4 Transportation Impacts

This chapter compares the potential transportation impacts associated with the implementation of passenger rail service within the corridor alternatives with the potential impacts of the No Build Alternative. Future ridership projections for passenger rail service are presented for each corridor alternative. In addition to passenger rail service characteristics, impacts to freight rail service, grade crossings, and vehicular traffic are discussed, including potential impacts during construction and long-term changes associated with highway/railroad grade crossings.

Rather than include transportation impacts in **Chapter 5, Existing Conditions and Environmental Consequences** as one facet of the environment, these impacts have their own chapter in this Tier 1 EIS. The impacts speak directly to the purpose and need for the project; and, as a transportation project is being proposed to solve a transportation problem, the transportation impacts of the two corridor alternatives and of the No Build Alternative are of a magnitude that warrants their own chapter in the EIS.

ADOT has coordinated with all local agencies to obtain readily available long-range transportation plans within the study corridor illustrated in **Figure 1-1**. Major existing and planned transportation facilities for each transportation mode have been identified, including locations with substantial existing levels of congestion. A list of these plans and studies is included in the AA.

A separate Service Development Plan (SDP) will be prepared as part of the APRCS following the approval of the Record of Decision (ROD). The SDP will provide more detail of the proposed passenger rail service.

4.1 Service Concept and Travel Forecasting

A primary objective of passenger rail is to deliver a service that can provide an effective alternative mode within the corridor. The success of the system depends on the travel time achievable and the reliability of the service compared to alternative travel modes. This section details the concept for service used for the Yellow and Orange corridor alternatives, assuming a regional higher speed (between 80 and 125 mph) train operation and building upon a blend of intercity and commuter considerations. These service assumptions (i.e., frequency of intercity or commuter trains, times of operation, schedule, stops, etc.) were developed to estimate ridership and capital and operating costs, as well as the effect of changes in vehicle miles traveled (VMT) on safety, noise, vibration, and air quality. The findings in this chapter are approximations based on a passenger rail system built on the alignments used in the AA. A future alignment elsewhere within the corridor alternatives may have different impacts and would be reevaluated in Tier 2 studies.

The FTA-developed Simplified Trips-on-Project Software (STOPS) model was used to provide an estimate of ridership for each of the corridor alternatives. The model replaces the standard "trip generation" and "trip distribution" steps with CTPP tabulations to predict detailed travel patterns, to quantify trips-on-project measure for all travelers and for transit-dependents, and to compute the change in automobile VMT based on the change in overall passenger rail ridership between the No Build and the corridor alternative scenarios.

4.1.1 Yellow Corridor Alternative

For the purposes of this transportation impact analysis, the alignment of the Yellow Corridor Alternative would take advantage of an existing UP ROW. A passenger rail system operating at grade within the corridor would likely affect land uses and crossings along its entire length. At the same time, it could serve major population and activity centers and connect key trip origins and destinations directly. Potential station stops (shown in **Table 4-1**), frequencies, and overall travel times between terminal stations for the Yellow Corridor Alternative are summarized in this section. Documented assumptions include all three modeled Yellow Corridor Alternative service patterns, defined below and shown in **Figure 4-1**. It is possible for the commuter and intercity service patterns to overlap and run concurrently.

- Commuter (Grand Corridor) – TUS to Surprise
- Commuter (Yuma West Corridor) – TUS to Buckeye
- Intercity – Downtown Tucson to Downtown Phoenix

Table 4-1. Yellow Corridor Alternative Conceptual Stations

Station Name	Grand Corridor Pattern	Yuma Corridor Pattern	Intercity Pattern
Tucson International Airport	X	X	
Tucson	X	X	X
Orange Grove	X	X	
Tangerine Road	X	X	
Eloy	X	X	X
Coolidge	X	X	
San Tan Valley	X	X	
Queen Creek	X	X	
Cooley	X	X	

