PROJECT: **30^{TH} AND MISSION STREET STATION, SAN FRANCISCO** Date: 7-20-01
CONTRACT NO. / WORK ORDER NO.: - - - - - - - - - - - - - - - - - **Due Date: 7-20-01**
SUBMITTAL#: **TRANSMITTAL #01** Sheet: 5 of 7
Document: 30^{TH} AND MISSION STREET INFILL STATION STUDY
Reviewer: R.AVERY / M.CHIU /J.GARCIA / H.S.AGROIA **Discipline: ENGINEERING** **Discipline Chief: Colin McDonald**

12	What are the minimum dimensions allowed for stair width, escalator width, and platform width?	Refer to Design Criteria Volume IIIA. Stair width = 5'-6", per Section 3.2.5.2A. At the minimum , it should be at least 44" wide, however 5'-6 is more desirable for egress. Escalator width = 4 feet, per Section 3.2.4.1B. ADAAG requires that escalators have a min. clear width of 32 inches. Platform width: The minimum clearance from the platform edge to a continuous obstruction (wall, guardrail, etc.) shall be 8 feet, per Section 3.1.1D. Refer to PUC Criteria dated 3/1/89 for Occupant Load, Emergency Egress & Total Exit Time etc.. Platform width must permit two trains (one in each direction) of one thousand people to be discharged onto it concurrently with 500-1,000 passengers already there without any exiting. The stair widths must allow these passenger to be discharged in 4 minute up the stairs & 6 minutes to exit station in accordance with CBC. The escalators can be considered as a staircase of half the capacity of a staircase of the same width. The number of staircases / escalators must be such that a fire at the foot of one bank still enables the 6 minute evacuation time. The escalators must be able to move ALL the ultimate maximum number of discharging passengers per train up in 1 minute. This may require faster escalators than BART currently uses. If this is the case BART will need to increase the criteria for th number of flat steps at the top and bottom of each escalator. (For example London is apparently using 150 ft / min escalators with SIX flat steps at each end). This may result in some complex structural issues in finding the space for the escalators. Staircase layouts must not leave narrow areas on the platform that large numbers of passengers have to pass through as this becomes a bottleneck for exiting. It occurs now in SF & Dublin during rush hour. ADAAG requires that platforms have a min. clear width of 5 ft from the platform edge detection. The Platform Edge Detection is 2 ft wide, plus an additional 1 ft at center platform door locations. This means that the platform must be at least 8 ft wide from the platform edge to any obstructions. Also refer to Mark Chan (Safety).	

SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT

PROJECT: **30TH AND MISSION STREET STATION, SAN FRANCISCO** Date: 7-20-01
CONTRACT NO. / WORK ORDER NO.: - - - - - - - - - - - - - - - - - **Due Date: 7-20-01**
SUBMITTAL#: **TRANSMITTAL #01** Sheet: 6 of 7
Document: 30TH AND MISSION STREET INFILL STATION STUDY
Reviewer: R.AVERY / M.CHIU /J.GARCIA / H.S.AGROIA **Discipline: ENGINEERING** **Discipline Chief: Colin McDonald**

REF NO.	Potential Operating Constraints/Issues	Comments	Remarks
13	What is the minimum separation allowed for vertically stacked tunnels?	22 feet, (TOR to TOR) was used, refer to Contract 1Z4481 page 182 (Contract 1K0016 page 10).	
14	Will BART ever employ skip-stop (bypass) operation?	Refer to Rudy Crespo (Transportation).	
15	Will BART use this for off-peak layover?	Yes, if the end-of-line facilities are provided. Get further information from Transportation.	
16	What are the systemwide impacts on train headways for the various operating concepts? a) Station stop on existing mainline for all trains b) Selected trains stop in pocket track with minimal disruption to through trains c) Dead-end pocket tracks with crossovers	Refer to Rudy Crespo (Transportation).	
17	Is train dispatch required to SFIA from this location?	Refer to Rudy Crespo (Transportation). Southward dispatching will probably be needed sometimes to help recovery from train delays.	

SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT

PROJECT: **30^{TH} AND MISSION STREET STATION, SAN FRANCISCO**
CONTRACT NO. / WORK ORDER NO.: - - - - - - - - - - - - - - - - -
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Date: 7-20-01
Due Date: 7-20-01
Sheet: 7 of 7

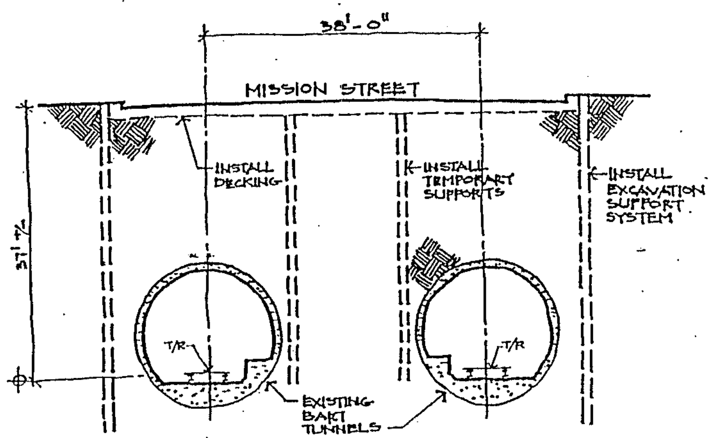
REF NO.	Potential Operating Constraints/Issues	Comments	Remarks
18	Will this station adversely effect train movements on the proposed Geary Corridor?	Refer to Rudy Crespo (Transportation).	
19	What is the preferred location for the surface intermodal center? Do we access station from one side of Mission or both?	Refer to Rudy Crespo (Transportation) and Marianne Payne (Station Area Planning Division).	
20	What are the ADA requirements for station platform development?	**ADAAG** Requirements/Regulations: Refer to two attached files (30thsta8.mlm & 30thsta9.mlm) from Jeff Garcia on the subject.	
21	Will BART accept No. 10 turnouts (27 MPH) for pocket and wye tracks?	No.10 turnouts (27 MPH) are acceptable for pocket tracks & x-overs, however No. 15 is the min. for mainline operations.	

APPENDIX F

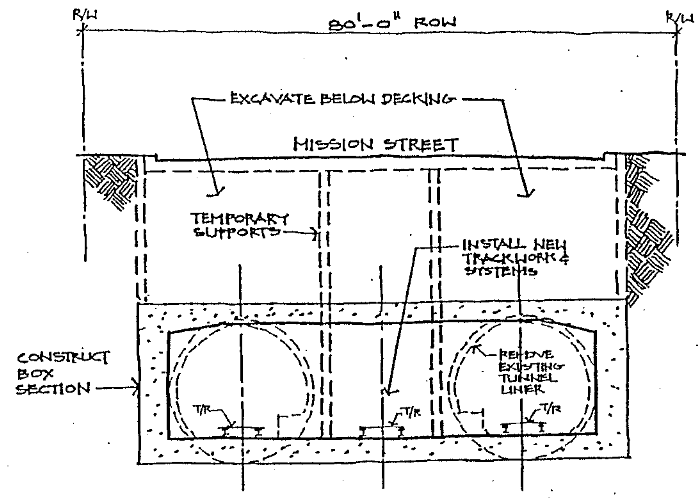
ON-LINE STATION ALTERNATIVE

Using Existing Track & Tunnel

(Bay Area Transit Consultants)



PHASE I



PHASE II

CUT & COVER CONSTRUCTION AT POCKET TRACK (STATION SIMILAR)

ELEMENTS REQUIRING FURTHER STUDY AND ENGINEERING ANALYSIS

- **Location:**
  - 1.0 miles to 24th St. Station
  - 1.2 miles to Glen Park Station
  - Good location for connections to MUNI
- **Operation:**
  - Additional station adds approximately 3 minutes to all train run times.
  - Pocket track would allow turn back of Southbound trains after stop at 24th Street Station.
  - Narrow track centers at existing mined tunnels will result in elongated concourse for vertical circulation.
- **Construction:**
  - Difficult construction within operating envelope.
  - Limits on excavation and excavation support systems due to high water table.
  - Methods and cost to support/relocate numerous existing utilities in Mission Street (cut & cover).
  - Consider bored construction for 1,000 foot pocket track section.
- **Other:**
  - Station on 3% grade (Criteria is 1% max. for stations).
  - Capital cost = $300 million* (1998 dollars).

* At this Preliminary Sketch level of design, estimate margin of error is -20% to +40%

ON-LINE STATION ALTERNATIVE USING EXISTING TRACK & TUNNEL

APPENDIX 'F'

30TH & MISSION BART INFILL STATION STUDY

FOR STUDY PURPOSES ONLY

Apndx-f.Dwg

APPENDIX G

OTHER ALTERNATIVES CONSIDERED

The following alternatives were initially developed in this study:

Alternative 1 – Double Pocket Turnback Station with Crossovers
(Redesignated Alternative 'B' – see main text)

Alternative 2 – Single Pocket Turnback Station with Crossovers

Alternative 3 – Single Pocket Turnback Station with Stub-end Storage Track & Crossover

Alternative 4 – Two-Way Single Center Pocket Turnback Station with Third Level Platform

Alternative 5 – Stacked Back-to-Back Center Pocket Turnback Station

Alternative 6 – Double Pocket Turnback Station
(Redesignated Alternative 'A' – see main text)

Subsequently, only Alternatives 1 and 6 were deemed sufficiently attractive to be considered for further study. These two alternatives have been redesignated Alternatives "B" and "A", respectively, and are fully discussed in the main text of this report. Alternatives 2 through 5 are illustrated in the accompanying figures and are briefly described as follows:

Alternative 2 – Single Pocket Turnback Station with Crossovers

This Alternative includes only a single platform and was developed as a possible least-cost alternative. However, from an operating standpoint the single pocket track obligates the operation of consecutive trains in opposite directions on the same track though the station. Fail-safe BART train control interlocking make this idea potentially feasible. Another problem is that, due to the alternation of southbound and northbound trains stopping at the platform, the headway (time between trains stopping there) would be increased and passenger convenience therefore substantially reduced. Accordingly, this would introduce an additional train control complexity. A single crossover between the mainline tracks at the south end of the pocket track is required to allow train entry into the 30th Street Station stop from the south.

Disadvantages of this Alternative far outweigh the possible cost savings and it has not received further consideration.

Alternative 3 – Single Pocket Turnback Station with Stub End Storage Track & Crossover

This Alternative requires that all trains arriving from the Eastbay which would stop at the proposed 30th Street Station, would have to turnback toward the Eastbay. The concept provides a single pocket track adjacent to the existing southbound mainline track, connected to the southbound mainline track at the north end of the station. A single crossover between the two mainline tracks would also be needed to allow turnback to the north. Alternative 3 could also be configured with a center pocket track using a "Y" connection to the mainline tracks at the north end.

This Alternative does not provide Daly City/SFO/Millbrae access from the new station, and so has been dropped from further consideration.

