Exhibit A

South Windsor Planning and Zoning Commission

Proposed Zoning Text Changes

Public Hearing March 14, 2023

Presented by: Bart Pacekonis, PZC Chair

Moratorium

On April 5, 2022 the Planning and Zoning Commission voted to implement an one year moratorium on applications/development of warehouses, distribution centers and similar “big box” projects which is in effect until April 22, 2023.

The purpose is to take a pause so the Commission, in concert with town staff, could review current regulations to determine if and what changes/additions/alterations are necessary to meet the evolving needs of the town. The goal is to more effectively plan and regulate development of large warehouse-type facilities within the industrial and commercial zones.

PZC Warehouse Subcommittee established in May of 2022– met over the past 9 months to review and proposed modifications to regulations. Tonight is a presentation of the proposed changes

Considerations for Subcommittee from adopted moratorium

- Zoning classification– i.e. Industrial, Commercial, variation of these (i.e. Industrial Park Zone)
- Level of “intensity” – i.e. the frequency at which products/materials are moved in and out of a facility
- Distance from residential areas of certain types of industrial uses
- Size of building; Number of dock doors
- Types of vehicles (tractor-trailers) using the facility; Impact on traffic/queuing
- Level of noise; Level of air pollution
- Hours of operation (i.e. 24/7)
- Outdoor storage requirements
- Number of full and part time employees (parking implications)
- Compliance with Plan of Conservation and Development

PZC Subcommittee work - examples

Changes in the regulations to address:

- Land uses, definitions and approval process
  - Create definitions for types of uses
  - Provide location setback requirements for types of uses
  - Determined application process – special exception versus site plan
  - Defined project information required related to operation on site and traffic patterns
  - Set performance criteria outlined for noise, air pollution and lighting
- Site design criteria considerations
  - Determine sizes/types of vehicles using the facility and design of parking areas to accommodate
  - Updated Traffic Study criteria for evaluating the development impact on traffic/queuing/access
  - Reviewed and updated parking requirements and reserve parking considerations
  - Defined criteria for outdoor storage locations and screening requirements
- Screening and Buffer requirements
  - Increase buffer plantings and included cross section examples of buffers
  - Defined screening and when required
  - Determine requirements of different types of outdoor storage screening

Intensity rankings

1	2	3	4	5
Very low intensity. Requires Site Plan	Low intensity. Requires Site Plan	Medium intensity. Requires Special Exception	High intensity. Requires Special Exception.	Very High intensity. Requires Special Exception.

Self storage type
- Drive up, climate-controlled, business, vehicle, etc.
- Typically just a few transactions/month or 12-15/year
- Personal residential use
- Typically in industrial and commercial zones
- Examples: Admiral, CubeSmart, Storage Sense

TBD
- Manufacturing
- Office
- Contractors
- Service/showrooms

Warehouse
- Primarily for storage
- Medium to high level of truck traffic
- Limited hours of operation
- Fewer dock doors than Distribution Center/Truck Terminal
- Intensity could be as high as a few transactions/day but should be no more
- 24/7 operation would require soundproofing
- Special Exception> 40,000 sf

Distribution Facility
- Heavy flow of traffic in and out all day
- Greater concentration of dock doors than Warehouse
- More air and noise pollution as a result of activity
- 24/7 operation would require soundproofing
- Examples: Home Depot, Aldi, Coke

Freight Terminal
- Most industrial application
- High noise and air pollution impact
- High traffic and congestion
- Requires greatest distance from residential
- 24/7 operation requires soundproofing
- Examples: R&L Carriers, Old Dominion

Last Mile Delivery Facility
- Highest level of activity – vehicles in and out consistently
- Loads moving quickly in and out should reduce idling but could enhance noise
- Examples: Amazon

Bus Storage Facility
- Factors similar to Freight Terminal
- Examples: DATTCO

If an applicant / developer cannot identify the specific application for a project (i.e. is it a Warehouse or is it a Truck Terminal?) the PZC will assume the highest level of intensity and most onerous requirements.

Types of facilities and definitions

- **Storage Facility**
  - Lowest level of intensity generally used by individuals or small business to store goods for a long period of time with low level of frequency moving in and out – generally less than once/month. Usually rented out for personal needs like furniture, or even a car. Small cube spaces part of a facility of dozens or even hundred of units. Renters can access facility at any time. Not intrusive in terms of traffic, queuing, noise, air pollution. Low impact application. Requires no employees and few parking spaces as functions as self-serve so hours of operation are generally irrelevant. Generates little to no noise/air pollution. No standard building configuration. No minimum distance from residential areas
- **Warehouse**
  - Can be referred as a high cube warehouse; typically a building at least 200,000 gross square feet with ceiling height of 24+ feet. Used for storage/consolidation of goods prior to their distribution. Typically has a high level of automation and high-efficiency processing enabling inside workers to process orders that leave the building. Medium level of intensity as goods are often housed for more than a month resulting in fewer issues with traffic congestion and queuing. Loading dock typically on one side. Usually lower number of dock doors – one per 20,000 sq. ft. Will have limited hours of operation – generally M-F early morning to late afternoon. Fewer employees and parking spaces versus other facilities due to lower intensity. Noise and air pollution should not be a factor. No minimum distance from residential areas; facilities greater than 40,000 sf require special exception
- **Distribution Center**
  - Many of the same elements as a Warehouse as the two terms are often used interchangeably or together. Distribution centers will have a higher level of intensity with goods moving in and out daily. Increased intensity results in greater traffic/queuing issues. Typically has more dock doors – i.e. one per 10,000 to 20,000 sq. ft. Also may have dock doors on two adjacent sides. Higher levels of automation versus Warehouse and greater truck parking needs. Greater noise and air pollution as a result of increased truck activity. Requires more employees and parking spaces per capita than Warehouse as a result of greater activity and intensity. May require 24/7 operation. Distance from residential area minimum of 500 feet. The distance is measured from the zone line to the property line.