Table 4-1. Yellow Corridor Alternative Conceptual Stations

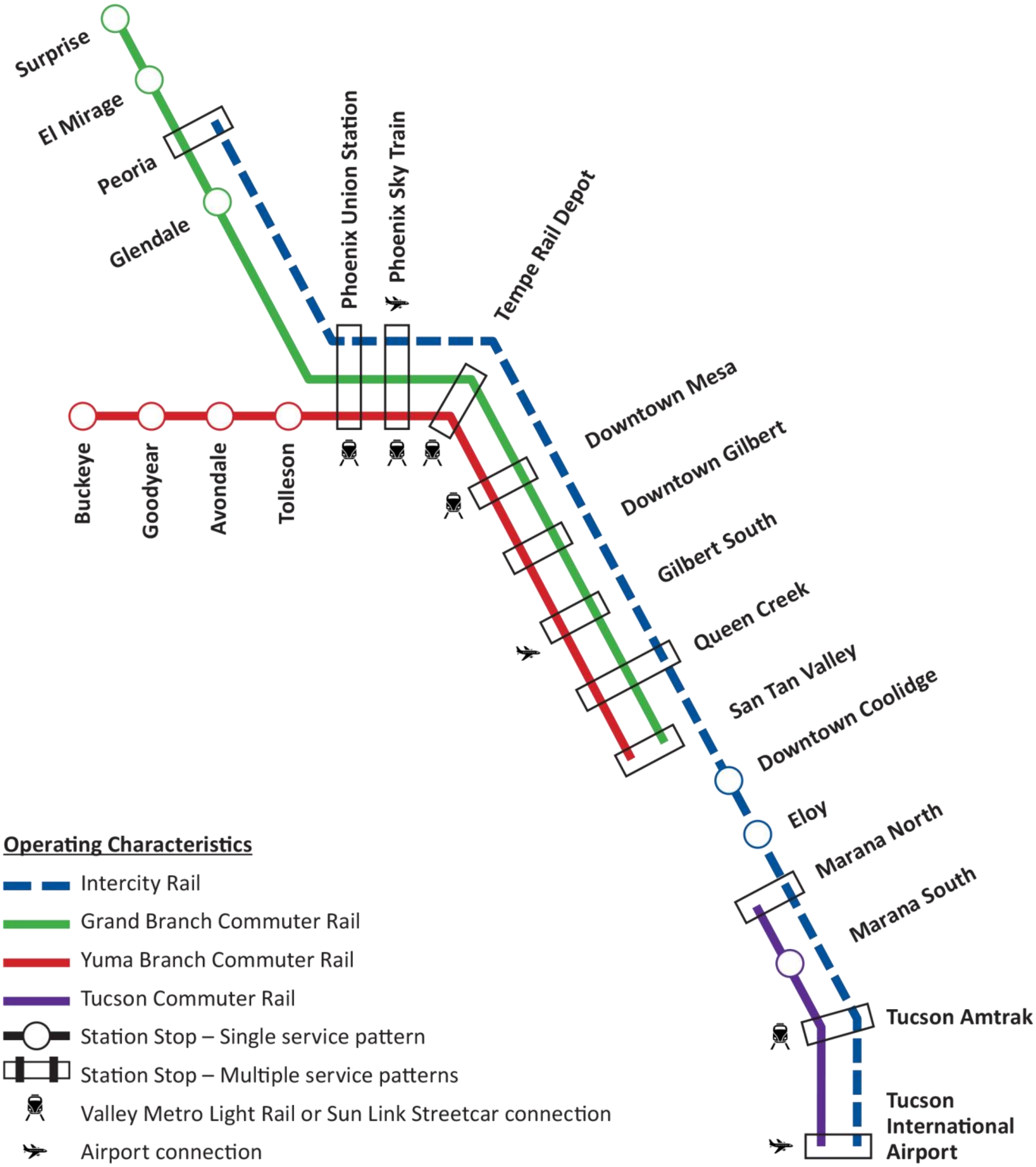
Station Name	Grand Corridor Pattern	Yuma Corridor Pattern	Intercity Pattern
Downtown Gilbert	X	X	
Downtown Mesa	X	X	
Tempe	X	X	
PHX	X	X	X
Phoenix	X	X	X
Glendale	X		
Peoria	X		
El Mirage	X		
Surprise	X		
Avondale		X	
Goodyear		X	
Buckeye		X	

Table 4-2 compares the assumptions for the combined frequencies (headways—the interval of time between trains on the same route—in minutes) of the three modeled Yellow Corridor Alternative service patterns.

Table 4-2. Yellow Corridor Alternative Frequencies

		Headways (minutes)			
From Time	To Time	Grand Corridor Pattern	Yuma Corridor Pattern	Intercity Pattern	Combined Headway between DT Phoenix & DT Tucson
			Southbound		
5:30:00	9:29:00	30	60	60	15
9:30:00	14:59:00	180	180	---	90
15:00:00	18:59:00	30	60	60	15
			Northbound		
5:30:00	9:29:00	30	60	60	15
9:30:00	14:59:00	180	180	---	90
15:00:00	18:59:00	30	60	60	15

Figure 4-1. Yellow Corridor Alternative Operational Context



Total travel times based on detailed station-to-station travel times used in the AA are displayed in **Table 4-3**.

