7 NOISE ANALYSIS

Applicable thresholds of significance for the project are Arizona Department of Transportation (ADOT) Noise Abatement Policy (2005) standards. Noise sensitive receivers are considered impacted if noise levels approach or exceed Federal Highway Administration (FHWA) Noise Abatement Criteria (NAC) (**Table 14**) or substantially exceed existing noise levels.

Table 14. Noise Abatement Criteria

"A"-Weighted Sound Level in Decibels (dBA)

Activity Category	LAeq1h	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, cemeteries and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.
Source: 23 CFR 772		

The NAC at Activity Category B land uses (67 dBA) is applied at primary outdoor areas of frequent human use, such as backyards and patios. The NAC at Activity Category E land uses (52 dBA) is applied inside the façade facing the roadway. The Guidelines for ADOT Noise Study Reports states "an outside-to-inside noise reduction factor of 20 dBA may be assumed." Therefore, the effective NAC at the exterior façade is 72 dBA.

ADOT defines the approach level as 3 dBA below the NAC. Therefore, noise levels of 64 dBA or higher at Activity Category B land uses or noise levels of 69 dBA or higher at Activity Category E land uses would constitute an impact. ADOT defines 'substantial' as 15 dBA.

Sound level measurements were conducted along the project area. Four long-term (24-hour) and 25 short-term (20-minute) measurements were performed. Simultaneous traffic counts were conducted with the short-term measurements.

The FHWA Traffic Noise Model (TNM) version 2.5 was used to estimate existing noise levels. The model used the existing alignment and building locations, obtained from the CAD files of the project area (KHA 2009). The model was validated using the observed field data. The existing vehicle speed on Grant Road and all 4-lane and 6-lane cross streets was assumed to be the current speed limit of 40 miles per hour (mph); the existing vehicle speed on 2-lane cross streets was assumed to be 30 mph. Roadways were assumed to operate at the upper threshold of Level of Service (LOS) C. For Grant Road and 4-lane cross streets, this corresponds to an hourly bidirectional volume of 2,360 vehicles; for 6-lane cross streets, 3,830 vehicles; and for 2-lane cross streets, 840 vehicles. The traffic mix was assumed to be 96 percent cars, 2 percent medium trucks, 0.75 percent heavy trucks, 0.5 percent buses, and 0.75 percent motorcycles, based on the traffic counts conducted during the short-term sound level measurements.

TNM was also used to estimate future noise levels with implementation of the project. The realignment and widening of Grant Road, and associated improvements to cross streets, were also obtained from the CAD files. Existing buildings that would be removed as a result of the project were removed from the model. The vehicle speed on the realigned and widened Grant Road was assumed to be the design speed of 35 mph. The LOS C hourly bidirectional volume of 3,830 vehicles was used on the realigned and widened Grant Road. No other modeling parameters were modified.

It was assumed that all project roadway improvements would use rubberized asphalt. ADOT guidance indicates that noise levels from roadways with rubberized asphalt are expected to be 3 dBA lower than normally predicted by TNM 2.5. Therefore, all future noise levels reported by the model were reduced by 3 dBA.

The results of the model indicate future unabated noise levels would approach or exceed the NAC at the locations as described in **Table 15.** These locations are exhibited in the Noise Study Report. The largest predicted noise level increase was approximately 4 dBA. Consideration of noise abatement analysis to determine feasible and reasonable methods to reduce the noise level at the impacted receptor areas is warranted. In accordance with 23 CFR 772, alternative noise abatement measures for reducing or eliminating noise impacts along the proposed corridor should be evaluated for all noise-sensitive receptors which would exceed the NAC.

Noise abatement measures for these locations have not been developed. Abatement measures will be determined in conjunction with each Grant Road final design project. Identification of appropriate abatement measures should be coordinated with Grant Road land use planning, and streetscape and landscape design. Several types of abatement to consider include:

- Acquisition of Rights-of Way – This abatement measure would serve to provide additional property alongside the proposed facility on which to construct noise barriers or to provide a buffer zone in which no noise sensitive land use would be permitted. However, due to the residential and other developments already existing along the corridor, the acquisition of ROW to create buffer zones would result in disruptive relocations and is therefore not recommended.
- Alteration of Horizontal and Vertical Alignments – Alignment modifications as a means of noise abatement would be infeasible due to the presence of the existing Grant Road and existing development in the area.
- Traffic Management – Measures such as traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, and modified speed limits would

prevent Grant Road from serving its intended purpose. Exclusive lane designations would be inappropriate for a project of this scope and would not reduce traffic-generated noise levels. Therefore, traffic management measures are not recommended.

While the above abatement measures were determined to be not appropriate for the project, other measures were found to be effective:

- Barrier System – An abatement measure that is deemed to be effective is the installation of noise barriers, which would diffract sound waves and block the line-of-sight between the roadway traffic and noise sensitive receivers. These barriers would therefore provide a reduction in noise levels.