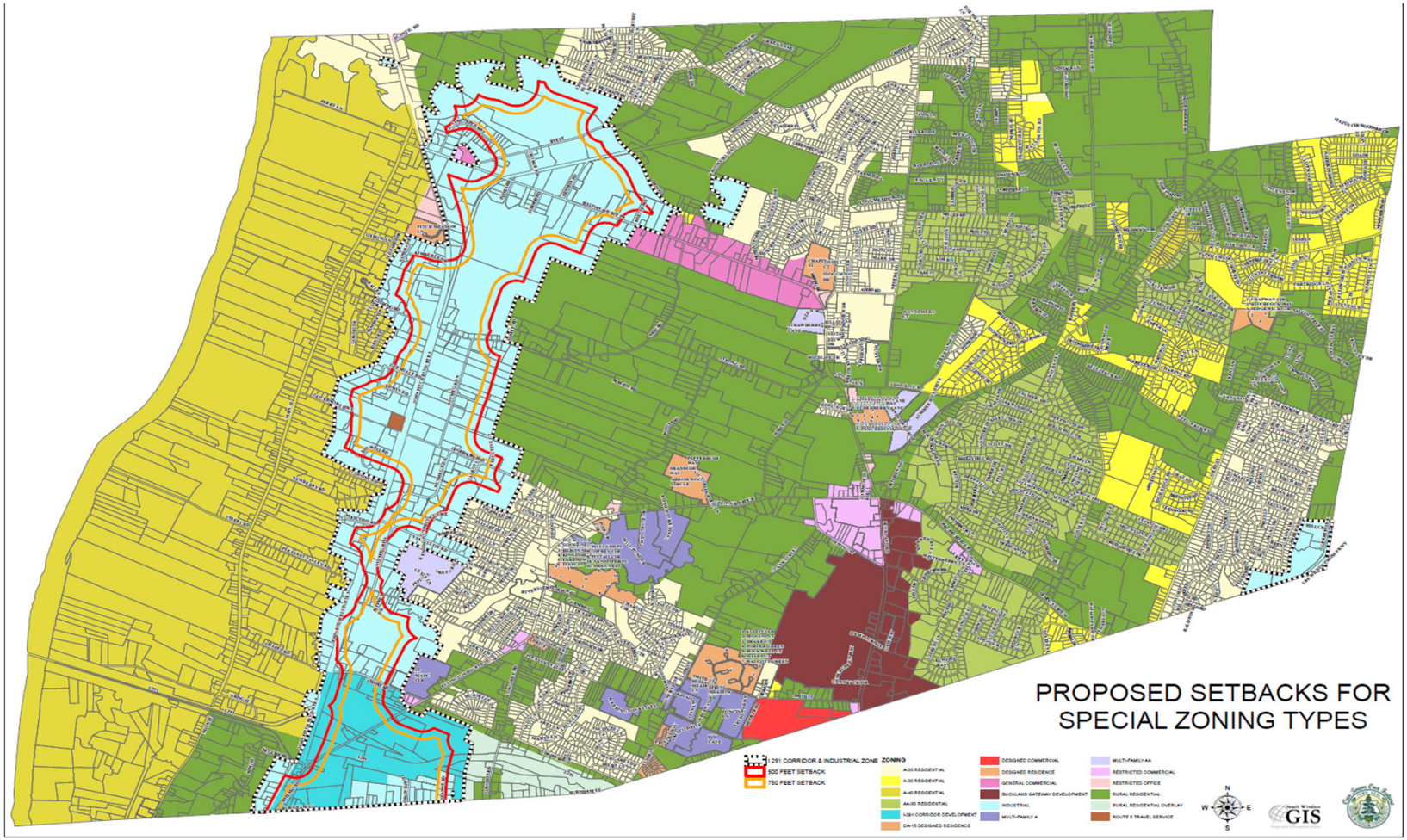
Types of facilities and definitions

- **Freight Terminal**
  - Also called a Transload Facility or a Parcel Hub or cross-dock facility. High intensity with high number of dock doors – typically 1 per 10,000 sq. ft. but can range to 1 per 5,000 – 15,000 sq. ft. May require dock doors on 2 or more sides. Typically has little storage as main purpose is for rapid transfer of loads from one vehicle to another. Most industrial of all applications with concentration of traffic moving in and out hourly. Can impact neighborhood traffic and present queuing challenges. Hours of operation often greater than other applications including need for 24/7 operation. Noise and air pollution problematic. Least desirable use near residential areas. Distance from residential minimum of 1000 feet. Consolidation of pallet loads, little storage duration. May include truck washing, fueling and maintenance areas. Number of employees and parking spaces vary based on operation but generally higher than Warehouse. The distance is measured from the zone line to the property line.

- **Last mile delivery facility**
  - Also called a Fulfillment Center. Generally the highest level of intensity with vehicle traffic in and out throughout the day. Often will use vans or other types of vehicles other than tractor-trailers on out-going distribution, but incoming loads are typically large trucks. Typical facility wojuld be an Amazon Distribution Center. Physical facility similar to Warehouse. Dock doors could be on two sides. Many elements similar to Warehouse or Distribution Center. Intensity requires high – maybe highest – number of employees and parking spots. Noise and air pollution should be moderate as trucks will quickly drop load and leave unlike Distribution Center or Freight Terminal where trucks may linger. Hours of operation should be limited. Distance from residential zone minimum of 750 feet. The distance is measured from the zone line to the property line.

- **Bus storage facility**
  - Also referred to as a bus yard or bus depot. This is any area where buses – or other large commercial or industrial vehicles - are housed and maintained. An example of this facility is the DAATCO bus yard at Strong and Nutmeg Roads. Generally, this facility would be high intensity as loud and heavy vehicles are entering and exiting frequently throughout the day. This facility would generate high levels of pollution, noise and other forms of disruptions as a result of the inherent activities at the facility (i.e.. Maintenance, repairs, cleaning, etc.) In the case of a DAATCO type facility there could be snow clearing activity as early as 3AM. The structures on the lot might vary per the needs of the use, but would generally include large garage and bay space, and office space. Much of the activity occurs on the grounds, not in the building. While not likely 24/7 operation, it could be. (An example of this facility is the DAATCO bus yard at Strong and Nutmeg Roads.) Distance from residential minimum of 750 feet. The distance is measured from the zone line to the property line.

Distance Setback for Types of Use



Add new Section 7.24 - excerpts

Section 7.24 Freight, Truck, Warehouse Distribution Center **Add Section 7.24**	Add- Section 7.24. Reviews Intent of this use. Provides definition for warehouse, distribution center, bus/truck storage facility, freight terminal, and last mile delivery facility. This section cover provisions, buffer/screening requirements and additional application information.

7.24.2 Provisions

A. At the time of application, all new facilities shall comply with the separating distances outlined above. An anticipated truck route shall be provided.

B. Details of the hours of operation for activities is required. The Commission may limit activities to specific hours to reduce impacts on residences.

C. Signage for directional guidance for vehicles entering and exiting the facility shall be provided on-site, including directional guidance to the nearest truck route.

7.24.3 Additional Application Information

The following additional information shall be provided at the time of application:

1. A general floor plan which illustrates the layout of the proposed uses;
2. A narrative detailing such items as: number of docks doors, hours of operation, proposed uses, level of "intensity" – i.e. the frequency at which products/materials are moved in and out of a facility; and
3. Any operation and outside maintenance plan for the facility including snow clearing operations, maintenance of detention basins, pavement markings, signage etc. shall be shown on the plans.

Add Performance Standards - examples

Added Section 4.5.8 Performance Standards **Add 4.5.8, 4.5.8.a, 4.5.8.b, 4.5.8.c**	Add- new section, which states that no development should have environmental impact, such as unreasonable emission of smoke, noise, dust, glare, fumes, odor, ionizing radiation, vibration, heat or any other pollutants. This added sub-section that highlighted noise and air pollution compliance and requirements.

a. Environmental Impact. No use shall be allowed that is noxious or offensive by reason of the emission of smoke, particulate matter, noise, dust, glare, fumes, odor, ionizing radiation, vibration, heat or any other pollutant or waste. All industrial uses which may potentially emit such pollutants, shall submit a written assessment of the environmental impacts of the proposed uses and a plan which demonstrates how the project will comply with local, state and federal environmental regulations.

b. Noise. Noise shall be controlled by design (sound wall placed close to the source of the noise) and/or vegetative screening to minimize impacts on adjacent streets and properties. In accordance with the provision of Section 22a-174-18 of the Connecticut State Statutes, no truck engine shall be allowed to idle for a period in excess of three minutes, when such vehicle is parked in any parking lot, truck loading area, transient loading space, or other location adjoining a residential area.

c. Air Pollution. In order to minimize the pollution of air, all uses shall comply with the standards and requirements of the vision of Section 22a-174-1 to 22a 174-200 of the Connecticut State Statutes inclusive and all other applicable federal, state and local laws

Add Section 4.5.9 Illumination	Add- new section, which requires exterior illumination and noise shall be controlled by design or screening as not to intrude upon adjacent streets or properties. Reduction of lighting during night time hours would be encouraged.
Add Section 4.5.10 Protection of Natural Diversity	Add- new section, which states that no land located within an area designated by DEEP can be developed without first applying to DEEP.