Table 4-3. Yellow Corridor Alternative Travel Times (Tucson to Phoenix)

Station Name	Commuter Operating Pattern	Intercity Operating Pattern
Northbound	1:35:00	1:23:00
Southbound	1:36:00	1:22:00

4.1.2 Orange Corridor Alternative

For the purposes of this transportation impact analysis, the Orange Corridor Alternative would not make use of the existing rail corridor but would follow existing or proposed highways. Similar to the analysis in the AA, the Orange Corridor Alternative is assumed to be located on a separate alignment within highway corridors and may be grade separated in places (most likely elevated) to eliminate the need for numerous grade crossings and expedite travel within the metropolitan Phoenix area. This alternative would afford opportunities for higher speed rail travel but would include a substantial structural component in the project cost. The use of existing or proposed highway corridors would also impose certain constraints on the potential alignments, some of which do not serve population centers directly. In some cases, this could necessitate the use of a secondary transit service (e.g., bus or light rail) to access destinations. Potential station stops (shown in **Table 4-4**), frequencies, and overall travel times between terminal stations for the Orange Corridor Alternative are summarized in this section. Documented assumptions include all three modeled Orange Corridor Alternative service patterns as described below and shown in **Figure 4-2.**

- Grand Corridor Pattern – TUS to Surprise
- Yuma West Corridor Pattern – TUS to Buckeye
- Intercity Pattern – Downtown Tucson to Downtown Phoenix

Table 4-4. Orange Corridor Alternative Conceptual Stations

Station Name	Grand Corridor Pattern	Yuma Corridor Pattern	Intercity Pattern
TUS	X	X	
Tucson	X	X	X
Marana - Orange Grove	X	X	
Marana - Tangerine	X	X	
Eloy	X	X	X

Table 4-4. Orange Corridor Alternative Conceptual Stations

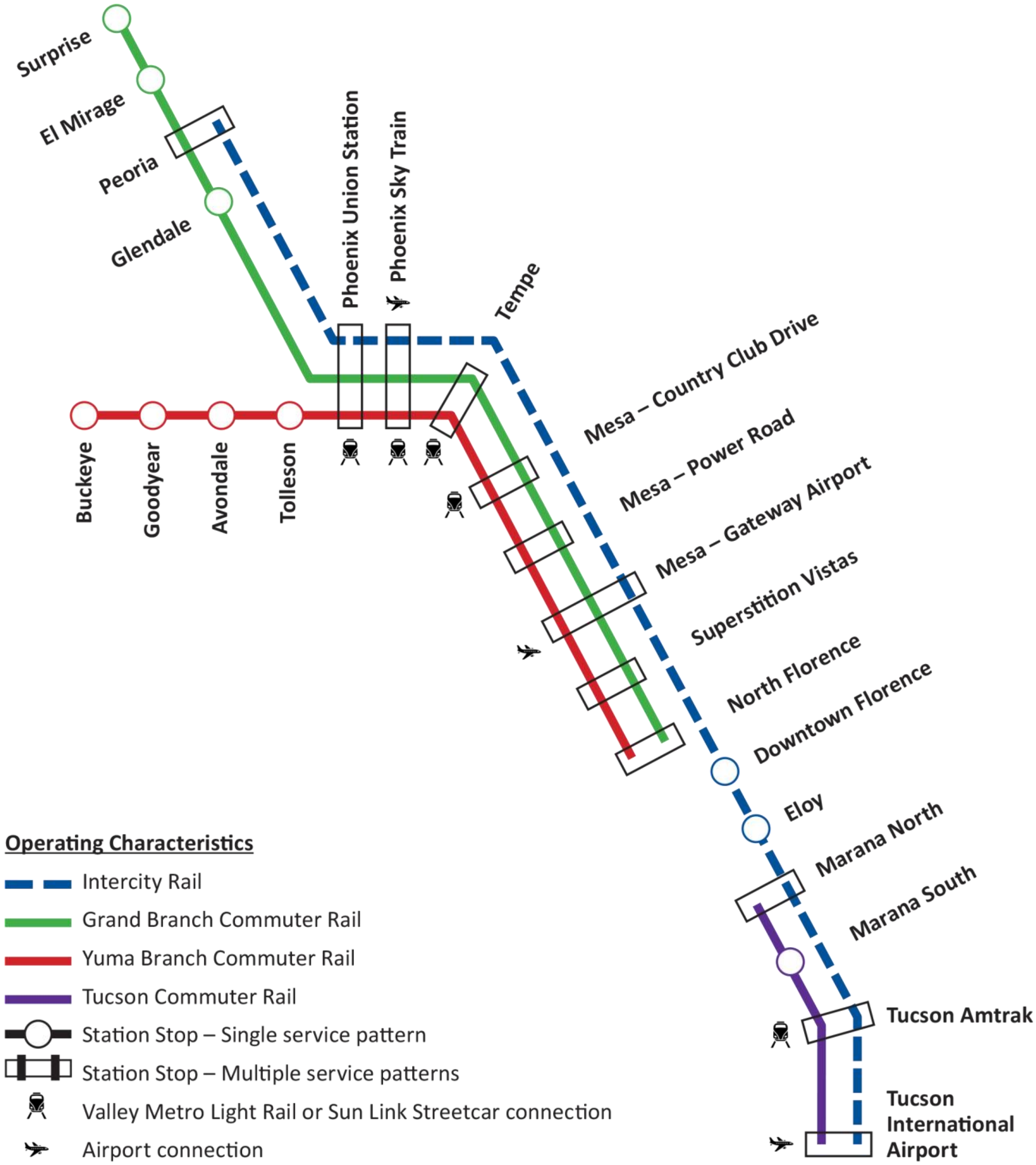
Station Name	Grand Corridor Pattern	Yuma Corridor Pattern	Intercity Pattern
Coolidge-Florence	X	X	
North Florence	X	X	
Superstition Vistas	X	X	
Mesa-Gateway Airport	X	X	
Mesa-Power	X	X	
Mesa-Country Club	X	X	
Tempe	X	X	
PHX	X	X	X
Phoenix	X	X	X
Glendale	X		
Peoria	X		
El Mirage	X		
Surprise	X		
Avondale		X	
Goodyear		X	
Buckeye		X	

