

TECHNICAL MEMORANDUM #3

May 25, 2011

To: Project Management Team

From: Carl Springer, PE, Julie Sosnovske, PE

Subject: **I-84 257th Avenue IAMP, Task 5: South Frontage Road Access Study**

P09042-011

This memorandum addresses several options for improving the South Frontage Road access and circulation patterns. While there are some major roadway improvements being considered in the Troutdale area to improve circulation and flow in the interchange area (explored later in Tech Memo #4), the intent of this memo is to look at some shorter term, less expensive improvements to South Frontage Road. This study specifically analyzes local circulation and access options to reduce trucking travel conflicts and improve mobility for through traffic.

BACKGROUND AND PURPOSE

The South Frontage Road has been identified as a critical operational bottleneck that limits the safety and effectiveness of facilities throughout the interchange management area. Conflicts between trucks and autos and between local and through traffic are prevalent along South Frontage Road. Operational characteristics of trucks are significantly different than automobiles and conflicts due to these characteristics are escalated due to the sheer number of trucks that use the businesses along South Frontage Road. The primary challenges fall into the following categories:

- Through circulation to vehicles destined to land uses north of I-84
- Through circulation for vehicles destined to land uses south on 257th Avenue
- Immediate ingress/egress to/from businesses along South Frontage Road

An example of one type of conflict that occurs on this roadway is where one truck will exit one of the truck stops, blocking all three lanes of traffic, allowing several other trucks to exit in front of it. This is neither safe, nor efficient. The purpose of this memorandum is to explore ideas for interim, cost effective improvements that will minimize the number of conflicts that occur on this roadway.

ACCESS MANAGEMENT OPTIONS CONSIDERED

Several options were considered and evaluated, as summarized below:

- Option A: Provide local truck access road from Travel Centers of America (TA) parking lot to signalized intersection at Marine Drive/South Frontage Road/I-84 EB Off-Ramp. This access would primarily serve outbound truck traffic since most trucks would enter the site via South Frontage Road where the fuel pumps are located.
- Option B: Construct fourth lane (the third lane, to be constructed on the north side of South Frontage Road is currently in the design process) on south side of South Frontage Road (partially exists today) to serve only traffic accessing South Frontage Road businesses. This lane would terminate prior to the 257th Avenue/South Frontage Road intersection so that it would not be used for through traffic destined for 257th Avenue.
- Option C: Combination of Option A and Option B.
- Option D: Redirect Love's Travel Stops and Country Stores (Love's) and traffic from the retail pad (formerly Burger King) to exit onto South Frontage Road via a new egress roadway (along the eastern edge of the TA parking lot) and traffic signal. In conjunction, add a fourth lane on South Frontage Road between Phoenix Drive and the last Love's driveway before 257th Avenue to provide ingress only to Love's and the former Burger King site. A potential intersection control scenario might include a raised median between the northernmost eastbound through travel lane and the two southernmost eastbound travel lanes.
- Option E: Construct two egress roads to support South Frontage Road businesses (primarily Love's Travel Stop and TA Truck Stop), one along the eastern edge of the TA parking lot and one along Culpepper Drive, just west of the TA property. In conjunction with this, add a new traffic signal at the TA driveway and close Love's driveways for the truck portion of their site. The auto access to the Love's site would remain.
- Option F: Redirect Love's Traffic to New TA Egress Drive, Positive Separation between South Frontage Road Through Lanes and Business Access Lane (between TA Auto Access and Love's Truck Access), New Traffic Signal on South Frontage Road at New TA Egress Drive.

ANALYSIS OF OPTIONS

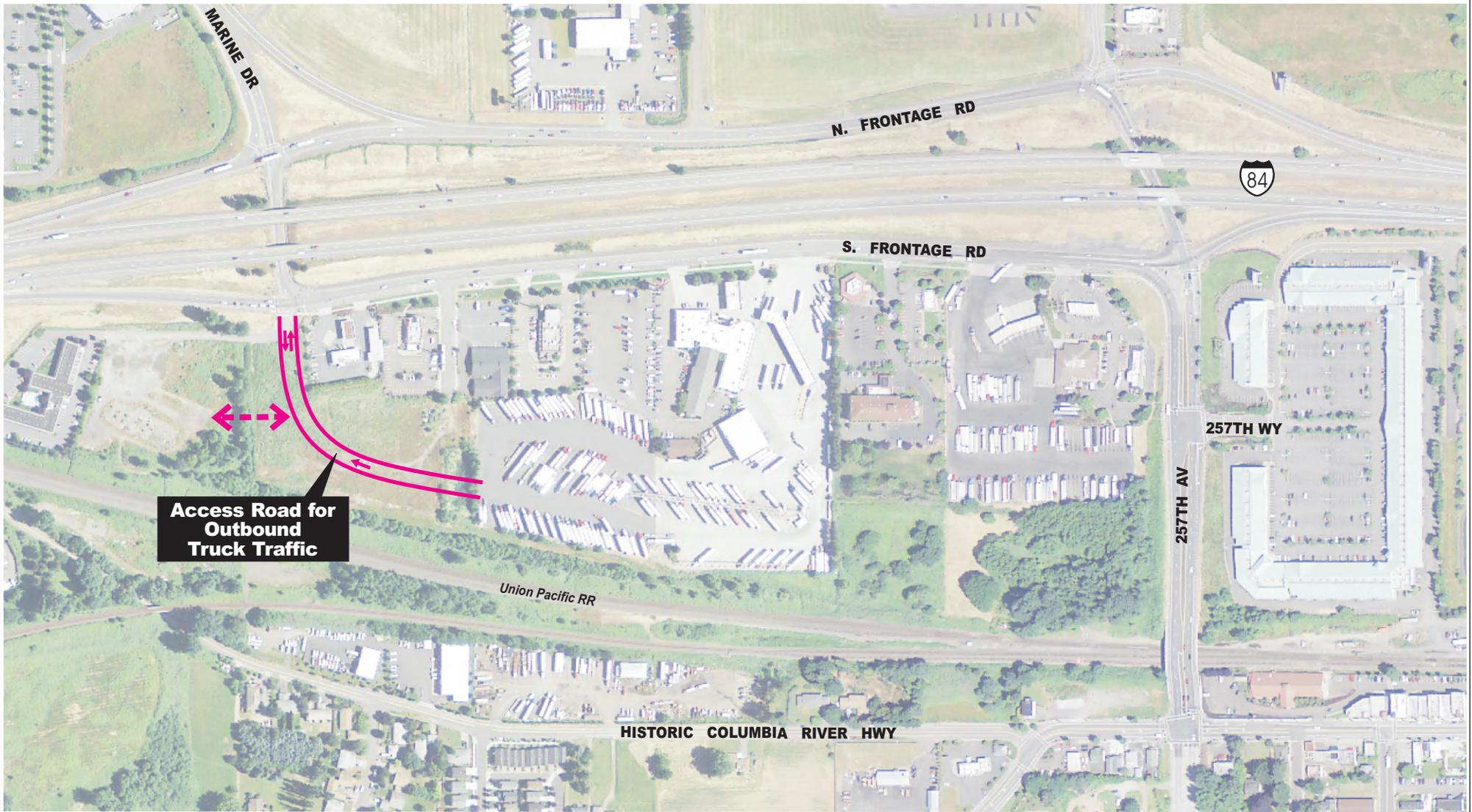
Each of the options is described in more detail below with a sketch showing what is proposed as well as a discussion of positive and negative impacts each option creates.