  The City policy details potential issues with the use of sound walls. The City policy identifies several disadvantages associated with noise barrier walls located on urban streets. These disadvantages include the following:

  - It is difficult to design effective noise barrier walls for locations where driveways, alleys, side streets or drainage facilities require openings in the walls that substantially reduce their effectiveness.
  - Walls can cause conflicts with sight distance requirements at intersections and driveways.
  - Noise barrier walls located close to the roadway can constitute fixed object hazards to vehicles.
  - Noise barrier walls interrupt the views from the residences.
  - The walls frequently attract graffiti and require continuous and costly maintenance.
  - The walls interfere with the Tucson Police Department's crime surveillance program. The Tucson Police Department has determined that surveillance and reporting of crimes by neighborhood residents and passing motorists has been the most effective means of monitoring and reporting neighborhood criminal activity.
  - The City cannot clean up trash and remove graffiti from the sides of the walls facing the residences without trespassing. In practice, this means that the side of the walls that cannot be directly accessed from the main roadway cannot be effectively maintained.
  - The construction of noise barrier walls significantly changes the visual character of the neighborhood. Frequently, the walls become the dominant visual feature of the roadway corridor.

- Landscape Buffers – Natural terrain features between the roadway and receiver can reduce noise. Earthen berms with heights equal to noise walls in the same location can provide an increased noise reduction of up to 3 dBA. Standard landscaping of flat ground provides minimal noise reduction; to achieve a 5-dBA reduction, a 100-foot-deep and 16-foot-tall stand of broadleaf trees is needed.

To evaluate the effectiveness of one abatement option, noise barrier walls at the edge of the right-of-way or at the property line of the impacted representative receptors were considered at the locations listed in **Table 15.** Evaluated noise barrier walls had an initial height of 6 feet, with incremental increases of 2 feet. Noise barrier walls were found to be an effective form of abatement at 11 of the 12 impacted areas.

At R20, the widening of Alvernon Way would move the right-of-way to within a foot of the eastern façades of the multifamily residential complex. Additionally, the driveway on the east is the only access point to the complex. Therefore, a noise barrier wall on the eastern side of the complex is not feasible. The existing outdoor usable areas are primarily on the eastern side of the buildings. These areas would be removed as part of the project. As such, the remaining outdoor usable areas would be along the north side of the south building and along the south side of the north building, adjacent to the access driveway. A 5-dBA reduction in the noise level at these areas can be provided with 6-foot-high sound walls on the east side of these areas and along the full east-west depth of the access driveway.

Table 15 shows the results of the noise barrier wall abatement analysis. Abated noise levels below the NAC are shown in bold. Barrier heights generating 5 dBA or more of insertion loss were considered feasible and are shown in bold.

Table 15. Future Predicted Noise Impacts (dBA Leq)

Receptor	Location Description	Peak Hour Traffic Noise Level								
		Existing	Future	Activity Category	NAC	Impact Type	6-Foot Barrier		8-Foot Barrier	
							Leq	Insertion Loss	Leq	Insertion Loss
R2	South side of Grant Road, east of 9th Avenue (between 9th Avenue and Stone Ave).	67	66	B	67	Approach	**61**	**5**	-	-
R3	South side of Grant Road, between Avenida El Capitan and 2nd Avenue.	65	65	B	67	Approach	**59**	**6**	-	-
R3A	South side of Grant Road, between Avenida El Capitan and 2nd Avenue.	65	64	B	67	Approach	60	4	**56**	**8**
R3B	South side of Grant Road, between Avenida El Capitan and 2nd Avenue.	65	65	B	67	Approach	**59**	**6**	-	-
R3C	South side of Grant Road, between Avenida El Capitan and 2nd Avenue.	65	66	B	67	Approach	**60**	**6**	-	-
R10	North side of Grant Road, between Warren and Campbell	63	64	B	67	Approach	**58**	**6**	-	-
R10C	North side of Grant Road, between Warren and Campbell	66	65	B	67	Approach	**59**	**6**		
R16	Doolen Middle School, ball park fields located on the north side of Grant Road, east of Country Club	65	65	B	67	Approach	**58**	**7**	-	-

Table 15. Future Predicted Noise Impacts (dBA Leq) (continued)

Receptor	Location Description	Peak Hour Traffic Noise Level								
		Existing	Future	Activity Category	NAC	Impact Type	6-Foot Barrier		8-Foot Barrier	
							Leq	Insertion Loss	Leq	Insertion Loss
R17	Adobe Manor Mobile Lodge, located on the north side of Grant Road, west of Sparkman Blvd.	62	66	B	67	Approach	**60**	**6**	-	-
R20	North of Grant Road, on the west side of Alvernon Way	65	65	B	67	Approach	**-**	**-**	-	-
R26	Crossroads Trailer Park Estates, located on the south side of Grant Road, between Mountain View Ave and Arcadia Ave.	62	64	B	67	Approach	**58**	**6**	-	-
R26A	Crossroads Trailer Park Estates, located on the south side of Grant Road, between Mountain View Ave and Arcadia Ave.	68	66	B	67	Approach	**59**	**7**	-	-