Diesel Particulate Health Risk Assessment For:

Home Depot at Highland & Arden Avenues

City of San Bernardino

Prepared For:

Lilburn Corporation

1905 Business Center Drive

San Bernardino, CA 92408

Submitted By:

Mestre Greve Associates

Division of Landrum & Brown

Matthew B. Jones P.E.

Fred Greve P.E.

27812 El Lazo Road

Laguna Niguel, CA 92677

Phone: 949•349•0671

October 10, 2011

MGA Report #525801-HRA01

Table of Contents

List of Tables ii

List of Figures ii

1.0 Introduction 1

1.1 Background on Diesel Particulate Matter 4

2.0 Methodology 6

2.1 Emission Factors 6

2.2 Delivery Truck Activity 7

2.3 Dispersion Model 18

2.4 Determination of Cancer Risk 18

2.5 Determination of Non-Cancer Risks 21

3.0 Impact Analysis 22

3.1 Threshold of Significance 22

3.2 Modeled DPM Concentrations 22

3.3 Cancer Risk Increase Due to Project 25

3.4 Non-Cancer Health Risk Due to Project 26

4.0 Mitigation Measures 26

APPENDIX 27

EMFAC2007 Modeling Files 27

AERMOD Modeling Files 27

List of Tables

Table 1 Diesel Truck PM_{10} Emission Factors 7
Table 2 Delivery Truck Activity 8
Table 3 Point Estimates for Daily Breathing Rate 19
Table 4 Cancer Risk Parameters by Receptor Type 20
Table 5 Cancer Risk Increase at Maximum Impacted Receptors 25
Table 6 Chronic Hazard Index at Maximum Impacted Receptors 26

List of Figures

Figure 1 Vicinity Map 2
Figure 2 Proposed Site Plan 3
Figure 3 Home Depot Loading Dock Delivery Truck Path 9
Figure 4 Home Depot Lumber Yard Delivery Truck Path 10
Figure 5 Home Depot Garden Center Delivery Truck Path 11
Figure 6 Major 1 Delivery Truck Path 12
Figure 7 Pad 1 Delivery Truck Path 13
Figure 8 Pad 2 Delivery Truck Path 14
Figure 9 Pad 3 Delivery Truck Path 15
Figure 10 Pad 4 Delivery Truck Path 16
Figure 11 Shops Delivery Truck Path 17
Figure 12 Annual Average DPM Concentrations 23
Figure 13 Peak 24-Hour Average DPM Concentrations 24

1.0 Introduction

The Home Depot at Highland and Arden Avenues project proposes the development of a commercial shopping center on approximately 17.37 acres at the southwest corner of Highland Avenue and Arden Avenue in the northeasterly portion of the City of San Bernardino. The project site was previously developed with multi-family residences that have since been demolished. The project proposes the construction of a 107,979 square foot home improvement center with an attached 28,111 square foot garden center, a 43,830 square-foot major retail structure that may include a grocery store, a 8,340 square foot multi-tenant building for various shops which may include restaurants, and four general commercial pads ranging in size from 5,500 square feet to 2,900 square feet that may include drive-thru restaurants, a gas station or bank. Up to 207,720 square feet of general commercial buildings is proposed.

Existing land uses in the project include residences along the western boundary between the site an Guthrie Street with commercial uses beyond, an elementary school and park to the south across 20th Street, multi-family homes to the east across Arden Avenue, and commercial uses to the north across Highland Avenue. The Foothill Freeway (I-210) bounds the project along the northwest corner.

The purpose of this report is to assess the potential of Diesel Particulate Matter (DPM) emitted from delivery trucks serving the tenants of the proposed project on the existing land uses surrounding the project site. DPM is one of several airborne Toxic Air Contaminants (TAC). ARB and South Coast Air Quality Management District (SCAQMD) studies show that DPM contributes approximately 70% of the potential inhalation cancer risk. Total cancer risk from TACs is estimated based on this ratio.

In 1998 the California Air Resources Board (ARB) identified particulate matter from diesel-fueled engines (Diesel Particulate Matter or DPM) as a Toxic Air Contaminant (TAC). As a part of the identification process, the ARB's Office of Environmental Health Hazard Assessment (OEHHA) evaluated the potential for DPM to affect human health. The OEHHA found that exposures to DPM resulted in an increased risk of cancer and an increase in chronic noncancer health effects including a greater incidence of cough, labored breathing, chest tightness, wheezing, and bronchitis.

At this time, tools and methodologies for assessing DPM impacts are limited, and not all state and federal transportation agencies even agree that DPM impacts can be modeled in a meaningful way. This analysis uses interim methodologies developed by the SCAQMD and the ARB. These methodologies are appropriate to develop an estimate of the DPM related impact upon the project. These methodologies are described in Section 2.2. This analysis is for information only as there is not yet wide agreement about the effects of DPM or the methodology to analyze the effects. This is discussed further in the next section which provides a background discussion on diesel particulates.

Figure 1
Vicinity Map

Mestre Greve Associates

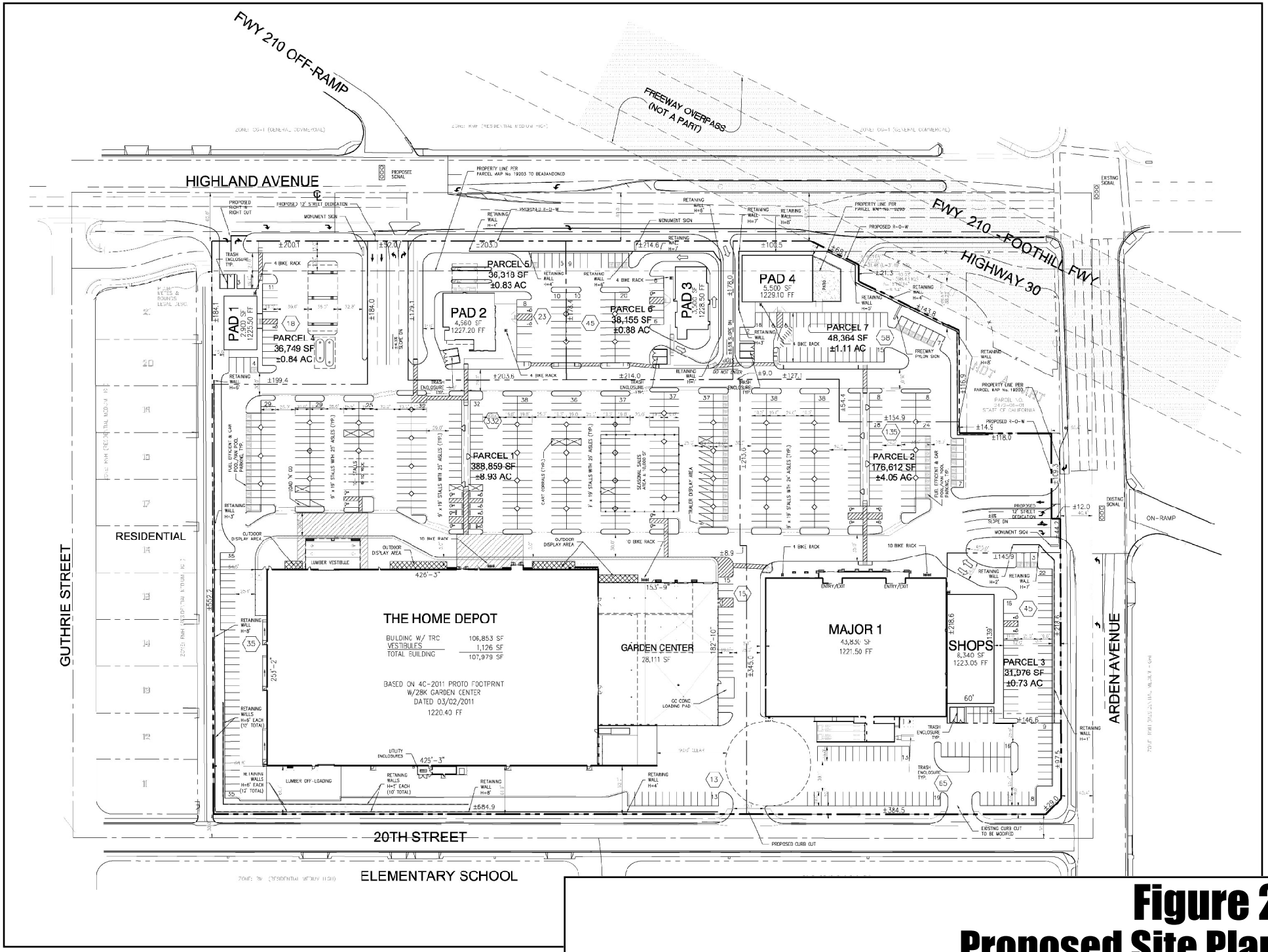


Figure 2
Proposed Site Plan

Mestre Greve Associates

1.1 Background on Diesel Particulate Matter

DPM has historically been used as a surrogate measure of exposure for whole diesel exhaust emissions. Although uncertainty exists as to whether DPM is the most appropriate parameter to correlate with human health effects, it is considered a reasonable choice until more definitive information about the mechanisms of toxicity or mode(s) of action of diesel exhaust becomes available. DPM consists of fine particles (fine particles have a diameter <2.5 μm), including a subgroup with a large number of ultrafine particles (ultrafine particles have a diameter <0.1 μm). Collectively, these particles have a large surface area which makes them an excellent medium for absorbing organics. Also, their small size makes them highly respirable and able to reach the deep lung.