Table 4-5 compares the assumptions for the combined frequencies (headways—the interval of time between trains on the same route—in minutes) of the three modeled Yellow Corridor Alternative service patterns.

Table 4-5. Orange Corridor Alternative Frequencies

		Headways (minutes)			
From Time	To Time	Grand Corridor Pattern	Yuma Corridor Pattern	Intercity Pattern	Combined Headway between DT Phoenix & DT Tucson
Southbound					
5:30:00	9:29:00	30	60	60	15
9:30:00	14:59:00	180	180	---	90
15:00:00	18:59:00	30	60	60	15
Northbound					
5:30:00	9:29:00	30	60	60	15
9:30:00	14:59:00	180	180	---	90
15:00:00	18:59:00	30	60	60	15

Figure 4-2. Orange Corridor Alternative Operational Context



Total travel times based on detailed station-to-station travel times used in the AA are displayed in **Table 4-6**.

Table 4-6. Orange Corridor Alternative Travel Times (Tucson to Phoenix)

Travel Direction	Commuter Operating Pattern	Intercity Operating Pattern
Northbound	1:44:00	1:30:00
Southbound	1:45:30	1:30:00

No passenger rail service currently operates within the Orange Corridor Alternative. UP operates approximately 10-15 freight trains per day on the Phoenix Subdivision line (between Eloy and downtown Phoenix) with speeds ranging between 15 miles per hour (mph) and 60 mph. Conditions would not change with the No Build Alternative.

4.1.3 Travel Demand/Benefits

Chapter 1, Purpose and Need of this Tier 1 EIS identifies the need to provide an effective alternative to automobile travel within the study corridor because conditions on the highway system are expected to deteriorate over time as population and travel in the corridor grow. The corridor alternatives were developed with that intent. The quantification of travel and safety benefits using anticipated changes in travel time, ridership, and VMT for each corridor alternative is the basis for the comparison of those measures in this chapter, as well as air quality and energy consumption (in **Chapter 5, Existing Conditions and Environmental Consequences**), compared with anticipated conditions under the No Build Alternative.

Corridor Alternatives

Travel Time

The SDP will be completed and adopted by ADOT following the publication of the Final EIS and issuance of a FRA Record of Decision. Given the assumed level of rail service outlined in the SDP as it is being developed, the corresponding personal vehicle travel time between the two urbanized areas is detailed in **Table 4-7**. No Build Alternative travel times are based on the Arizona Statewide Travel Demand Model version 2 (AZTDM2).