Alternative 4 – Two-Way Single Center Pocket Turnback Satiation with Third Level Platform

Alternative 4 consists of a two-way, single pocket track constructed between the existing mainline tracks and connected to the existing mainline tracks at each end of the station area. These track connections are configured as a 'Y' or 'wishbone' shape. Similar to Alternative 2, this alternative must operate two-way train traffic through a single station track. It would thus also require complex signal interlocking protection for fail-safe train control operations. However, the position of the new platform track between the two main tracks is preferred to that of Alternative 2 where the platform is located on one side. The primary advantage of this alternative is that it could be constructed largely within the public street right-of-way. Impacts on private right-of-way could thus be less than the two-level alternatives, which require more space outside of the existing mainline track envelope. Soil mix wall construction methods could be utilized to confine trackway construction trenching to the center of Mission Street.

This Alternative requires a two-way track so it has the same major operational and service drawbacks of Alternative 2, and therefore it has not been considered for further study. However, it was innovative and of sufficient interest so that an operational review was conducted and is described below.

Alternative 5 – Stacked Back-to-Back Center Pocket Turnback Station

This scheme has only limited merit from a geometric standpoint in that it better meets certain BART trackway design criteria. However, it is essentially a back-to-back turnback station for both directions, and does not provide for through-train movements serving the new station stop. Only turnback trains from either direction would serve the station, and all through-trains would bypass the station. This is a poor service scenario because the turnback trains would be less frequent.

There is no need presently envisioned for a southbound turnback in context with current operations planning, and therefore this Alternative has been dropped.

Operations Review of Alternative 4

Operational benefits of this Alternative include:

- The central pocket track provides operational flexibility by allowing trains to merge and diverge to/from main line tracks from both directions; with minimal conflict. Thus it is an ideal location to store disabled trains.

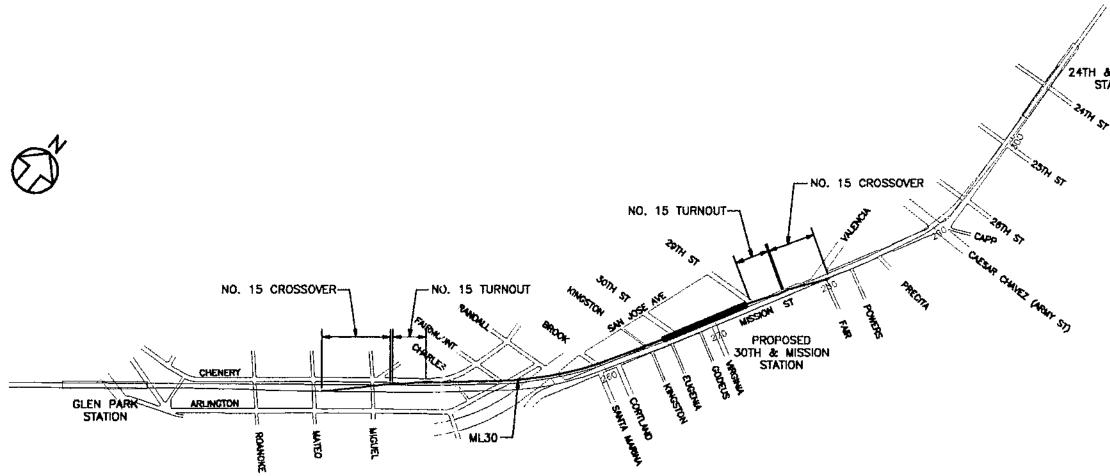
- If used for bypass/express operations on the center track, the double side platforms has the potential to reduce station dwells by allowing train doors to open on both sides for quicker boarding and alighting.

Operational drawbacks of this Alternative include:

- In the northbound direction, the steeper down grade of the new center track from 3.121 per cent to 4.0 per cent may significantly lengthen braking distances for trains.

- Because the single track and platforms must share both directions, not all trains would stop at 30th Street Station. Thus, 30th Street passengers would not receive the same level-of-service as passengers at other stations.

- Northbound and southbound trains diverted off the main line would have to alternate use of a common track, significantly reducing operational flexibility. Train sequencing and timing would be critical, adding to operational complexity.



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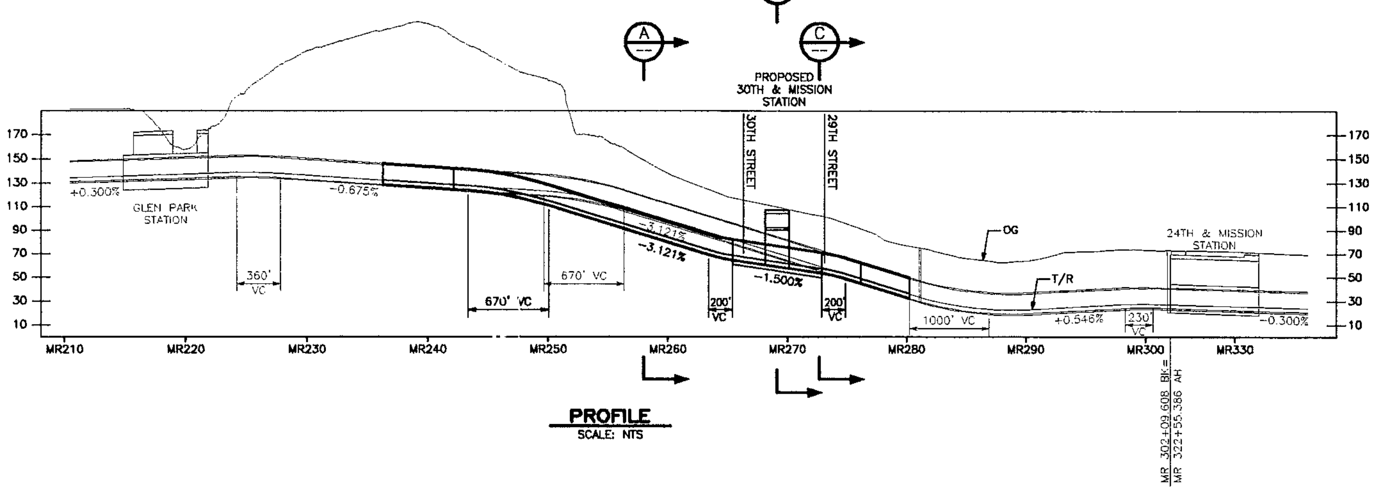

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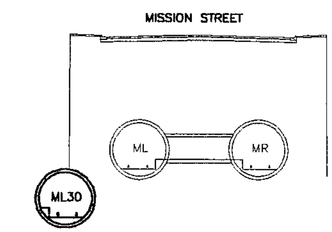

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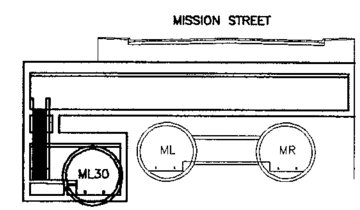
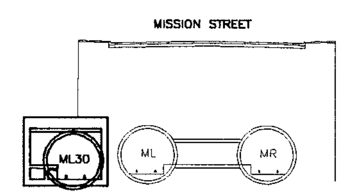
SCALE: NTS



SECTION B–B
SCALE: NTS



SECTION C–C
SCALE: NTS

ALTERNATIVE 2
SINGLE POCKET TURNBACK STATION WITH CROSSOVERS

APPENDIX 'G'

30TH & MISSION BART INFILL STATION STUDY
John T. Warren & Associates, Inc

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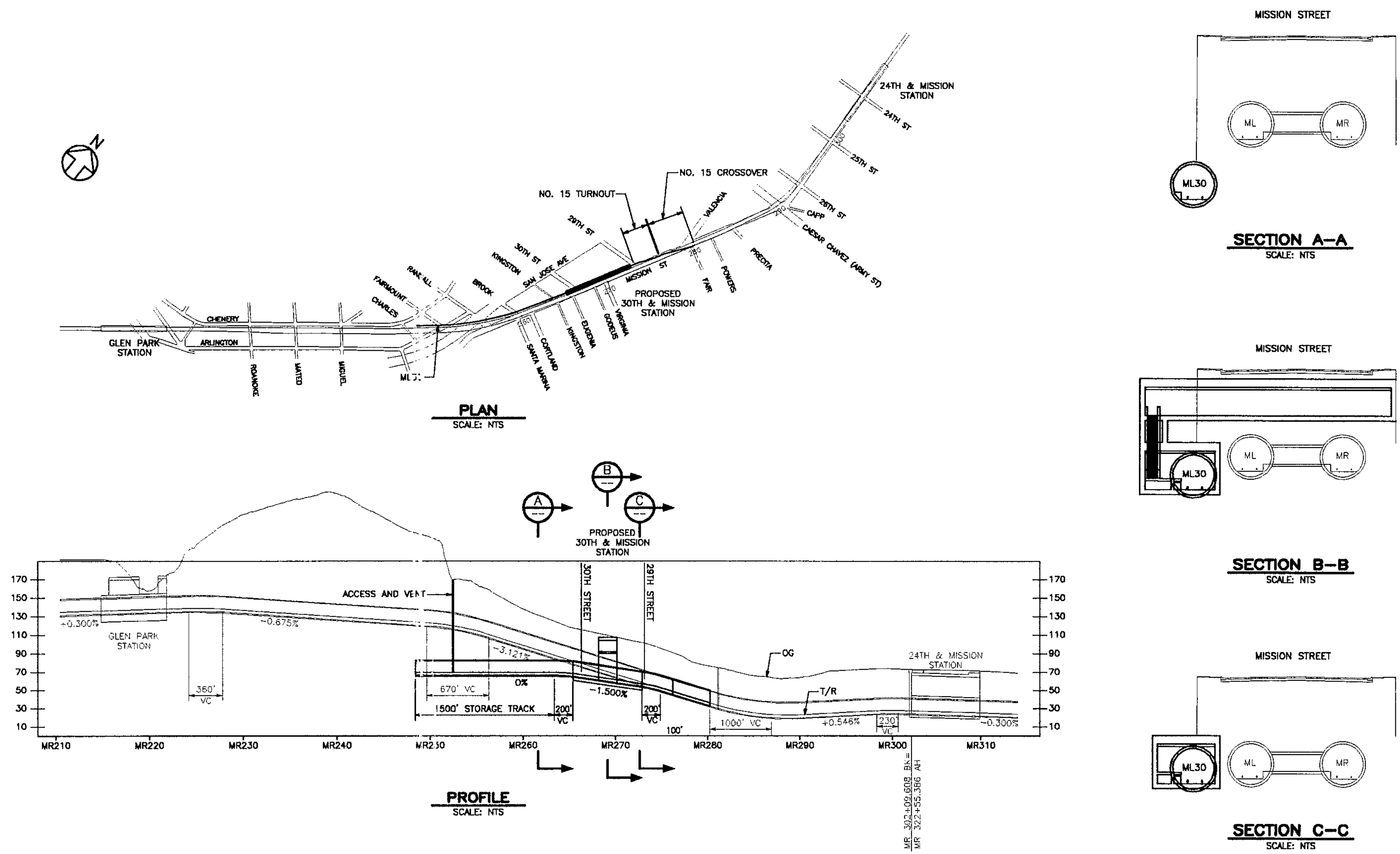
Apndx-alt-2.Dwg



ALTERNATIVE 3

SINGLE POCKET STATION WITH STUB-END STORAGE TRACK AND CROSSOVER

APPENDIX "G"