Diesel exhaust emissions vary significantly in chemical composition and particle sizes between different engine types (heavy-duty, light-duty), engine operating conditions (idle, accelerate, decelerate), and fuel formulations (high/low sulfur fuel). Also, there are emission differences between on-road and non-road engines simply because the non-road engines to date are generally of older technology. The mass of particles emitted and the organic components of the particles from on-road diesel engines have been reduced over the years. Available data for on-road engines indicate that toxicologically relevant organic components of diesel exhaust emitted from older vehicle engines are still present in emissions from newer engines, though relative amounts have decreased. There is currently insufficient information to characterize the changes in the composition of diesel exhaust from non-road diesel engines over time.

During an exhaustive 10-year scientific process, the OEHHA found that human exposure to DPM resulted in an increased risk of cancer and chronic non-cancer health effects, including a greater incidence of cough, labored breathing, chest tightness, wheezing, and bronchitis. The OEHHA estimated that, based on available studies, the potential cancer risk from exposure to DPM of 1 microgram per cubic meter (μg/m3) over a 70-year lifetime ranged from 130 to 2,400 excess cancers per million people. The ARB's Scientific Review Panel (SRP) approved the OEHHA's determination concerning health effects and approved these values as the range of risk for DPM. This wide range demonstrates the uncertainty in the cancer risk from DPM.

The SRP concluded that a value of 300 excess cancers per million people per $\mu g/m^3$ of DPM was appropriate as a point estimate of unit risk factor (URF) for DPM. There is not yet a scientific consensus concerning the appropriate URF for DPM. In "Health Assessment Document for Diesel Engine Exhaust" (May 2002), the U.S. Environmental Protection Agency (EPA) determined that the literature did not support identifying a URF for DPM. The EPA data indicated that the potential cancer risk from exposure to DPM of 1 microgram per cubic meter ($\mu g/m^3$) over a 70-year lifetime ranged from 10 to 1,000 excess cancers per million, although lower risk and even zero risk cannot be ruled out by the current data.

The OEHHA also concluded that exposure to DPM concentrations greater than 5 $\mu g/m^3$ can result in a number of long-term (chronic) non-cancer heath effects including greater incidence of cough, phlegm, and bronchitis. The EPA has come to the same conclusion. The 5 $\mu g/m^3$ value is referred to as the Chronic Reference Exposure Value (REL) for DPM. The SRP supported the OEHHA's conclusion and noted that the REL may need to be lowered further as more data emerge on potential adverse non-cancer effects of DPM.

To provide a perspective on the contribution that DPM has on the overall statewide average ambient air toxics potential cancer risk, the ARB evaluated risks from specific compounds using data from ARB's ambient monitoring network. ARB maintains a 21-site air toxics monitoring

network which measures outdoor ambient concentration levels for approximately 60 air toxics. The ARB has determined that, of the top ten inhalation risk contributors, DPM contributes 71% of the total potential cancer risk (the remaining 29% is split among butadiene, benzene, carbonyls and other pollutants).

The SCAQMD also conducted a study of air toxics in the South Coast Air Basin (SCAB), Multiple Air Toxics Exposure Study II (MATES-II), in 1998 and 1999. The MATES-II study estimated that the average basin wide potential cancer risk from DPM was about 1,000 excess cancers per million, or 71 percent of the 1,400 average excess cancers per million from all air toxics in the SCAB. This is consistent with the ARB findings. It should be noted that this estimated risk is based on a 70-year exposure to TAC concentrations measured and modeled during the MATES-II study period and do not take into account any future reductions in TAC concentrations

Average ambient concentrations of air toxics are higher in the SCAB than elsewhere in the state, resulting in higher estimates of risk for residents in the SCAB. In general, the highest risks areas have high concentrations of mobile sources. Higher risk levels occur in the south-central Los Angeles area and in the Los Angeles/Long Beach harbor area.

To address the impacts of DPM, the ARB developed a DPM Risk Reduction Plan in 2008 containing several measures including new vehicle emission standards, reformulated diesel fuels, idling limitations, retrofitting existing diesel fueled vehicles used by government agencies, along with measures to control rail emissions as well as other DPM sources. The emissions calculations in this report used EMFAC2007 to calculate emission factors. EMFAC2007 is a computer model published by the ARB that calculates vehicular emission factors. Emission factors calculated with EMFAC2007 include the effects of the new diesel fueled vehicle emissions standards as well as other DPM Risk Reduction measures. However, as a part of their Diesel Risk Reduction Program CARB is enacting regulations requiring retrofitting of existing diesel sources with emissions control equipment that will further reduce emissions. Reductions from potential regulations are not included in the EMFAC2007 program.

2.0 Methodology

Estimating cancer risk increase and non-cancer health hazards from Diesel Particulate Matter (DPM) requires estimating DPM concentrations at sensitive receptors in the vicinity of the source. Concentrations are the mass of pollutant per volume of air and are typically measured in terms of micrograms (μg) of DPM per cubic meter (m^3) of air. Concentrations are location specific and depend on the amount of pollutants emitted, the location of the emissions relative to the receptor, how the emissions are released, and weather conditions (primarily wind speed and direction). Determination of pollutant concentrations requires the use of a dispersion model which takes all of the pollutant source and weather information and estimates pollutant concentrations based well accepted mathematical equations.

The following sections describe the information used to estimate the emissions of DPM due to activity associated with the proposed project, the dispersion model and assumptions used to estimate pollutant concentrations at nearby sensitive receptors, and the calculations used to estimate cancer risk and non-cancer health impacts from the DPM emissions. Section 2.1 describes the emission factors used to estimate the DPM emissions from the delivery trucks associated with the project. Section 2.2 presents the delivery truck activity and characteristics used to estimate the emissions from the delivery trucks as well as the DPM concentrations in the area around the project. Section 2.3 describes the dispersion model and inputs used to estimate DPM concentrations. Section 2.4 describes the methodology used to calculate cancer risk from the DPM concentrations. Section 2.5 describes the methodology used to calculate the non-cancer health index from the DPM concentrations.

2.1 Emission Factors

EMFAC2007 is the California Air Resource Board's on-road vehicle emissions model. This model is used for all regulatory modeling of on-road vehicle emissions in the State of California. The EMFAC2007 model was used to estimate particulate emissions from diesel trucks. Specifically, particulate emission rates from Heavy Heavy Duty Diesel trucks were calculated for idling conditions as well as trucks traveling at 10 miles per hour and trucks traveling at 25 miles per hour. The trucks were assumed to travel at an overall average speed of 25 miles per hour on public roads and 10 miles an hour within the project. DPM emission factors decrease as speeds increase (up to approximately 35 miles per hour), so using lower speeds represents a worst-case assumption. The idling emission factor was used to represent trucks idling as they arrive or depart their destination within the project.

Table 1 presents the emission factors obtained from EMFAC2007 used to modeling diesel truck emissions for this project. These emissions represent an average diesel truck in the South Coast Air Basin in 2013. In the future, newer, cleaner trucks will replace older, higher polluting, trucks reducing the fleet average emissions. EMFAC2007 projects decreases in running emission factors of approximately 3% per year until 2025. Between 2025 and 2040 the annual decrease is projected to be reduced from 3% per year to 0.1 % per year. Idling emission factors are projected to decrease by approximately 1% per year until 2025. Between 2025 and 2040 the annual decrease is projected to be reduced from 1% per year to 0.1 % per year. As described in Section 2.4, cancer risk is based on a multi year exposure (70 years for residents, 40 years for workers, and 9 years for students). By basing the calculations on 2013 emission factors, worst-case cancer risks will be determined because they will not include projected future emissions reductions that will result in receptors being exposed to reduced concentrations.

Table 1
Diesel Truck PM_{10} Emission Factors

Speed	Emission Factor (g/sec)
Idle	0.000359
10 mph	0.00318
20 mph	0.00315

2.2 Delivery Truck Activity

Delivery truck activity characteristics were developed in consultation with the project applicant. At this time, the only known tenant of the center is Home Depot. Therefore, data for the Home Depot delivery trucks is based on actual expected operating conditions for the store. For the other buildings, specific tenants are not known. A mix of expected tenant types was assumed along with activity parameters based on the applicant and consultants experience with similar projects. Table 2 presents a summary of the truck activity parameters used to model DPM concentrations.

The data in Table 2 is grouped by the building being served by the delivery trucks. For Home Depot, delivery trucks will travel to one of three destinations, the Lumber Yard Loading Dock, the Main Loading Dock and the Garden Center Loading Dock. For each of the other buildings there is a single destination. The Major 1 building has a loading dock and all delivery trucks were assumed to travel to the loading dock. For the shops and the pad buildings, the trucks were assumed to travel to the front of the store.

For each destination, an expected range of weekly delivery trucks was estimated and is presented in Table 2. The modeling was performed assuming the maximum number of trucks in the expected range to provide a conservative estimate of the project's impacts. Some uses are expected receive deliveries only during the week (Monday through Friday) and others are expected receive deliveries during the week and on Saturday. The maximum number of trucks per week was divided by the number of days per week to estimate the number of trucks per day, on the days in which deliveries are received. Finally, a range of times when deliveries are most likely to arrive was estimated. Note that specific determination of delivery times is not possible as they vary based on operational needs and traffic patterns. Therefore, the times presented in Table 2 are not intended to limit or represent the only times in which delivery trucks would be expected to arrive at the site. The times represent the periods when the trucks are most likely to arrive at the facility. Cancer risk is based on an annual average concentration and therefore is relative to annual average operations Occasional trucks arriving outside of the hours shown are not statistically significant. The trucks were assumed to arrive at the project randomly (i.e. with a uniform distribution) within the time periods shown in Table 2.