Option A: New Egress from TA Truck Parking Area to Marine Drive/South Frontage Road

The intent of this option is to provide truck traffic using the TA site a signalized egress point onto South Frontage Road. This option is shown in Figure 1. Benefits and costs are detailed below:

- Benefits
 - Signalized access to South Frontage Road for TA truck traffic
 - Could be built on ultimate alignment of proposed Marine Drive Extension
 - Reduced TA truck traffic exiting the TA site from TA driveways on South Frontage Road
 - Circular flow of truck traffic through the TA site
 - Reduction of on-site conflicts between trucks entering/exiting the site
- Costs
 - Requires acquisition of property to west of existing TA Truck Stop
 - May constrain adjacent property making it less usable for future development
 - Impacts to Marine Drive/South Frontage Road/I-84 EB Off-Ramp are unknown – intersection may not be able to handle additional traffic without improvements
 - Signalized egress for truck traffic may not be very efficient. Trucks take more time to get up to speed and side street traffic would likely have limited green time assigned to it by the traffic signal because of the high volume of eastbound through traffic on South Frontage Road
 - Requires some out-of-direction travel for trucks leaving the TA site
 - Requires some trucks to travel through the already congested I-84 Eastbound Ramps/Marine Drive/South Frontage Road intersection twice
 - May require some reconfiguration of the existing truck parking at the TA site to accommodate the new access roadway
 - Requires reconfiguration of access from properties southwest of the I-84 Eastbound Ramps/Marine Drive/South Frontage Road intersection to the egress roadway

Analysis was conducted to determine whether the traffic signal at Marine Drive/South Frontage Road/I-84 EB Off-Ramp can handle the additional traffic this option would generate. The results of this analysis indicate that the intersection would work well under existing conditions (level of service B, volume-to-capacity ratio 0.55) and would operate right at capacity under future base conditions (2035 No Build) (level of service D, volume-to-capacity ratio ~1.0). While the future operating conditions are not ideal, this could be a viable short term improvement.



Access Road for Outbound Truck Traffic

- LEGEND**
-  - Proposed Access
 -  - New Connection

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NO SCALE

Figure 1
OPTION A
Troutdale Interchange

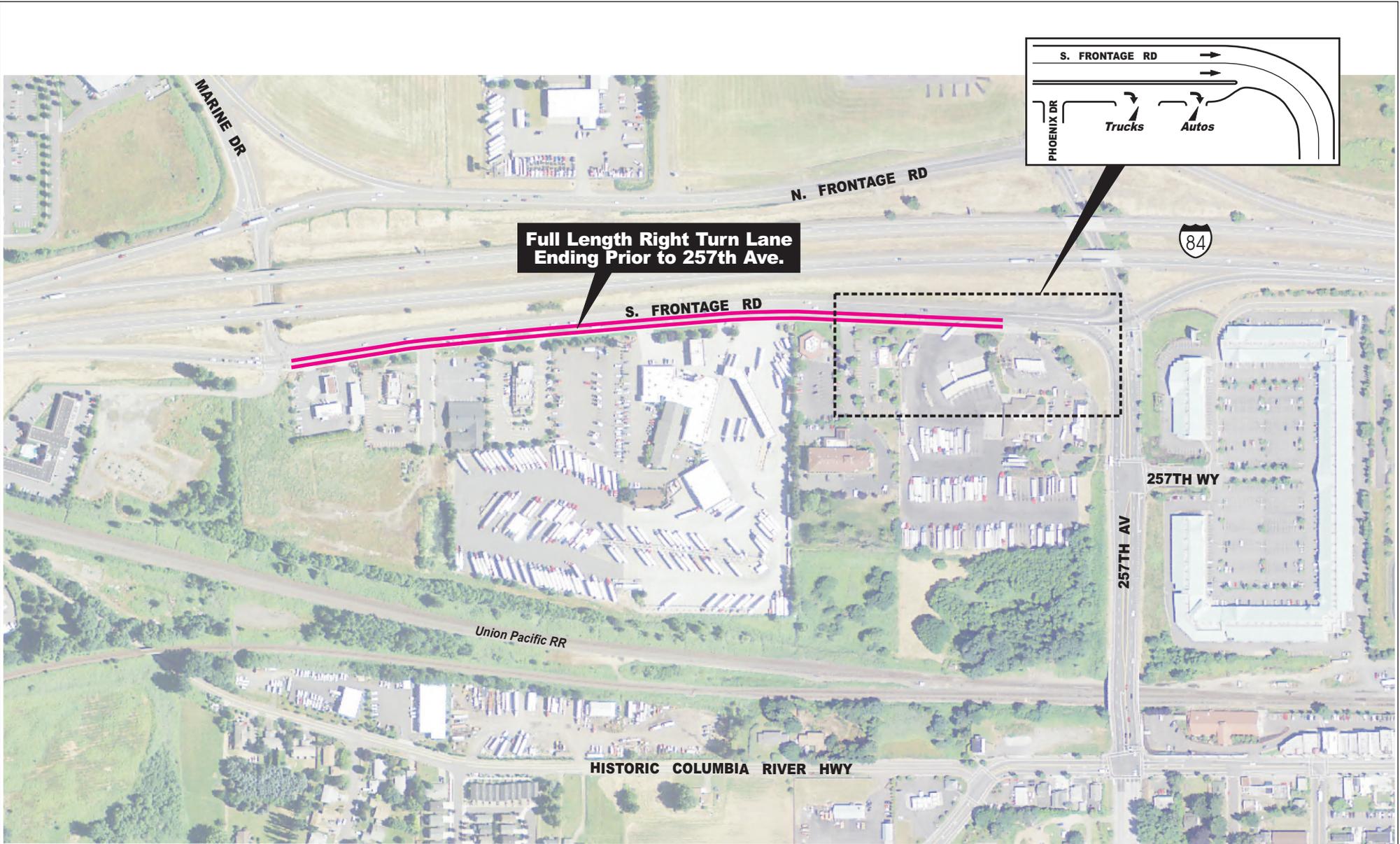
Option B: Construct Fourth Lane on South Side of South Frontage Road, Terminating Prior to 257th Avenue (PARTIAL SOLUTION).