30TH & MISSION BART INFILL STATION STUDY

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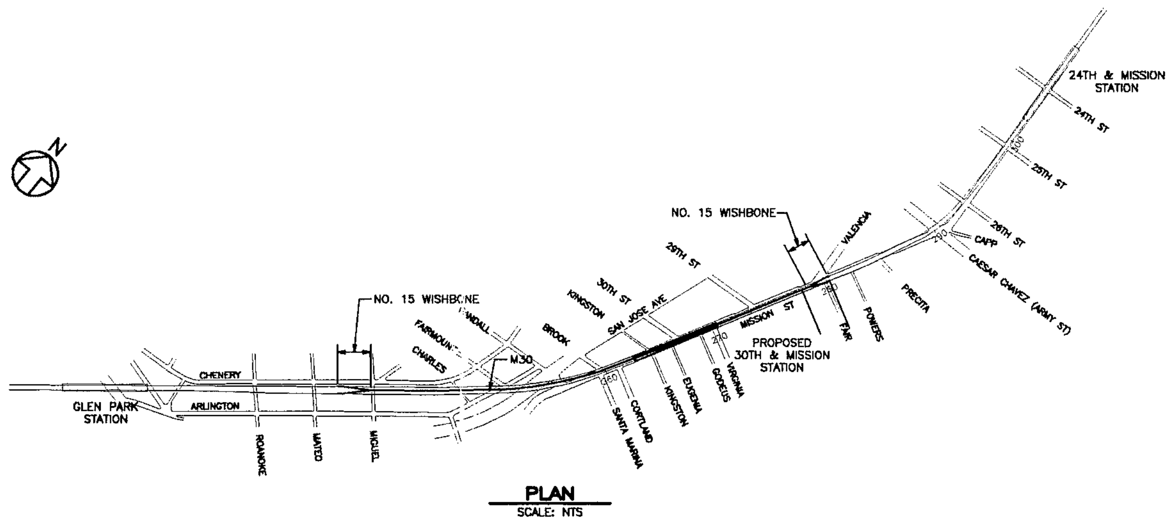
Apndx-alt-3.Dwg



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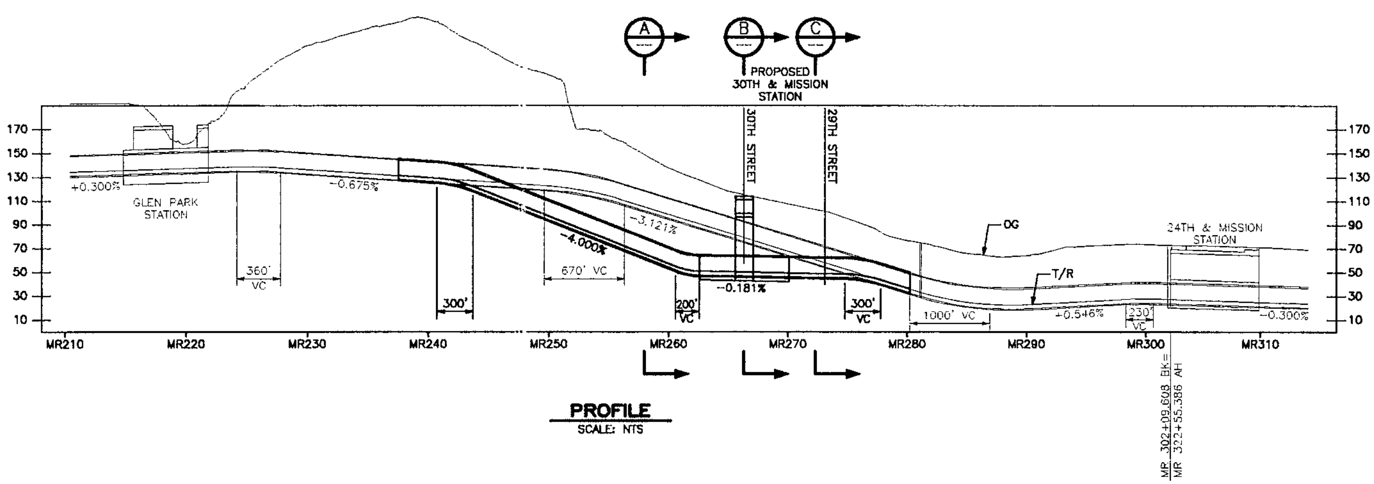

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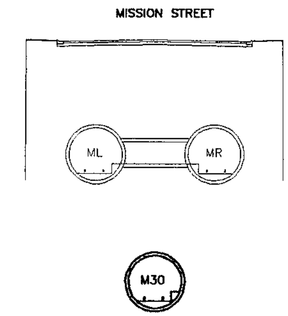

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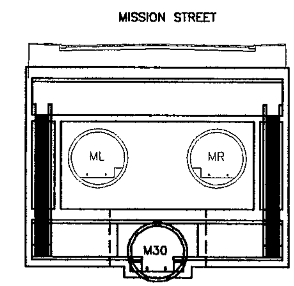

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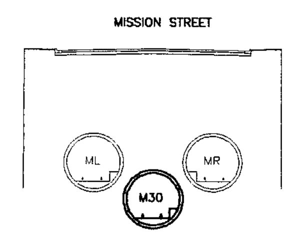

SECTION C–C
SCALE: NTS

ALTERNATIVE 4

TWO-WAY SINGLE CENTER POCKET TURNBACK STATION WITH THIRD LEVEL PLATFORM

APPENDIX 'G'

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30TH & MISSION BART INFILL STATION STUDY
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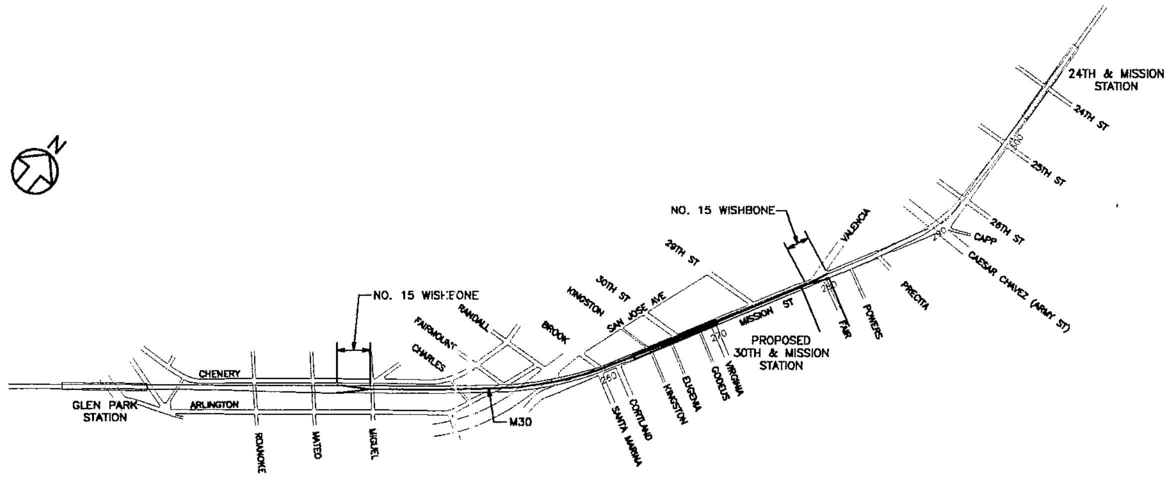
Apndx-alt-4.Dwg



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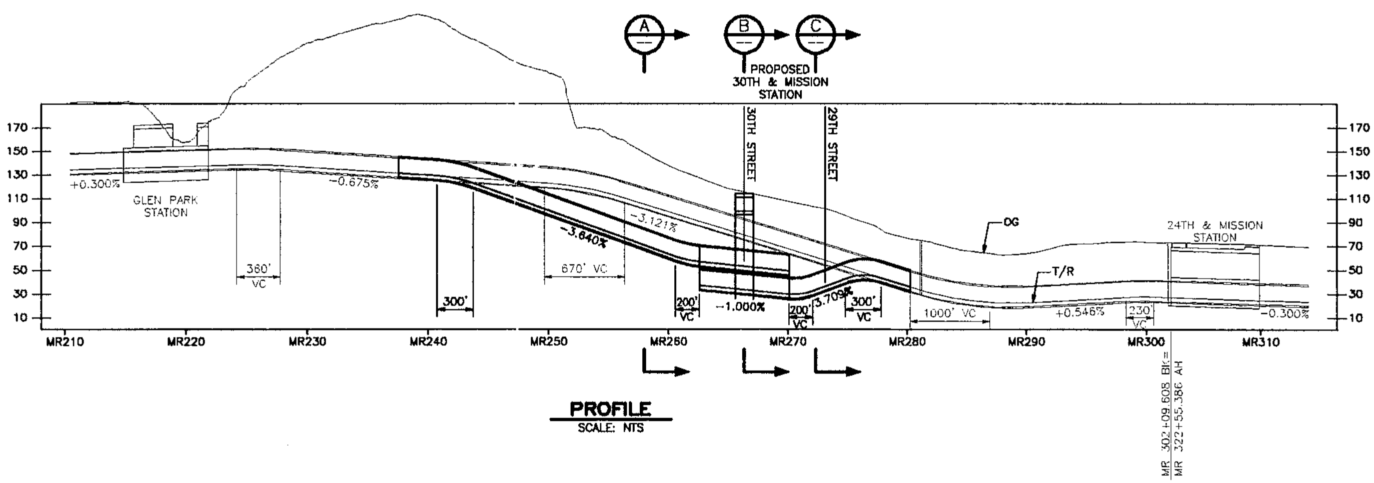

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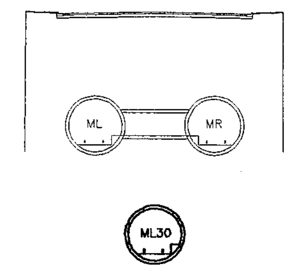

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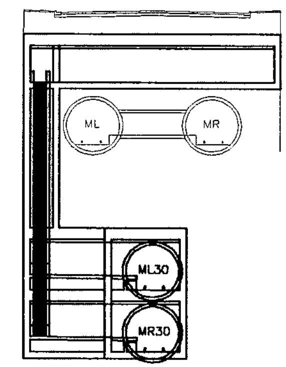

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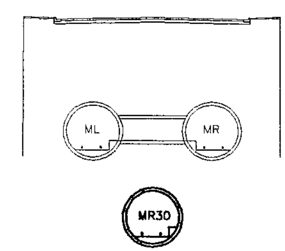

SECTION C–C
SCALE: NTS

ALTERNATIVE 5
STACKED BACK-TO-BACK CENTER POCKET TURNBACK STATION

APPENDIX "G"