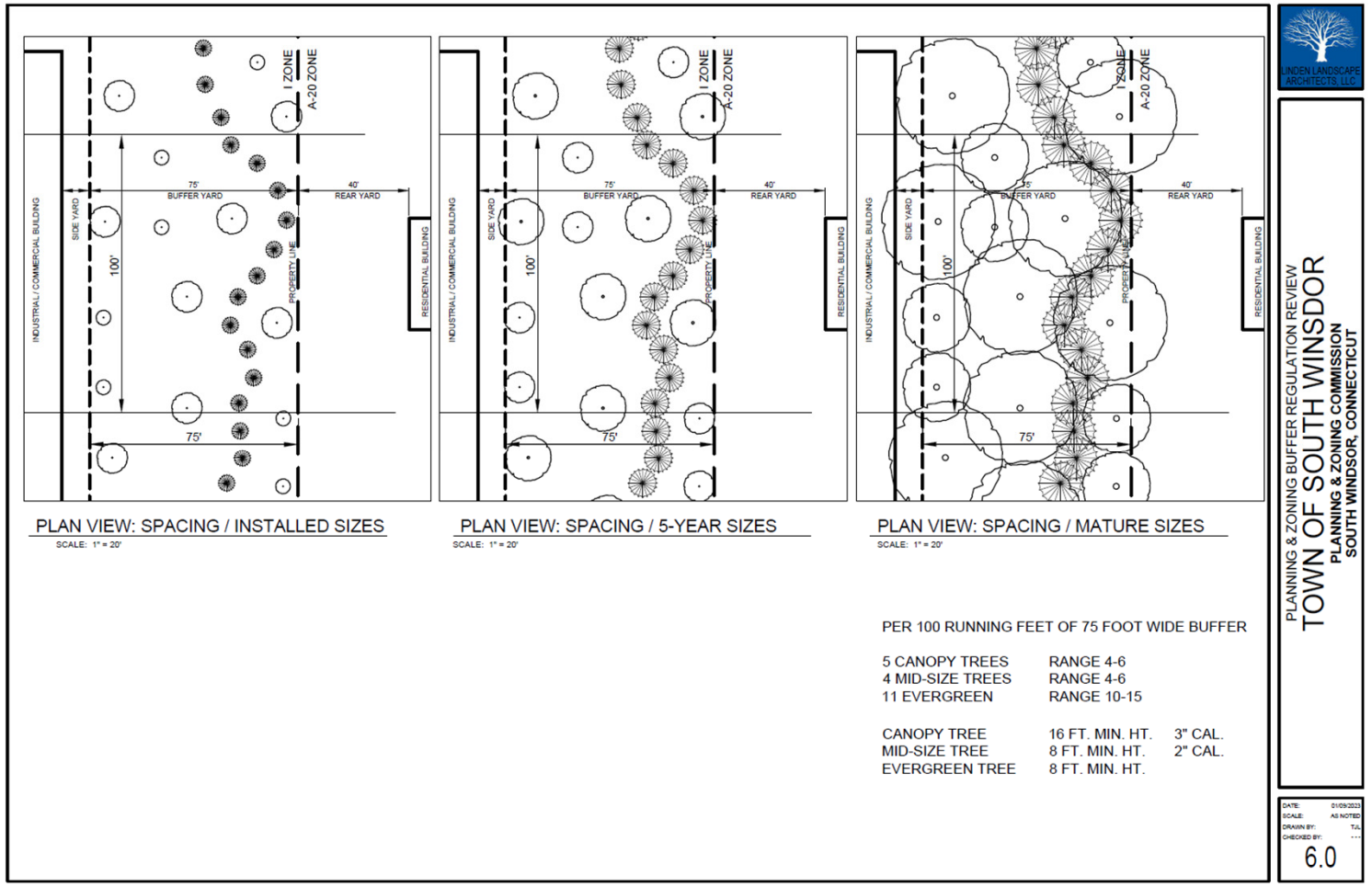
Parking Lot Design Changes

Section 6.4 Parking and Access **Modify Table 6.4.3B**	Modify- Table 6.4.3B Minimum Required Parking Spaces for Commercial and Industrial Uses to add separate requirement for Distribution Facilities and modify Manufacturing and Warehouse parking.
Section 6.4.4 Off-Street Parking- General Provisions **Modify 6.4.4.A 6.4.4.I and 6.4.4.J**	Modify-6.4.4.A Parking requirements to be exclusive for any truck parking requirements. 6.4.4.I Perimeter Circulation Road to allow for limited employee parking. 6.4.4.J Construction of Parking to include parking lots to have proper drainage and conform with Federal ADA requirements.
Section 6.4.5 Design of Parking Areas **Modify 6.4.5.A** **Add 6.4.5.I, 6.4.5.J, 6.4.5.K, 6.4.5.L**	Modify- 6.4.5.A to add truck turnaround may be required. Add- 6.4.5.I to address wider truck access. Add- 6.4.5.J to address turning radius in accordance with Public Improvement Specifications. Add- 6.4.5.K identify parking spaces on site plans with signage. Add- 6.4.5.L no parking to interfere or block designated loading areas. Employee parking to not be located near truck traffic.
Section 6.4.8 Off-Street Loading **Add Section 6.4.8.1** **Add 6.4.8.1.A** **Modify 6.4.8.B** **Add 6.4.8.C** **Add 6.4.8.D**	Add- Section 6.4.8.1 General Provisions Add- 6.4.8.1.A Loading and Screening requirements. Some requirements inckude: warehouse truck loading aprons to be no closer than 150 feet from residential boundary lines and truck loading areas to be complete screened. Modify- 6.4.8.B Loading Docks/Receiving Areas to allow the Commission to permit truck loading area aprons between sides of the building and a secondary frontage. Add- 6.4.8.C Protection of Buildings- require bumpers at dock-height doors and bollards to be located to either side of drive through doors and building corners adjacent to paved accessways. Minimum heights for truck loading docks and fuel pump canopies. Add- 6.4.8.D Loading Space Standards for new buildings or additions of 10,000 SF or more. Standards include one space for each use between 10,000-20,000 sf and one space for each additional 10,000 sf. Truck loading spaces shall be at least 10 feet in width and 25 feet in length. Truck trailer storage space to be 12 feet in width and 65 feet in length.
Section 6.4.9 Modification of Minimum Required Parking Spaces **Modify 6.4.9**	Add- Maximum parking reduction of 10% with option to show reserve spaces Add- Items 1 and 2 under this section to review conditions of parking reduction.