Table 4-7. Estimated Rail and Auto Travel Times between Tucson and Phoenix

	Yellow Corridor Rail Alternative (Hrs:Min)	Orange Corridor Rail Alternative (Hrs:Min)	No Build Alternative (Auto Travel) (Hrs:Min)
2010			1:53
2035	1:23 (Intercity)	1:30 (Intercity)	2:22
2050	1:23 (Intercity)	1:30 (Intercity)	2:59

Ridership

Ridership forecasts are a measure of the potential success of the proposed service based on the demand for its use. Ridership was estimated using an FTA forecasting model called STOPS. It was designed specifically to estimate ridership on fixed guideway systems. While its original purpose was for travel in urban environments on New Starts and Small Starts (FTA grant programs for funding major infrastructure investments) projects, it generates reasonably high-level forecasts for the Tier 1 EIS analysis of the Tucson to Phoenix corridor.

The development of STOPS evolved directly from the requirement established in FTA's Final Rule on major capital investments: to provide a simplified method that project sponsors can use, at their option, to quantify the trips-on-project measure and the VMT change needed for the environmental effects analysis.

Because the proposed service is a blended concept that includes intercity and commuter trips, the STOPS application was set up to identify trips of less than 40 miles and trips of more than 40 miles. The longer trips are an estimate of the expected intercity travel demand.

The output from STOPS shows both unlinked and linked transit trips in the modeled area. The "unlinked" trips are all the component segments of a transit trip identified separately (i.e., a transfer from one bus route to another represents two unlinked trips), while "linked" trips count the entire trip from beginning to end as a single trip (i.e., the same two unlinked trips in the transfer above represent a single linked trip). This information is shown quantitatively in **Table 4-8**.

Table 4-8. Year 2035 Tucson-Phoenix Commuter and Intercity Trip Demand

	Yellow Corridor Alternative	Orange Corridor Alternative	No Build Alternative
Unlinked transit trips	476,000	475,000	451,000
Linked transit trips	343,000	343,000	324,000
Total Daily Rail Ridership	**20,060**	**18,080**	N/A
Intercity trips (>40 miles)	3,360	4,140	N/A
Commute trips (<40 miles)	16,700	13,940	N/A
Total by Service Type	20,060	18,080	
Daily VMT reduction	566,914	570,268	N/A
Daily VHT reduction	17,522	17,655	N/A
Notes: VHT = Vehicle Hours Traveled			

Safety

Overall passenger safety in the corridor would improve because passenger rail service would divert some automobile trips to an alternate mode of travel. The safety risk to travelers would decrease, as rail travel is statistically safer per passenger mile than automobile travel. The overall potential decrease in automobile traffic that could be realized with implementation of passenger rail service would be expected to reduce potential automobile injuries and fatalities within the corridor. The potential annual reduction in fatalities and injuries within the Yellow and Orange corridor alternatives is estimated as part of FTA STOPS model forecasts and shown in **Table 4-9**.

Table 4-9. Safety Improvement (per 1,000,000 VMT in 2035)

	Yellow Corridor Alternative	Orange Corridor Alternative	No Build Alternative[a]
Annual fatality reduction	2.2	2.2	N/A
Annual injury reduction	33.2	33.4	N/A
Note: Assumes trains run 300 days a year. [a] Potential increases in fatalities and injuries under the No Build Alternative were not estimated for this Tier 1 analysis.			

With additional trains operating within either corridor alternative, the possibility of train collisions is increased as a result of increased activity between freight and passenger services and a higher number of trains at grade crossings; however, the signaling system, such as positive train control as required by the Rail Safety Improvement Act of 2008 (RSIA), would be designed to mitigate this risk.

No Build Alternative

Current travel time between Tucson and Phoenix is approximately 113 minutes and is projected to increase to 179 minutes by 2050, even with the addition of substantial new roadway capacity along I-10 and on the proposed North-South Corridor, based on AZTDM2. No passenger rail service currently exists in the Tucson-to-Phoenix corridor.

4.2 Operational Impacts to Freight Rail Service

4.2.1 Corridor Alternatives

Yellow Corridor Alternative

ADOT has had ongoing discussions with UP, the freight operator in the corridor, related to the proposed Yellow Alternative. Based on the information obtained from UP and analysis of the alternative, the implementation of passenger rail within the Yellow Corridor Alternative is not expected to result in a change in the number of freight trains currently operating in the Tucson to Phoenix corridor, although some freight train scheduling modifications may be required to prevent conflicts with passenger service. Upgrades to the existing UP track were assumed as part of this alternative in addition to projects to accommodate passenger rail operations. These potential improvements include:

- New at-grade single track
- New at-grade siding tracks
- New siding turnouts, where needed
- New roadway-rail grade crossings
- Reconfiguration of UP track where needed
- Centralized train control signal systems
- Positive train control systems where required by FRA regulations.