30TH & MISSION BART INFILL STATION STUDY
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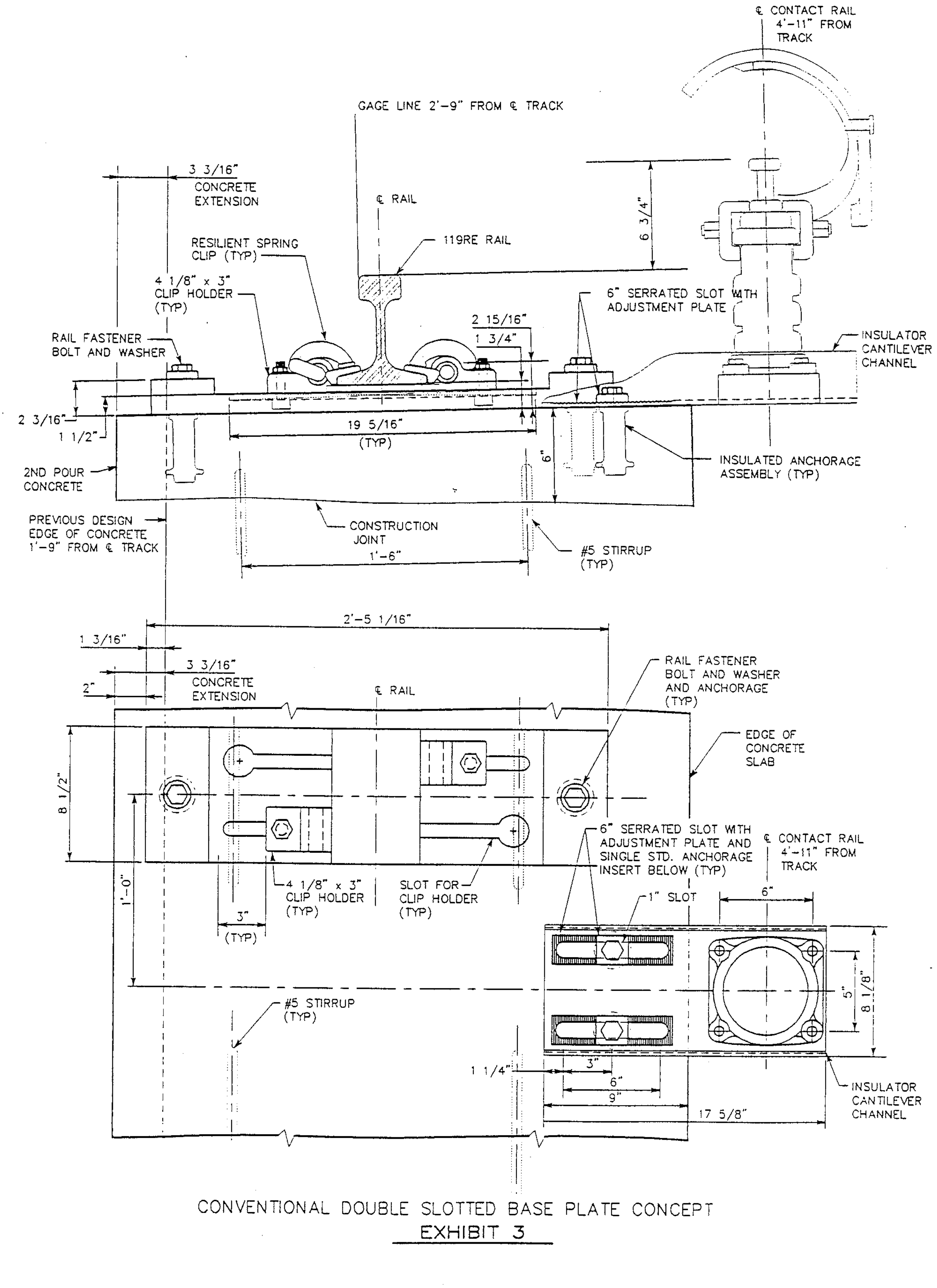
Apndx-alt-5.Dwg

APPENDIX H

SAMPLE TRACKWORK DETAILS

H-1	**T-slot Rail Fastener**
H-2	**Boot-Tie Installation**
H-3	**Boot-Tie Detail**



CONVENTIONAL DOUBLE SLOTTED BASE PLATE CONCEPT

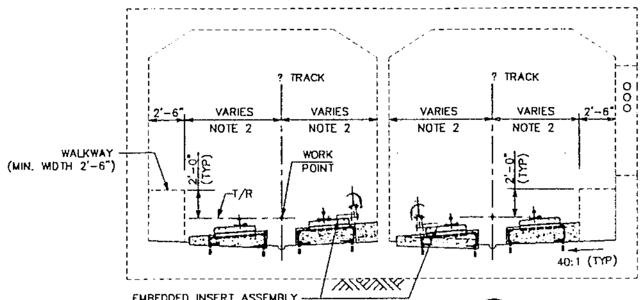
EXHIBIT 3

APPENDIX 'H-1'

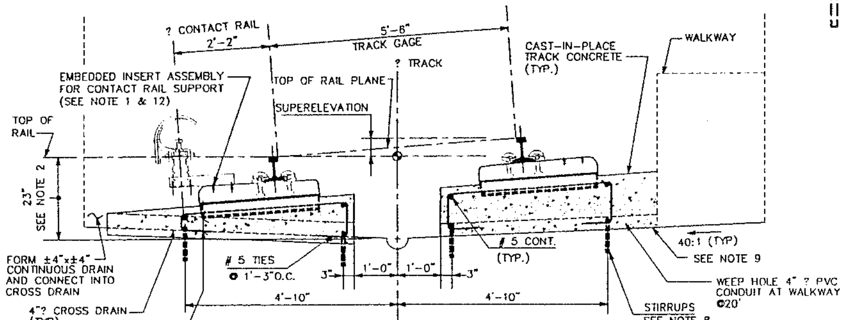
30TH & MISSION BART INFILL STATION STUDY

FOR STUDY PURPOSES ONLY

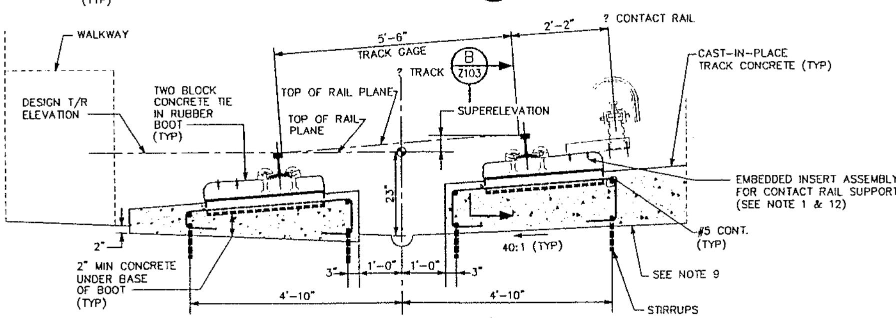
Apndx-h3.DWG



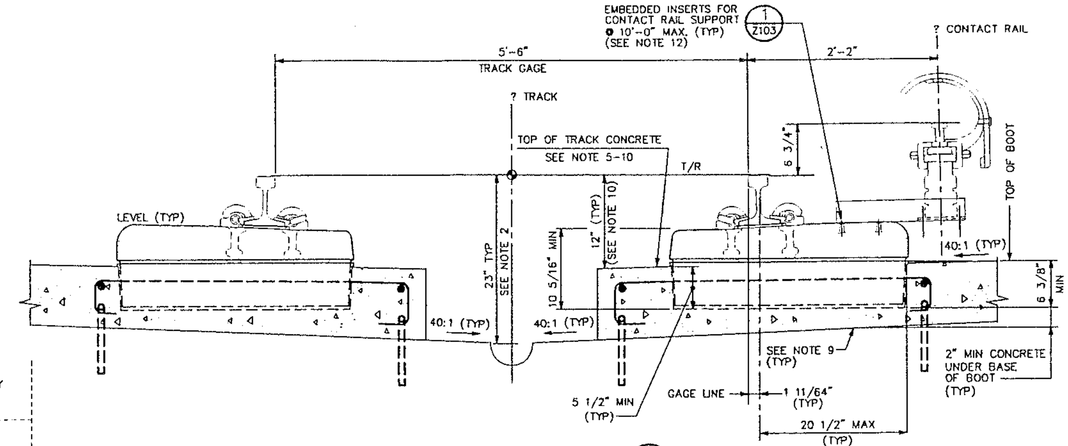
SUBWAY SECTION (A / Z102)



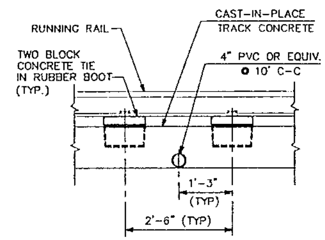
SUPERELEVATED SECTION (B / Z102)



SUPERELEVATED SECTION (C / Z102)



TANGENT TRACK SECTION (D / Z102) Z101



SECTION AT CROSS DRAIN OR WEEP HOLE

LOW SIDE

SECTION (E / Z102)

NOTES

1. LONGITUDINAL REINFORCEMENT SHALL TERMINATE WITH 90 DEGREE HOOK AT ALL EXPANSION JOINTS AND CONCRETE POUR ENDS.
2. THEORETICAL DESIGN DIMENSION. THESE DIMENSIONS ARE CONTROLLED BY THE TRACK ALIGNMENT AND PROFILE, BUT MAY VARY DUE TO THE EXISTING CONDITIONS. THE TRACK CONCRETE DEPTHS SHOWN ARE THEORETICAL DESIGN DEPTHS.
3. 2 INCH MINIMUM COVER ON ALL REINFORCING STEEL.
4. ROUND ALL SHARP CORNERS OF THE TRACK CONCRETE TO 3/8 INCH MINIMUM RADIUS.
5. THE TOP SURFACE OF THE APPROACH SLAB WILL MATCH THE DESIGN CROSS SLOPE OF THE TOP OF SUBGRADE OR THE TOP OF SUB-BALLAST.
6. INTERRUPT THE LONGITUDINAL STEEL FOR DRAINAGE CHASES.
7. INTERRUPT LONGITUDINAL STEEL AT BLOCK-OUTS FOR THE TRAIN CONTROL CROSS BOUND CABLE ENTRY. FOR LOCATIONS REFER TO TRAIN CONTROL DRAWINGS.
8. STIRRUPS ARE NO. 5 BARS TO FORM 10 INCH LONG STIRRUPS AT 18 INCH CENTER TO CENTER.
9. ALL SURFACES THAT SUPPORT TRACK CONCRETE SHALL BE TREATED AS A CONSTRUCTION JOINT.
10. ON RESILIENT TIE TRACK WITH SUPERELEVATION, TOP OF THE TRACK CONCRETE SHALL PARALLEL THE TOP OF RAIL PLANE. ON TANGENT TRACK, TOP OF CONCRETE SHALL SLOPE, AT 40:1 TOWARDS THE TRACK CENTERLINE.
11. THE RESILIENT TIE SHALL PROVIDE THE 1:40 SLOPE, RAIL CANT, TOWARDS THE TRACK CENTERLINE.
12. RESILIENT TIES SHALL BE CAST WITH A LEVEL BEARING SURFACE, PARALLEL TO THE TOP OF RAIL PLANE, CROSS LEVEL OF THE RAILS, AND FOUR 5/8 INCH DIAMETER INSERTS TO ATTACH CANTILEVER BRACKETS FOR THE CONTACT RAIL INSULATOR. REFER TO DRAWING NO. Z103, CONTACT RAIL SUPPORT.