Table 2
Delivery Truck Activity

Destination	Trucks Per Week Range	Trucks Per Week Maximum	Days of Week	Trucks Per Day	Time of Day[2] Start	Time of Day[2] End
Home Depot						
Lumber Yard LD	2-5	5	M-F	1.00	6:00 AM	7:00 PM
Main Loading Dock	6-10	10	M-F	2.00	6:00 AM	7:00 PM
Garden Center LD	1-6	6	M-F	1.20	6:00 AM	7:00 PM
Major 1 (Super Market)						
M1 Loading Dock	7-14	14	M-Sat	2.33	6:00 AM	3:00 PM
Pad 1 (Gas Station)						
Pad 1	4-7	7	M-Sat	1.17	6:00 AM	7:00 PM
Pad 2 (Bank)						
Pad 2	3-6	6	M-F	1.20	9:00 AM	5:00 PM
Pad 3 (Restaurant)						
Pad 3	1-3	3	M-F	0.60	6:00 AM and 2:00 PM	10:00 AM and 4:00 PM
Pad 4 (Retail)						
Pad 4	1-3	3	M-F	0.60	9:00 AM	7:00 PM
Shops						
Shops	1-5	5	M-F	1.00	9:00 AM	7:00 PM
Totals		**59**		**11.1**		

1. The "Time of Day" represents the most probable hours when delivery trucks will visit the site and not store operating hours or limits on delivery hours. Occasionally, trucks may arrive outside of these hours, but because cancer risk is based on annual averages these occasional deliveries outside of the hours shown are not statistically significant. Delivery trucks were assumed to arrive randomly within the time period shown (i.e. evenly distributed)

Figures 3 through 11 present the anticipated delivery truck paths used for the dispersion modeling. The percent of trucks on each path is indicated along with the location of the destination of the trucks. The trucks were assumed to arrive and depart equally to the east and west on the Foothill Freeway (I-210). Those arriving from the west were assumed to exit the freeway and cross Highland Avenue into the project. Except for the Home Depot Lumber Yard trucks, all trucks arriving from the east were assumed to use either the Highland Avenue entrance or the Arden Avenue entrance. All Lumber Yard Trucks are anticipated to us the Highland Avenue entrance exclusively. All trucks were assumed to exit to Arden Avenue as there freeway access is much more difficult when exiting onto Highland Avenue.

The figures also show the destination of the trucks which are also areas were the trucks will idle on arrival and departure. CARB regulations limit truck idling to five minutes. Therefore, each truck was assumed to idle at its destination for five minutes.

