1.0 PROJECT INFORMATION

Davis Development (Davis) is proposing to construct a residential multifamily community development located east of E-470 State Highway (E-470), north of 6th Parkway, and west of Gun Club Road in the City of Aurora, Colorado. The proposed development consists of 264 units on 12.8 acres. The site location, Figure 1, is shown in **Appendix A**.

2.0 NOISE STUDY PROCEDURES

The FHWA Traffic Noise Model® (TNM 2.5) was used to predict existing and future design year 2040 hourly equivalent traffic noise levels, Leq(h), for noise-sensitive locations (receivers) within the proposed development. Noise-sensitive locations consist of 22 first floor receivers representing 22 potential sites for multi-family units along the property line closest to E-470. Noise modeling was used for the prediction of future peak hour traffic noise levels. The Davis Development Site Plan and receiver locations are shown in Figure 2 in **Appendix B**.

3.0 NOISE IMPACT CRITERIA

The Colorado Department of Transportation (CDOT) Noise Analysis and Abatement Guidelines (NAAG) provides the guidelines used to assess the potential negative impacts from highway traffic noise levels and determines the need for noise abatement. The noise level impact methodology used for this analysis is based on the current CDOT NAAG (September 2020). The Federal Highway Administration (FHWA) has established Noise Abatement Criteria (NAC) and procedures for assessing traffic noise that are to be used in the planning and design of highways.

The CDOT NAAG is based on the noise levels approaching the FHWA NAC. CDOT defines “approaching” as within 1 dBA of the FHWA NAC for Activity Categories A, B, C, D, and E. There are no noise impact thresholds for Activity Category F or G. The CDOT NAAG determines highway traffic noise level impacts and considers mitigation for residential land uses when the predicted noise level is equal to or greater than the noise impact threshold of 66 dBA. **Table 1** shows CDOT’s NAC. The CDOT NAAG requires that the one-hour equivalent sound level (Leq) be used in the analysis.

TABLE 1 CDOT NOISE ABATEMENT CRITERIA			
Activity Category	**Activity L_{eq} (dBA)[1, 2]**	**Evaluation Location**	**Activity Description**
A	56.0	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[3]	66.0	Exterior	Residential.
C[3]	66.0	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	51.0	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[3]	71.0	Exterior	Hotels, motels, time-share resorts[4], offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	Not Applicable	Not Applicable	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), warehousing, malls[5], stores[5], shops[5], and Government managed land.[4,6]
G	Not Applicable	Not Applicable	Undeveloped lands that are not permitted.

[1] Table 1 of 23 CFR 772 allows state highways agencies to use either Leq(h) or L10(h) on a project, but not both. CDOT uses Leq(h), which is an Hourly A-weighted sound level in dBA.

[2] NACs are for impact determination only. They are not design standards for noise abatement measures.

[3] Includes undeveloped lands permitted for this activity category.

[4] This activity description is not listed in Table 1 of 23 CFR 772.

[5] This activity description is not listed in Table 1 of 23 CFR 772 but is in FHWA's FAQ D7.

[6] Areas of frequent human use within the Government (Federal, State, and County) managed land will be treated as the appropriate land use (e.g., a campground would be Activity Category C, as described in Section 3.5.4 of the CDOT NAAG).

4.0 NOISE MODELING METHODOLOGY AND TNM 2.5 VARIABLES

The FHWA-approved Traffic Noise Model version 2.5 (TNM 2.5) is the computer noise model used for the prediction of highway and roadway traffic noise levels. The output of the model is dependent upon variables, which include atmospheric conditions, roadway geometries, topographic data, ground types, noise receiver locations, traffic volumes, vehicle speed, and vehicle mix.

Atmospheric Conditions

Noise levels are affected by temperature and humidity. Temperature gradients cause refraction effects. For example, in the morning, when the ground is still cool from the night before but the upper air is warming due to the sun, noise can bounce between the gradient and the ground, forming regions of higher and lower noise intensity. Noise attenuation is also affected by humidity. Dry air absorbs more acoustical energy than moist air because dry air has a higher density than moist air at a given temperature. For noise modeling purposes, FHWA recommends the default values of 68 degrees Fahrenheit for the temperature and 50 percent humidity.

