TRI-COUNTY
METROPOLITAN
TRANSPORTATION
DISTRICT
OF OREGON

TRI-MET

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PORTLAND, OREGON 97202

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COLUMBIA REGION
ASSOC. OF GOVERNMENTS

September 25, 1978

Mr. Charles H. Graves
Director, Office of Planning Assistance
Urban Mass Transportation Administration
700 Seventh Street
Washington, D. C. 20590

Dear Mr. Graves:

The enclosed material provides our response to comments submitted by UMTA on the Banfield Transitway project draft environmental impact statement (DEIS) by your letter dated June 28, 1978. The response has been developed jointly by ODOT and Tri-Met, representing an evaluation of the points raised in each of the comments. The responses were previously reviewed with UMTA and FHWA staff in the meetings held in the UMTA Washington offices on August 15, 1978.

The Tri-Met Board of Directors on September 22, received a briefing on the UMTA comments and the response to each of the comments. Copies of the enclosed material are being provided to the City of Portland, Multnomah County and the City of Gresham. Each of the above jurisdictions is directly involved in the process of arriving at the local decision on the Banfield project.

Representatives of both ODOT and Tri-Met will be available to discuss the UMTA comments and our responses during the UMTA staff visit to Portland tentatively scheduled for October 18 and 19.

Sincerely,

Robert A. Burco
Director of Transportation

E. R. Peter Cass
General Manager, Tri-Met

RAB/ERPC:dp
Enclosures

Cc: Dee V. Jacobs, UMTA, San Francisco
Denton U. Kent, CRAG, Portland
Glen Green, FHWA, Salem
F. William Fort, UMTA, Seattle

UMTA COMMENT NO. 1: A TSM alternative which includes both arterial and freeway improvements should be considered. This alternative should combine the best features of the Low Cost Improvements (LCI) alternative as well as freeway ramp metering with HOV bypass lanes and provisions for bus transfers along the Banfield Freeway. The alternative warrants consideration because it provides for improved operation of the Banfield Freeway, including preferential treatment of HOV, while allowing for minimal investment in freeway improvements.

RESPONSE

An alternative involving ramp metering and a low capital cost approach has been formulated and analyzed. A ramp metering alternative would consist of six lanes on the Banfield Freeway, from I-5 to I-205, with minimum lane widths and no shoulders east of Hollywood. Ramps would be metered, with HOV bypass lanes at 82nd, 57th, 39th, and 33rd Avenues westbound during the A.M. peak period. During the P.M. peak period, eastbound on-ramps would be metered at Union, Grand, 16th, 39th, and 60th Avenues. Most buses from East Multnomah County would use I-205 or the 82nd Avenue on-ramp to access the Banfield Freeway. Those operating in the southerly sections of East County would not use the Banfield, but would be routed onto Division Street, where a reversible lane would be in operation for buses during peak hours. Other elements associated with this alternative include auto-related improvements in the Hollywood District, at the 12th/Sandy/Burnside intersection, and along 60th and Belmont Streets (as described in the DEIS for the Low Cost Improvements Alternative).

The construction cost for the Banfield portion of this ramp metering alternative is estimated at less than $2 million, significantly lower than that of any other Banfield alternative. Minimum property and dislocation would be required. Annual transit operating costs would be similar to those of the HOV alternatives, or about $16 million in 1990 to accommodate approximately 18 million East Side passenger trips.

Discussion

From a traffic standpoint, freeway operation would be improved over any of the other alternatives, including the No-Build and Low Cost Improvements Alternatives. Ramp metering would keep traffic volumes low, with approximately 4950 outbound vehicles in the peak hour (passing 28th Avenue) versus 5850 for the No-Build and 6030 for the Low Cost Alternative. Average peak hour speeds of 43 mph would be 20 mph faster than those of the No-Build and 9 mph faster than the Low Cost.