NOT FOR CONSTRUCTION
DRAWING DEPICTS CONTRACT REQUIREMENTS

REV	DATE	BY	SUB	APP	DESCRIPTION
A	12JN97				ISSUED FOR BID

DESIGNED BY R. BANCHERO
DRAWN BY A. SCHRODER
CHECKED BY A. TOLENTINO
IN CHARGE K. HEILIG
DATE 12JN97

SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT

BAY AREA TRANSIT CONSULTANTS
BECHTEL-PARSONS BRINCKERHOFF-TODD-WARREN
SUBMITTED

BAY AREA TRANSIT CONSULTANTS
BECHTEL-PARSONS BRINCKERHOFF-TODD-WARREN
APPROVED

SAN FRANCISCO AIRPORT EXTENSION LINE, TRACKWORK, AND SYSTEMS

RESILIENT TIE TRACK WITHOUT TIE BAR SECTIONS AND DETAILS

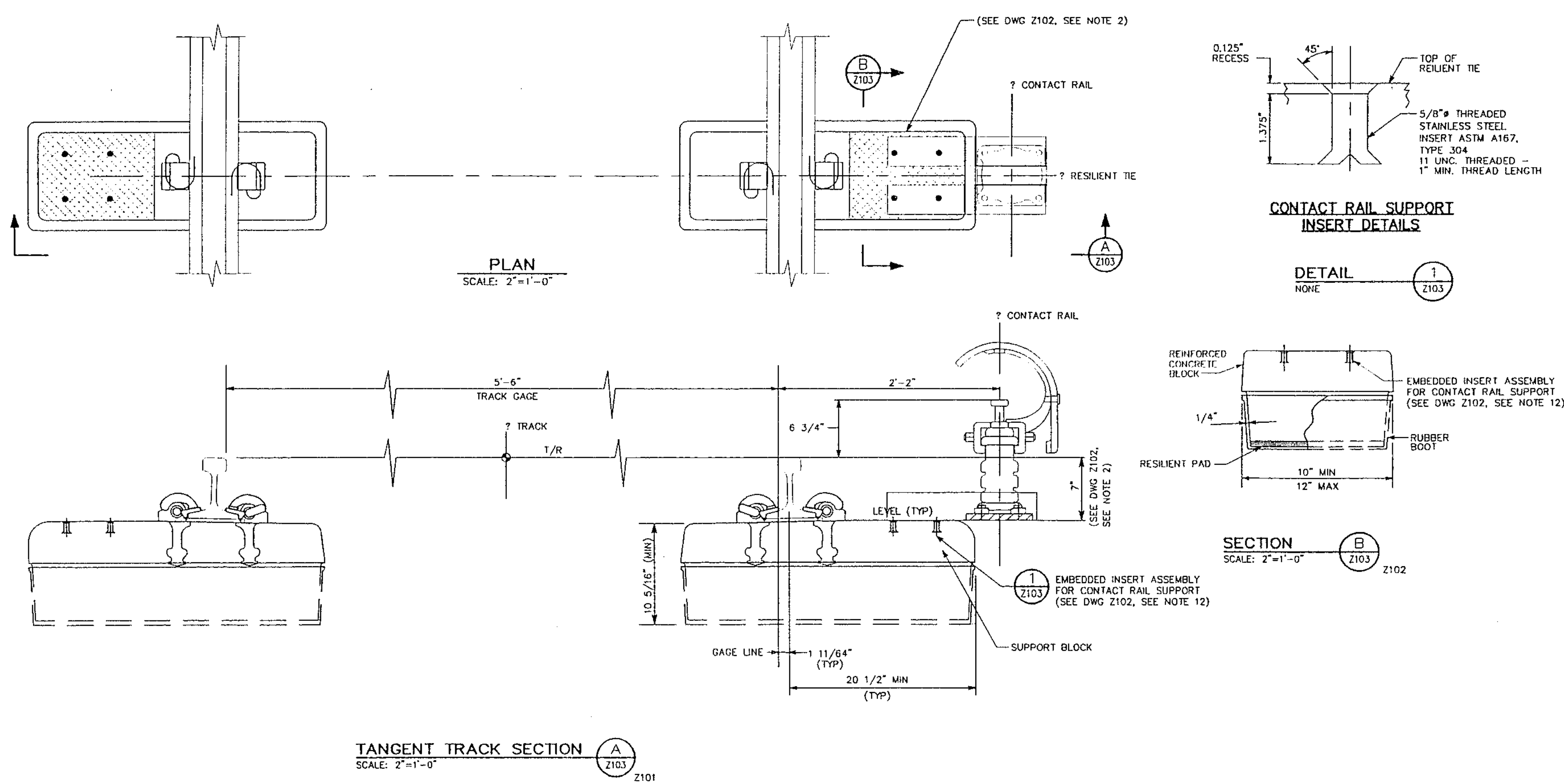
CADD FILE NO WFAAZ102 | CADD DATE 13MY97
SCALE NONE
CONTRACT NUMBER 12YC-120 | ACTIVITY CODE
DWG NO Z102 | REV A | PAGE NO

APPENDIX 'H-2'

30TH & MISSION BART INFILL STATION STUDY

FOR STUDY PURPOSES ONLY

Apndx-h2.Dwg



NOT FOR CONSTRUCTION
DRAWING DEPICTS CONTRACT REQUIREMENTS

REV	DATE	BY	SUB	APP	DESCRIPTION
A	18FE97				ISSUED FOR BID

DESIGNED BY R. BANCHERO
DRAWN BY A. SCHRODER
CHECKED BY A. TOLENTINO
IN CHARGE K. HEILIG
DATE 12JN97

SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT

BAY AREA TRANSIT CONSULTANTS
BECHTEL–PARSONS BRINCKERHOFF–TODD–WARREN
SUBMITTED

BAY AREA TRANSIT CONSULTANTS
BECHTEL–PARSONS BRINCKERHOFF–TODD–WARREN
APPROVED

SAN FRANCISCO AIRPORT EXTENSION LINE, TRACKWORK, AND SYSTEMS

RESILIENT TIE TRACK
WITHOUT TIE BAR
PLANS AND SECTIONS

CADD FILE NO WFAAZ103 | CADD DATE 12MY97
SCALE AS SHOWN
CONTRACT NUMBER 12YC-120 | ACTIVITY CODE
DWG NO Z103 | REV A | PAGE NO

APPENDIX 'H-3'

30TH & MISSION BART INFILL STATION STUDY

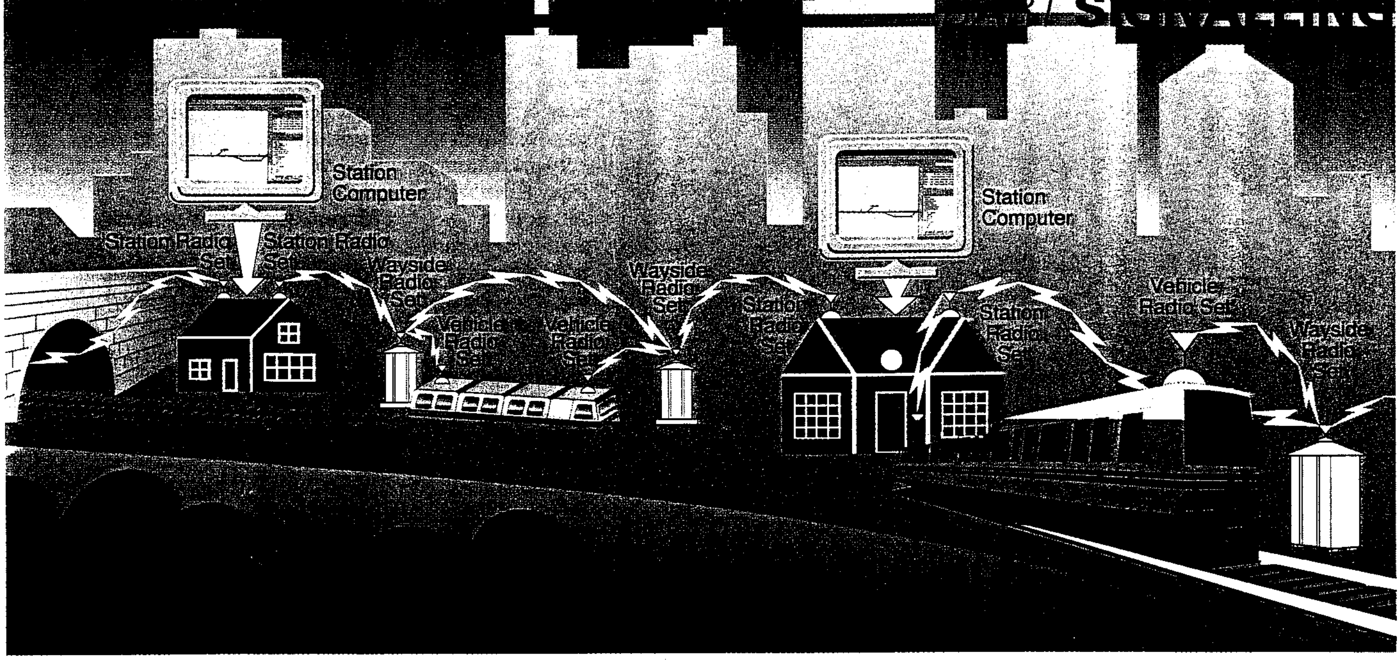
FOR STUDY PURPOSES ONLY

Apndx-h3.Dwg

APPENDIX I

DESCRIPTION OF ADVANCED AUTOMATIC TRAIN CONTROL (AATC) SYSTEM

Reproduced from *'Railway Gazette International'*, June 2002



Advanced Automatic Train Control pioneered in San Francisco

This month Bay Area Rapid Transit will put its Advanced Automatic Train Control moving block control into revenue service. Radio-based technology helps keep down installation costs in the $40m project to reduce headways and increase capacity on the busy A and M lines

FORMING PART of an upgrade of Bay Area Rapid Transit's A and M lines, the busiest routes on the 153 km network, Advanced Automatic Train Control is expected to obtain its safety case approval this month, paving the way for revenue service.

BART already handles 90 million passenger journeys a year, and in the mid-1990s projections for traffic growth suggested that BART urgently needed to increase line capacity. Critical points on the network are the Oakland Wye, used by every train on the network, and the Trans-Bay Tube. Building new lines under the Bay would cost many billions of dollars, and the search for a more cost-effective alternative fell on resignalling to permit shorter headways on the existing network.

BART began developing AATC in 1994, working with Hughes Aircraft and Morrison Knudsen Corp. At that time $19·5m of government defence conversion funding was provided to support the adaptation of Enhanced Position Location Reporting System military radio technology for civilian use. EPLRS has now been in service with the US military for over 15 years, and it is well suited for use in busy radio traffic and noisy electromagnetic environments.

AATC was installed on BART's Hayward test track, and trials were carried out for several months in 1996 (RG 7.98 p463).

Shortly afterwards, however, the launch of a pilot service on operational lines was delayed while the project alliance was restructured. Morrison Knudsen withdrew, and Hughes (later Raytheon) licensed EPLRS to Harmon Industries. Harmon was awarded a $45m development and implementation contract in 1998, with Raytheon as a subcontractor. Harmon was acquired by GE Transportation Systems, and the production version of AATC was developed by GETS Global Signaling and BART.

AATC is a full moving-block control system designed to keep installation costs low. Bob Miller, BART's Group Manager, Systems Capital Program, says AATC will cut headways and shorten end-to-end journey times, improving the ability to recover after delays and allowing BART to run its existing service with one fewer trainset. With fewer brake-to-power transitions, energy consumption will be reduced.