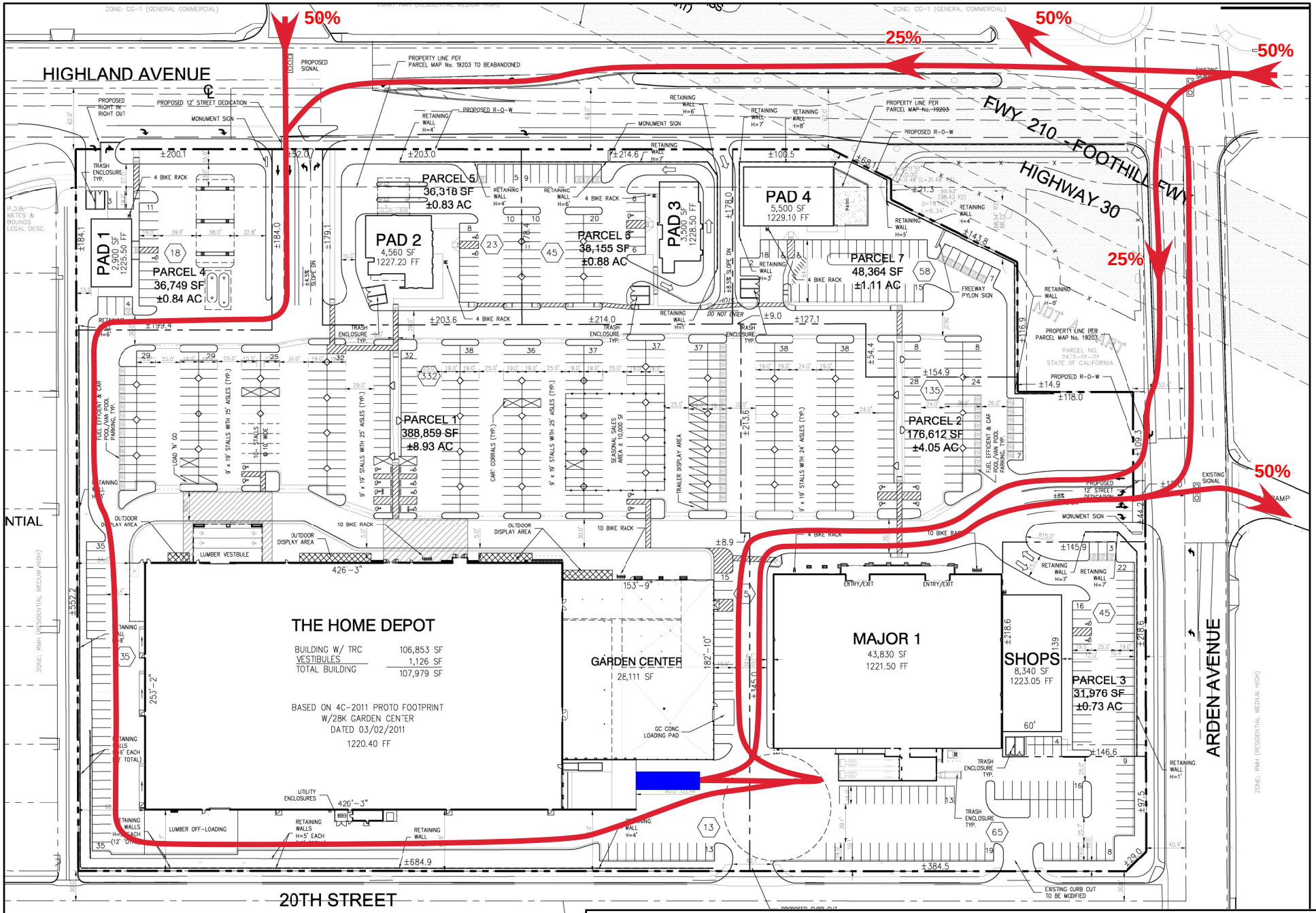


Figure 3 - Home Depot Loading Dock Delivery Truck Path

Mestre Greve Associates

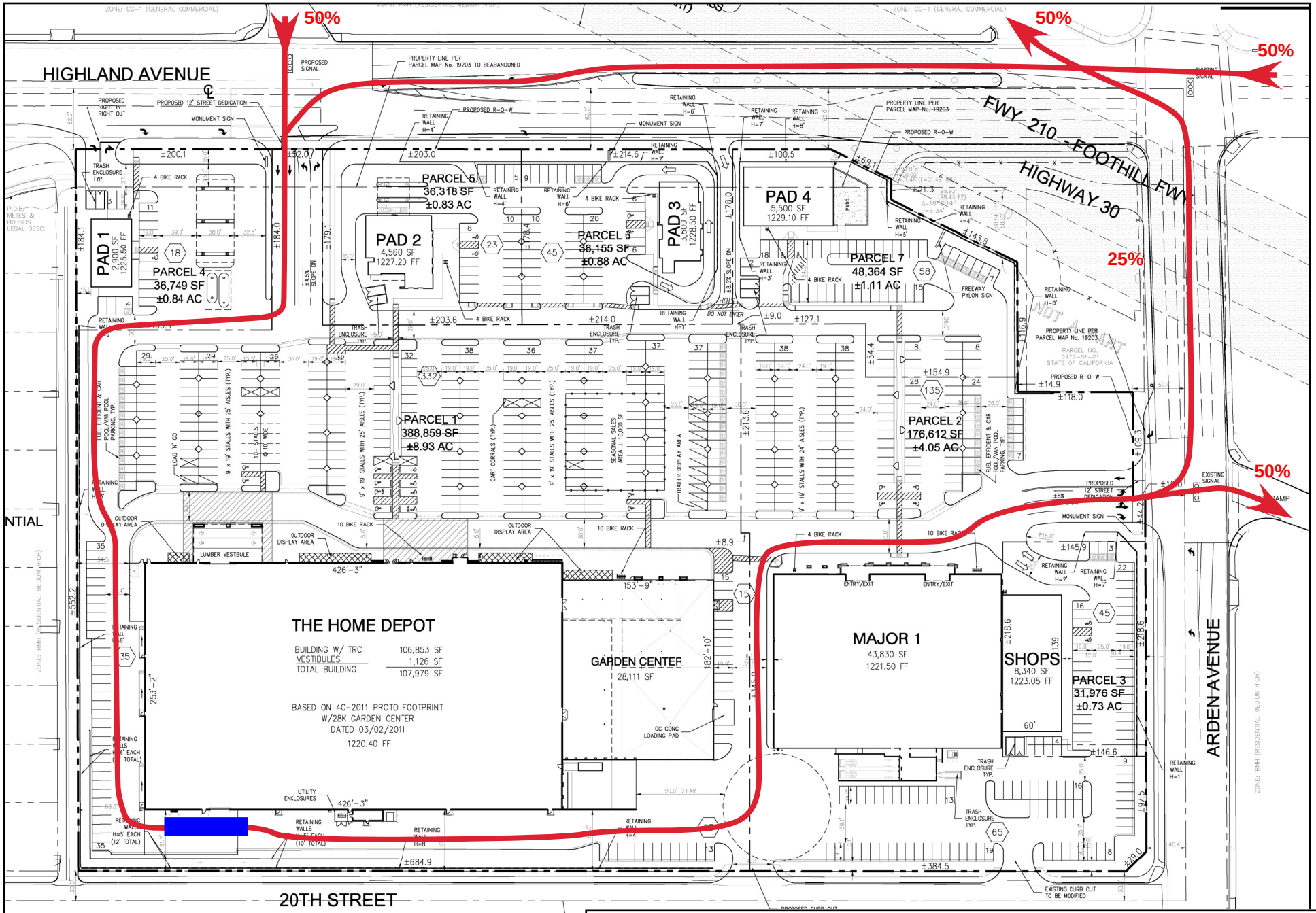


Figure 4 - Home Depot Lumber Yard Delivery Truck Path

Mestre Greve Associates

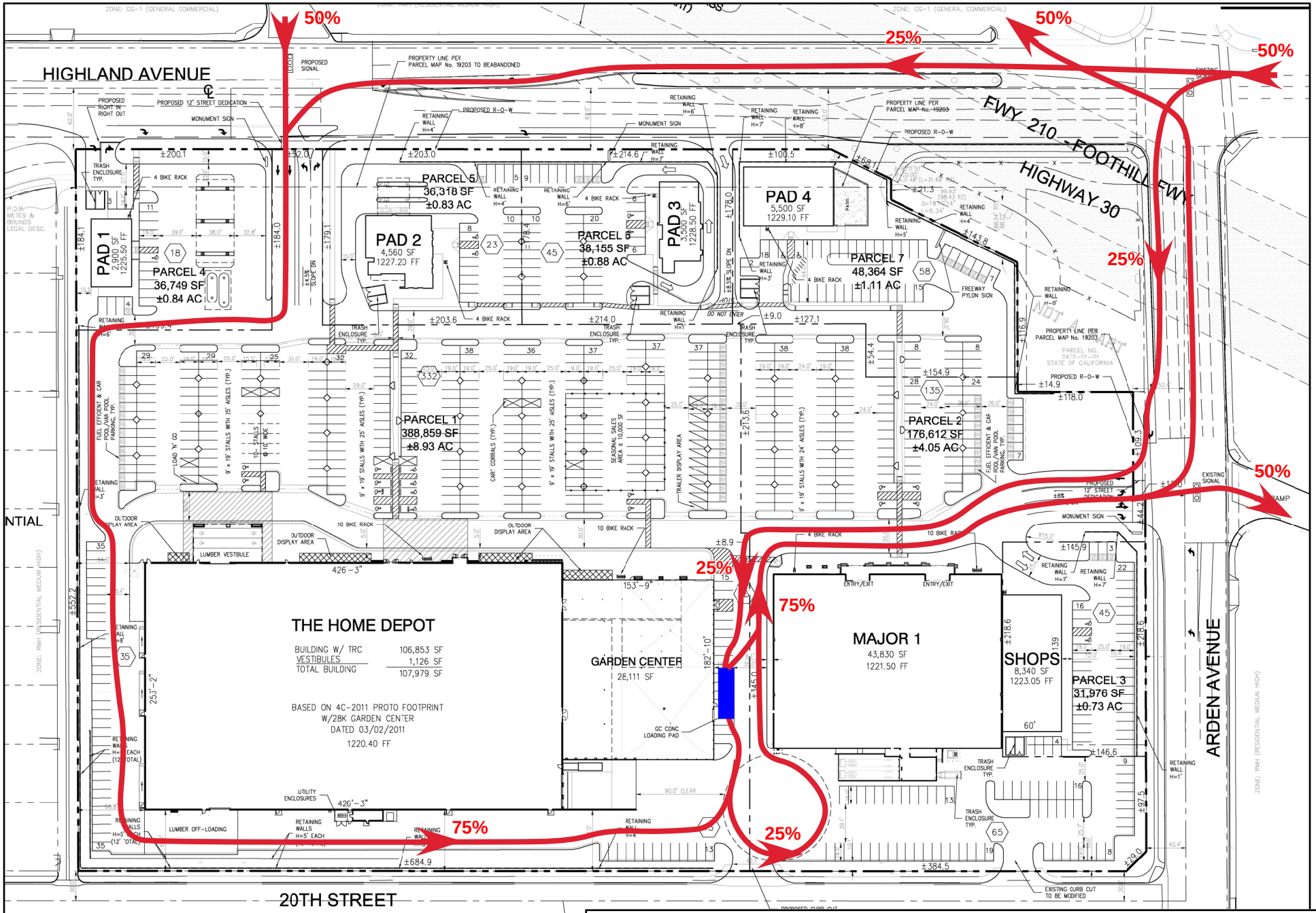
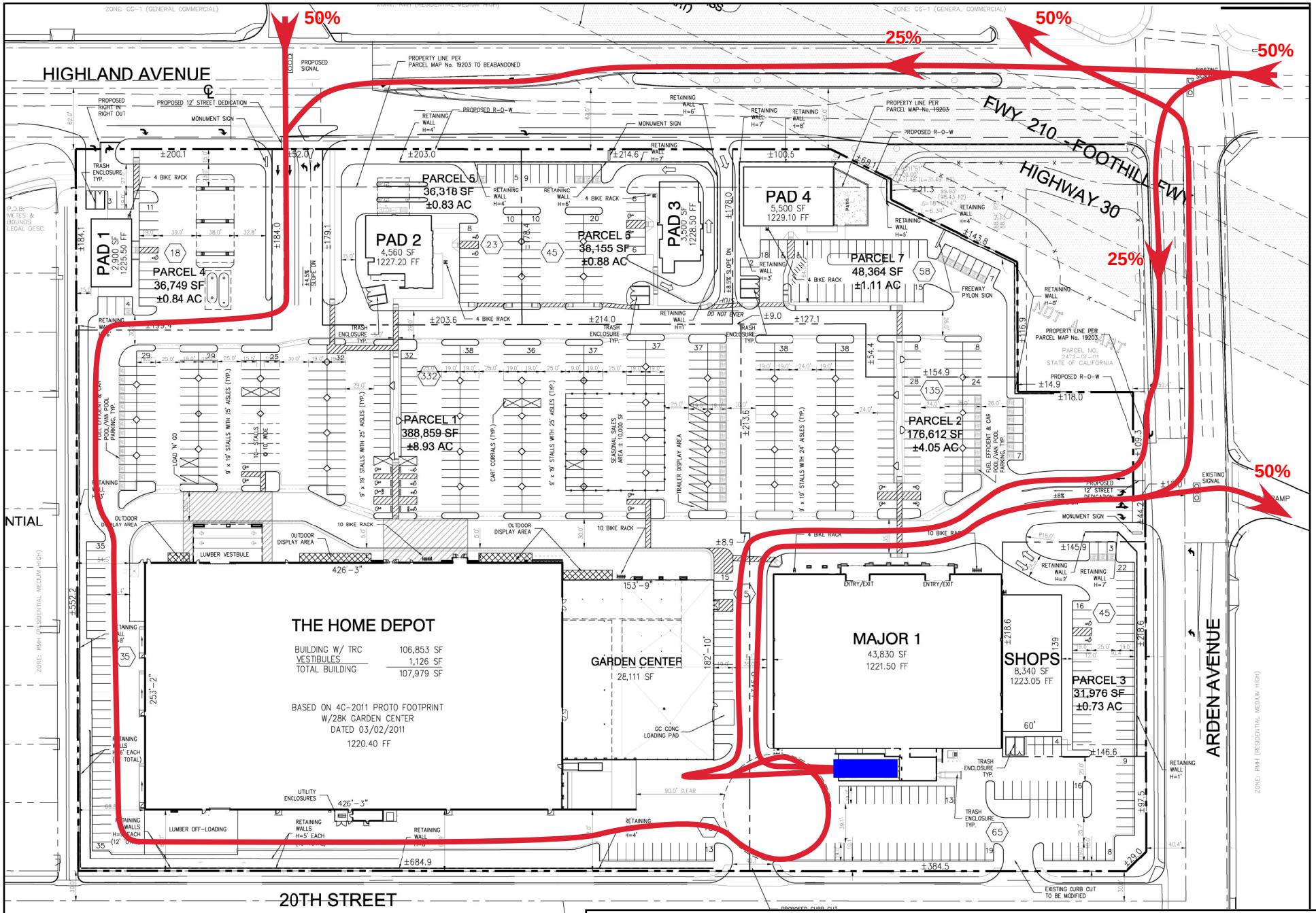