This improvement in freeway flow would be made at the expense of arterial streets, which would be used by most of the diverted freeway traffic. Peak-hour speeds on the east-west streets in East Portland would average about 20 mph, a slight improvement over No-Build conditions (18 mph) and a decrease from the Low Cost option (22 mph). More significantly, annual vehicle miles of travel on city streets would increase to 228 million (compared to 225 million under No-Build and 193 million under Low Cost). This would result in a corresponding increase in auto-related air pollution, noise, and accidents on city streets. This diversion of traffic off the freeway is also in conflict with the City's Arterial Streets Policy.

Another factor of concern to the road user is the perpetuation of minimum lane widths and no shoulders along a substantial portion of the Banfield Freeway. These elements were originally conceived as part of a temporary experiment and are not considered desirable on a long-term basis either by ODOT or FHWA. Improvement of the freeway to full lane widths and shoulders to alleviate this condition is estimated to cost an additional $29 million.

From a transit standpoint, the ramp metering alternative would be operationally very similar to the HOV Alternative. Suburban buses from much of East County would be rerouted onto the Banfield for their trip into downtown Portland. The possibility of stations along the Banfield portion of the route was explored; this was found to increase costs substantially because of the need to rebuild overpasses and purchase land to provide either ramps up to street level or freeway-grade pullout lanes and passenger platforms.

There are two important differences from the HOV alternative, however. First, in order to retain a low cost approach, there would be no busway along I-205; addition of such an I-205 busway would raise total capital costs by about $39 million. In order to access the Banfield, buses would therefore have to operate in mixed traffic, either along the I-205 Freeway or on parallel city streets. With mixed operation on I-205, the provision of stations would be operationally difficult. Without stations, transfer connections would be poor and there would be no possibilities for transit-oriented joint development. If the buses were to use city streets instead of I-205 to access the Banfield, speeds would be lower and the probability of congestion and delay would be higher.

A second difference from the HOV alternative is that there would be no exclusive facilities for buses to and from downtown Portland through the Lloyd Center area. The HOV alternative provides a special Banfield on/off ramp for buses at 16th Avenue, as well as two lanes reserved for transit along Holladay Street. Without these facilities, buses will have to travel in mixed traffic, using Holladay Street westbound and Oregon Street eastbound. This latter street is two blocks away from Holladay and is removed from many of the commercial and employment destinations in this area. It also involves an indirect and time-consuming eastbound connection to the Banfield via 12th, Irving, and the 16th Avenue on-ramp. Addition of a more direct eastbound on-ramp is estimated to cost $1.5 million.

Conclusions

The chief advantage of this alternative lies in its low capital cost and its improvement of peak-hour freeway traffic conditions; it could also be implemented sooner than most of the other alternatives. Its disadvantages include the diversion of more traffic to city streets, perpetuation of minimum design features on the freeway, and a poorer level of transit service than the other build alternatives. In particular, it would entail some of the transit operational disadvantages of the HOV alternative (lack of stations along the Banfield) as well as those of the Low Cost Alternative (lack of an I-205 busway). As a result, transfers will be more difficult, access to transit facitities will be poor for East Portland residents, and joint development possibilities will be eliminated. Rectification of some of these problems (such as adding shoulders to the Banfield or constructing an I-205 busway) will quickly raise the capital cost of this alternative to a level not unlike that of the high-cost build alternatives. For these reasons, there is little advantage in adding this alternative to the Banfield Transitway project. Ramp metering will continue to be explored, however, as a method of managing the freeway traffic flow in conjunction with a regional evaluation of ramp metering applications. This investigation is independent of any particular Banfield Project option and is currently being undertaken by the Oregon Department of Transportation.

UMTA COMMENT NO. 2: A modified busway alternative which would minimize capital investments in the Banfield corridor should be evaluated. Specifically, it should consist of a separated reversible busway adjacent to the existing freeway with access and egress to major arterials (39th, 60th, and 82nd Avenues). This alternative should be designed with an objective to reduce overall costs through the application of minimum design standards.