This option was developed to try to remove local access traffic from through traffic destined to either 257th Avenue south or to the north side of the interchange. It is critical that this lane terminate prior to 257th Avenue to keep through traffic out of it as much as possible. Signage would be provided to direct through traffic to avoid the southernmost lane. Option B is shown in Figure 2. Benefits and costs are detailed below:

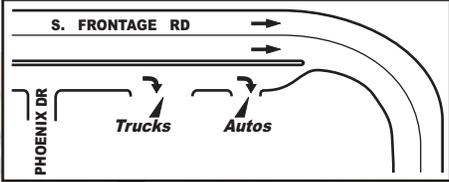
- Benefits
 - Separates some local access traffic from through traffic
 - Improves conflicts between trucks exiting South Frontage Road businesses and through traffic
- Costs
 - Significant right-of-way impacts to businesses along South Frontage Road
 - Creates additional lane of weaving for vehicles heading from South Frontage Road businesses to eastbound left turn or through lane on South Frontage Road at 257th Avenue
 - Does not remove all conflicts between trucks exiting South Frontage Road businesses and through traffic

This option could help reduce conflicts between truck traffic and through traffic along South Frontage Road. Truck traffic will use more than one lane to maneuver and many trucks will still need to head north on 257th Avenue and may still block traffic to allow fellow truckers easier egress.

This option should be considered a partial solution since egress needs to be provided to patrons of Love's, Days Inn and Shari's. As shown in Figure 2, these vehicles would be trapped, without access to South Frontage Road. Even if the positive separation does not extend as far west as Phoenix Drive, it would still be very difficult for vehicles turning from northbound Phoenix Drive to eastbound South Frontage Road to maneuver into the appropriate lane between Phoenix Drive and 257th Avenue.



**Full Length Right Turn Lane
Ending Prior to 257th Ave.**



LEGEND

 - Proposed Access

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NO SCALE

Figure 2

OPTION B
Troutdale Interchange

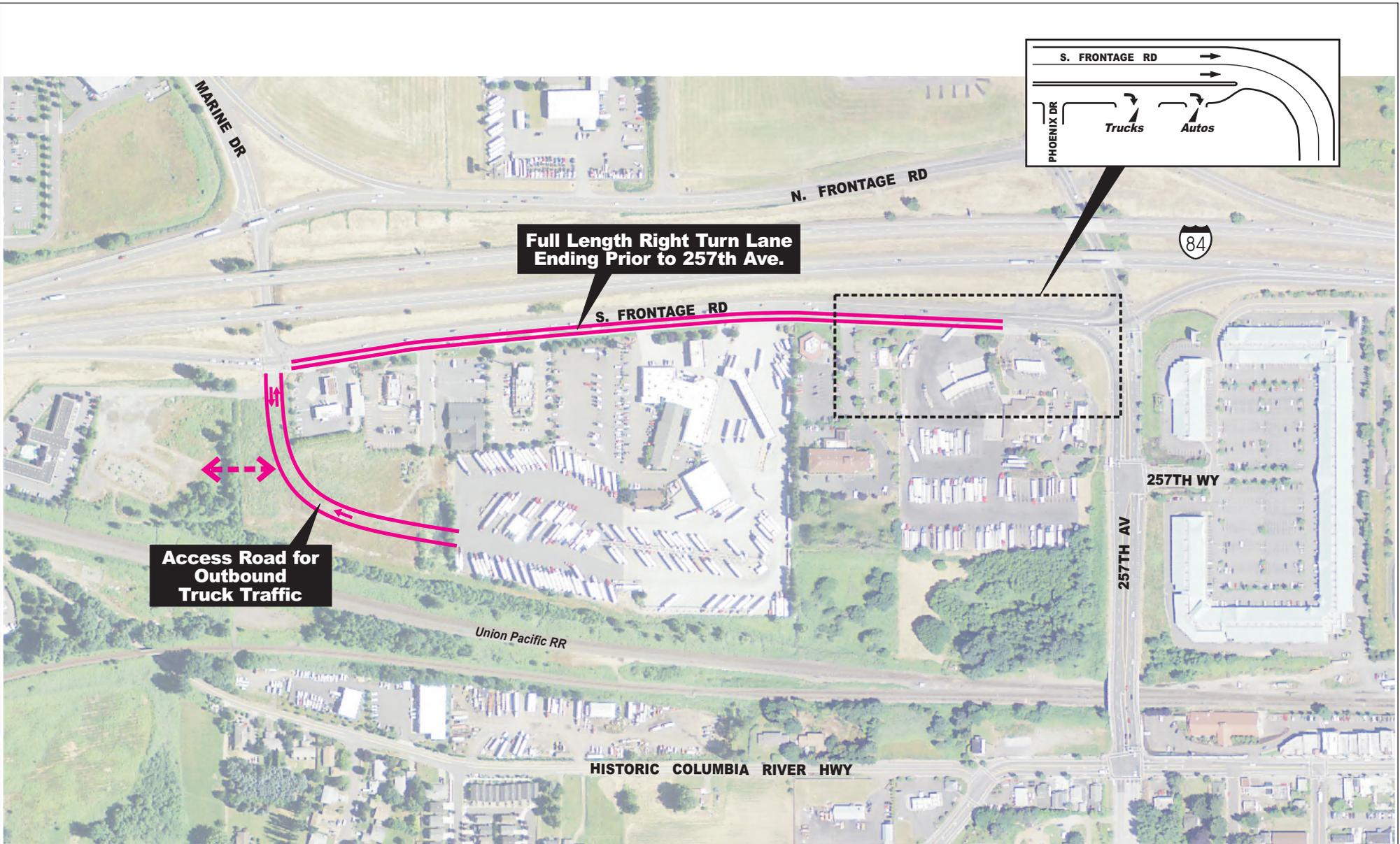
Option C: Combination of Option A and Option B.