Roadway Geometry & Topographic Data and Ground Type

The roadway geometries and topographic data for the project were obtained from Google Earth. Field grass was used to approximate the ground type between the roadway and receptors.

Receptor and Receiver Locations

The CDOT NAAG defines a "receptor" as a discrete or representative location of a noise sensitive area(s) for any of the land uses listed in **Table 1**. A "Receiver" is defined as a location used in noise modeling to represent the measured and predicted noise level at a particular point. The noise-sensitive receptors are located near the proposed patios or common outdoor areas of use.

Traffic Volumes

Traffic volumes were obtained from the Colorado Online Transportation Information System Traffic Data Explorer, the volumes and truck data are shown in **Appendix C**.

Vehicle Speed

The posted speed limit on E-470 within the project limits is 70 mph. The E-470 freeway mainline modeled vehicle speed for autos, medium and heavy trucks was 75 mph and ramps at 50 mph for all vehicle types.

Vehicle Mix

The percentages of vehicles by type (vehicle mix) is an important input for the noise model, because different vehicle types exhibit different base or reference noise emission levels, such as trucks that produce higher reference levels than cars, and larger trucks that produce higher reference levels than smaller trucks. Vehicle types are defined as follows:

- Cars (Auto): All vehicles with two axles and four wheels designed primarily for passenger transportation or cargo (light trucks). Generally, the gross vehicle weight is less than 10,000 pounds.
- Medium Trucks: All vehicles having two axles and six wheels designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 10,000 pounds but less than 26,400 pounds.
- Heavy Trucks: All vehicles having three or more axles and designed for the transportation of cargo. Generally, the gross weight is greater than 26,400 pounds.

This noise analysis focuses on automobile, medium truck, and heavy truck usage along E-470. The vehicle mix used in this analysis is shown in **Appendix C**.

5.0 FUTURE NOISE ENVIRONMENT AND IMPACT DETERMINATION

Table 2 shows the future projected 2040 noise levels at the residential homes in the Davis Multifamily Development. The first column identifies the noise receiver identification number for the homes closest to E-470. The second column shows the description of each modeled noise receiver. The third column shows the future predicted 2040 unmitigated noise levels. The fourth column shows the future 2040 mitigated noise levels with an 8-foot sound wall. The fifth column shows the insertion loss or difference in noise levels from unmitigated to mitigation with an 8-foot sound wall. The 2040 unmitigated noise levels range from 51 to 63 dBA. All 2040 noise levels under are below the CDOT noise impact threshold of 66 dBA. The TNM traffic volumes used for the analysis are shown in **Appendix C**.

TABLE 2 TNM 2.5 PREDICTED NOISE LEVELS DAVIS MULTIFAMLY DEVELOPMENT				
Receiver ID	**Description**	**2040 Unmitigated Noise Levels (dBA)**	**2040 Mitigated Noise Levels with 8' Sound Wall (dBA)**	**Difference in Noise Levels (dBA)**
R1	1st floor exterior	50.7	48.8	1.9
R2	1st floor exterior	53.0	49.7	3.3
R3	1st floor exterior	54.9	50.4	4.5
R4	1st floor exterior	56.8	50.6	6.2
R5	1st floor exterior	62.6	58.7	3.9
R6	1st floor exterior	62.9	59.0	3.9
R7	1st floor exterior	63.4	59.3	4.1
R8	1st floor exterior	59.8	58.4	1.4
R9	1st floor exterior	57.6	57.5	0.1
R10	1st floor exterior	56.4	56.6	-0.2
R11	1st floor exterior	55.9	56.2	-0.3
R12	1st floor exterior	56.5	56.7	-0.2
R13	1st floor exterior	57.5	57.4	0.1
R14	1st floor exterior	57.8	57.4	0.4
R15	1st floor exterior	58.2	57.7	0.5
R16	1st floor exterior	58.4	57.9	0.5
R17	1st floor exterior	57.9	57.5	0.4
R18	1st floor exterior	59.1	58.4	0.7
R19	1st floor exterior	61.3	59.9	1.4
R20	1st floor exterior	61.0	59.9	1.1
R21	1st floor exterior	56.7	56.8	-0.1
R22	1st floor exterior	55.5	55.7	-0.2