These projects would allow continued service to freight customers and mitigate potential restrictions to freight movements.

Orange Corridor Alternative

The implementation of passenger rail within the Orange Corridor Alternative would have minimal impact to existing freight rail service. Impacts would be restricted to the portion of the corridor between Tempe and downtown Phoenix/West Valley and downtown Tucson to TUS. Within the portion of the passenger rail corridor which is shared with the freight rail corridor, the following typical projects would be implemented:

- Rehabilitation of single track where necessary
- New at-grade single track
- New at-grade siding tracks
- Centralized train control signal systems
- Positive train control systems where freight and passenger train activity intersect

During operation of the passenger rail system, freight rail service could be maintained with minimal scheduling modifications and limited need for coordination with the passenger rail service.

4.2.2 No Build Alternative

The No Build Alternative consists of current freight rail conditions with no additional track upgrades, capacity increases, or signal projects planned.

4.3 Grade Crossing Impacts

4.3.1 Corridor Alternatives

Yellow Corridor Alternative

Under the Yellow Corridor Alternative, modifications or improvements would be made to all grade crossing signals. Additionally, it is possible that some grade crossings would be converted to grade-separated crossings. All grade crossings would be upgraded to four-quadrant gates. For locations already equipped with four-quadrant gates, construction to accommodate the upgraded service could be required, such as in areas with additional track. Grade-separated crossings can be considered as part of implementing the Yellow Corridor Alternative and require further analysis. Some locations can be determined using safety records maintained by ADOT, but the identification of the exact locations would require further analysis. Vehicular delay at the grade crossings would increase due to the addition of the more frequent passenger rail operations and advanced warning times. This delay would be eliminated at grade separations.

Orange Corridor Alternative

Under the Orange Corridor Alternative, modifications or improvements would be made to all grade crossing signals, which are limited to the areas between Marana and TUS, and between downtown Tempe and downtown Phoenix. Additionally, 15 new grade-separated crossings would be assumed to be installed in the area between Marana and Phoenix-Mesa Gateway Airport as part of the North-South Corridor development and the use of the Superstition Vistas transit corridor. All grade crossings would be upgraded to four-quadrant gates. For locations already equipped with four-quadrant gates, construction to accommodate the upgraded service may be required, such as in areas with additional track. Vehicular delay at existing grade crossings would increase due to the addition of passenger rail service operations and advanced warning times.

4.3.2 No Build Alternative

Under the No Build Alternative, no passenger rail system would be constructed, and no changes to existing roadway-rail grade crossings would be anticipated. No projects are currently planned to upgrade existing grade crossings beyond regular maintenance. The No Build Alternative would have no effect on UP operations.

4.4 Rail Service Impacts during Construction

4.4.1 Corridor Alternatives

In the case of the Yellow Corridor Alternative, ADOT would obtain permission and participation from UP for all construction that would take place within the railroad ROW, including coordination to ensure continued access and maintenance of customer service. In the case of the Orange Corridor Alternative, the corridor has little interaction with the railroad, although permission would be sought for any coordination needs in the short distance between Tempe and Phoenix and in downtown Tucson. In general, corridor construction would affect rail traffic by reducing operating train speeds through construction zones and adding to rail travel time. This may occur when adding new siding tracks, double-tracking, upgrading signals, and modifying grade crossings. The other impact would be schedule adjustments for existing operations to create windows of opportunity for temporary suspension of rail operations on selected track sections, such as when new turnouts are being placed for passing sections and new sidings or if a potential safety risk may occur. During construction, temporary "shoo-fly" trackage may need to be installed for longer disruptions; or brief track outages, which would interrupt freight service temporarily, may be necessary. Minimal construction impacts are associated with the Orange Corridor Alternative as compared to the Yellow Corridor Alternative.

4.4.2 No Build Alternative

Under the No Build Alternative, construction would be limited to regular maintenance activities; therefore, no impacts to rail service would occur.

4.5 Vehicular Traffic Impacts during Construction

4.5.1 Corridor Alternatives

Vehicular traffic would be temporarily affected at locations where grade crossings would be separated or modified. While the exact construction zones have not been determined at this time, temporary lane closures or roadway closures would likely be required to construct a passenger rail system. Grade crossing construction would, at a minimum, slow traffic down as it passes through the construction zone. In some cases, temporary diversion of traffic to adjacent crossings could be required.