Similarly, the costs and effects of providing access and egress from the Busway alternatives (4a and 4b) to major arterials should be discussed.

RESPONSE

A reversible busway similar to that described above has previously been considered as a project alternative. It was dropped in 1976 after analysis indicated minimal capital cost savings and significant operational problems. The following was recorded by an ODOT memorandum dated October 22, 1976 and summarized in the Banfield Transitway DEIS (Volume I, page 77):

Separated one-lane, reversible busway with stations

Description: This proposal would place a one-lane busway in the south, median, or north side location, similar to the two-lane proposals. The width of the busway would be 22 feet -- adequate for a disabled bus to stop without completely blocking the busway. Peak direction buses would use the busway and off-peak buses would use the freeway.

Origin: This proposal came from the TAC.

Disposition: The cost savings realized by constructing one-lane busway (22 feet) versus a two-lane busway (28 feet) were small in comparison to operational problems caused by a one-way busway. That off-peak transit riders could not use stations on the busway is a major drawback of this scheme. Possibility of having a two-lane busway from the Mall to 39th was considered as a possible compromise by Tri-Met. However, to connect the full two-lane, two-way, 28 foot separated busway on I-205 to the Mall with a one-way facility would be inconsistent and would not adequately serve the I-205 busway. This alternative was dropped because of these considerations by the TAC, with concurrence from the ICC and the TTAC.

Not mentioned in the above excerpt is the added operational cost associated with bus usage of congested freeway lanes. The directional split of traffic on the Banfield Freeway is 40%/60% during peak hours. This means that heavy traffic will be encountered by buses traveling against the peak direction, resulting in slower speeds, higher operating costs, and a poorer level of service to passengers than with a two-way busway. An additional problem is how off-peak buses would access the I-205 busway from the Banfield. A recent re-evaluation of this alternative has confirmed the above findings.

In response to the second part of the comment, the costs and impacts of the Busway Alternatives (4a and 4b) do include access and egress along the facility at 39th, 60th and 82nd. Pedestrian access would be available at station areas at each of these locations, and bus access ramps to and from arterial streets would be located at Hollywood (39th and 42nd) and 60th Avenues; bus ramps to and from 82nd Avenue have been omitted because of space constraints and gradients which create severe engineering problems with concurrent high costs. In addition, stations and access ramps are now being investigated at 53rd and 67th Avenues as possible substitutes for those at 60th.

It should be noted that route plans developed for the computer demand modeling process assumed that the station ramps would be used only to bring Banfield buses up to stops at street level, not to give East Portland buses direct access to the busway. This was an expedient to simplify the modeling. Intersecting north-sourth lines were considered as purely crosstown routes which would not operate into downtown Portland. In reality, a few peak-hour trips on these intersecting lines would probably access the busway and operate into downtown Portland, increasing the overall flexibility of the East Portland transit network. If undertaken, this operational refinement would slightly increase the operating costs of the Busway alternative.

UMTA COMMENT NO. 3: It is our understanding that Tri-Met has developed a work program to examine the impact of using articulated buses in the analysis of alternatives. The information obtained from this study should be used before selecting the preferred alternative.

RESPONSE

A concern for achieving greater productivity has been emphasized throughout the investigation of the alternatives for the Banfield Transitway Project. The potential to increase productivity associated with the several "bus-only" transit alternatives and the bus components of the LRT alternatives through the use of larger, articulated buses has been investigated currently. This potential will be verified in the coming months as the first large-scale deliveries of articulated buses are taking place in America and as experience is gained with their operation under American conditions.