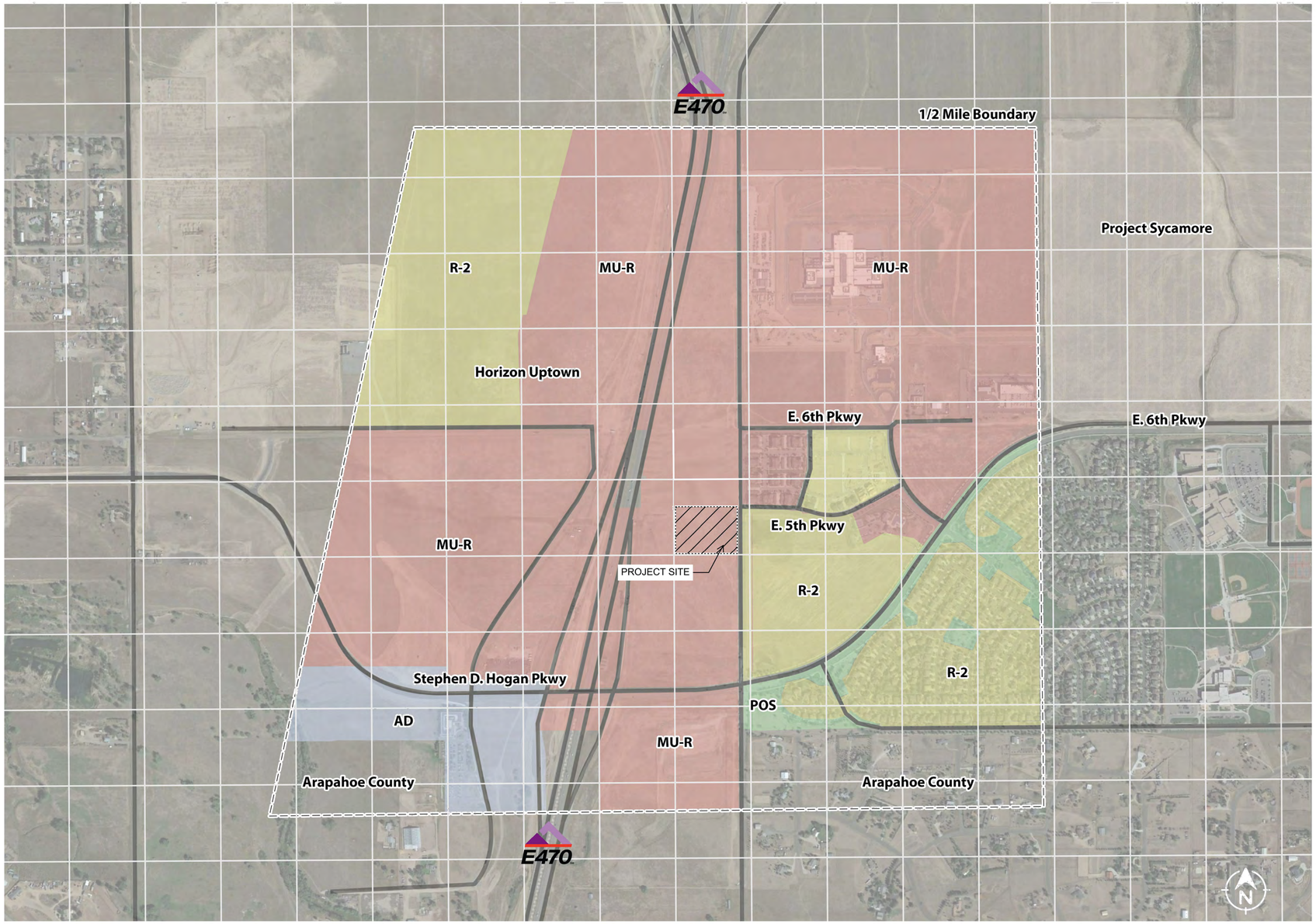
6.0 STATEMENT OF LIKELIHOOD

The predicted 2040 noise levels range from 51 to 63 dBA. All 2040 noise levels are below the Colorado Department of Transportation (CDOT) noise impact threshold of 66 dBA. An 8-foot sound wall was evaluated at the property line. CDOT has determined that a sound wall must be designed to achieve a minimum of 5 dBA for at least three impacted receptors to be feasible and 7 dBA for at least two benefited receptors to be reasonable. The evaluated 8-foot sound wall reduced noise levels by 5 dBA at only two of the 22 noise receiver locations, therefore, a sound wall is not recommended.

In summary, noise levels at the proposed Davis Multifamily Development do not exceed the CDOT noise impact threshold of 66 dBA. Due to noise attenuation over distance, the existing topography provides sufficient attenuation from traffic noise from E-470.

The following Appendices are included in this Memorandum:
Appendix A – Davis Multifamily Development Site Location
Appendix B – Site Plan and Modeled Noise Receiver Locations
Appendix C - TNM 2.5 Traffic Volumes

APPENDIX A – DAVIS MULTIFAMILY DEVELOPEMNT SITE LOCATION



Zoning Designations

- PROPERTY BOUNDARY
- MIXED-USE REGIONAL (MU-R)
- MEDIUM DENSITY RESIDENTIAL(R-2)
- AIRPORT DISTRICT (AD)
- PARKS AND OPEN SPACE (POS)

CHECKED BY: XX
DRAWN BY: XX

Kimley»Horn

1125 17TH STREET
SUITE 1400
DENVER, CO 80202
(303) 228-2300
WWW.KIMLEY-HORN.COM

DAVIS DEVELOPMENT MULTIFAMILY

5TH AVENUE AND GUN CLUB ROAD
AURORA, COLORADO

OWNER:
DAVIS DEVELOPMENT, INC.