Technology

The backbone of AATC is a robust radio network providing data communication and radio-ranging determination of train location. AATC communicates vital location data using the radio network rather than inductive loops or balises.

Jeffrey K Baker
Product Manager
GE Transportation Systems Global Signaling

The 'brains' of the network are computers installed at stations or other convenient points. These collate location and status messages from trains, calculate train location, control speeds, generate movement authorities and control the moving blocks. The calculations can be modified from the BART control centre to enforce temporary speed restrictions or regulate traffic.

Each computer is connected to two station radios, which serve as master radios in the network. These station radios form part of a trackside network, communicating with other radios positioned alongside the railway on each side of the station. The network uses store-and-forward (bucket brigade) architecture, providing trains with multiple copies of every message for reliability.

On-train radios listen to the lineside communications, receiving messages that are outbound from the station computer and transmitting status messages back. Trains receive commands from the four closest lineside radios, so even in tunnels the

Top: The AATC system architecture uses a 'bucket brigade' radio network to send commands to and from the on-train computers; at any moment each train should be in contact with four lineside radios

Due to start this year, Phase 3 of the project will see the installation of AATC through the Trans-Bay Tube and the Oakland Wye, providing capacity to accommodate extra services to and from San Francisco International Airport

train has multiple opportunities to hear the instructions. Use of lineside equipment permits simple, low-cost hardware to be installed on the trains.

Spread-spectrum and time division multiplexing are used to communicate with trains every 0·5 sec. Messages to trains are synchronised, and time-of-arrival measurements used to determine the location, speed and direction of each train. Head-end and tail-end radios provide redundant on-board communication and monitor train integrity and length. By updating the speed command for each train every 0·5 sec, the Station Computer provides basic Automatic Train Operation within a vital closed-loop control.

Testing in San Francisco and New York since 1999 has demonstrated message delivery reliability above 99·9%, with an ability to calculate train location to within 5 m for 99·9% of the time, and speed to within 2·5 km/h.

The plug-and-play nature of the network virtually eliminates the maintenance requirements and exacting specifications of loops and balises.

If any radio in the network fails, it is removed from the network automatically. Communication then continues normally, skipping over the failed unit until corrective action can be taken. The maintenance department is automatically alerted to the failure so that a new radio can be deployed when convenient. On power-up, the new radio joins the existing network and seamlessly begins transferring messages to and from neighbouring radios without requiring programming or special software. All radios contain the same software, so there is no need to hold an extensive range of spares.

The vital station computer calculates the location, direction and speed of each train, monitors train integrity, and sends speed and acceleration commands to all trains. The vital station computer calculates the status of fixed obstacles and the position of the rear of trains ahead in a true moving-block fashion to enforce the correct safe speed for the train.

The computers have off-the-shelf Motorola PowerPC processors, with checked-redundant architecture for safety. Diagnostic and logging functions are provided, along with local displays of the status of trains in the area. Errors in lineside or on-train equipment are reported for use in maintenance planning.

A non-vital processor can supply speed request information to the vital computer to co-ordinate the movements of trains, implementing schedule recovery or energy management algorithms. Each computer has a set of processors configured as a hot standby unit, able to take over control on the fly.

Mixed operation possible

GETS Global Signaling developed AATC to meet the requirements of the urban transport industry, rather than for a single customer. AATC can be integrated with traditional signalling and legacy on-board equipment, meaning the control system does not need to change significantly when AATC is installed.

With AATC, the only lineside installations are the radios, power supplies and station computers. Configuration and programming are automatically carried out by the system.

When new train control technology is deployed on an existing railway, phased installation can reduce disruption. AATC can overlay existing in-cab signalling, providing AATC-equipped trains with speed commands by radio and using existing track circuits to track unequipped trains. Trains enter AATC territory at line speed, seamlessly reverting to cab-signalling control as they leave.

Station computers are designed to interface to the existing signalling for tracking unequipped trains, but can also be operated as a stand-alone control system without underlying track circuits. AATC allows for operation without track circuits, but is compatible with installations requiring broken rail detection.

Not every section of a metro needs to be equipped with AATC, which can be installed incrementally according to traffic and budget constraints. Mixed-mode operation is possible, with both AATC equipped and unequipped trains operating in the same area. Instead of equipping the entire fleet with AATC technology at one time, a migration path is available for installation, with commissioning of lines and trains as the need arises. ■

San Francisco pionnier avec l'Advanced Automatic Train Control

Ce mois-ci, le Bay Area Rapid Transit met en service l'Advanced Automatic Train Control, un système de contrôle-commande avancé, destiné à améliorer la capacité sur ses deux lignes les plus chargées. L'AATC emploie la radio comme mode de transmission avec les systèmes embarqués, réduisant les coûts d'installation en comparaison avec les balises traditionnelles et circuits de voie. Mis au point par GE Transportation Systems Global Signaling, ce dispositif entièrement à cantons glissants reposant sur la radio, va rendre possible une intervalle plus courte entre les trains, des circulations plus rapides et des dépenses d'énergie maîtrisées

San Francisco Pionier für Erweiterte Automatische Zugsicherung

Diesen Monat beginnt die Bay Area Rapid Transit mit dem Einsatz einer Erweiterten Automatischen Zugsicherung (AATC, Advanced Automatic Train Control) zur Steigerung der Kapazität auf den zwei am stärksten ausgelasteten Linien. AATC benutzt ortsfeste Funkanlagen zur Kommunikation mit fahrzeuggebundenen Systemen, was die Installationskosten im Vergleich mit herkömmlichen Balisen und Gleisstromkreisen reduziert. Das von GE Transportation Systems Global Signaling entwickelte funkbasierte Bewegliche Block-System ermöglicht kürzere Zugfolgezeiten, kürzere Reisezeiten und geringere Energiekosten

Introducción pionera del control automático avanzado del tren en San Francisco

Este mes el Bay Area Rapid Transit comenzará a usar el control automático avanzado del tren para mejorar la capacidad en su dos líneas de mayor trafico. La AATC hace uso de radios laterales para la comunicación con los sistemas del tren, reduciendo los costes de instalación en comparación con la balizas tradicionales y el circuitos de vía. Desarrollado por GE Transportation Systems Global Signaling, este sistema de control de bloque móvil completo con base en radio permitirá tiempos más cortos, trayectos más rápidos y una reducción en los costes de energía

APPENDIX J

ITEMIZED CONSTRUCTION COST ESTIMATES

SCOPE OF ESTIMATE

The work of the proposed construction would include furnishing all labor, equipment, materials and services required to construct a BART station in San Francisco at 30th and Mission Street. The station would be constructed while maintaining the BART system fully operational. The following three alternatives have been considered:

1. **Alternative 'A', On-Line Station**, including tie-ins to operating mainlines and removing/abandoning existing mainlines after the station and new mainlines are completed.
2. **Alternative 'A' With Station Pocket Track,** same as above plus constructing a new Pocket Track south of the proposed 30th Street Station.
3. **Alternative 'B' Off-Line Station**, including tie-ins to operating main lines and construction of four new number 15 turnouts and one number 15 crossover. Existing main lines would remain operational.

Each Alternative estimate is divided into the following facility groups, which could later be developed into possible contract packages:

1. Tunnels
2. Cavern (south tie in)
3. Cut and Cover Station
4. Cut and Cover (north tie in)
5. Pocket Track
6. Systems, Including Trackwork

Additional cost items for each facility and structure estimate consist of the following estimated as a percent of facility constriction:

1. Site Preparation/Demolition
2. Traffic Maintenance & Control
3. Utilities and Relocations
4. Site Restoration

5. Unforeseen construction activities (de-watering, underpinning, settlement monitoring and control, noise and vibration mitigation, etc.)

QUANTITY DEVELOPMENT

Quantification for this estimate has been developed from the drawings and sketches included in this report. Linear and lump sum quantification was used based upon BART historic costs developed for Eastbay and Southbay BART extensions contract packages and ongoing "Replacement Value Estimates" for the BART Seismic Retrofit Project.

PRICING BASIS

All unit costs in the estimates are representative of contractor bid prices at first quarter of 2002 pricing levels. Unit rates in the estimates include contractor indirect costs, mark-up and profit.

BART General Conditions:

A five per cent allowance of construction costs has been utilized to cover the following:

1. Differing site conditions
2. Partnering
3. Dispute resolution
4. Operating system access delays
5. Construction safety incentives / disincentives
6. Engineer's office, vehicles and services
7. Operation and maintenance instructions and personnel training

City Imposed Conditions:

A 10 per cent allowance of construction costs has been included in the estimate to cover costs for traffic and MUNI re-routing and restoration costs, and street and limited neighborhood upgrades after construction.

Contingencies:

A 25 per cent contingency allowance is included in the estimate. This contingency covers design, scope, construction estimating and pricing contingency up to the project completion.

Soft Costs:

The following line item costs have been included as a percentage of the total construction costs:

1.	Pre-project / Environmental studies	3%
2.	Preliminary Engineering	4%
3.	Agency administration	5%
4.	Community outreach	1%
5.	Professional services (Engineering, Project Management, & Construction Management	30%
6.	Pre-operating expenses (Start-up and Testing)	2%

Escalation:

Excluded

Schedule:

Schedule impact is not included in the estimate

Assumptions:

The following assumptions have been utilized in developing this estimate:

1. It is assumed that the contractor would be required to provide necessary insurance coverage in addition to BART OCIP insurance, and these costs are included in the unit cost rates.
2. Utilities: water, gas, power, telephone, temporary electrical power, water and other temporary utility costs would be provided by the contractor and are included in the utility allowance item. Agreements costs between utility agencies and BART are included in "soft costs" items in the estimate.
3. All property acquisitions including easements, encroachments are excluded.
4. Soil improvements around the existing operating BART tunnels are included in the estimate as a linear-measure cost allowance along the station and cut-and-cover segments.
5. It is assumed that tunnel segments could be constructed at least a tunnel-diameter width away from the existing operating tunnels, thus avoiding possible settlement in the operating tunnels, and eliminating the need for soil improvements along the tunnel segments.

