San Francisco Bay.
- East Approach to Dumbarton Bridge; Concrete Trestle on San Francisco Bay.
- East Approach to Dumbarton Bridge; Timber Trestle on San Francisco Bay.
- West Approach to Newark Slough; timber trestle.
- Newark Slough Bridge: one steel swing span and two steel deck girder transition spans.
- East Approach to Newark Slough; timber trestle.

As discussed in a related study document titled *Capital Investments Working Paper: Corridor Rehabilitation, Redwood Junction to Newark Junction*, the proposed bridge improvements and estimated capital costs are provided. The proposed improvements follow:

- Replace all timber trestles with precast prestressed concrete box girders on concrete pile bents.
- Replace Dumbarton Bridge steel trusses and deck girders with precast prestressed concrete box girders on concrete pile bents.
- Rehabilitate Dumbarton Bridge steel swing span and swing span mechanical system.
- Replace Newark Slough steel deck girders with precast prestressed concrete box girders on concrete pile bents.
- Rehabilitate Newark Slough steel swing span and swing span mechanical system.

5.2 Fixed Bridge Maintenance Assumptions

- Perform structural inspection of all structures once every two years.
- For purposes of estimating operating and maintenance costs, future restorations and major repairs are not included here and are considered future capital improvements.
- Maintenance of track, ballast, and signals is covered under maintenance-of-way cost estimates.

5.3 Movable Bridge Operating and Maintenance Assumptions

Both the Dumbarton and Newark Slough moveable bridge operations must be maintained in accordance with U.S. Coast Guard regulations. The Coast Guard has recently indicated that as many as 30 commercial fishing boats and several recreational vessels require the Dumbarton Bridge to be opened each day. Barge trips to Moffett Field, dredges, and construction rigs occasionally require a Dumbarton Bridge opening.

The Newark Slough has minimal vessel traffic (on the order of once a year) requiring the opening of the swing span. Levee construction and maintenance barges, U.S. Fish & Wildlife vessels, and other activities require the swing span to be opened. The Alameda County Flood Control District, the National Wildlife Refuge, and other agencies have an interest in maintaining navigation through the Newark Slough, including the serviceability of the moveable bridge.

The Coast Guard has expressed willingness to consider special regulations fair to all parties for both bridges. It is noted that commercial fishing vessels commute to their work by waterway. Their schedules are controlled by factors such as tides, trip itinerary, and other business/personal interests. The Coast Guard has indicated that the Dumbarton Bridge could operate under procedures that require the bridge to be opened at specific periods during the day, including brief periods during the commute hours. Alternatively, an agreement could be proposed that leaves the bridge open during non-commute hours and provides for a "call up" or notification to the bridge owner/operator to open the bridge during commute hours. The on-call bridge opening could be delayed by several minutes depending on the location of the next train.

The Newark Slough Bridge could be regulated under a program that requires advance notice to the bridge owner/operator. The advance notice could be proposed as one month; however, a reasonable response would be given if emergency flood control or levee maintenance is required.

For study purposes the following assumptions apply to the maintenance and operation of the two moveable bridges.

- Provide one bridge tender at the Dumbarton Bridge, four hours in the morning, four hours in the afternoon and evening on weekdays during commuter train operations.
- Provide bridge tender (two people) four times a year, four hours each trip, for the Newark Slough Bridge.
- Perform one mechanical/electrical inspection of both moveable bridges each year.
- Perform structural inspection of both bridges once every two years.
- The Dumbarton Bridge tender will perform minor servicing and cleaning.
- Additional mechanical and electrical servicing and fueling will be performed once each quarter (four times per year).
- For purposes of estimating operating and maintenance costs, future restorations and major repairs are not included here and are considered future capital improvements.
- Painting of steel members would occur once every 15 years.
- Labor costs include benefits.

5.4 Bridge Operating and Maintenance Cost Estimates

Table 5-1 Annual Operating and Maintenance Costs: Dumbarton Corridor Bridges summarizes the activities and associated costs for maintaining the modified bridge facilities.

5.5 Maintenance-of-Way Assumptions

- The following track, roadway, and signal improvements would have to be performed as part of the capital improvement program:
  - Trackway: Upgrade turnouts, replace switch ties, resurface and ballast the corridor, rebuild at-grade crossings, create bypass for Leslie Salt, improve Redwood Junction, improve Newark Junction.
  - Signals: Install CTC.
- Inspections by a two-person crew occurs once a month.
- Annual signal maintenance is a lump sum estimate.
- Track maintenance and clearing of right-of-way debris and foliage occurs 10 days per year using a four-person crew.
- Labor costs include benefits.
- Electricity charges are included and discussed below.
- Major future renovations and upgrades are not included and are considered future capital improvements.