This option was developed because it was thought that the first two options would complement each other. The additional lane on the south side of South Frontage Road would be much more effective if many of the trucks that are now exiting the TA Truck Center would exit via the Marine Drive/South Frontage Road/I-84 EB Off-Ramp traffic signal. With this large number of trucks (about 30 during the PM peak hour) now in the lane heading toward their ultimate destination, the new lane to the south can be used primarily for entering traffic and autos. The conflicts should be much less and the condition where one truck blocks all lanes for other trucks would be eliminated, at least at the TA site. This option is shown in Figure 3. Benefits and costs associated with this option are described below:

- Benefits
 - Removing exiting truck traffic from TA Truck Center makes the additional “local access” lane even more effective since one key conflict is removed (this conflict would still remain at the Love’s site)
 - Same additional benefits described above for Option A and Option B
- Costs
 - No additional costs beyond those already described in Option A and Option B, above

This option could make a difference in the short term along South Frontage Road. While truck/auto conflicts will still remain on the east end of South Frontage Road, many of the major truck/auto conflicts at the TA driveways would be reduced. Option A and Option B would work together to help separate key conflicts (trucks/autos, local/through traffic) with more impacts than either would individually.

Without some connection between the Love’s property and the TA property, this option would create the same problem as Option B, trapping Love’s, Days Inn and Shari’s patrons without an exit onto South Frontage Road. A potential connection is shown in Figure 3, which would alleviate this problem. However, this would focus more traffic at the TA access without providing any better control.



LEGEND

-  - Proposed Access
-  - New Connection

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NO SCALE

Figure 3

OPTION C
(Combination of Options A & B)
Troutdale Interchange

Option D: Redirect Love’s Traffic to New Signal at New TA Egress Drive, New Right-Turn Lane between Phoenix Drive and 257th Avenue

This option would create a new egress drive along the eastern edge of the TA property. It would also focus Love’s and TA’s exiting traffic to one signalized location, while adding a new lane on the south side of South Frontage Road for ingress traffic. This option is shown in Figure 4 and benefits and costs are described below:

- Benefits
 - Focuses Love’s and TA’s egress truck traffic at one signalized location
 - Separates Love’s ingress traffic from through traffic on South Frontage Road
- Costs
 - Right-of-way adjacent to Love’s site
 - Traffic signal installation
 - New egress roadway along east edge of TA parking lot
 - Not clear whether signalized access for trucks will provide substantial benefit due to the large amount of green time required for a meaningful number of trucks to be able to egress onto South Frontage Road
 - Requires provision of access between auto and truck portions of Love’s site
 - Requires access between Love’s and TA’s properties
 - Brings additional truck and vehicular traffic to TA property
 - Requires mixing of auto and truck traffic on Love’s site

Intersection Analysis and Control

Analysis was conducted to determine how a new traffic signal at the TA driveway would operate (Table 1). While this intersection would fail in the future ($v/c > 0.85$) when all South Frontage Road lanes are under traffic signal control, another option could be considered which separates through traffic from turning traffic, as described below (partial intersection control).