Exclusions:

In addition to the above, the following are also excluded from the estimate:

1. Right-of-way costs
2. Escalation beyond 1st quarter 2002
3. Environmental and hazardous works
4. Project insurance
5. Financing and interest during construction
6. Vehicles

BART 30th Street Station @ Mission Street

ESTIMATE SUMMARY, ALTERNATE A

Description	UNIT	QUANTITY	Unit Price	AMOUNT X $1000
Tunnels	LS	1	84,235,320	84,235
Cavern @ Tie In	LS	1	21,240,000	21,240
Cut & Cover Station	LS	1	75,627,520	75,628
Cut & Cover @ Tie In	LS	1	23,577,600	23,578
Systems	LS	1	22,502,625	22,503
Sub Total				227,183
Mobilization	%	10	22,718,307	22,718
BART General Conditions	%	5	11,359,153	11,359
City Imposed Conditions	%	10	22,718,307	22,718
Sub Total, Construction Cost	LS			261,261
Contingency, (% of Construction Cost)	%	25	65,315,131	65,315
Soft Costs:(% of Construction Cost)				
Pre-Project/ Environmental Studies	%	3	7,837,816	7,838
Preliminary Engineering	%	4	10,450,421	10,450
Agency Administration	%	5	13,063,026	13,063
Community Outreach	%	1	2,612,605	2,613
Professional Services, (Eng.,PM & CM)	%	30	78,378,157	78,378
Pre-Operating Expenses, (Start Up & Testing)	%	2	5,225,210	5,225
Total Project Cost @ 2002 Dollars	LS			444,143
Right of Way Costs				
Escalation				
Environmental & Haz Mat				
Insurance				
Financing & Interest During Construction				
Vehicles				
Grand Total				

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
TUNNELS

LENGTH ______ x WIDTH ______ = AREA ______ SQ FT

DESIGN SECTION ______ | QUANTITIES BY E Rasi | 4/1/02 | ESTIMATE NO. ______

QUANTITIES CHCKD. BY ______ | DATE 4/02/02 ______ | PRICED BY. E. Rasi

COST INDEX ______

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Bored Tunnels, 2x 2440 LF(Incl. Cross Passages)	LF	4,880	13,200	64,416,000
2	Soil Improvement, 200 LF from Station	LF	400	4,000.00	1,600,000
3	Ventilation Structure with Equipment	LS	1	2,000,000	2,000,000
4	Remove Exist Tunnels & Tracks 2x 1540 LF	LF	3,080	1,000	3,080,000
5	Abandon Exist Tunnels & Tracks 2x 900 LF	LF	1,800	500	900,000
	Sub Total Structural Items				**71,996,000**
4	Site Preparation	%	2	1,439,920	1,439,920
5	Traffic Maintenance & Control	%	3	2,159,880	2,159,880
6	Utilities & Relocations	%	1	719,960	719,960
7	Site Restoration	%	1	719,960	719,960
8	Unforeseen Construction Activities	%	10	7,199,600	7,199,600
		SUBTOTAL			**84,235,320**

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

30th Street Station
Cavern @ Tie In

LENGTH________ x WIDTH________ = AREA________ SQ FT

DESIGN SECTION ________	QUANTITIES BY	E Rasi	4/1/02	ESTIMATE NO. ________	
	QUANTITIES CHCKD. BY ________		DATE 4/02/02___	PRICED E	E. Rasi
				COST INDEX ________	

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Mined Cavern	LF	240	50,000	12,000,000
2	Construction Shafts,Operation & Handling	EA	2	1,000,000	2,000,000
3	Tie Ins to Mainline	EA	2	2,000,000	4,000,000
	Sub Total Structural Items				**18,000,000**
4	Site Preparation	%	2	360,000	360,000
5	Traffic Maintenance & Control	%	3	540,000	540,000
6	Utilities & Relocations	%	2	360,000	360,000
7	Site Restoration	%	1	180,000	180,000
8	Unforeseen Construction Activities	%	10	1,800,000	1,800,000
		SUBTOTAL			**21,240,000**

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
Cut & Cover Station

LENGTH ___ x WIDTH ___ = AREA ___ SQ FT

DESIGN SECTION ___	QUANTITIES BY	E Rasi	4/1/02	ESTIMATE NO. ___	
	QUANTITIES CHCKD. BY ___		DATE 4/02/02	PRICED BY. ___	E. Rasi
				COST INDEX ___	

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Cut & Cover Station, 730 ' Structure	SF	91,600	300	27,480,000
2	Soil Improvement, 1500 LF within Station	LF	1,500	4,000	6,000,000
3	Remove Existing Tunnels & Tracks within Station	LF	1,500	1,000	1,500,000
4	Station Architectural Work	SF	91,600	100	9,160,000
5	Station Mechanical Work	SF	91,600	30	2,748,000
6	Station Electrical Work	SF	91,600	60	5,496,000
7	Escalators	EA	8	750,000	6,000,000
8	Elevators	EA	2	350,000	700,000
	Sub Total				**59,084,000**
9	Site Preparation	%	3	1,772,520	1,772,520
10	Traffic Maintenance & Control	%	5	2,954,200	2,954,200
11	Utilities & Relocations	%	5	2,954,200	2,954,200
12	Site Restoration	%	5	2,954,200	2,954,200
13	Unforeseen Construction Activities	%	10	5,908,400	5,908,400
		SUBTOTAL			75,627,520

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
Cut & Cover @ Tie in

LENGTH_______ x WIDTH_______ = AREA_______ SQ FT

DESIGN SECTION _______	QUANTITIES BY	E Rasi	4/1/02	ESTIMATE NO. _______
	QUANTITIES CHCKD. BY _______		DATE 4/02/02___	PRICED BY. E. Rasi
				COST INDEX _______

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Cut & Cover @ Tie in Structure, 340 '	LF	340	30,000	10,200,000
2	Soil Improvement around exist. Tunnels	LF	680	4,000.00	2,720,000
3	Tie Ins to Mainline	EA	2	2,000,000.00	4,000,000
4	Remove Existing Tunnels & Tracks within Stru	LF	1,500	1,000	1,500,000
	Sub Total Structural Items				**18,420,000**
5	Site Preparation	%	3	552,600	552,600
6	Traffic Maintenance & Control	%	5	921,000	921,000
7	Utilities & Relocations	%	5	921,000	921,000
8	Site Restoration	%	5	921,000	921,000
9	Unforeseen Construction Activities	%	10	1,842,000	1,842,000
		SUBTOTAL			**23,577,600**

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
Systems

LENGTH______ x WIDTH______ = AREA______ SQ FT

DESIGN SECTION ______ QUANTITIES BY E Rasi 4/1/02 ESTIMATE NO. ______
QUANTITIES CHCKD. BY ______ DATE 4/02/02__ PRICED BY. E. Rasi
COST INDEX ______

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Trackwork & 3rd Rail	RF	3,770	710	2,676,700
2	Trackwork & 3rd Rail Tie ins	EA	4	300,000	1,200,000
3	Traction Power	RF	3,770	440	1,658,800
4	Train Control	RF	3,770	1,200	4,524,000
5	Fare Collection	LS	1	1,000,000	1,000,000
6	Communications & Station SCADA	RF	3,770	400	1,508,000
7	Tie In to LMA	LS	1	3,000,000	3,000,000
8	Systems Tie ins to Mainline	LS	4	1,000,000	4,000,000
	Sub Total Systems Items				**19,567,500**
9	Site Preparation	%	1	195,675	195,675
10	Traffic Maintenance & Control	%	3	587,025	587,025
11	Utilities & Relocations	%	0	-	-
12	Site Restoration	%	1	195,675	195,675
13	Unforeseen Construction Activities	%	10	1,956,750	1,956,750
		SUBTOTAL			22,502,625

BART 30th Street Station @ Mission Street

ESTIMATE SUMMARY, ALTERNATE A (with Pocket Track)

Description	UNIT	QUANTITY	Unit Price	AMOUNT X $1000
Tunnels	LS	1	80,842,320	80,842
Pocket Track	LS	1	21,996,000	21,996
Cavern @ Tie In	LS	1	19,440,000	19,440
Cut & Cover Station	LS	1	75,627,520	75,628
Cut & Cover @ Tie In	LS	1	23,577,600	23,578
Systems	LS	1	25,862,925	25,863
Sub Total,				247,346
Mobilization	%	10	24,734,637	24,735
BART General Conditions	%	5	12,367,318	12,367
City Imposed Conditions	%	10	24,734,637	24,735
Sub Total, Construction Cost	LS			309,183
Contingency, (% of Construction Cost)	%	25	77,295,739	77,296
Soft Costs:, (% of Construction Cost)				
Pre -Project/ Environmental Studies	%	3	9,275,489	9,275
Preliminary Engineering	%	4	12,367,318	12,367
Agency Administration	%	5	15,459,148	15,459
Community Outreach	%	1	3,091,830	3,092
Professional Services,(Eng., PM & CM)	%	30	92,754,887	92,755
Pre-Operating Expenses (Start Up & Testing)	%	2	6,183,659	6,184
Total Project Cost @ 2002 Dollars	LS			525,611
Right of Way Costs				
Escalation				
Environmental & Haz Mat				
Insurance				
Financing & Interest During Construction				
Vehicles				
Grand Total				

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
TUNNELS

LENGTH______ x WIDTH______ = AREA______ SQ FT

DESIGN SECTION ______ QUANTITIES BY E Rasi 4/1/02 ESTIMATE NO. ______
QUANTITIES CHCKD. BY ______ DATE 4/02/02 PRICED BY. E. Rasi
COST INDEX ______

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Bored Tunnels, 2x 2440 LF(Incl. Cross Passages)	LF	4,880	13,200	64,416,000
2	Soil Improvement, 200 LF from Station	LF	400	4,000.00	1,600,000
3	Ventilation Structure with Equipment	LS	1	2,000,000	2,000,000
4	Remove Exist Tunnels & Tracks 2x (2440'-1900')LF	LF	1,080	1,000	1,080,000
	Sub Total Structural Items				**69,096,000**
5	Site Preparation	%	2	1,381,920	1,381,920
6	Traffic Maintenance & Control	%	3	2,072,880	2,072,880
7	Utilities & Relocations	%	1	690,960	690,960
8	Site Restoration	%	1	690,960	690,960
9	Unforeseen Construction Activities	%	10	6,909,600	6,909,600
		SUBTOTAL			80,842,320

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
Pocket Track

LENGTH ______ x WIDTH ______ = AREA ______ SQ FT

DESIGN SECTION ______ | QUANTITIES BY: E Rasi | 4/1/02 | ESTIMATE NO. ______

QUANTITIES CHCKD. BY ______ | DATE 4/02/02 | PRICED BY. ______ E. Rasi

COST INDEX ______

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Cut & Cover Tunnel	LF	1,000	6,000	6,000,000
2	Mined Tunnel	LF	900	10,000	9,000,000
3	Remove Exist Tunnels & Tracks 2x 1900' LF	LF	3,800	1,000	3,800,000
	Sub Total Structural Items				**18,800,000**
4	Site Preparation	%	2	376,000	376,000
5	Traffic Maintenance & Control	%	3	564,000	564,000
6	Utilities & Relocations	%	1	188,000	188,000
7	Site Restoration	%	1	188,000	188,000
8	Unforeseen Construction Activities	%	10	1,880,000	1,880,000
		SUBTOTAL			21,996,000

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

30th Street Station
Cavern @ Tie In

LENGTH________ x WIDTH________ = AREA________ SQ FT

DESIGN SECTION ________ | QUANTITIES BY E Rasi | 4/1/02 | ESTIMATE NO. ________

QUANTITIES CHCKD. BY ________ | DATE 4/02/02 | PRICED E E. Rasi

COST INDEX ________

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Mined Cavern	LF	240	50,000	12,000,000
2	Construction Shafts,Operation & Handling	EA	2	1,000,000	2,000,000
3	Tie Ins to Mainline	EA	2	2,000,000	4,000,000
	Sub Total Structural Items				**18,000,000**
4	Site Preparation	%	2	360,000	360,000
5	Traffic Maintenance & Control	%	3	540,000	540,000
6	Utilities & Relocations	%	2	360,000	360,000
7	Site Restoration	%	1	180,000	180,000
8	Unforeseen Construction Activities	%	10	1,800,000	1,800,000
		SUBTOTAL			**19,440,000**