Generally, it is expected that with their larger passenger capacities, these articulated buses can replace conventional transit buses on a 1:1.4 or 1:1.5 ratio in service. These could provide service where passenger demand dictates a high frequency of buses (that is, where headways are not at some minimum level set by "service standards" policies). Early and limited experience with these articualted buses indicates that their operating costs may be 10% to 25% greater than those of conventional buses. These costs will become known more reliably as experience is gained with the operations of the larger test fleets now being introduced. It is clear, however, that worthwhile savings may be realized through the application of these larger transit buses. This is currently being examined by Tri-Met staff in terms of particular applications on individual routes, both in the Banfield Corridor and throughout Tri-Met's operating network.

Preliminary Findings

In the Banfield Corridor there are approximately 80 to 85 more buses required under the various "all-bus" alternatives than for the corresponding LRT options. Of these, just fewer than one-half would be expected to be added for additional peak period capacities. If service were to be provided by 25 articulated buses rather than the 36 to 38 conventional transit buses projected, a savings of from 10 to 15 buses should be realized, resulting in an estimated cost savings of between $400,000 and $600,000 per year in direct operating costs for these "all-bus" alternatives.

Substantial savings are thus indicated, and warrant serious follow-up of this concept in detail to work out the scheduling associated with the articulated buses' lower average operating speeds. (Lower speeds are due to additional bus stop dwell times associated with increased passenger loadings, as well as to lesser acceleration rates due to lower power-to-weight ratios and more conservative operation with more standee passengers than is the case with present Tri-Met bus scheduling and operation.)

Other aspects of operating articulated buses here must be examined, including maintenance facilities and staff training, wage rates that will apply for these buses, and the like.

These savings, however, would not match those expected from the LRT project alternatives. By 1990, an LRT line in the Banfield Corridor would save operating costs of at least $2.3 million per year compared to a bus option with equivalent capacity using standard buses, and $1.7 million compared to a bus option with articulateds. If articulated buses were used in the LRT alternative to provide service on heavy feeder or parallel local lines, the savings in operating costs over an all-bus option would be even greater. In addition, the adoption of the larger, articulated buses likely provide other benefits under the various "all-bus" alternative schemes that would be realized through implementation of an LRT system plan.

Rather, the greater impact for these indicated savings appears to lie in selected applications throughout Tri-Met's route network. Some eleven routes have been identified where articulated buses might replace conventional buses to save approximately 64 such standard buses (137 articulate buses in place of 201 standard buses presently operated) in peak service and yet still maintain headways at 10 minutes or less. Analyses will continue on this subject, but oriented towards systemwide savings that can be realized under any Banfield alternative.

UMTA COMMENT NO. 4: The apparent inconsistency of standee policy for bus and light rail alternatives should be addressed.

RESPONSE

The calculation of vehicle capacity and average peak-hour loading is necessary in order to estimate transit vehicle requirements and daily operating costs. If loadings are overestimated, then fewer vehicles than necessary will be calculated and costs will be underestimated; conversely, if loadings are underestimated, vehicle requirements and costs will be overestimated. The resolution of this issue revolves around two factors: the physical capacities of the vehicles themselves and observed patterns of peak-hour ridership.

Observations in Portland and elsewhere indicate that crush loads are experienced on transit vehicles only during a small part of the peak period; average loadings over the whole peak are lower. For example, in Portland, crush loading can accommodate up to 73 passengers at the maximum load point of a line. Over the entire peak hour, however, the maximum load averages only about two-thirds of this, or 49 passengers per bus. This information is summarized on Table 4-1.

For the Banfield Transitway Project, our planning work assumed an average maximum peak-hour load of 50 passengers per bus. This is simply a rounding off of the 49-passenger average loading in order to make computations easier. Thus on the average, there would be 5 standing passengers per bus at the maximum load point <u>over the whole peak hour</u>, while up to 28 standees per bus could be expected <u>during the peak 15 minutes</u>.