Construction of grade-separated crossings would be staged to minimize street closures. This may be accomplished by closing the outside lanes during retaining wall and bridge abutment construction while maintaining traffic on the inside lane. The adjacent parallel streets would be used for detour traffic during street closures. Another option is to construct a temporary detour around the construction site, which would reduce the amount of out-of-direction travel to parallel routes.

Where impacts to vehicular traffic occur, emergency services, schools, businesses, and other activities requiring vehicular access would be affected by potential delays or detours. Construction-related impacts to vehicular traffic would be temporary, however; and ADOT would undertake a public outreach program prior to construction to notify schools, emergency service providers, residents, and businesses.

4.5.2 No Build Alternative

No construction activity associated with a passenger rail system would occur in the No Build Alternative.

4.6 Station Location and Local Parking Impacts

4.6.1 Corridor Alternatives

Concept plans have not been developed for station locations, as specific locations have not yet been determined. Station area concept plans would be developed as the projected ridership forecasts are refined, to allow the determination of required station size, number of parking spaces, transit amenities, and vehicular circulation. It is assumed that the location of new stations would be easily accessible from the highway and arterial system and would also accommodate transit, bicycle, and pedestrian access. Generalized station type concepts (i.e., hub, regional, local, emerging) have been developed as a model for future stations pending the requisite information about demand for services and physical location. These are presented in the *Station Area Planning Guidance for Communities* at the end of the *Alternatives Analysis Appendix*.

Constructing and operating passenger rail stations have the potential to generate impacts that require mitigation. These could be related to:

- property acquisition and displacements,
- changes in land use and economic development potential,
- the need to relocate and/or reconstruct displaced community facilities,
- congestion resulting from intensified travel activity at stations, including parking, facilities, that could require reconfiguration of existing streets or diversion of vehicular traffic, and
- the need to facilitate station access by alternative modes while ensuring pedestrian and bicycle safety as a result of increased congestion.

Any such impacts would be addressed during Tier 2 analysis.

4.6.2 No Build Alternative

No station construction or effects on local parking would take place under the No Build Alternative.

4.7 Corridor Cross Sections

The transportation impact analysis of the Yellow and Orange Corridor Alternatives did not consider detailed design concepts of a passenger rail track alignment. However, in order to better understand the potential impact of an alignment's built condition within a corridor, typical rail cross sections were developed. These cross sections are not meant to distinguish between the Yellow and Orange Alternatives, and are intended only as a means to gauge potential ROW impacts of different possible scenarios. More detailed analysis in the future may bring to light factors or conditions which change these assumptions. **Figure 4-3**, **Figure 4-4**, and **Figure 4-5** show the typical cross sections for single track, double track, and double track with a station platform, respectively. While these cross sections are only an illustration of possible configurations, any elements such as station platforms or other features would be designed and constructed to conform to the requirements of the Americans with Disabilities Act (ADA).