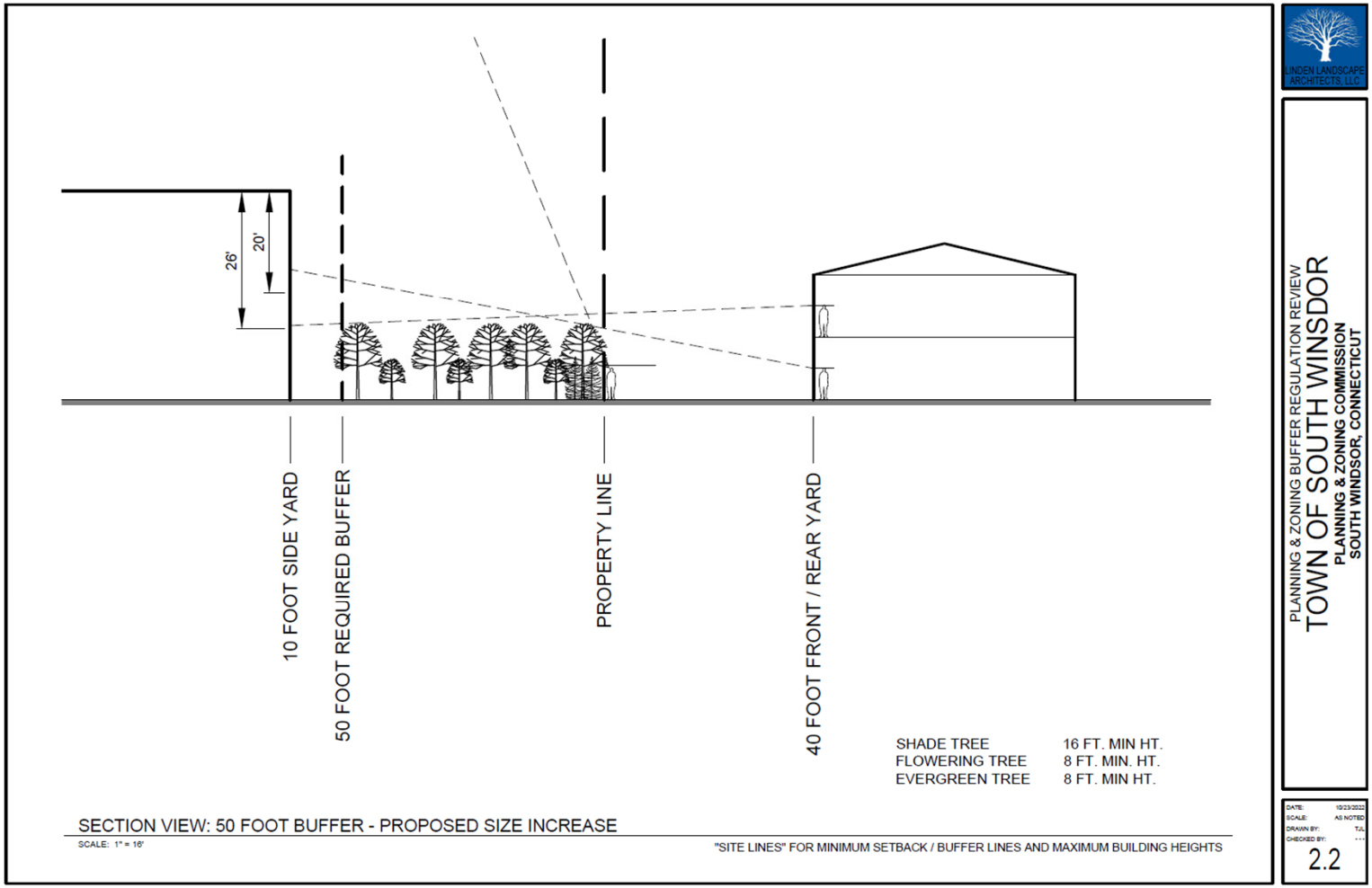
Buffer Changes

Zone/Use	Buffer Width
GC, RC, TS	**50 feet**
Industrial	75 feet; Applicant may request reduction to 50 feet in accordance with Sec. 6.2.4.C.1 and 6.2.4.C.2 - See Appendix for Buffer Designs
Section 6.2 Landscaping and Buffers **Modify 6.2.1.B** **Modify 6.2.1D** **Add 6.2.1.G** **Add 6.2.1.H**	Modify- 6.2.1.B identification of invasive plant species by DEEP. Modify- 6.2.1.D Potentially requiring fencing around detention basins with decorative fencing required if facing a public way. Add 6.2.1.G Landscaping to include crop pollinators Add 6.2.1.H Landscape strips between commercial properties shall be monitored for trash.
Section 6.2.2 Maintenance of Landscaping **Modify 6.2.2**	Modify 6.2.2 Commission to require additional bonding for sites without irrigation systems and all buffer bonds to be held for a minimum of two years to ensure survival.
Section 6.2.4 Buffers **Modify 6.2.4.A** **Modify 6.2.4.B.2** **Add 6.2.4.B.4.c** **Add 6.2.4.B.4.d** **Modify 6.2.4.B.8** **Modify Table 6.2.4A Buffer Widths** **Modify 6.2.4.C.1** **Modify 6.2.4.C.2** **Modify 6.2.4.D** **Modify 6.2.4.E** **Modify 6.2.4.F**	Modify 6.2.4 Purpose to include pollutants and further describe the purpose of a buffer. Modify 6.2.4.B.2 to add at time of the application and adjust height of evergreen trees, shade trees and caliper. Suggests reviewing Section 11.1.9.2 Cross Sections. Add 6.2.4.B.4.c Multifamily Assisted Housing Add 6.2.4.B.4.d Senior Residence Development Modify 6.2.4.B.8 to further review alternative buffer and planting requirements. Modify Table 6.2.4A Buffer Widths Buffer Width in GC, RC and TS zone to be 50 feet and in I zone to be 75 feet. Modify 6.2.4.C.1 any pre-existing lot in the I zone prior to these adopted regulations can maintain a 50-foot approved buffer. Modify 6.2.4.C.2 when a 75-foot buffer is required the buffer width can be reduced to 50-feet upon demonstration of performance standards. Modify 6.2.4.D from Interplanted Buffer to Buffer Plantings and combine language in Item E Non Interplanted Buffer. Remove tree suggestions. Modify 6.2.4.E from Non Interplanted Buffer to Alternative Buffer and review options for alternative buffers and requirements. Modify 6.2.4.F from Alternative Buffers to Berms. Review berm designs and requirements.
New- Section 6.2.5 Screening Requirements	Add Section 6.2.5 Screening Requirements- The section reviews the purpose, standards and types of screening the Commission will now require.

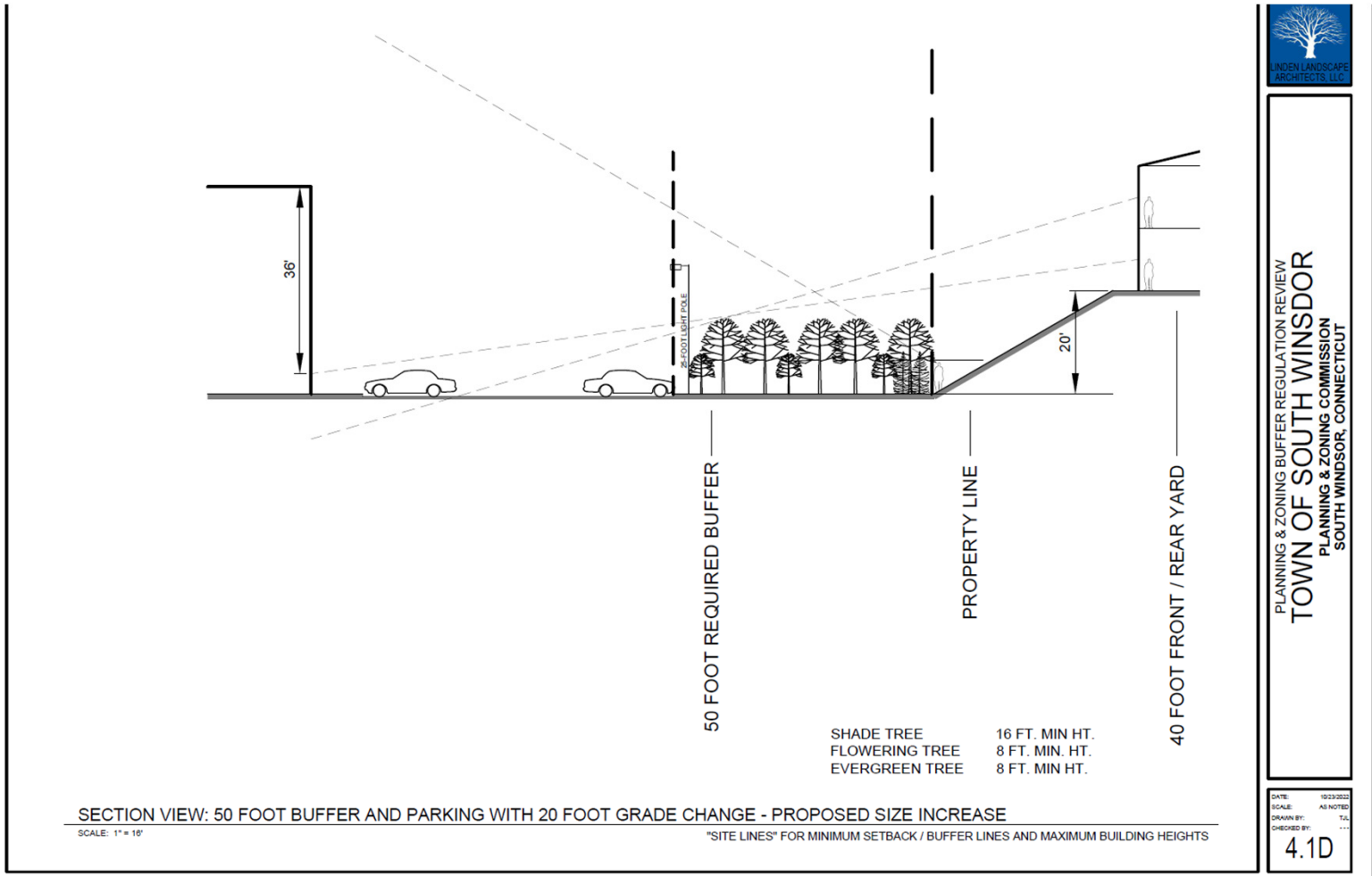
Buffer Cross Section Samples – Plantings