For LRT vehicles, the exact same criteria were used in order to keep the comparison valid. Crush loadings were assumed for the peak 15 minutes, while average peak-hour loadings were calculated at about two-thirds of the crush load. The crush load of the Du Wag "Type B" car used in the analysis is about 287, based on the standard seating configuration. The average maximum laoding over the entire peak hour would be 192 passengers, using the two-thirds criterion. We assumed an even lower loading of 183 in order to err in the high side when estimating costs (183 is quoted by the manufacturers as the "comfortable" capacity of the car). Since the seated capacity of the Type B LRT vehicle is 72, there would be an average of 111 standees during the peak hour.

Thus, the number of standees was not a policy input to the process. It was an output, based on the assumption of crush loading during the "high peak" for both buses and rail cars, and a peak-hour loading factor of two-thirds the crush level.

The fact that there would be more standees on rail cars than on buses is a phenomenon commonly observed among transit systems. Rail cars are designed to accommodate more standees, through wider aisle space and wider, more numerous doors. The smoother acceleration and deceleration of rail vehicles is also more conducive to standing. (It is often observed that passengers stand on rail vehicles even when seats are available, while they stand on buses only when all seats are occupied.) This is one of the many reasons that rail is chosen for high-demand corridors.

Table 4-1

ASSUMED TRANSIT VEHICLE LOADINGS AND CAPACITIES

	Standard Bus	Type B LRT Vehicle *
a. Crush Capacity	73	287
b. Average Peak-Hour Maximum Load ("a" x .67)	49	192
c. Average Peak-Hour Maximum Load Assumed for Project	50	183
d. Seated Capacity	45	72
e. Average Number of Standees Per Vehicle Assumed for Project ("c" - "d")	5	111

*Capacities of LRT cars vary. These figures are based upon the Type B car, with an interior configuration favoring fewer seats and more standees. Other cars suitable for Portland could accommodate up to 115 seats and 85 standees.

UMTA COMMENT NO 5: Marginal costs and effects of all alternatives, (e.g., the additional cost per additional passenger) should be presented.

RESPONSE

Cost estimates and patronage projections for each project alternative were summarized in the project's DEIS. These were based upon previous work presented in the project report, East Side Transit Operations (p. 42). This document outlines the estimated capital and operating costs for the transit component of the Banfield Project. By comparing the costs and ridership projections of each "build" alternative with those of the No-Build option, the marginal cost to attract each additional rider to transit can be calculated. This marginal cost, and its derivation, is shown in Table 5-1.

The columns at the left portion of the table display transit total annual costs. As described in the Operations report, these include 1990 transit operating costs as well as the amortization of all transit capital costs (including vehicles required through 1990 and the construction cost of all transit facilities needed for an East Side transit network). The columns in the center of the table present annual East Side ridership projections for 1990. Both the total annual costs (T.A.C.) and ridership of each alternative are compared with the No-Build to determine the increase over a "do nothing" strategy. The right-hand column of the table shows the end result of this analysis -- the marginal T.A.C. per additional transit passenger.

Table 5-1 indicates that HOV alternative 3a and the Low Cost Alternatives are the most effective, with respective marginal costs of $1.75 and $2.20 per passenger. However, these alternatives involve minimal freeway improvements or entail significant impacts to urban neighborhoods, as outlined in the Operations study. The other alternatives provide more adequate facilities and

and service designs, and range from $2.33 to $3.10 per additional 1990 passenger attracted, with the Banfield/Burnside LRT option at the low end of this range.