According to the JPB, the average cost of electrical power for the 50-mile Peninsula Corridor for all Caltrain functions including train signals, stations, parking lots, maintenance/layover facilities, and miscellaneous services is $35,000 per month. On a per-mile basis, the average electrical power cost is $700. Using this baseline, the 11-mile Dumbarton Corridor electricity costs would be on the order of $7,770/month. This value appears excessive since the Dumbarton Corridor is planned to have only two stations with no buildings (Chilco and Newark), about 11 grade crossings, no maintenance facilities, solar-powered marine navigation lights, and diesel-powered swing-span motors. For planning purposes it is assumed the electric utility bill for the Dumbarton Corridor would be half the Peninsula Line average, or $350 per mile per month, which results in a monthly cost of approximately $3,900.

5.6 Track, Roadbed, and Signal Maintenance Cost Estimates

The Capital Investment Working Paper referenced in Subsection 5.1 also discusses proposed roadbed, track and signal/communication improvements that will be completed prior to commencing train service. **Table 5-2 Annual Operating and Maintenance Costs: Dumbarton Corridor Track, Roadbed and Signals** summarizes the activities and costs for the basic railroad right-of-way and signal/communication facilities.

Table 5-1
ANNUAL OPERATING AND MAINTENANCE COST
DUMBARTON CORRIDOR BRIDGES

Ref.	Bridge Type/Operating/Maintenance Activity	Estimated Annual Cost
	Dumbarton Swing Span and Newark Swing Span	
1.	Dumbarton Bridge Tender: 2000 hrs. x $50/hr.	$ 100,000
2.	Newark Slough Bridge Tender: 2 x 16 hrs. x 50/hr.	$ $2,000
3.	Mechanical/Electrical Inspection: $10,000/year	$ 10,000
4.	Structural Inspection: $20,000 every two years	$ 10,000
5.	Mechanical/Electrical Servicing and Fueling	$ 10,000
6.	Painting: $100,000/15 years	$ 7,000
7.	Miscellaneous and Travel	$ 10,000
	Subtotal for Both Swing Span Bridges	**$ 149,000**
	Concrete Bridges	
01.	Structural Inspections $50,000 every two years	$ 25,000
	Agency Overhead (approximately 31.5%)	$ 55,000
	Total Annual Maintenance for Bridges	**$ 229,000**

Table 5-2
ANNUAL OPERATING AND MAINTENANCE COST: DUMBARTON CORRIDOR TRACK, ROADBED, AND SIGNALS

Item/Analysis **Dumbarton Corridor Maintenance-of-Way**	Estimated Annual Cost
Annual Costs (Maintenance-of-Way)	
1. Inspections	$ 72,000
a. Labor: Hi-Rail and Walking; 2 men x 4 hrs. x 10 days/month x $75/hr. x 12 months	
b. Other Direct Cost: $100/day x 10 days/month/12 months	12,000
Subtotal	$ 84,000
2. Signals: Maintenance	
a. Labor:	$ 100,000
b. Other Direct Costs:	20,000
Subtotal	$ 120,000
3. Track Maintenance and Clearing of Foliage/Debris	
a. Labor: 4 men x 8 hrs.x 10 days x $75/hr.	$ 24,000
b. Other Direct Costs: $200/day x 10 days	2,000
Subtotal	$ 26,000
Items 1, 2, and 3 Subtotal	**$ 230,000**
4. Allowance for Agency Overhead (approximately 31.5%)	$ 72,000
5. Electrical Utility a. $3,900/month x 12 months	$ 47,000
Total Annual Maintenance of Way Cost	**$ 349,000**

6.0 ESTIMATED ANNUAL OPERATING COSTS

This section applies the previously established per-train cost rates and independent operating cost evaluations to derive a total estimate of annual operating costs for Dumbarton rail service.

6.1 Estimated Annual Operating Costs for Proposed Service

The following table shows the estimate of annual operating costs that will be associated with the proposed Dumbarton rail service, with the final values rounded slightly to reflect the level of analysis.

Table 6-1
ESTIMATED ANNUAL OPERATING AND MAINTENANCE COSTS

Train Operations:		
Six trains between Union City and Millbrae		
Six trains @ ($ 805 + 544) = $ 8,094 per day	Times 253 days =	$ 2,048,000
Six trains between Union City and San Jose		
Six trains @ ($ 1080 + 544) = $ 9,744 per day	Times 253 days =	$ 2,465,000
Subtotal Annual Cost for Train Operations		**$ 4,513,000**
Station Operations, East of Redwood Junction:		
Four stations @ $53,000 per year =		**$ 210,000**
Maintenance Costs for Dumbarton Corridor facilities:		
Maintenance of Bridges	$ 229,000	
Maintenance of Way, including Signals and Communication Systems	$ 349,000	**$ 578,000**
	Total =	**$ 5,301,000**

Costs are based on current year, 1999 costs.