Appendix E
National Research Safety Statistics on Light Rail

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As part of the qualitative safety analysis performed for the East Link light rail alternatives, the guidance in following Federal Transit Administration (FTA) publications and Sound Transit Central Link collision data was used to generate many of the conclusions regarding the safety of the alternatives:

- Transit Cooperative Research Program (TCRP) Report 17, Integration of Light Rail Transit into City Streets, 1996
- TCRP Report 69, Light Rail Service Pedestrian and Vehicular Safety, 2001.

This appendix summarizes findings from these reports that apply to the track designs proposed for the East Link Project.

E.1 At-Grade Side-Running within Right-of-Way but Outside Vehicle Travel Way, and At-Grade Median-Running with Curb and Fencing

This design has distinct advantages in fewer accidents between trains and pedestrians or vehicles because of the separation between train traffic from vehicular and pedestrian traffic. This can be seen in the findings from TCRP Report 17, which showed that only 8 percent of accidents occurred along these types of facilities despite the fact that these designs accounted for 62 percent of mainline track miles. Furthermore, TCRP Report 17 reported an overall average of 1.11 accidents per year per mainline track mile for the light rail systems surveyed. For designs with less train separation, the average was 3.7 accidents per year per mainline.

The findings are also backed by TCRP Report 69, in which the survey of current systems found that 77 percent of light rail track miles fit into this design category, but only 13 percent of annual accidents occurred on these track miles. Furthermore, the average number of accidents per crossing was 0.17 accidents per crossing-year, compared to 0.54 accidents per crossing-year for the category with less train separation**.**

However, this design does exhibit safety problems in terms of crash severity. Because the more exclusive right-of-way allows for higher travel speeds, collisions tend to be more severe. TRCP Report 69 reported that, for this design, 19 percent of vehicle-train accidents resulted in a fatality, and 29 percent of pedestrian-train accidents resulted in a fatality. In comparison to the less exclusive designs, fatal accidents accounted for 1 percent and 18 percent, respectively.

E.2 At-Grade Median-Running with Curb or Striping, and Nonexclusive Designs

These designs are use lower speeds for the trains, and the trains mix with vehicle and pedestrian traffic in the same right-of-way with little or no physical separation. The general experience is that these designs have more accidents because of the increased interaction between the trains and pedestrians or vehicles. This is supported by TCRP Report 17, which found that 92 percent of accidents were along these types of routes despite the fact that only 38 percent of mainline track miles were of this design. TRCP Report 69 revealed similar patterns, because the average crossing had 0.54 accidents per crossing-year, compared to 0.17 accidents per crossing-year for the more exclusive design type.

From a traffic safety perspective, this design performed better in accident severity. Fatal accidents represented a far smaller percentage for both vehicle-train and pedestrian-train accidents. The lower light rail travel speeds with this design appear to provide some protection to pedestrians and motorists.

In addition to the national research conducted, relevant local data is available along Martin Luther King, Jr. Way in the City of Seattle. The light rail train system along Martin Luther King Jr. Way operates along four miles of

track at-grade in the center median similar to many East Link alignment profiles. Since the opening of the Central Link system in July 2009, seven light rail train and vehicle accidents and one light rail train and pedestrian accident occurred and overall corridor accidents per year reduced from 327 (before light rail) to 134 (after light rail). The light rail train and vehicle or pedestrian accidents constitute about 6% of the total number of accidents along the corridor and the corridor total reduced by close to 60% once the LRT revenue service began. The LRT median barrier restricting vehicle turns to signalized intersection was a contributing factor in the overall accident reduction along the corridor. None of the LRT-related accidents were considered life-threatening and all of the LRT-vehicle accidents involved vehicles illegally turning.

E.3 Elevated Median-Running, and Retained-Cut Median-Running

Both designs separate transit and vehicle operations, one with an elevated track and the other with a retained cut. Because the trains and motorists operate in separate travelways, there is no ability for a vehicle-train accident to happen or for a train to collide with a pedestrian or bicyclist. Furthermore, the designs provide additional safety by separating opposite directions of travel, limiting mid-block turning movements, and even converting some intersections into right-in/right-out (RI/RO) design. These will effectively eliminate mid-block accidents that involve left-turning traffic. However, it is possible that some of the mid-block accidents could redistribute to nearby intersections because motorists would have to choose different routes in order to complete their trips, such as a U-turn at a signal followed by a right turn instead of a direct left turn.


City of Des Moines, WA

Likely the largest traffic safety issue is vehicle accidents with the center pier of an elevated track or the concrete wall protecting a trench track. However, the expectation is that these accidents would happen at low vehicle speeds (≤35 miles per hour [mph]) and would likely result in property damage only. Furthermore, increased median widths to provide greater offset distances could be used for either design. In addition, for the elevated track design, alternative curb designs that provide more protection could be used instead of the traditional 6-inch curb. Such alternative designs may include taller 9-inch curbs or a low-profile median barrier used in the City of Des Moines, Washington, as shown in the photo above (FTA, *Public Roads,* "Preventing Roadway Departures," July/August 2005. http://www.tfhrc.gov/pubrds/05jul/03.htm*).*

E.4 One-Way Couplets with At-Grade Tracks within Street Travelway

Numerous cities in the United States, such as Denver, Colorado, have designed and built light rail systems that operate on one-way streets in the opposite direction. In general, the conversion of two-way streets to one-way couplets with light rail can have both positive and negative impacts for motor vehicle, pedestrian, and bicycle traffic. For example, one-way streets have fewer conflict points at intersections, which can reduce vehicle collisions. However, higher travel speeds that can accompany one-way streets can create additional safety problems for pedestrians and bicyclists.

Specifically regarding the East Link Couplet Alternative (C4A), the light rail train would travel southbound on 108th Avenue NE along the west side of the street in an exclusive lane. Auto traffic would travel one-way northbound in up to three lanes to the east. This would obey United States driving conditions with oncoming traffic (light rail) to the left. The advantage of light rail traveling in the opposite direction from automobiles is that drivers can see the light rail train coming towards them, particularly as they turn left. If the train traveled the same direction as the cars, drivers would be turning right across the track with a train potentially coming from behind, out of their vision. In the downtown environment, the proposed configuration (light rail train opposite cars) also represents a typical street for pedestrians and cross-traffic with the curbside lane/track coming from the

left. Finally, buses require a contra-flow lane on the one-way streets adjacent to the Bellevue Transit Center to maintain their routing and provide full access, so with the proposed roadway configuration, they would be able to share the track with the train between NE 8th and NE 4th streets in a joint-use operation.

Along 110th Avenue NE, light rail and vehicle operations would operate in the opposite directions as 108th Avenue NE but the same conclusions for 108th Avenue NE apply.