Figure 5 - Home Depot Garden Center Delivery Truck Path

Mestre Greve Associates

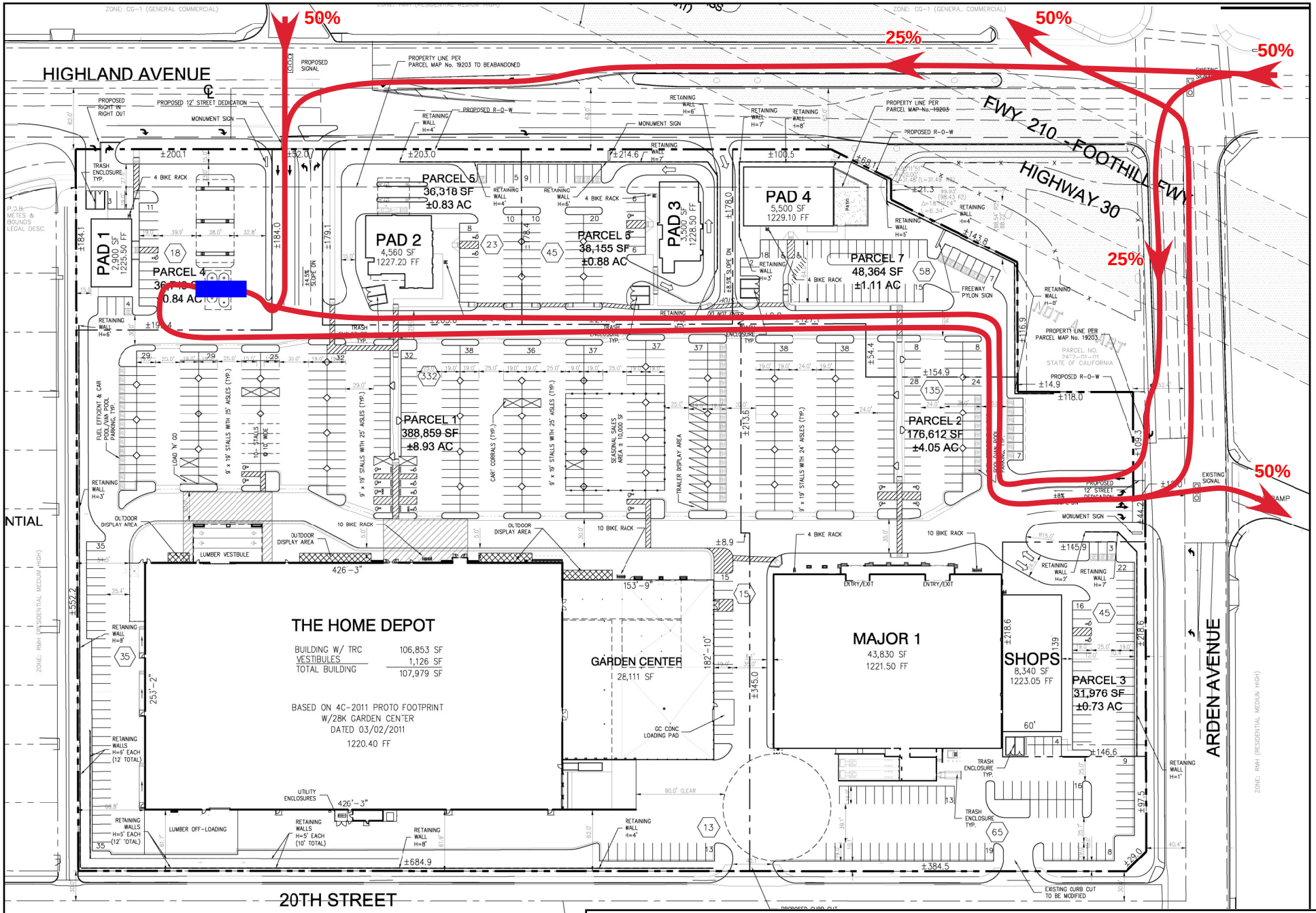


Delivery Truck Travel Route

Destination/ Idling Location

Mestre Greve Associates

Figure 6
Major 1 Delivery Truck Path

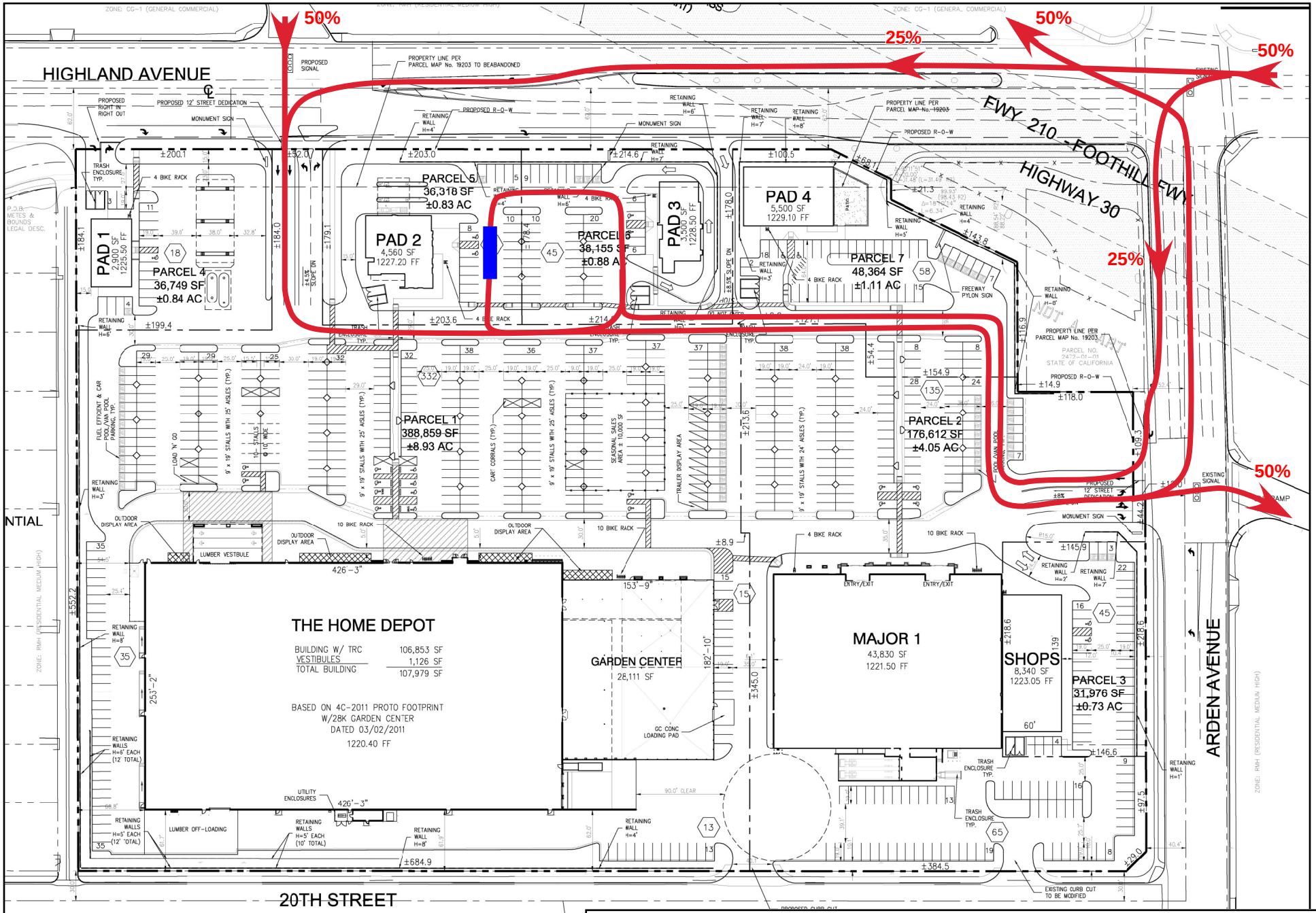


Delivery Truck Travel Route

Destination/ Idling Location

Figure 7
Pad 1 Delivery Truck Path

Mestre Greve Associates

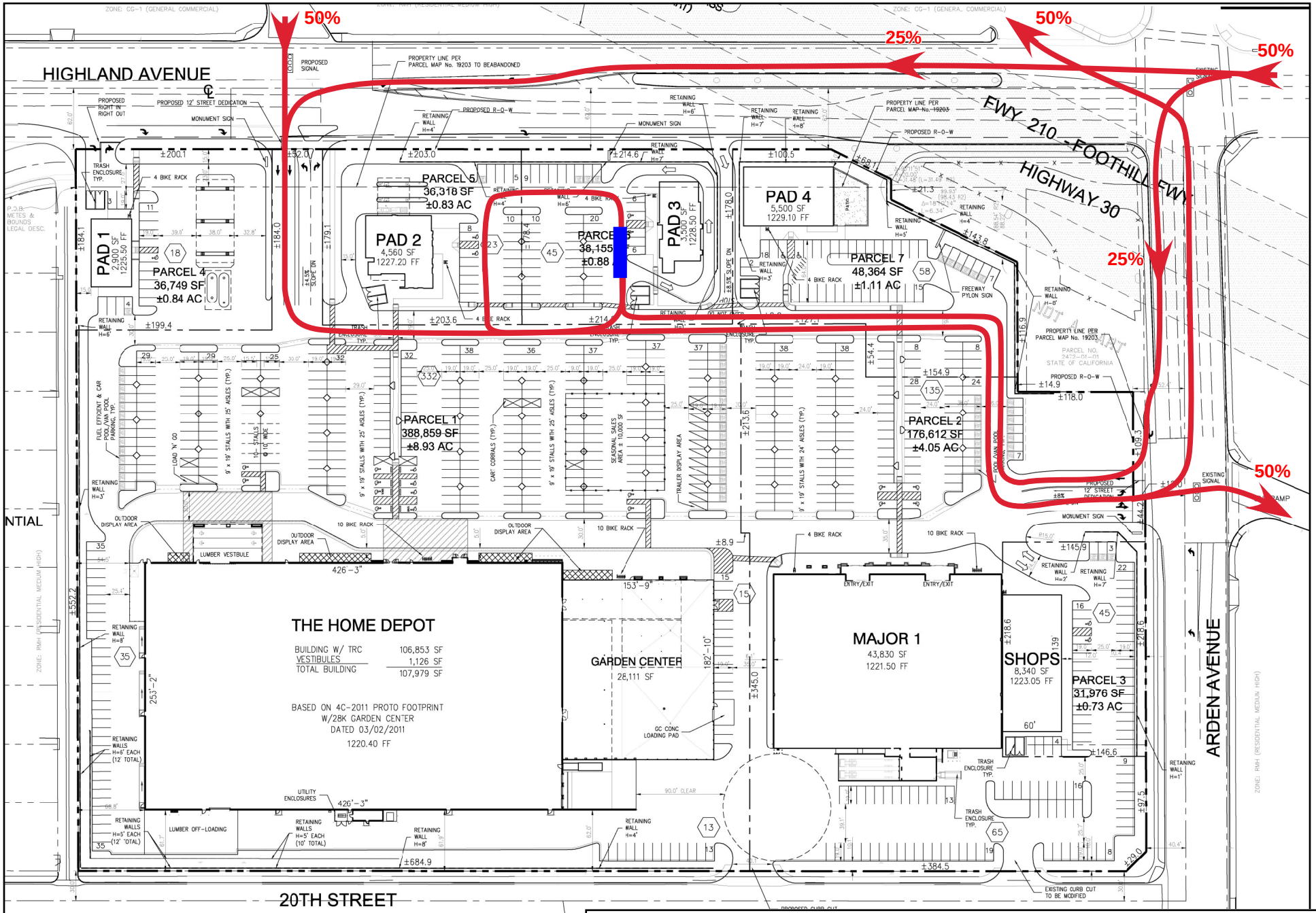


Delivery Truck Travel Route

Destination/ Idling Location

Mestre Greve Associates

Figure 8
Pad 2 Delivery Truck Path



Delivery Truck Travel Route

Destination/ Idling Location

Figure 9

Pad 3 Delivery Truck Path

Mestre Greve Associates

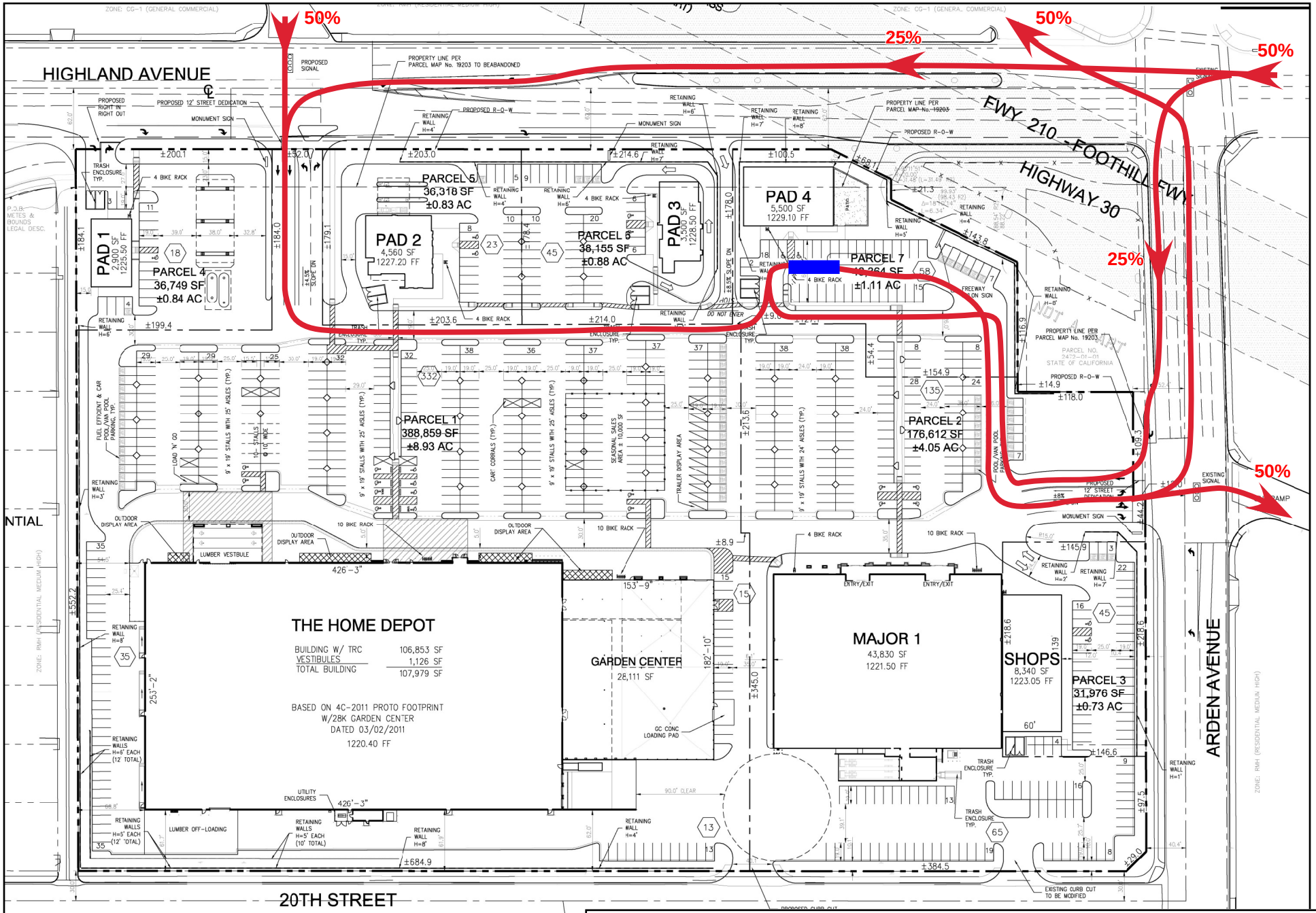
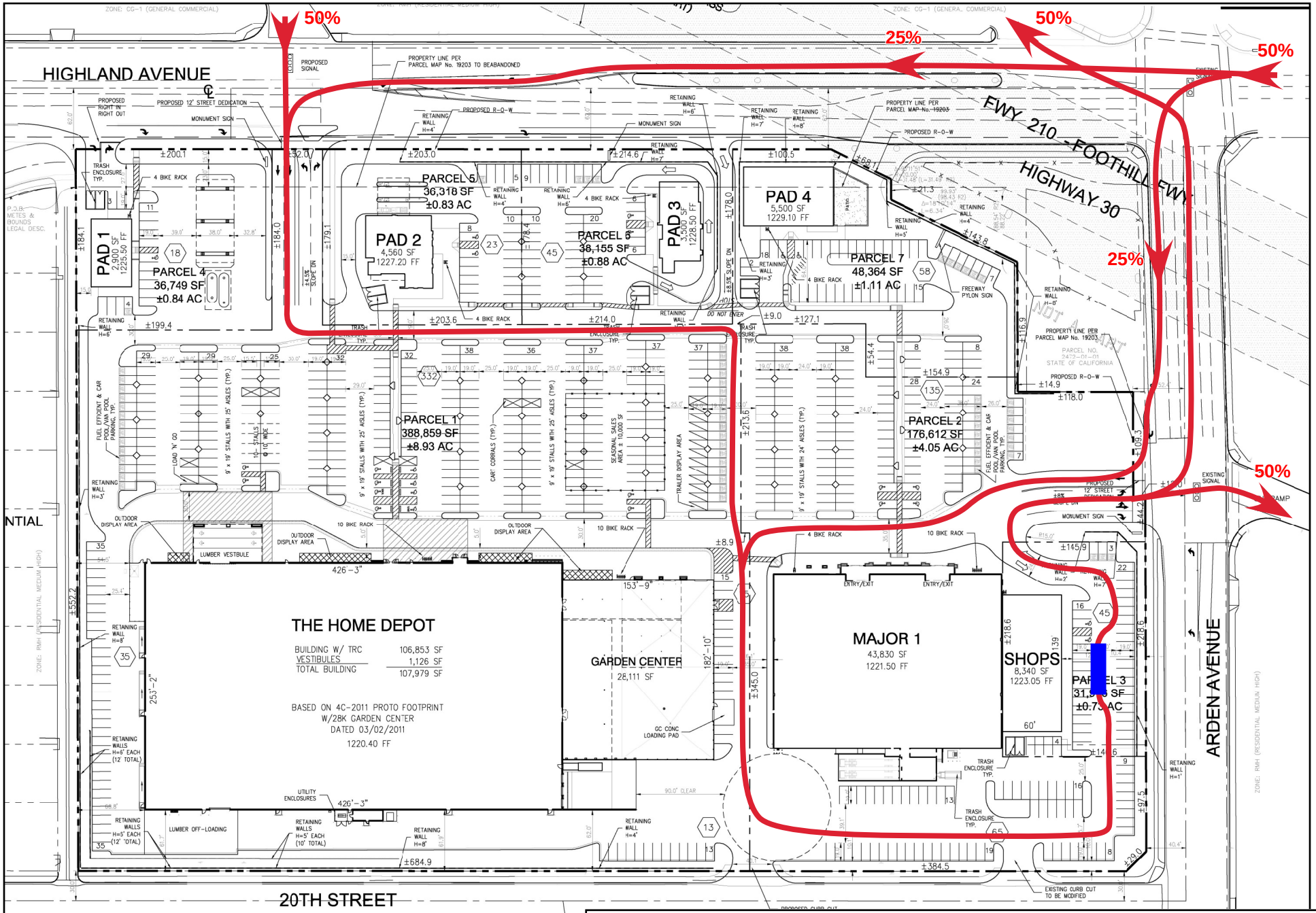


Figure 10
Pad 4 Delivery Truck Path

Mestre Greve Associates



Delivery Truck Travel Route

Destination/ Idling Location

Figure 11
Shops Delivery Truck Path

Mestre Greve Associates

2.3 Dispersion Model

The U.S. Environmental Protection Agency's required regulatory pollutant dispersion model AERMOD was used to estimate pollutant concentrations at sensitive receptors in the vicinity of the project. Specifically, the AERMOD release 11103 released on April 13, 2011 was used. ISC-AERMOD View by Lakes Environmental was used to generate the input file for AERMOD. The model was set to calculate the highest 24-hour average concentration as well as the annual average concentrations.

Weather data prepared by the South Coast Air Quality Management District specifically for the AERMOD model was used for the dispersion modeling (http://www.aqmd.gov/smog/metdata/MeteorologicalData.html). This data file represents actual measured weather conditions at the San Bernardino Location for the years 2005, 2006, and 2007.

Truck travel paths represent Line Sources. AEROMOD does not directly model Line Sources. Line sources were modeled as Separated Volume Sources using the method described in Volume II of the U.S. EPA User's Guide for the Industrial Source Complex (ISC3) Dispersion Models (US EPA 1992). The line sources were modeled with a 12 foot release height and a 1 meter vertical dimension. The truck idling locations were modeled as area sources with a 12 foot release height and a 1 meter initial vertical dimension. As discussed above, the 25 mph emission factor was assumed for all truck travel on public roads and the 10 mph emission factor was assumed for all truck travel within the project site. The idling emission factor was assumed for each idling area. Each truck was assumed to idle for five minutes at its destination. CARB regulations limit idling to five minutes or less.