Figure 4-3. Cross Section – Single Track

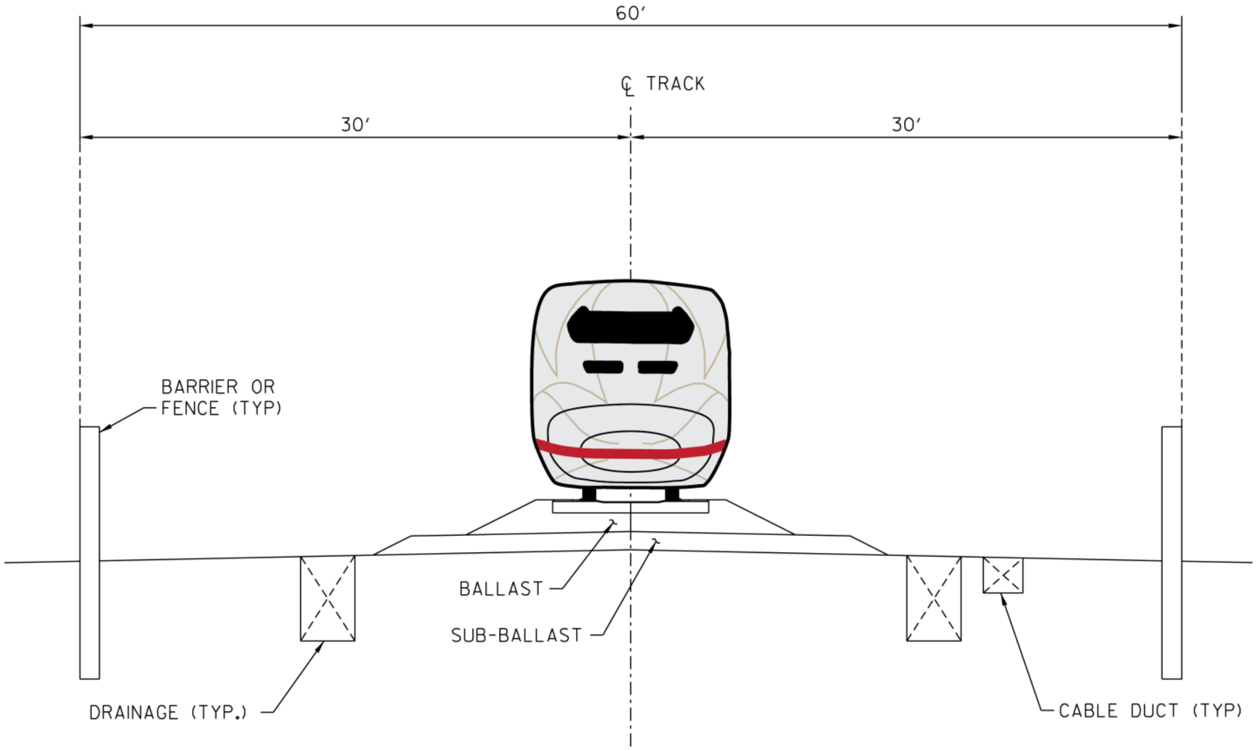


Figure 4-4. Cross Section – Double Track

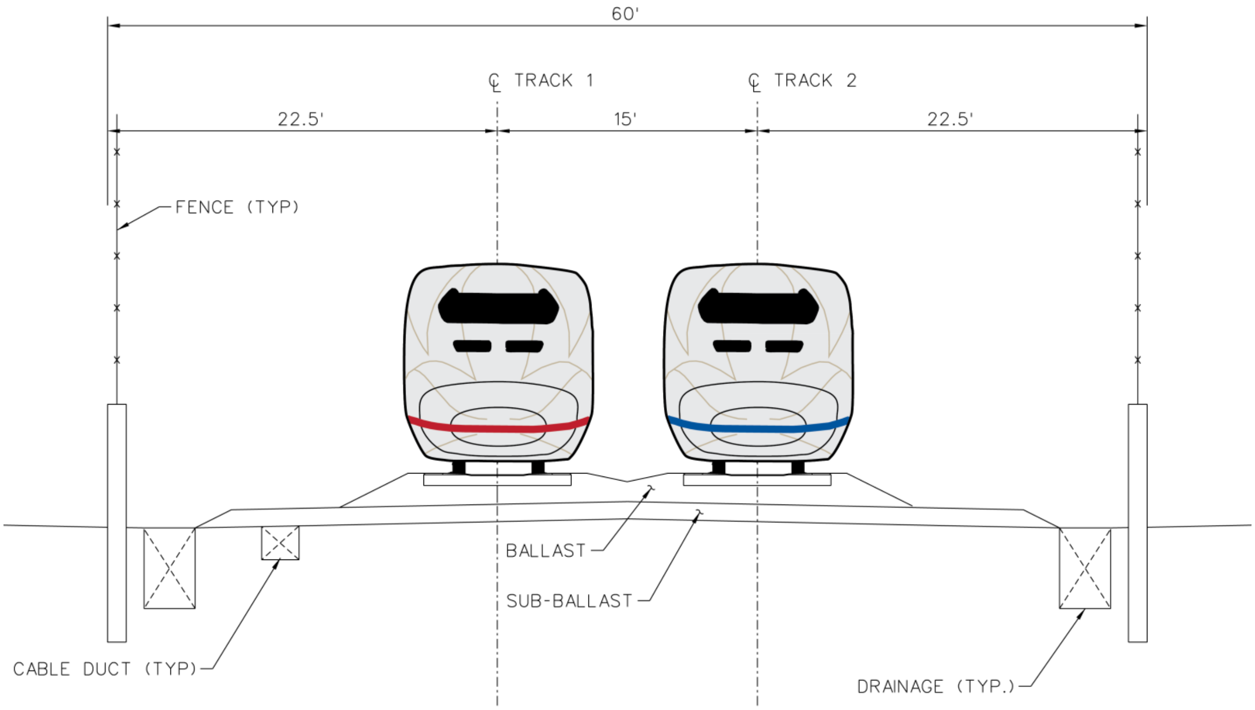


Figure 4-5. Cross Section – Station Platform