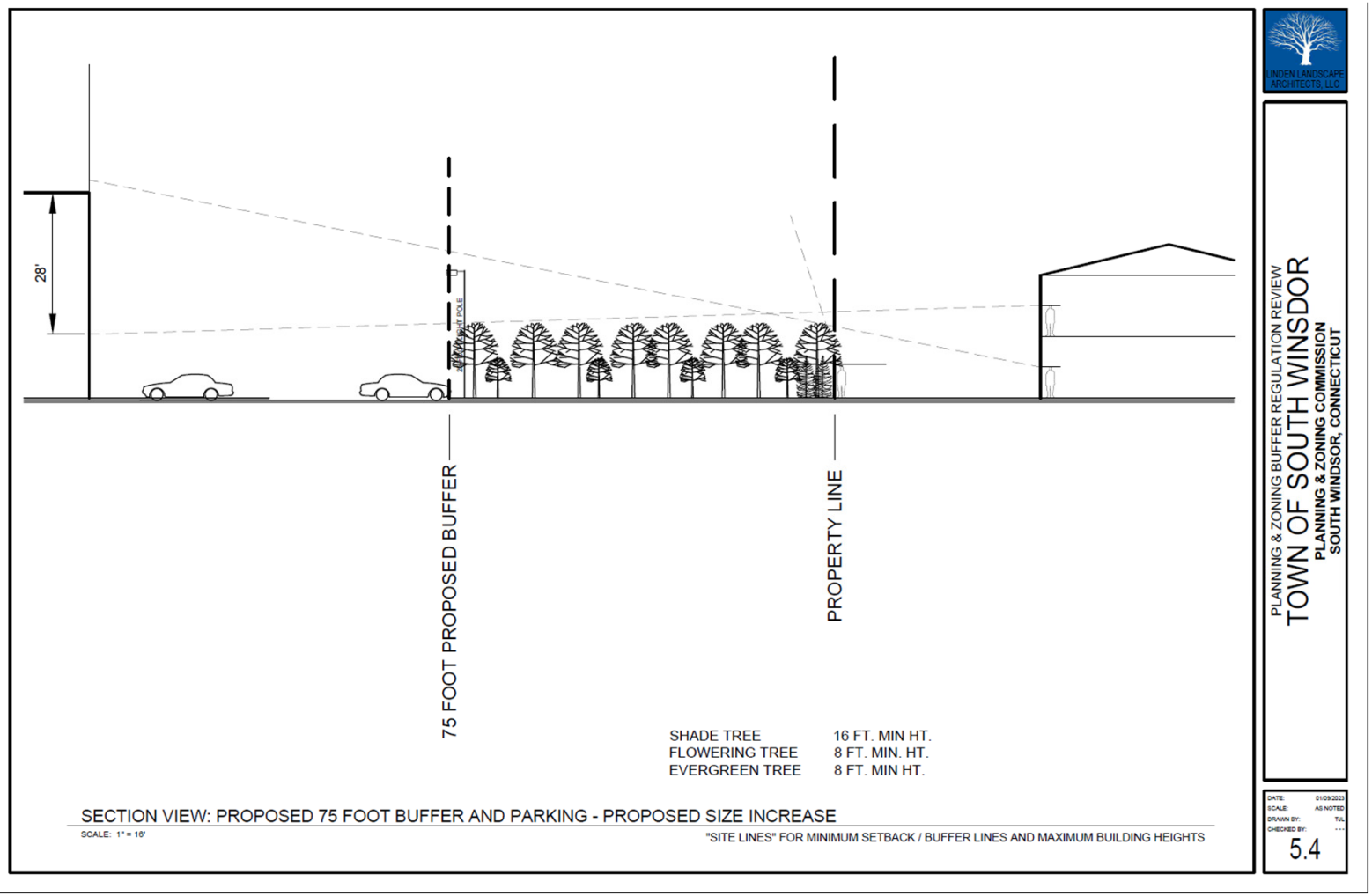
Buffer Cross Section Samples – Exhibit A



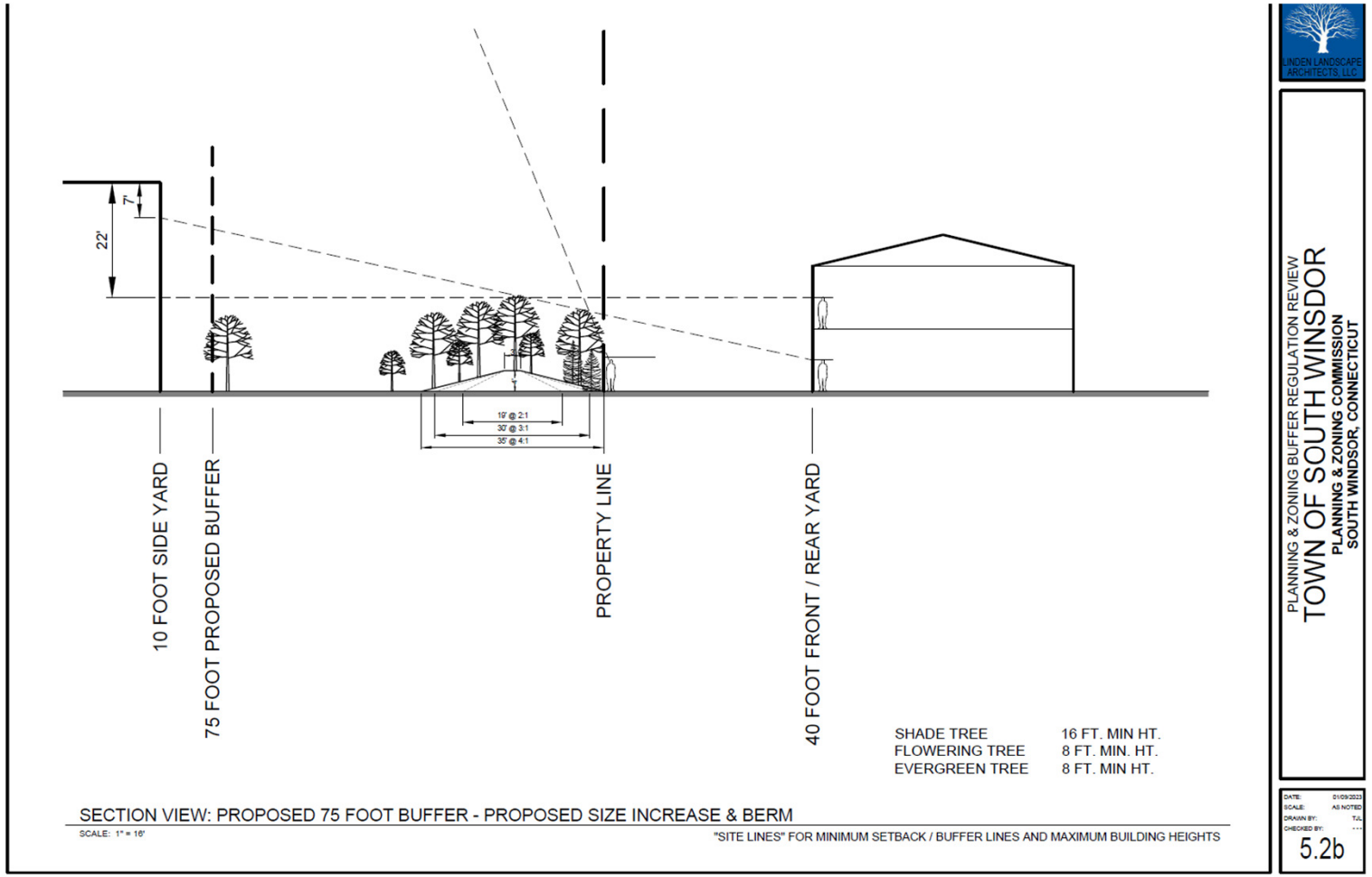
Buffer Cross Section Samples – Exhibit C



Buffer Cross Section Samples – Exhibit E



Buffer Cross Section Samples – Exhibit G



Types of Buffer Designs

- A. Air quality - Buffers can affect the surrounding environment by temperature reduction, air pollutant removal and energy effects on building. The following are suggested design principles:
  - Design considerations should consider topographical, meteorological and other landscape scale factors; plant buffers close to the air pollution sources(s);
  - Plant moderately dense buffers for best air pollution removal; use trees, shrubs and grasses for multi-layered trapping; select plants with dense branching and twig structure;
  - Plant buffers in energy conserving locations managing the landscaping for shade and wind;
  - Plant tress that have leaves with hairy, resinous and coarse surfaces to capture more particles than smooth leaves;
  - Use multiple species to minimize risks with low diversity;
  - Use long-lived species that requires minimal maintenance; and/or
  - Select species with disease and pest resistance and are suitable for the site.
- B. Noise Control - Buffers can reduce noise from roads, driveways and other on-site sources. The following are suggested design principles;
  - Along roadways, locate the plantings close to the noise source while providing an appropriate setback for pedestrian access and snow removal;
  - Choose evergreen species best at providing year-round noise control;
  - Create a dense buffer with trees and shrubs to prevent gaps in the landscaping;
  - Select plants that are tolerant of air pollution and de-icing methods;
  - Consider topography and using existing landforms as noise barriers where possible; and/or
  - Construct noise barriers walls.
- C. Visual Screening – Buffers can provide visual screening of activities on adjacent sites. The following are suggested design principles:
  - Create a design with dense and multi-layered vegetation, particularly shrubs to screen views; and
  - Plant tree species that have maximum screening values. Deciduous plants provide 40% less screening than evergreens after leaf fall, so evergreens or a wider deciduous buffer may be necessary for screening year-round. Consider vegetation and viewpoint height in design of the buffer.
- D. Crop Pollinator Habitat – Landscaping plans can provide valuable resources for crop pollinators including shade, nesting sites, water, nectar, pollen and protection from pesticides. Buffers can be designed to reduce wind and aid in foraging and pollination efficiency. Ideally, buffers should be >1000 feet from crops to be most effective.