2.4 Determination of Cancer Risk

It is important to understand that cancer risk represents the probability that a person develops some form of cancer. The estimated risk does not represent mortality rates. It is also important to understand that the risk described in these calculations reflects a level of exposure that would be virtually impossible to experience, and that for most individuals, exposure to a particular contaminant such as DPM, would be considerably less due to shorter duration of residence in the area, amount of time spent at the residence daily and throughout the year, and the split between time spent indoors versus outdoors. Studies have shown that the typical person spends approximately 87 percent of their time indoors, 5 percent of their time outdoors, and 7 percent of their time in vehicles. Indoor DPM levels are typically lower than outdoor levels. One study indicated that indoor concentrations were 67 percent of outdoor concentrations. However, this would be dependent on factors such as open windows and HVAC system filtration efficiencies. The least expensive ventilation system filters have little or no effect on the small diesel particulates. More expensive filters can filter out the larger diesel particulates but the ultra fine particulates are primarily unaffected.

The cancer risk from DPM is estimated by first calculating the dose of DPM through inhalation. The dose is then multiplied by the Cancer Potency Factor to determine potential risk of developing cancer over a 70-year lifetime. The dose is calculated through the following equation:

$$Dose_{inh} = \frac{C_{air} \times DBR \times A \times EF \times ED \times 10^{-6}}{AT}$$

where,

$Dose_{inh}$	Average daily dose per body weight through inhalation (mg/kg/day)
C_{air}	Annual average DPM concentration in air (µg/m3)
DBR	Daily breathing rate in volume (liters) per body weight (kilograms) per day (L/kg/day)
A	Inhalation absorption factor (unitless)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
AT	Averaging Time Period (days)

The annual average concentration is determined by the AERMOD modeling discussed above. The point estimates for daily breathing rate from the OEHHA Hotspot guidelines are presented in Table 3.

Table 3
Point Estimates for Daily Breathing Rate

Exposure Duration	Rate (L/kg/Day)
9 Years	
Average	452
High End	581
30 & 70 Years	
Average	271
High End	393
Off-Site Worker	
(Single Value)	149

The values for a 9-year duration are higher than the others because they are representative of a child's breathing rate. The data is intended to represent the first 9-years of life. The 30 and 70-year rates are based on average human lifetime breathing rates. The Off-Site Worker rate is based on a 70 kg worker breathing 1.3 m^3/hour for an eight-hour day. The breathing rate recommended by the EPA is 1.3 m^3/hr as an average for outdoor workers.

The Inhalation Absorption Factor (A) is an adjustment factor to be used if the fraction of the substance that is absorbed by the body is different from the fraction used to determine the Cancer

Potency Factor. Per OEHHA recommendations it is assumed that for most TAC's, including DPM, there is no difference and the factor is 1.

Exposure Frequency (EF) is the number of days in a year that a receptor is exposed to the substance being analyzed. For a residential receptor one assumes this is 365 days per year. For a worker the exposure is 5 days per week or 261 days per year. For teachers and students the exposure is 5 days a week for 36 weeks per year, or 180 days per year.

The Exposure Duration (ED) is the amount of time in a persons life that they are exposed to the TAC being analyzed. This is typically 9, 30 or 70 years. Nine years represents the average time a person lives at one residence. Thirty years represents the high end of time a person lives at a residence. Seventy years represents a typical lifetime. Because the methodology used to determine the Cancer Potency Factor is based on long term—near lifetime—exposure, applying this factor to assess shorter duration exposures introduces uncertainty into the analysis. OEHHA does not support the use of cancer potency factors for exposures of less than 9 years.

The Averaging Time Period (AT) is the time over which the cancer risk is assessed. Standard risk assessment methodology calculates the risk over an average, 70-year, lifetime. Therefore, the Averaging Time Period is 25,500 days.

The cancer risk is determined by multiplying the Dose with the Cancer Risk Potency Factor. The Cancer Risk Potency Factor describes the potential risk of developing cancer per unit of average daily dose over a 70-year lifetime. The Cancer inhalation potency factors have been determined by the OEHHA or by the U.S. EPA and endorsed by the OEHHA. The inhalation potency factor determined by OEHHA is 1.1 $(mg/kg\text{-}day)^{-1}$. Multiplying this factor by the dose and by 1,000,000 (one-million) gives the cancer risk caused by the DPM in terms of number of cancers per million of exposed persons.

Table 4
Cancer Risk Parameters by Receptor Type

Receptor Type	Daily Breathing Rate (L/kg/day)	Inhalation Absorption Factor	Exposure Frequency (Days/Year)	Exposure Duration (Years)	Averaging Time Period (Days)
Resident	393	1	365	70	25,550
Worker	149	1	261	40	25,550
Teacher	149	1	190	40	25,550
Student	581	1	180	9	25,550

2.5 Determination of Non-Cancer Risks

The relationship for the non-cancer health effects of DPM is estimated by the following equation:

$$HI_{DPM} = C_{DPM}/REL_{DPM}$$

where,

HI_{DPM} Hazard Index; an expression of the potential for non-cancer health effects.

C_{DPM} Worst-case 24-hour average DPM concentration ($\mu g/m^3$).

REL_{DPM} Reference exposure level (REL) for DPM; the DPM concentration at which no adverse health effects are anticipated.

The chronic REL for DPM was established by OEHHA as 5 $\mu g/m^3$.

3.0 Impact Analysis

3.1 Threshold of Significance

South Coast Air Quality Management District (SCAQMD) recommends significant thresholds for new sources of hazardous air pollutants (HAPS) at it's CEQA Air Quality Analysis Guidance Handbook website (http://www.aqmd.gov/ceqa/hdbk.html). SCAQMD's recommended significance threshold for increased cancer risk is an increase due to the project of greater than 10 in a million. The recommended threshold for non-carcinogen impacts is a Hazard index greater than 1. These thresholds will be used for this project.

The project will result significant impact due to diesel truck pollutant emissions if:

- The cancer risk due to exposure of DPM from the project is greater than 10 in a million

  OR

- The Chronic Hazard Index due to exposure of DPM from the project is greater than 1.

3.2 Modeled DPM Concentrations

Figures 12 and 13 show the results of the dispersion modeling and present projected DPM concentration contours in the areas bounding the project site. Figure 12 shows the annual average concentrations and Figure 13 shows the peak 24-rour average concentrations.

Figure 12 that the highest annual average DPM concentration of 0.008 $\mu g/m^3$ is projected to occur just south of the project near the Home Depot and Major 1 loading docks. However, this maximum occurs within the 20th Street right-of-way which is not a sensitive receptor location. The maximum concentration within a sensitive receptor area is 0.006 $\mu g/m^3$ just south of the overall maximum. This occurs on the edge of the school located across 20th Street. This concentration potentially impacts both students and teachers. The highest annual average DPM concentration impacting a residence is 0.005 $\mu g/m^3$. The highest annual average DPM concentration impacting an off-site worker is 0.0028 $\mu g/m^3$ at the commercial area west of the residences adjacent to the project. The increased risk of persons contracting cancer due to these exposures are examined in Section 3.3.

Figure 13 that the highest 24-hour average DPM concentration of 0.04 $\mu g/m^3$ is projected to occur just south of the project near the Home Depot and Major 1 loading docks. However, this maximum occurs within the 20th Street right-of-way which is not a sensitive receptor location. The maximum concentration within a sensitive receptor area is 0.036 $\mu g/m^3$ just south of the overall maximum. This occurs on the edge of the school located across 20th Street. This concentration potentially impacts both students and teachers. The highest annual average DPM concentration impacting a residence is 0.025 $\mu g/m^3$. The highest annual average DPM concentration impacting an off-site worker is 0.019 $\mu g/m^3$ at the commercial area west of the residences adjacent to the project. The non-cancer health risks due to these exposures are examined in Section 3.4.