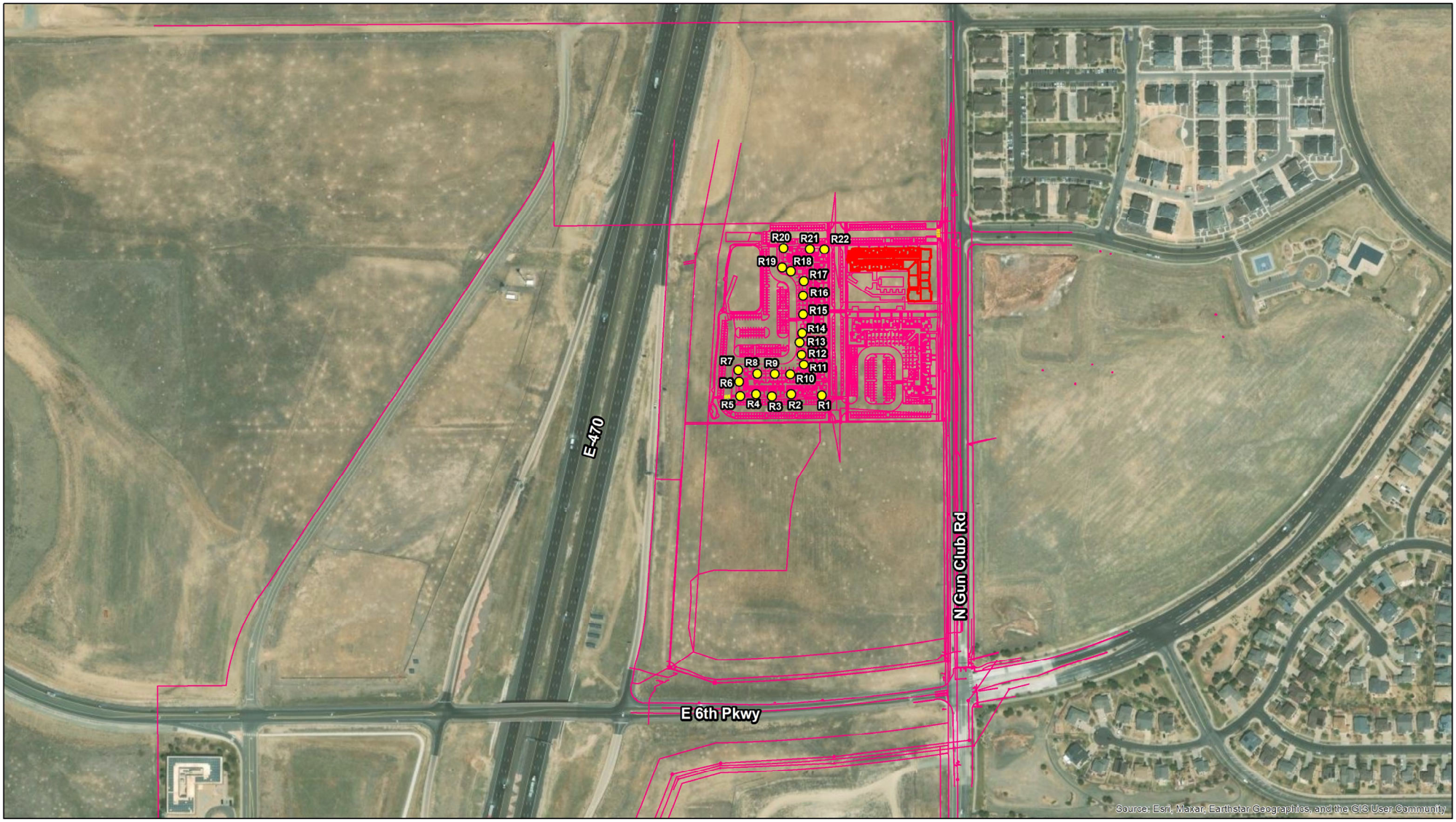
7375 W 52ND AVE. STE.200
ARVADA, CO 80002
MICHAEL LEE
303.302.2502

NOT FOR CONSTRUCTION

DATE:
04/13/2022 SP-01
09/14/2022 SP-02

SHEET TITLE:
CONTEXT MAP

APPENDIX B – SITE PLAN AND MODELED NOISE RECEIVER LOCATIONS



0 150 300
FEET

Revised: 5/19/2023
SOURCE: World Imagery

Legend

- Noise Receiver

newton
Environmental Consulting, LLC

APPENDIX C – TNM 2.5 TRAFFIC VOLUMES

APPENDIX C

Davis Mulifamily Development TNM Traffic Volumes

E-470 at 6th Parkway Existing and Future Truck Volumes									
Route	**Milepost Start**	**Milepost End**	**AADT**	**AADT Year**	**Truck %**	**AADT Trucks**	**20 Year Factor**	**2040 Truck ADT**	**Location**
470B	16.451	19	22,000	2020	5.7	1,250	1.55	1,938	ON E-470 TOLL RD N/O JEWELL AVE
470B	19	20.547	22,000	2020	5.8	1,270	1.54	1,956	ON E-470 TOLL RD S/O I-70

TNM Modeled Volumes				
2040 AADT	2040 Peak Hour Volume	2040 Peak Hour Auto	2040 Peak Hour MT	2040 Peak Hour HT
33880	3388	3191	34	163

https://dtdapps.coloradodot.info/otis/TrafficData

Speed Limit: 75 mph

On Ramp volume is assumed to be 100 vehicles per hour because - no data available