TABLE 5-1

MARGINAL COSTS PER ADDITIONAL PASSENGER OF BANFIELD PROJECT ALTERNATIVES

Alternative		1990 Total Annual Cost: Projected (millions)	1990 Total Annual Cost: Marginal Increase Over No-Build (millions)	1990 Originating Passengers: Projected (millions)	1990 Originating Passengers: Marginal Increase Over No-Build (millions)	Marginal T.A.C. per Additional Passenger
No-Build	1	$13.7	---	13.5	---	---
Low Cost Impr.	2a,b	18.1	$ 4.4	15.3	2.0	$ 2.20
HOV Lanes	3a	22.1	8.4	18.3	4.8	1.75
	3b,c	25.8	12.1	18.3	4.8	2.52
Busway	4a	28.6	14.9	19.2	5.7	2.61
	4b	28.3	14.6	19.2	5.7	2.56
LRT: Burnside	5-1a,b	27.0	13.3	19.2	5.7	2.33
LRT: Division	5-2a,b	29.3	15.6	18.6	5.1	3.06
LRT: I-205	5-3a,b	25.8	12.1	17.4	3.9	3.10

UMTA COMMENT NO. 6: The concerns raised on the travel forecasting procedures in UMTA's November 14, 1977, letter to Mr. Wentworth, copy attached, should be addressed.

RESPONSE

A report titled Banfield Transitway Project Supplemental Technical Report, Travel Demand Forecasts (May, 1978) was forwarded to UMTA on June 22, 1978. It is anticipated that this report constitutes an adequate response to UMTA concerns, as identified in the November 14, 1977 letter. A discussion of any remaining modeling questions would best be handled by separate discussion and correspondence.

UMTA COMMENT NO 7: The bus system for the entire region, excluding the Banfield corridor, should be discussed describing the system and its costs.

RESPONSE

Initial work for the Banfield Project assumed service improvements throughout the Tri-Met system. An extensive bus network was, accordingly, devised for the Banfield and other corridors. This network of feeder and local buses was held constant in testing each Banfield trunkline alternative (e.g., busway, HOV lanes, LRT, etc.); the regionwide transit network is described in the Travel Demand Forecasts report, Chapter 5 and Appendix D-1.

All of the work was, subsequently, revised in order to introduce operating cost savings. The above-mentioned bus network was a principal focus of this effort. The approach used was to keep routes much as they are today, but utilize certain TSM improvements (such as signal preemption) and management strategies (such as timed transfers) to reduce costs. This is in contrast to the total revision of routes and schedules that was made previously.

A comparison of these two approaches is summarized in Table 7-1, which indicates the daily bus mileage associated with one of the project alternatives (Banfield/Burnside LRT). As shown in the table, systemwide bus mileage is approximately 104,000 with the "expanded service" approach, and 84,000 with the more conservative approach. Operations cost of each approach is calculated at $1.50 per mile, plus about 30% to allow for deadheading.

The expanded service approach was used as the basis of costs in current project documentation (such as DEIS, East Side Transit Operations, etc.) and represents the upper limit of probable systemwide bus operating costs. The more conservative approach, which offers passengers a lower level of service, can be considered the lower limit. Actual bus operating costs are likely to fall somewhere between these two extremes.

TABLE 7-1

1990 DAILY BUS MILEAGE ASSOCIATED WITH BANFIELD/BURNSIDE LRT ALTERNATIVE (excluding deadheading)

	Banfield Corridor	Other Corridors	Systemwide Total
"Expanded Service" Approach	19,800	84,300	104,100
Conservative Approach	14,800	68,800	83,600

UMTA COMMENT NO. 8: Additional information should be provided to support the conclusion that some alternatives offer more positive economic development and land use stimulus than others. A discussion of joint development opportunities would be particularly helpful.

RESPONSE

The project report, Light Rail Transit Land Use Considerations, presents a very detailed analysis of joint development opportunities associated with the LRT alternatives. This report resulted from joint efforts by the staffs of the City of Portland, Multnomah County, City of Gresham, and Tri-Met to evaluate past and future development trends and how they might be impacted by a light rail facility. It should be consulted for an assessment of joint development/ value capture possibilities.

The Land Use Consideration report utilized studies made in collaboration with the UMTA-sponsored Rice Center team. Light rail transit is described in the report as a mechanism for reorienting new growth, not for stimulating it. When combined with creative land use controls and favorable market conditions, LRT has the potential of attracting high intensity residential and commercial development around station areas.