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Screening requirements- excerpts

Standards for Screening

1. Natural areas for screening - Where an existing vegetated area is located on the same property as the proposed development; is within or includes the required buffer; and is of sufficient height, length and depth and contains adequate and sufficient healthy vegetation to provide a visually opaque screen year round as required in this section, no further improvements shall be required. Such area must remain intact and be protected throughout all phases of development, including any land disturbance.
2. Height of required screening - The height of required screening shall be sufficient to block the view of the feature, land use or activity for which the screening is required. To maximize site line obstruction, a screen shall be placed immediately adjacent to the feature to be screened with accommodations for reasonable access, use, and maintenance of the features and equipment, as necessary.
3. Mechanical equipment for all uses other than single-family residential and duplexes at ground level and mounted on roofs, including, but not limited to HVAC equipment, transformers and generators shall be screened. The length of a required screen shall be that which is necessary to screen the feature, land use or activity from protected properties, streets, and rights-of-way as provided in this section, however screening cannot obstruct the line of sight for vehicular traffic and must comply with the requirements of Corner Visibility, sight triangle requirements.
4. Roof mounted mechanical equipment shall not be visible in any direction from any adjacent properties, roads and public rights-of-way. Screening of roof-mounted equipment shall be accomplished by solid and permanent roof-mounted screens, compatible with the architectural style, materials and color of the building upon which the equipment is located. Where it can be clearly demonstrated in the application that such equipment is not visible from any adjacent existing residential properties, properties in residential zoning districts, roads and public rights-of-way, the rooftop screening will not be required. This will be verified at the time of the Certificate of Occupancy and screening measures may be required if it is determined that objects are visible.

Types of Screening

1. Fences, walls and/or chain-link fences with strips composed of wood, plastic, metal may be used in meeting screening requirements. A combination of eight (8) foot tall fencing and a five (5) foot wide landscape planter may be provided in lieu of solid fencing along the side and rear property lines in areas where the site is not visible to the public to ensure adequate screening and attenuate noise.

2. Anti-graffiti coating or an equivalent measure to prevent graffiti shall be provided for all screen walls visible to the public.

Thank you!

Exhibit B

95 Cody Circle
South Windsor, CT 06074
March 14, 2023

Planning and Zoning Commission
Town of South Windsor
Town Hall
1540 Sullivan Avenue
South Windsor, CT 06074

Dear Planning and Zoning Commissioners.

I would like to thank you and the town staff for all your hard work drafting the recommended changes to the zoning regulation. These proposed additions demonstrate the commission's unquestionable sincerity towards the health and well-being of our families and community.

Clearly the proposed provisions in Table 4.1.1A, prohibiting Distribution Centers (500 ft) and Fulfillment Centers (750 ft) from residential zones and the new requirement of a Special Exception for all Industrial buildings over 40,000 ft are extremely strong protections for residential neighborhoods.

There is still concern is that Warehouses do not contain the same (500 ft) prohibition as Distribution Centers. Safeguarded solely by the Special Exception, the specter of a Mega-Warehouse adjacent to residential neighborhoods remains in place for a couple of reasons. First, a denial of a special exception application has proven not be legally insurmountable to applicants. Secondly, residents are subject to the possibility of a future Planning and Zoning Commission, whose composition might not be as educated to the adverse effects of Mega-Warehouses nor as compassionate as you.

I understand in theory that a Warehouse could be viewed as less harsh than a Distribution Center, but its impact is not dissimilar enough to warrant lesser protections. The proposed section 7.24 provides greater detail of Distribution Center and Warehouse uses however the only measurable to characterize the use of a proposed site plan is the ratio 2,000 SF per loading docks per square foot.

For example, two identical 40' foot tall, 280,000 SF buildings that either have 23 loading docks (as a Distribution Center) or 14 loading docks (as a Warehouse) are virtually indistinguishable in their harm and incompatibility to abutting residential zones. Furthermore, the omission of Warehouses from the 500 ft residential prohibition, actually incentivizes developers to build larger, more harsh buildings abutting residential areas.

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For example, if a developer wanted to build a 200,000 SF building with 14 loading docks adjacent to residential zone, they could not because it would be defined as a Distribution Center and the 500 ft prohibition would be in place, however if they increased the building to 280,000 SF and kept the 14 loading docks, it would be categorized as a warehouse, and they would be able to apply for a Special Exception.

Why should a building with the same number of loading docks, but 80,000 SF larger, be considered by the commission as less harsh, and not subject to the 500 ft protection? The most reasonable path to correct this loophole would be to include Warehouses in the 500 ft residential zone protection (or at least those over 40,000 SF).

Thank you for the time and energy you volunteer to South Windsor. It is very much appreciated.

Respectfully,

Richard Delhaie Jr.

2/2 RD

Exhibit C

RCBJ
Rockland County Business Journal

Local Codes Need To Become More Specific To Address A Variety Of Warehouse Uses

July 4, 2022 Rcbizjournal

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Voiced by Amazon Polly

Citizen Involvement Altered The Course On Planning Approval For A 220,000 Square Foot Warehouse In Valley Cottage

By Rick Tannenbaum

The ITE (Institute of Transportation Engineers) recognizes at least five different types of warehouses and has different land use codes for each one, from what it deems an ordinary warehouse to various kinds of high-cube distribution and fulfillment centers, including cold-storage warehouses.

Most municipal zoning codes lump them all together into a general warehouse category, not recognizing the variety and intensity of uses which different types of warehouses encompass. (Most municipalities do have a separate use designation for mini-warehouses, which are really self-storage units, but that's the subject for a different day.)

For example, a warehouse for a moving and storage company with a few trucks and some long-term storage is a much less intensive use than a typical Amazon or UPS facility with large trucks bringing in masses of goods and a fleet of smaller trucks and vans making deliveries all day long in and around residential areas. Both can be built as-of-right under most current "warehouse" zoning.

Zoning codes need to be updated to reflect these different types of warehousing uses so that each type of warehouse use is situated appropriately in each municipality, whether that be encouraged in proximity to major highways or prohibited in residential neighborhoods. The ITE has dramatically different traffic calculations for each type of warehouse use, and planning boards need to recognize these differences when assessing traffic, air quality, noise, and quality of life environmental impacts. Many don't.

The Clarkstown Planning Board last week greenlighted a proposal for a 220,000 square-foot warehouse on 20+ acres in Executive Park along Route 303.

Lincoln Equities Group of Rutherford NJ agreed to limit its project to being a category "150 warehouse," foreclosing on the possibility of using the facility as a package hub or a fulfillment center, even though either of those uses were permitted as-of-right by the local zoning code. This compromise arose from the recognition that the applicant's traffic study only projected traffic for the 150-warehouse category (see below) in support of its finding that there would be no significant impact on local traffic. By limiting its traffic presentation to the least intensive

According to the ITE: A high-cube warehouse is a building that typically has at least 200,000 gross square feet of floor area, has a ceiling height of 24 feet or more, and is used primarily for the storage and/or consolidation of manufactured goods prior to their distribution to retail or other locations. This definition applies to both the 9th and 10th editions of the ITE manual.