Table 1: New Traffic Signal at TA Access

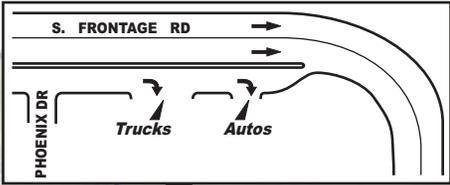
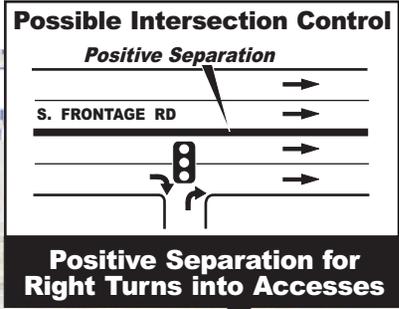
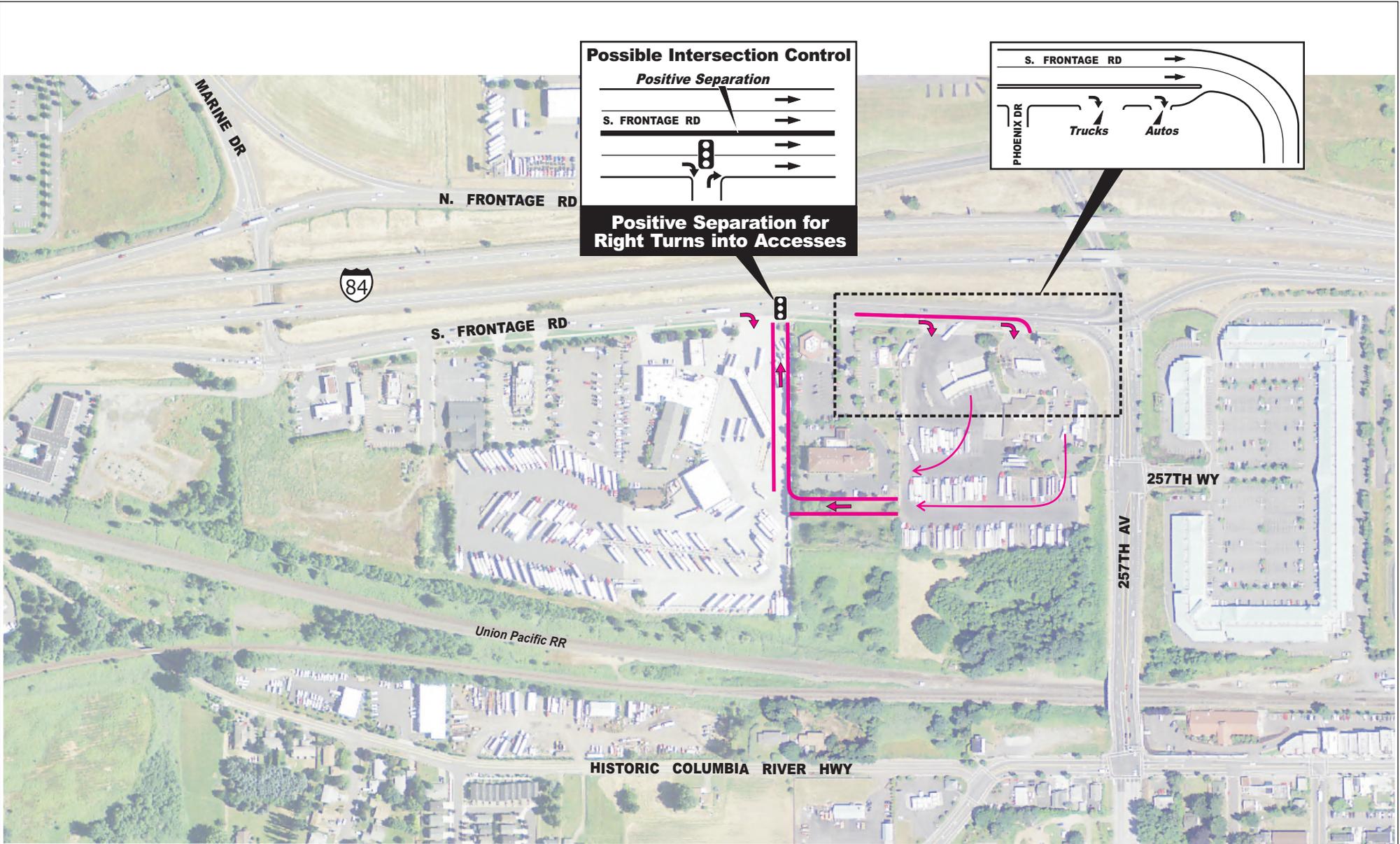
Intersection Configuration	Existing PM Peak LOS V/C	Future (2035) PM Peak LOS V/C
Full Intersection Control	B 0.62	C 0.96
Partial Intersection Control* (Through lanes separated)	C 0.41	B** 0.57

* Does not address weaving between New Signal and 257th Avenue.

** Note that improved level of service for Partial Intersection control scenario is a result of increase through traffic on South Frontage Road, which does not stop and therefore does not experience delay. The volume-to-capacity ratio is, however, higher in the future.

One possible configuration for a traffic signal at the potential TA egress roadway would include positive separation between the northern two eastbound through lanes on South Frontage Road and the two southernmost eastbound through lanes (one would be new). The benefit of separating two lanes would be to allow through traffic to continue unimpeded while providing signalized egress for truck and vehicular traffic.

A major consideration of this traffic control configuration would be the weaving that would occur between the new signalized intersection and the intersection at 257th Avenue/South Frontage Road. Not considering the effect of the weaving to the east, a traffic signal with the intersection control described above would work well under both Existing and 2035 No Build conditions.



LEGEND

- Proposed Access

- Traffic Signal

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NO SCALE

Figure 4

OPTION D

Troutdale Interchange

Option E: Construct Two New Egress Roadways to support South Frontage Road businesses (primarily Love’s and TA). The Roadways would provide focused truck and vehicular egress along the eastern edge of the TA property and along Culpepper Drive. A New Traffic Signal would be constructed at the newly configured TA egress.

This option focuses egress for much of the Love’s and TA truck traffic at two locations, one signalized. This option is shown in Figure 5. Benefits and costs associated with this option are described below:

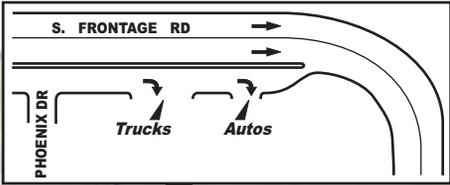
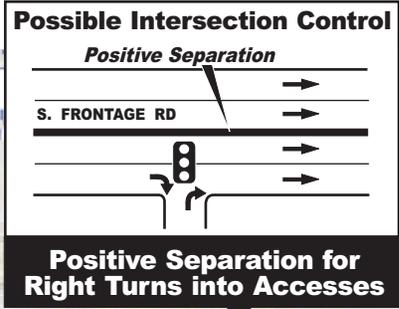
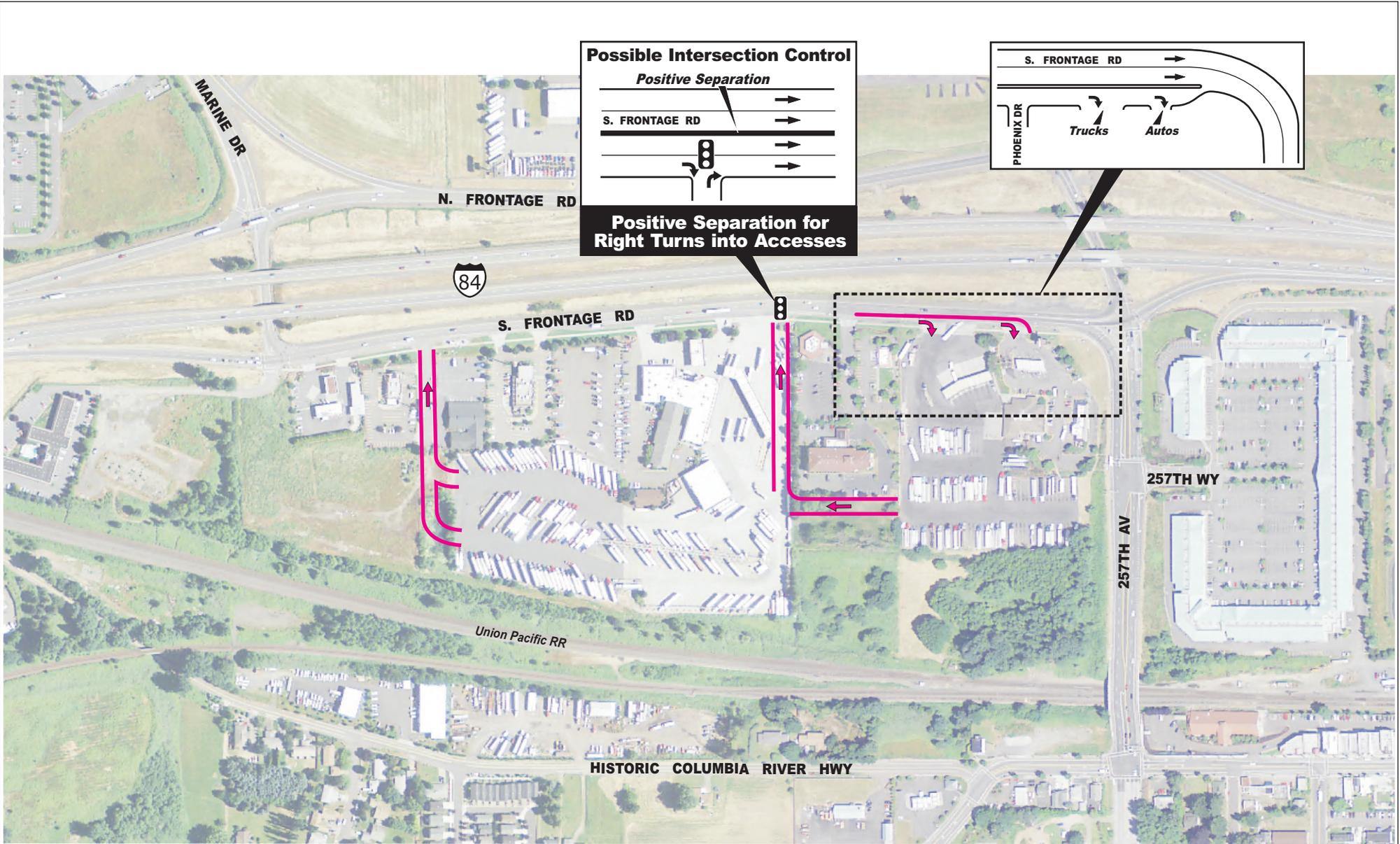
- Benefits
 - Provides one signalized access to South Frontage Road
 - Focuses access to South Frontage Road at two points
 - Focuses some of the conflicts on South Frontage Road
 - Local vs. through traffic
 - Truck vs. auto traffic
 - Requires minimal right-of-way acquisition
 - Traffic entering South Frontage Road from Culpepper Drive may benefit somewhat from traffic gaps created by the traffic signal at I-84 Eastbound Ramps/Marine Drive/South Frontage Road
- Costs
 - Requires some right-of-way acquisition
 - Connection between Love’s and TA properties
 - Connection between TA property and Culpepper Drive (through undeveloped property currently owned by TA)
 - Requires installation of traffic signal
 - Not clear whether signalized access for trucks will provide substantial benefit due to the large amount of green time required for a meaningful number of trucks to be able to egress onto South Frontage Road
 - Brings additional traffic to TA property
 - Requires mixing of auto and truck traffic on Love’s site – which is not possible today due to physical separation between the two areas of the site

Intersection Analysis and Control

Intersection analysis was conducted to determine how a traffic signal at this location would operate under the Option E access configuration. Table 2 summarizes these results under full and partial intersection control (similar to Option D).

Table 2: New Traffic Signal at TA Access

Intersection Configuration	Existing PM Peak		Future (2035) PM Peak	
	LOS	V/C	LOS	V/C
Full Intersection Control	B	0.60	B	0.94
Partial Intersection Control* (Through lanes separated)	B	0.40	B	0.57



LEGEND

- Proposed Access
- Traffic Signal

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Figure 5

OPTION E

Troutdale Interchange

Similar to Option D, one possible configuration for a traffic signal at the TA egress roadway would include positive separation between the northern two eastbound through lanes on South Frontage Road and the two southernmost eastbound through lanes (one would be new). Benefits and costs of this configuration would be the same as described previously, with serious consideration required due to the weaving potential between the potential new traffic signal and 257th Avenue.

It was assumed that 25% of the TA trucks would use the Culpepper access and the remainder would use the new signal. All Love's trucks would use the new signal as would all Love's auto traffic. TA autos were assumed to continue to use the driveways they use currently.