The basic advantage of LRT over the all-bus alternatives is in its use of fixed station facilities and in the number of these stations located at strategic development sites. The No-Build and Low Cost bus options, for example, involve no station facilities at all. Future development would continue in its present pattern, dispersed throughout much of East County. The HOV alternative would have six stations along the I-205 busway, and the Busway alternative would add three more stations along the Banfield. These bus stations could provide some focus for a reorientation of future growth. Their effect upon economic and

and land development would be substantially the same as one of the LRT options, Alternative 5-3, which features a rail line on the Banfield I-205 alignment. As described in the Land Use Considerations report, I-205 transit stations (either bus or rail) could attract some 8,600 residents to the corridor by 1990.

In contrast, an LRT line going all the way to Gresham would penetrate the area where population growth has been the greatest. The Burnside alignment, for example, would feature over twice as many station sites as the I-205 rail and busway alignment (more if certain stations under study are added). These sites have been carefully screened for surrounding property values, land use, and susceptability to redevelopment. According to the Land Use Considerations report, at least 16,000 new residents could be attracted to station areas along the Burnside alignment by 1990.

It is important to emphasize that the LRT alignments to Gresham penetrate the area of greatest development activity in the East Side; other project options have stations only within the East Portland area, where development patterns have been more stable and less prone to intensifications. For these reasons, the favorable economic and land use impacts of the all-bus options are considered to be significantly fewer than those of the LRT options serving Gresham.

UMTA COMMENT NO. 9: There should be an explantion of the reasons why joint LRT use with the Union Pacific rail facilities was not considered.

RESPONSE

The possibility of joint use of the Union Pacific Railway facilities by Tri-Met was examined in detail during the study. Two types of joint use were explored:

- Joint use of the tracks
- Joint use of the right-of-way, with separate railroad and transit tracks.

It was concluded that joint use of tracks was not practical for the following reasons:

Track Incompatibility - The railroad uses wide-flanged wheels while the LRT line would use narrow-flanged streetcar wheels. Additional special work would be required at switches and crossings.

Track Capacity - The Sullivan Gulch Line is part of Union Pacific's Transcontinental Mainline. The traffic density over this line is approximately 12.5 million tons annually, with between 8 and 12 train movements daily. Many of these trains are of great length, descending the grade to Portland at a low speed. Operation of the Albina Yard in Portland frequently requires an incoming train to be held on the single track approach to Portland, blocking the Mainline. It would not be practical to operate a two-way light rail service at 5-minute headways on a line used in this manner.

Electrification Incompatibility - The Sullivan Gulch Line on the Union Pacific is scheduled for electrification at 50 or 25 KV AC. This system is incompatible with standard LRT electrification at 600 or 750 volts DC.

Speed - While the railroad operates at approximately 20 miles an hour on the downgrade, the light rail line is based on a maximum operating speed of 55 miles an hour over this segment.

Train Protection - This segment of the Union Pacific is scheduled to operate under CTC, while the LRT system will use a two-aspect automatic block system.

Stations and Clearance - The LRT station designs and clearance requirements are different from those required for railroad operation. Not only are the vehicles narrower than standard railroad vehicles, but the clearance requirements are considerably less.

These factors resulted in the conclusion by Tri-Met, ODOT, and the Union Pacific Railroad that joint track use was impractical on this segment.

Joint use of right-of-way was also studied. As a result of this work, the Union Pacific has tentatively agreed that those portions of their right-of-way that lie more than 21 feet south of the center line of their main track can be made available to the project. This configuration was used in the DEIS alternatives. The agreement is subject to the successful resolution of technical details such as the potential interference between the Tri-Met power and signaling system and the Union Pacific signaling system.

Additional work is planned by ODOT and Tri-Met during the next few months to refine designs to develop this shared right-of-way in the most cost-effective manner.