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
Cut & Cover Station

LENGTH ____ x WIDTH ____ = AREA ____ SQ FT

DESIGN SECTION ____ QUANTITIES BY E Rasi 4/1/02 ESTIMATE NO. ____

QUANTITIES CHCKD. BY ____ DATE 4/02/02 PRICED BY. ____ E. Rasi

COST INDEX ____

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Cut & Cover Station, 730 ' Structure	SF	91,600	300	27,480,000
2	Soil Improvement, 1500 LF within Station	LF	1,500	4,000	6,000,000
3	Remove Existing Tunnels & Tracks within Station	LF	1,500	1,000	1,500,000
4	Station Architectural Work	SF	91,600	100	9,160,000
5	Station Mechanical Work	SF	91,600	30	2,748,000
6	Station Electrical Work	SF	91,600	60	5,496,000
7	Escalators	EA	8	750,000	6,000,000
8	Elevators	EA	2	350,000	700,000
	Sub Total				**59,084,000**
9	Site Preparation	%	3	1,772,520	1,772,520
10	Traffic Maintenance & Control	%	5	2,954,200	2,954,200
11	Utilities & Relocations	%	5	2,954,200	2,954,200
12	Site Restoration	%	5	2,954,200	2,954,200
13	Unforeseen Construction Activities	%	10	5,908,400	5,908,400
		SUBTOTAL			**75,627,520**

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
Cut & Cover @ Tie in

LENGTH_______ x WIDTH_______ = AREA_______ SQ FT

DESIGN SECTION _______ QUANTITIES BY E Rasi 4/1/02 ESTIMATE NO. _______

QUANTITIES CHCKD. BY _______ DATE 4/02/02___ PRICED BY. E. Rasi

COST INDEX _______

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Cut & Cover @ Tie in Structure, 340 '	LF	340	30,000	10,200,000
2	Soil Improvement around exist. Tunnels	LF	680	4,000.00	2,720,000
3	Tie Ins to Mainline	EA	2	2,000,000.00	4,000,000
4	Remove Existing Tunnels & Tracks within Stru	LF	1,500	1,000	1,500,000
	Sub Total Structural Items				**18,420,000**
5	Site Preparation	%	3	552,600	552,600
6	Traffic Maintenance & Control	%	5	921,000	921,000
7	Utilities & Relocations	%	5	921,000	921,000
8	Site Restoration	%	5	921,000	921,000
9	Unforeseen Construction Activities	%	10	1,842,000	1,842,000
		SUBTOTAL			**23,577,600**

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
Systems

LENGTH ______ x WIDTH ______ = AREA ______ SQ FT

DESIGN SECTION ______ QUANTITIES BY E Rasi 4/1/02 ESTIMATE NO. ______
QUANTITIES CHCKD. BY ______ DATE 4/02/02 PRICED BY. E. Rasi
COST INDEX ______

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Trackwork & 3rd Rail	RF	3,770	710	2,676,700
2	Pocket Track Trackwork & 3rd Rail	LF	1,900	360	684,000
3	Pocket Track EQ Lateral Turnout	EA	1	300,000	300,000
4	Trackwork & 3rd Rail Tie ins	EA	4	300,000	1,200,000
5	Traction Power	RF	4,720	440	2,076,800
6	Train Control	RF	4,720	1,200	5,664,000
7	Communications & Station SCADA	RF	4,720	400	1,888,000
8	Fare Collection	LS	1	1,000,000	1,000,000
9	Tie In to LMA	LS	1	3,000,000	3,000,000
10	Systems Tie In to Mainline	LS	4	1,000,000	4,000,000
	Sub Total Systems Items				**22,489,500**
11	Site Preparation	%	1	224,895	224,895
12	Traffic Maintenance & Control	%	3	674,685	674,685
13	Utilities & Relocations	%	0	-	-
14	Site Restoration	%	1	224,895	224,895
15	Unforeseen Construction Activities	%	10	2,248,950	2,248,950
		SUBTOTAL			**25,862,925**

BART 30th Street Station @ Mission Street

ESTIMATE SUMMARY, ALTERNATE B

Description	UNIT	QUANTITY	Unit Price	AMOUNT X $1000
Tunnels	LS	1	79,578,720	79,579
Cavern @ 15 Turnout	LS	1	21,240,000	21,240
Cut & Cover Station	LS	1	63,107,840	63,108
Cut & Cover Turnout & Crossover Structure	LS	1	46,233,600	46,234
Systems	LS	1	25,607,625	25,608
Sub Total				235,768
Mobilization	%	10	23,576,779	23,577
BART General Conditions	%	5	11,788,389	11,788
City Imposed Conditions	%	10	23,576,779	23,577
Sub Total, Construction Cost	LS			271,133
Contingency, (% of Construction Cost)	%	25	67,783,238	67,783
Soft Costs: (% of Construction Cost)				
Pre-Project/ Environmental Studies	%	3	8,133,989	8,134
Preliminary Engineering	%	4	10,845,318	10,845
Agency Administration	%	5	13,556,648	13,557
Community Outreach	%	1	2,711,330	2,711
Professional Services, (Eng., PM & CM)	%	30	81,339,886	81,340
Pre-Operating Expenses (Start Up & Testing)	%	2	5,422,659	5,423
Total Project Cost @ 2002 Dollars	LS			460,926
Right of Way Costs				
Escalation				
Environmental & Haz Mat				
Insurance				
Financing & Interest During Construction				
Vehicles				
Grand Total				

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
TUNNELS

LENGTH______ x WIDTH______ = AREA______ SQ FT

DESIGN SECTION ______ | QUANTITIES BY E Rasi | 4/1/02 | ESTIMATE NO. ______
QUANTITIES CHCKD. BY ______ | DATE 4/02/02 ______ | PRICED BY. ___ E. Rasi
COST INDEX ______

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Bored Tunnels, 2x 2440 LF(Incl. Cross Passages)	LF	4,880	13,200	64,416,000
2	Soil Improvement, 200 LF from Station	LF	400	4,000.00	1,600,000
3	Ventilation Structure with Equipment	LS	1	2,000,000	2,000,000
	Sub Total Structural Items				**68,016,000**
4	Site Preparation	%	2	1,360,320	1,360,320
5	Traffic Maintenance & Control	%	3	2,040,480	2,040,480
6	Utilities & Relocations	%	1	680,160	680,160
7	Site Restoration	%	1	680,160	680,160
8	Unforeseen Construction Activities	%	10	6,801,600	6,801,600
		SUBTOTAL			79,578,720

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

30th Street Station
Cavern @ Turnout

LENGTH_______ x WIDTH________ = AREA________ SQ FT

DESIGN SECTION ________ QUANTITIES BY E Rasi 4/1/02 ESTIMATE NO. ________

QUANTITIES CHCKD. BY ________ DATE 4/02/02____ PRICED E E. Rasi

COST INDEX ________

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Mined Cavern	LF	240	50,000	12,000,000
2	Construction Shafts,Operation & Handling	EA	2	1,000,000	2,000,000
3	Tie Ins to Mainline	EA	2	2,000,000	4,000,000
	Sub Total Structural Items				**18,000,000**
4	Site Preparation	%	2	360,000	360,000
5	Traffic Maintenance & Control	%	3	540,000	540,000
6	Utilities & Relocations	%	2	360,000	360,000
7	Site Restoration	%	1	180,000	180,000
8	Unforeseen Construction Activities	%	10	1,800,000	1,800,000
		SUBTOTAL			**21,240,000**

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
Cut & Cover Station

LENGTH ______ x WIDTH ______ = AREA ______ SQ FT

DESIGN SECTION ______ | QUANTITIES BY: E Rasi | 4/1/02 | ESTIMATE NO. ______

QUANTITIES CHCKD. BY ______ | DATE 4/02/02 | PRICED BY. ______ E. Rasi

COST INDEX ______

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Cut & Cover Station, 730 ' Structure	SF	74,700	300	22,410,000
2	Soil Improvement, 1500 LF within Station	LF	1,500	4,000	6,000,000
3	Station Architectural Work	SF	74,700	100	7,470,000
4	Station Mechanical Work	SF	74,700	30	2,241,000
5	Station Electrical Work	SF	74,700	60	4,482,000
6	Escalators	EA	8	750,000	6,000,000
7	Elevators	EA	2	350,000	700,000
	Sub Total				**49,303,000**
8	Site Preparation	%	3	1,479,090	1,479,090
9	Traffic Maintenance & Control	%	5	2,465,150	2,465,150
10	Utilities & Relocations	%	5	2,465,150	2,465,150
11	Site Restoration	%	5	2,465,150	2,465,150
12	Unforeseen Construction Activities	%	10	4,930,300	4,930,300
		SUBTOTAL			**63,107,840**

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
Turnout & Crossover

LENGTH________ x WIDTH________ = AREA________ SQ FT

DESIGN SECTION ________ QUANTITIES BY E Rasi 4/1/02 ESTIMATE NO. ________

QUANTITIES CHCKD. BY ________ DATE 4/02/02___ PRICED BY. E. Rasi

COST INDEX ________

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Cut & Cover TO & Crosover Structure, 740 '	LF	740	30,000	22,200,000
2	Soil Improvement around exist. Tunnels	LF	1,480	4,000	5,920,000
3	Tie Ins to Mainline	EA	4	2,000,000.00	8,000,000
	Sub Total Structural Items				**36,120,000**
4	Site Preparation	%	3	1,083,600	1,083,600
5	Traffic Maintenance & Control	%	5	1,806,000	1,806,000
6	Utilities & Relocations	%	5	1,806,000	1,806,000
7	Site Restoration	%	5	1,806,000	1,806,000
8	Unforeseen Construction Activities	%	10	3,612,000	3,612,000
		SUBTOTAL			**46,233,600**

BART 30th Street Station @ Mission Street

CONCEPTUAL ESTIMATE

STRUCTURE
30th Street Station
Systems

LENGTH ______ x WIDTH ______ = AREA ______ SQ FT

DESIGN SECTION ______		QUANTITIES BY	E Rasi	4/1/02	ESTIMATE NO. ______		
		QUANTITIES CHCKD. BY ______		DATE 4/02/02	PRICED BY.	E. Rasi	
					COST INDEX ______		

	CONTRACT ITEMS	UNIT	QUANTITY	PRICE	AMOUNT
1	Trackwork & 3rd Rail	RF	4,170	710	2,960,700
2	No 15 TO	EA	4	300,000	1,200,000
3	No 15 Crossover	EA	1	600,000	600,000
4	Traction Power	RF	4,170	440	1,834,800
5	Train Control	RF	4,170	1,200	5,004,000
6	Communications & Station SCADA	RF	4,170	400	1,668,000
7	Fare Collection	LS	1	1,000,000	1,000,000
8	Tie In to LMA	LS	1	3,000,000	3,000,000
9	Systems Tie In to Main Line	LS	5	1,000,000	5,000,000
	Sub Total Systems Items				**22,267,500**
10	Site Preparation	%	1	222,675	222,675
11	Traffic Maintenance & Control	%	3	668,025	668,025
12	Utilities & Relocations	%	0	-	-
13	Site Restoration	%	1	222,675	222,675
14	Unforeseen Construction Activities	%	10	2,226,750	2,226,750
		SUBTOTAL			25,607,625

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