Code	Description	Unit of Measure	Trips Per Unit	Setting/Location: General Urban/ Suburban	Setting/Location: Dense Multi-Use Urban
PORT AND TERMINAL					
30	Intermodal Truck Terminal	1,000 SF GFA	1.72		
90	Park-and-Ride Lot with Bus Service	Parking Spaces	0.43		
INDUSTRIAL					
110	General Light Industrial	1,000 SF GFA	0.63		
130	Industrial Park	1,000 SF GFA	0.40		
140	Manufacturing	1,000 SF GFA	0.67		
150	Warehousing	1,000 SF GFA	0.19		
151	Mini-Warehouse	1,000 SF GFA	0.17		
154	High-Cube Transload & Short-Term Storage Warehouse	1,000 SF GFA	0.10		
155	High-Cube Fulfillment Center Warehouse	1,000 SF GFA	1.37		
156	High-Cube Parcel Hub Warehouse	1,000 SF GFA	0.64		
157	High-Cube Cold Storage Warehouse	1,000 SF GFA	0.12		
160	Data Center	1,000 SF GFA	0.09		
170	Utilities	1,000 SF GFA	2.27		
180	Specialty Trade Contractor	1,000 SF GFA	1.97		

The two most relevant Land Use categories for High-Cube Warehouses are 155 (High-Cube Fulfillment Center Warehouses) and/or 156 (High-Cube Parcel Hub Warehouse). Local zoning codes generally do not recognize these more intensive uses and leave it to planning boards to determine whether or not high-cube warehouses are appropriate in the locations proposed. Complicating the matter even more is that many developers will not disclose to planning boards who their intended tenants are. And, some building are constructed on spec, without a particular tenant signed up.

The difference between the code choices is significant, as the ITE Common Trip Generation Rates for each category differs significantly.

For the 150 general warehousing category, the ITE estimates .19 trips per 1000 square feet of Gross Floor Area for Peak Hour Trip Generation Rates.

For High-Cube Fulfillment Center Warehouses (category 155), the ITE estimates 1.37 trips per 1000 square feet of Gross Floor Area for Peak Hour Trip Generation Rates.

HIGH-CUBE WAREHOUSE VEHICLE TRIP GENERATION ANALYSIS

PREPARED FOR

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

AND

NATIONAL ASSOCIATION OF INDUSTRIAL AND OFFICE PROPERTIES

PREPARED BY

INSTITUTE OF TRANSPORTATION ENGINEERS

WASHINGTON, DC

OCTOBER 2016

ACKNOWLEDGEMENT AND DISCLAIMER

This report was prepared as a result of work sponsored, paid for, in whole or in part, by the South Coast Air Quality Management District (SCAQMD) and NAIOP (National Association of Industrial and Office Properties (NAIOP). The report is the product of a collaborative process by which ITE, SCAQMD, and NAIOP embarked upon an effort to better understand vehicle trip generation rates at high-cube warehouse facilities.

The NAIOP Inland Empire and Southern California Chapters provided direct input for various items of the report, including a suggested high-cube warehouse classification system.

EXECUTIVE SUMMARY

Purpose – South Coast Air Quality Management District (SCAQMD) and NAIOP (National Association of Industrial and Office Properties) provided funding to the Institute of Transportation Engineers (ITE) to help in the establishment of national guidance for the estimation of vehicle trip generation at what are commonly called high-cube warehouse distribution centers (HCW).

Definition of High-Cube Warehouse – A high-cube warehouse is a building that typically has at least 200,000 gross square feet of floor area, has a ceiling height of 24 feet or more, and is used primarily for the storage and/or consolidation of manufactured goods (and to a lesser extent, raw materials) prior to their distribution to retail locations or other warehouses. A typical HCW has a high level of on-site automation and logistics management. The automation and logistics enable highly-efficient processing of goods through the HCW. For the purpose of this trip generation analysis, HCWs are grouped into five types: fulfillment center, parcel hub, cold storage facility, transload facility, and short-term storage facility.

Data Sources – The analysis contained herein is based on data from 15 separate data sources, including recent data collected under the sponsorship of SCAQMD and NAIOP. The database includes trip generation information from 107 individual sites.

Findings – The HCW market continues to evolve as individual tenants/owners implement different e-commerce business plans. For example, some deliver goods to the customer within two days and others deliver orders to the nearest store for customer pick-up. As business plans and technology continue to evolve, these should continue to be monitored. Although the tenant or its planned operations are often unknown at the time of site development review, for the purpose of estimating vehicle trip generation, it may be as important to know the tenant as much as other facility factors.

For transload, short-term storage, and cold storage HCWs, the proportionate mix of types of vehicles (i.e., cars versus trucks) accessing the site is very consistent, both daily and during the AM and PM peak hours.

For a cold storage HCW, the currently available data demonstrates a useable, direct correlation between building size and vehicle trip generation.

The single data points for fulfillment centers and parcel hubs indicate that they have significantly different vehicle trip generation characteristics compared to other HCWs. However, there are insufficient data from which to derive useable trip generation rates.

For transload and short-term storage HCW sites, additional data sites and additional information on past sites are needed in order to derive useable trip generation rates.

Recommendations (Action Plan) – A strategically-developed data collection program is needed that targets each type of HCW individually. The strategy should include a prioritized plan for collecting additional data at five classifications of HCWs that are representative of the types of facilities expected to be commonly developed in coming years. The data should be collected at mature facilities, each of which clearly fits within one HCW classification, during periods of typical levels of activity based on the types of facilities and businesses served.

All future data collection should seek to acquire an enhanced set of site descriptive information that will enable development of better predictive models than are currently available.

STUDY PURPOSE AND PROCESS

South Coast Air Quality Management District (SCAQMD) and NAIOP (National Association of Industrial and Office Properties) provided funding to the Institute of Transportation Engineers (ITE) to help in the establishment of consensus-based national guidance for the estimation of trip generation at what are commonly called high-cube warehouses (HCW). This report documents the results of that effort to develop a credible and defensible procedure for collecting and analyzing site trip generation data for use in transportation impact analyses (TIA) and air quality/vehicular emissions analyses (AQA[1]) for HCW-type facilities.

ITE convened a meeting of practitioner-based experts at ITE Headquarters on April 1, 2015. The meeting participants are listed in Table 1. At the meeting's conclusion, several individuals were tasked with development of specific products, including the following:

- An overall work plan for this report and for subsequent data collection and analysis
- A clear and consistent definition of HCW for this report and for future studies and analysis
- A vehicle classification scheme that satisfies ultimate data requirements for TIA and AQA and complies with reasonable data collection capabilities and budgets

ITE staff assumed responsibility for compilation and analysis of existing HCW trip generation data.

The full expert panel provided comments and suggestions on each interim product that eventually became part of this complete report. Nevertheless, responsibility for content completeness and data analysis accuracy rests with ITE staff.

Table 1. Expert Panel for High-Cube Warehouse Trip Generation Study

Mr. Brian Bochner	Texas A&M Transportation Institute, College Station, Texas
Mr. Paul Basha	City of Scottsdale, Arizona
Mr. Milton Carrasco	Transoft Solutions, Inc., Richmond, British Columbia
Dr. Kelly Clifton	Portland State University, Portland, Oregon
Mr. Henry Hogo (for Mr. Barry Wallerstein)	South Coast Air Quality Management District, Diamond Bar, California
Mr. Kim Snyder	Prologis, Cerritos, California
Ms. Cecilia Ho	Federal Highway Administration, Washington, DC
Mr. Ian Macmillan	South Coast Air Quality Management District, Diamond Bar, California
Mr. Thomas Phelan	VHB, Newark, New Jersey
Mr. Jeremy Raw	Federal Highway Administration, Washington, DC
Mr. Erik Ruehr	VRPA Technologies, San Diego, California
Mr. Frank Sherkow	Southstar Engineering and Consulting, Inc., Yachats, Oregon
Mr. Joe Zietsman	Texas A&M Transportation Institute, College Station, Texas
Mr. Tom Brahms	Institute of Transportation Engineers, Washington, DC
Mr. Kevin Hooper	Institute of Transportation Engineers, Washington, DC
Ms. Lisa Tierney	Institute of Transportation Engineers, Washington, DC

[1] In California, when a new warehouse project is proposed, it undergoes environmental review pursuant to the California Environmental Quality Act (CEQA). Air quality analyses conducted pursuant to CEQA typically compare project emissions against local air district thresholds to determine the potential significance of the project's air quality impacts. These emission estimates rely on trip generation rates to determine the volume of cars and trucks that could visit the proposed project site.