Based on these assumptions, the Culpepper/South Frontage Road access would remain unsignalized and would operate acceptably under both Existing conditions (LOS A) and under 2035 No Build conditions (LOS D). The new signal at the TA driveway would fail under full intersection control in the future ($v/c > 0.85$), but under partial intersection control, it would operate at level of service B under both Existing and 2035 No Build conditions, with the volume-to-capacity ratio declining slightly from 0.40 to 0.57 under the partial intersection control configuration described above. Again, this does not consider the effects of weaving east of the signal, which could be a serious concern.

Option F: Combination of Option A and Option D - Redirect Love's Traffic to New TA Egress Drive, Positive Separation between South Frontage Road Through Lanes and Business Access Lane (between TA Auto Access and Love's Truck Access), New Traffic Signal on South Frontage Road at TA Egress Drive. Also, add one-way egress connection from TA parking lot to Marine Drive/South Frontage Road (two-way for a short distance at South Frontage Road to allow access to properties to west). New right-turn lane for length of South Frontage Road, including positive separation from approximately 600 feet west of new TA Egress Drive (gap in positive separation between signal and Phoenix Drive).

This option separates through traffic headed from Portland to Troutdale (south of the interchange) from local business traffic along South Frontage Road. It also focuses egress for much of the Love's and TA truck traffic at two locations, one along the eastern border of TA's property and one at Marine Drive. Since weaving between through and local traffic is a concern east of the TA access/egress, a new signal is proposed to regulate traffic at the new TA egress drive, approximately 1,000 feet in advance of the 257th Avenue intersection. This option is shown in Figure 6. Benefits and costs associated with this option are described below:

- Benefits
 - Focuses truck access to South Frontage Road at two locations
 - Separates TA's and Love's ingress and egress traffic from through traffic on South Frontage Road
 - Addresses weaving concern between "through" and "local" traffic in advance of 257th Avenue intersection
 - Promotes circular flow of truck traffic through TA site and reduces conflicts between trucks entering and exiting the site
- Costs
 - Requires right-of-way acquisition and construction of additional right turn lane for length of South Frontage Road
 - Requires right-of-way acquisition—connection between Love's and TA properties
 - Requires right-of-way acquisition—connection between TA property and Marine Drive (may be owned by TA)
 - Requires installation of traffic signal (New TA Egress Drive)
 - Requires modification of traffic signal (Marine Drive/S. Frontage Road)
 - Requires installation of positive separation
 - Brings additional traffic to TA property
 - Requires mixing of auto and truck traffic on Love's site – which is not possible today due to physical separation between the two areas of the site

This option has the benefit of separating local/truck traffic from through traffic by using positive separation between through traffic lanes and a local traffic lane wide enough to accommodate truck maneuvering. A traffic signal approximately 1,000 feet in advance of the 257th Avenue intersection would predominately serve through traffic, but would provide better access to the intersection for trucks as well. It would eliminate the weaving concern noted in Options D and E, however, the access at Phoenix Drive will not be restricted and would remain a possible conflict.

This option will require additional study to determine its feasibility, including specific right-of-way requirements, capacity requirements (i.e. number of lanes for through versus local/truck traffic),

positive separation start and end points and construction costs. Preliminary traffic signal capacity analysis was conducted at the Marine Drive/South Frontage Road and New TA Egress/South Frontage Road intersections and is summarized in Table 3.

Table 3: Option F Intersection Analysis Summary

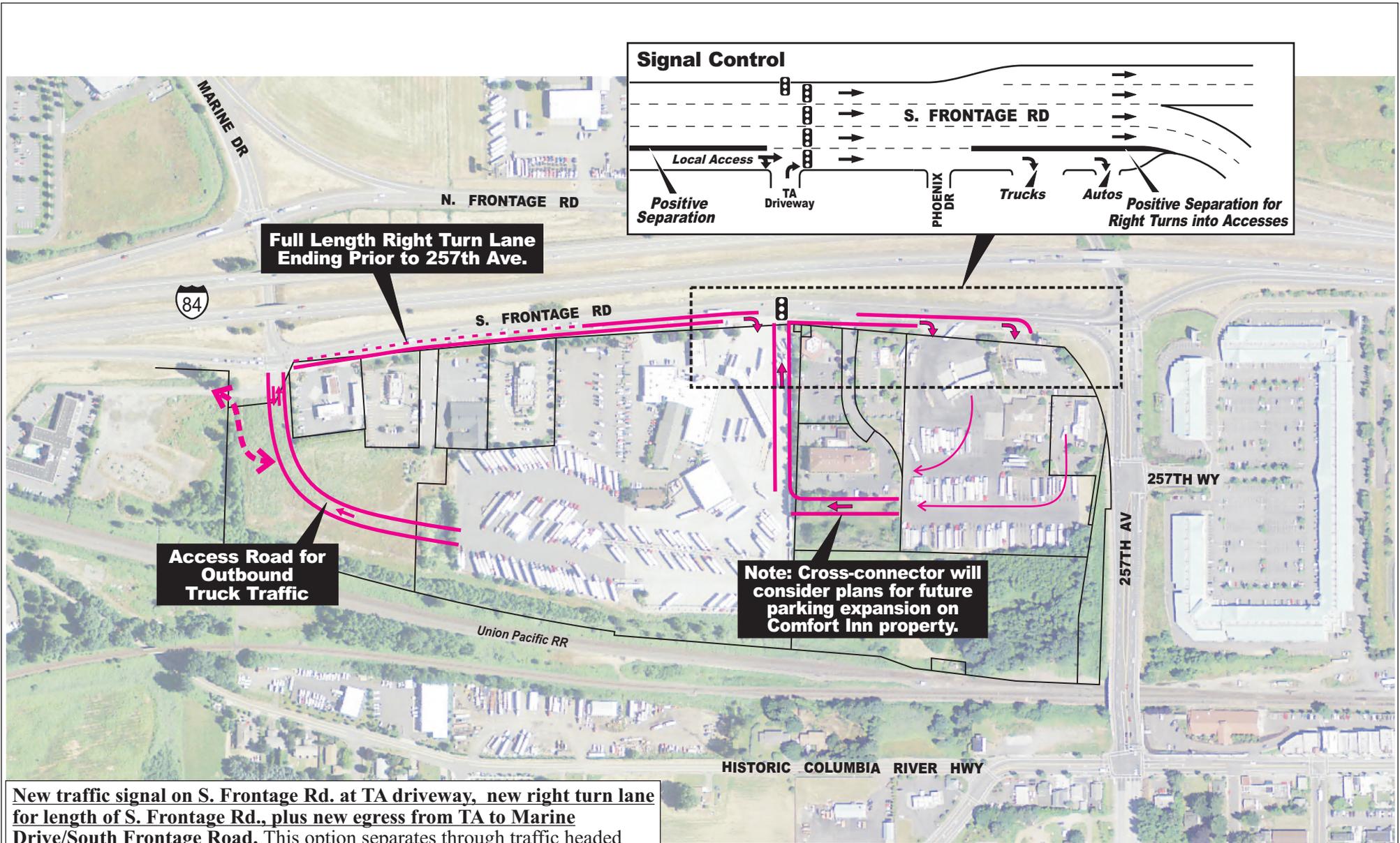
Intersection Configuration	Existing PM Peak		Future (2035) PM Peak ¹	
	LOS	V/C	LOS	V/C
Marine Drive/S. Frontage Rd.	B	0.55	D	0.99
New TA Egress/S. Frontage Rd.	B	0.61	B	0.88