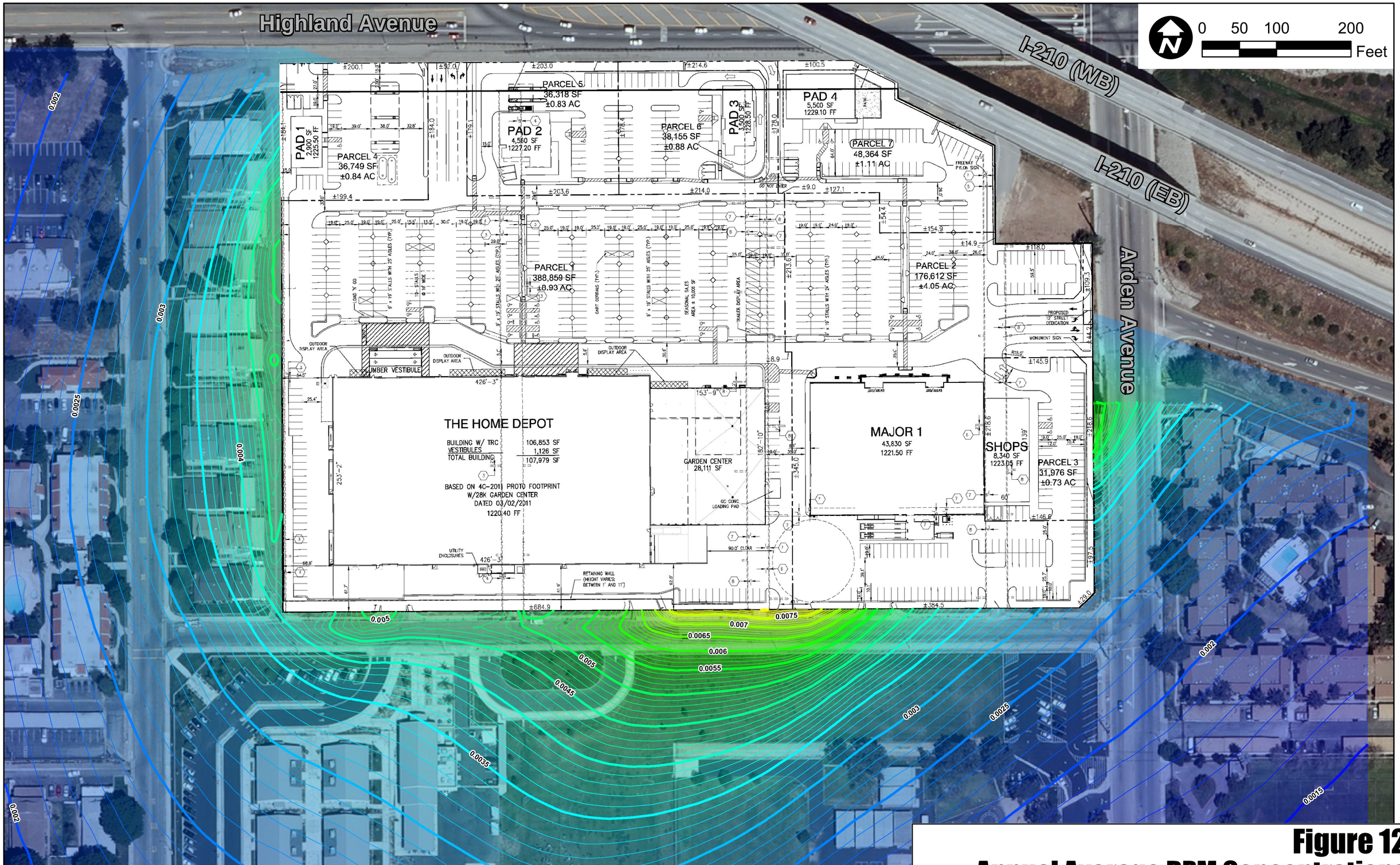


Figure 12
Annual Average DPM Concentrations

Mestre Greve Associates

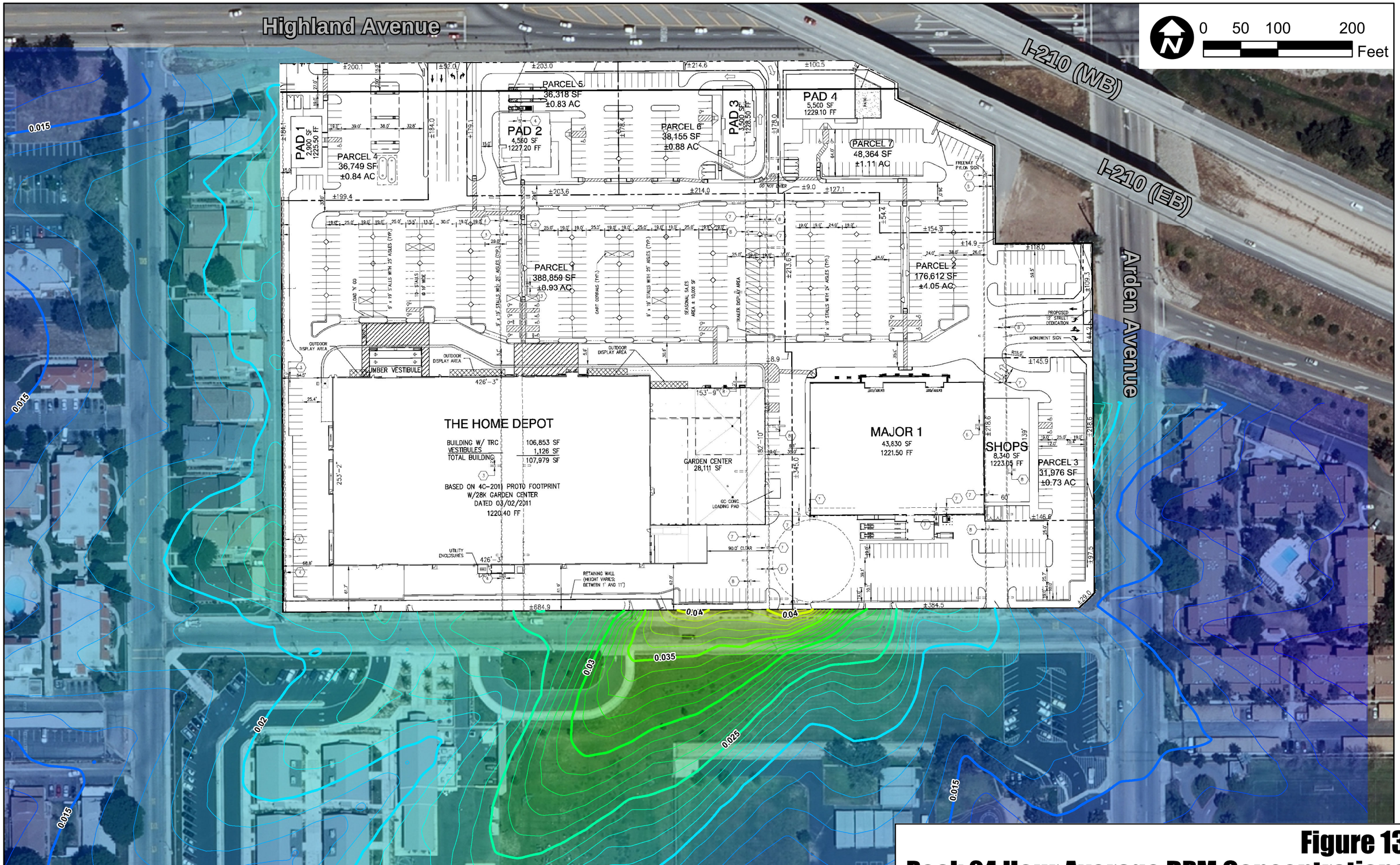


Figure 13
Peak 24 Hour Average DPM Concentrations

Mestre Greve Associates

3.3 Cancer Risk Increase Due to Project

Table 5 presents the maximum annual average DPM concentrations for the four receptor-types bordering the project; residents, workers, teachers, and students. The resident category represents the residences that bound the project to the west as well as the residences located to the east across Arden Avenue. The worker category represents the commercial area located to the west of the project across Guthrie Street. The teacher and student categories represent the school located to the south of the project across 20th Street. The table also presents the increased cancer risk due to exposure due to DPM calculated from the concentration as described in Section 2.4.

SCAQMD data indicates that the cancer risk from DPM represents approximately 70% of the total cancer risk from all Hazardous Air Pollutants (HAP). The final column estimates the overall increase in cancer risk due to exposure to all HAPs.

Table 5
Cancer Risk Increase at Maximum Impacted Receptors

Receptor Category	Annual DPM Concentration ($\mu g/m^3$)	Increase in Cancer Risk Per Million From Exposure to: DPM	All HAP*
Resident	0.0050	2.2	3.1
Worker	0.0028	0.2	0.3
Teacher	0.0060	0.3	0.4
Student	0.0060	0.2	0.3

* Estimated Assuming DPM Represents 70% of Total Cancer Risk

The concentrations presented in Table 5 represent the highest DPM concentrations in each one of these areas and therefore represent the worst-case cancer risk that assumes that a receptor spends all of their time at that point for the entire exposure period assumed in the cancer risk calculation (i.e.; 70 years/24 hours a day for residents, 40 years/8 hours a day/5 days a week for workers, 40 years/8 hours a day/180 days per year for teachers and 9 years/8 hours a day/180 days per year for a student.) Cancer risk away from these maximums scale linearly with the DPM concentration (e.g.; a residential receptor exposed to 0.0035 $\mu g/m^3$ would have a increased cancer risk of 0.0035/0.0050*2.2 = 1.5 per million).

Table 5 shows that the maximum cancer risk increase due to the proposed project is 3.1 in a million which is well below the significance threshold of 10 in a million. Therefore, the project will not result in a significant impact due to increased cancer risk from DPM emissions.

It should be noted that the cancer risk calculated for this analysis was based on projected composite average emission factors for heavy duty trucks in the South Coast Air Basin in 2013. Therefore, the cancer risk calculation does not include the effects of future reductions in diesel truck particulate emissions due to newer, cleaner trucks, replacing older higher polluting trucks. EMFAC2007 projects that in the future, 70 year average composite average particulate emissions from heavy heavy duty trucks are projected to be reduced by approximately 80% compared to 2013, 40 year average emissions are projected to be reduced by approximately 75%, and 9 year average emissions are projected to be reduced by approximately 28%. Therefore, accounting for these future reductions would reduce the calculated cancer risk presented in Table 5 by 75% for Residents, 75% for Workers and Teachers, and 28% for Students.

3.4 Non-Cancer Health Risk Due to Project

Table 6 presents the maximum annual average DPM concentrations for the four receptor-types bordering the project; residents, workers, teachers, and students. The resident category represents the residences that bound the project to the west as well as the residences located to the east across Arden Avenue. The worker category represents the commercial area located to the west of the project across Guthrie Street. The teacher and student categories represent the school located to the south of the project across 20th Street. The table also presents the hazard index due to exposure due to DPM calculated from the concentration as described in Section 2.5.

Table 6
Chronic Hazard Index at Maximum Impacted Receptors

Type	Concentration ($\mu g/m^3$)	Chronic Hazard Index
Resident	0.0250	0.005
Worker	0.0190	0.004
Teacher	0.0360	0.007
Student	0.0360	0.007

Table 6 shows that the maximum chronic hazard index due to the proposed project is 0.007, which is well below the significance threshold of 1. Therefore, the project will not result in a significant impact due to non-cancer health risk from DPM emissions.

4.0 Mitigation Measures

The analysis presented above shows that Diesel Particulate Matter (DPM) emissions associated with the proposed project will not result in a significant impact. Therefore, mitigation is not required.

APPENDIX

EMFAC2007 Modeling Files

To minimize paper consumption these files are available electronically on request.

AERMOD Modeling Files

To minimize paper consumption, these files are available electronically on request.