As shown in Table 3, both intersections would operate acceptably in the near term. However, in the future, the Marine Drive/South Frontage Road intersection will operate nearly at capacity. Both Existing and Future analysis assumes the existing configuration at the Marine Drive/South Frontage Road intersection (i.e. Marine Drive remains one-way southbound). Since this is intended to be a short term solution, preliminary analysis indicates that it would operate acceptably.

Since there is a good chance that the I-84 bridge over Marine Drive will be widened to accommodate two-way traffic on Marine Drive in the near future (possibly within 5 years), future (2035) intersection level of service analysis was run at the Marine Drive/South Frontage Road intersection, assuming the improvement was in place.² Based on these assumptions, the Marine Drive/South Frontage Road intersection would operate acceptably (LOS D, V/C=0.94).

¹ Note that future volumes assume growth on South Frontage Road, but no growth for South Frontage Road land uses. This analysis scenario was run simply as a sensitivity test to determine how well these intersections would work as traffic on South Frontage Road grows. Metro is currently updating 2035 growth forecasts to adjust for recession impacts. As a result, the 2035 conditions described above would likely occur well after 2035.

² See note 1 above: Again, no growth assumed for South Frontage Road land uses.



Full Length Right Turn Lane Ending Prior to 257th Ave.

Access Road for Outbound Truck Traffic

Note: Cross-connector will consider plans for future parking expansion on Comfort Inn property.

New traffic signal on S. Frontage Rd. at TA driveway, new right turn lane for length of S. Frontage Rd., plus new egress from TA to Marine Drive/South Frontage Road. This option separates through traffic headed from Portland to Troutdale (south of the interchange) from local business traffic along South Frontage Road and regulates traffic at TA's existing driveway. It includes construction of a right turn lane for the length of S. Frontage Rd. Impacts include right-of-way (including cross-access easement on Comfort Inn property), traffic signal and positive separation costs, the mixing of auto and truck traffic on Love's site, and worsened signal operation at Marine Drive/S. Frontage Rd. Benefits include focusing TA truck traffic at two signalized accesses, allowing circular flow of truck traffic through the TA site and reducing conflicts between trucks entering and exiting the site.

LEGEND

- Proposed Access
- New Connection
- Approximate Property Lines
- Traffic Signal

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NO SCALE

Figure 6

OPTION F
Troutdale Interchange

SUMMARY/RECOMMENDATIONS

Any of these options would provide an improvement to operations along South Frontage Road. Option B should be considered a partial solution since it would “trap” vehicles entering the Love’s, Comfort Inn and Shari’s sites without providing them a feasible egress. Options A, C and F would require the most right-of-way acquisition, but Options C, D, E and F would require some sort of cross-access easement between the Love’s and TA properties and with Options D, E and F also requiring an easement along the east side of the TA property providing egress for properties to the east. Operationally, none of the options meet ODOT’s volume-to-capacity standard under Future traffic volume conditions, except Option F, however, each of them could be feasible short term solutions.

Option A, C and F would put additional pressure on the Marine Drive/I-84 Eastbound Off-Ramp traffic signal and the consequences of exceeding capacity at this location are high, since the Eastbound Off-ramp could back up onto I-84. A traffic signal at the TA access (Options D, E and F) would be less likely to create such a safety concern on I-84, however, any option that adds a traffic signal midway on South Frontage Road and does not fully control all approach lanes will introduce a weaving conflict that could be very significant. Further study is required to better understand the feasibility of that element.

Input from the Policy Advisory Committee indicates interest in Option F. However, this option has been removed from consideration for technical/legal reasons since it lacks support from affected property owners.

If this option were to be considered, additional analysis will be necessary to determine how specific elements of Option F will be designed, for example how far back the positive separation is carried west of the new TA Egress driveway, where cross-access easements should be located between the TA property and Marine Drive and between the Love’s property and the new TA Egress drive. It was the committee’s desire that the Comfort Inn property be impacted as little as possible, with consideration given to their plans for parking lot expansion in the future.

The purpose of this study was to determine whether there were any short term, lower cost, options to improve access and circulation on South Frontage Road. Since the preferred option has been removed from consideration, the Marine Drive Extension, as recommended in the Troutdale TSP, would again become an important project for the City and ODOT to pursue.