HIGH-CUBE WAREHOUSE DEFINITION

A high-cube warehouse (HCW) is a building that typically has at least 200,000 gross square feet of floor area, has a ceiling height of 24 feet or more, and is used primarily for the storage and/or consolidation of manufactured goods (and to a lesser extent, raw materials) prior to their distribution to retail locations or other warehouses. A typical HCW has a high level of on-site automation and logistics management. The automation and logistics enable highly-efficient processing of goods through the HCW.[2]

A classification scheme for different types of HCWs is presented in Table 2 along with their distinctive characteristics. The characteristics of a typical standard warehouse are provided for comparative purposes. The five types of HCW are the following:

- Transload – usually pallet loads or larger handling products of manufacturers, wholesalers/distributors, or retailers with little or no storage durations
- Short-Term Storage – products held on-site for a short time
- Cold Storage – HCW with permanent cold storage in at least part of the building
- Fulfillment Center – storage and direct distribution of e-commerce product to end users
- Parcel Hub – transload function for a parcel delivery company

[2] High-cube warehouses are classified as Land Use Code 152 in ITE *Trip Generation Manual*, 9th Edition. The definition provided in *Trip Generation Manual* for HCW is as follows:

> "High-cube warehouses/distribution centers are used for the storage of materials, goods and merchandise prior to their distribution to retail outlets, distribution centers or warehouses. These facilities are typically characterized by ceiling heights of at least 24 feet with small employment counts due to a high level of mechanization. High-cube warehouses/distribution centers generally consist of large steel or masonry shell buildings and may be occupied by or multiple tenants. A small ancillary office use component may be included and some limited assembly and repackaging may occur within these facilities.
>
> "High-cube warehouses/distribution centers may be located in industrial parks or be free-standing. Intermodal truck terminal (Land Use 030), industrial park (Land Use 130), manufacturing (Land Use 140) and warehousing (Land Use 150) are related uses."

When the 10th edition of *Trip Generation Manual* is developed, the findings and recommendations of this report will be reflected in an updated definition for high-cube warehouses.

Table 2. High-Cube Warehouse Classifications

	Standard Warehouse/ Storage	Transload Facility	Short-Term Storage	Cold Storage	Fulfillment Center	Parcel Hub
Description and Key Warehouse Functions						
Typical Functions	Products stored on-site typically for more than one month	Focus on consolidation and distribution of pallet loads (or larger) of manufacturers, wholesalers, or retailers; little storage duration; high throughput and high-efficiency	Focus on warehousing/ distribution with distribution space operated at high efficiency; often with custom/special features built into structure for movement of large volumes of freight	Temperature-controlled for frozen food or other perishable products stored in any type of HCW; building built with substantial insulation, including foundation, walls, and roof[3]	Storage and direct distribution of e-commerce product to end users; smaller packages and quantities than for other types of HCW; often multiple mezzanine levels for product storage and picking	Regional and local freight-forwarder facility for time-sensitive shipments via air freight and ground (e.g., UPS, FedEx, USPS); site often includes truck maintenance, wash, or fueling facilities
Break-Bulk or Assembly	Can include break-bulk and assembly activities	Very limited pick-and-pack area within facility	May or may not include break-bulk, repack or assembly activities	Limited or no break-bulk, repack or assembly activities	Pick-and-pack area comprises majority of space	Limited or no break-bulk, repack or assembly activities
Place in Supply Chain		Usually for final distribution to retail stores but can be for manufacturer to wholesale distribution		Typically, late in the supply chain for final distribution to retail stores or local, smaller distribution centers	Typically, freight for final consumption (business-to-business and consumers)	Can be situated at multiple points in the supply chain (intermediate or final delivery)

[3] Cold storage products (e.g., flowers and other perishables) that are not frozen must be shipped within hours or a few days. Cold storage products that are frozen may take a long time to ship. Products in these facilities may be treated more like typical HCW products.

	Standard Warehouse/ Storage	Transload Facility	Short-Term Storage	Cold Storage	Fulfillment Center	Parcel Hub
Location	Typically in an industrial area within urban area or urban periphery	Typically in an area with convenient freeway access; often in rural or urban periphery area	Typically in an area with convenient freeway access	Depends on supply and demand markets	Often near a parcel hub or USPS facility, due to time sensitivity of freight	Typically in close proximity to airport; often stand-alone
Overall Site Layout						
Employee Parking		Smaller employee parking ratio (per facility square foot) than fulfillment center or parcel hub	Smaller employee parking ratio (per facility square foot) than fulfillment center or parcel hub		Larger parking supply ratio than for all other HCW types	Larger employee parking ratios; truck drivers often based at facility (i.e., parking may be for both site employees and drivers)
Truck & Trailer Parking	Limited truck parking area; increases with distance to major distribution hub	Large, open trailer parking area surrounding facility; produces high land to building ratio	Ratio of truck parking spaces to docks can vary between 0.5:1 and 1.5:1, with 1:1 being very common	Can vary with whether products are frozen or perishable[4]	Significantly higher truck parking ratios than for other HCWs	Very high truck parking ratios to dock positions, often 2:1 or more
Loading Dock Location	Either on one side or on two adjacent sides	Minimum of two sides (adjacent or opposite); can be on four sides	On either one or two sides			Usually on both long sides of building; can be on four sides
Building Dimensions						
Length vs. Depth		Typical length vs. depth ranges between 3:1 and 2:1; shallower than Standard	Typical length vs. depth is 2:1; shallower than Standard			Typical configuration is cross-dock; building typically more shallow (150-300 feet across) than other HCWs

[4] Cold storage product handling must be done quickly. Any product stored in a trailer on the site requires either an idling truck or an external power supply to maintain the temperature within the required ranges.

	Standard Warehouse/ Storage	Transload Facility	Short-Term Storage	Cold Storage	Fulfillment Center	Parcel Hub
Ceiling Height	Typically between 28 and 40 feet	Typically, lower than for other HCW	Typically between 28 and 34 feet, with some facilities in excess of 40 feet	Typically higher (70-100 feet) to maximize efficiency of refrigeration; frozen food tends to have a higher ceiling than produce handling	Often as high as 40 feet in order to accommodate up to three levels of interior mezzanines	Typically not as tall as other HCW; commonly between 18 and 20 feet range; racking not usually provided (i.e. floor-stack only)
Number of Docks	Low number of dock positions to overall facility, 1:20,000 square feet or lower	Typical dock-high loading door ratio is 1:10,000 square feet; common range between 1:5,000 & 1:15,000 square feet	Typically, 1:10,000 square feet or lower			
Automation						
Material Handling Systems	Little or no automation; mechanization limited to pallet jacks and forklifts	Very highly-mechanized material handling systems	Very highly-mechanized material handling systems; high ratio of material handling equipment to overall floor area	Very high clear height requires sophisticated material handling equipment	High levels of automation in material handling equipment	High levels of automation in material handling equipment
Conveying Systems	Little or no automation	Usually automated mechanized conveying	Usually limited automated conveying	Very high clear height requires a sophisticated conveyance system	High levels of automation in conveying systems	High levels of automation in conveying systems
Warehouse Mgmt Systems (WMS)		Some facilities use ASRS (Automated Storage and Retrieval Systems)			High levels of automation; some use of ASRS	High levels of automation

Table 2. Additional Descriptive Features

Typical Floor Area Ratios range between 35 and 60 percent. Standard, Fulfillment Center, and Parcel Hub sites tend to have higher values than Transload and Short-Term Storage HCW.

Office/Employee Welfare[5] Space is highly variable and is insignificant within overall building square footage. Common values are between 3,000 and 5,000 square feet for Cold Storage and between 5,000 and 10,000 square feet for Transload Facility, Fulfillment Center, and Parcel Hub.

Movement of Goods in Trucks – For a Transload site, typical truck movements are comprised of full load, large trailers, both inbound and outbound. For some "last mile" or local distribution centers, long-haul trucks or international containers can arrive loaded and depart empty, while local delivery trucks arrive empty and depart loaded. For national and regional distribution centers, trucks can come in loaded and re-load with different product mix and depart loaded.

Hours of Operation and Peak Periods – Peak truck movement activity is often outside the peak commuting period on the adjacent street system. HCW operations are often 24 hours per day, every day of the year. For a Standard site, there is a greater likelihood that the site peak period of traffic operations may coincide with or be near the street peak period.

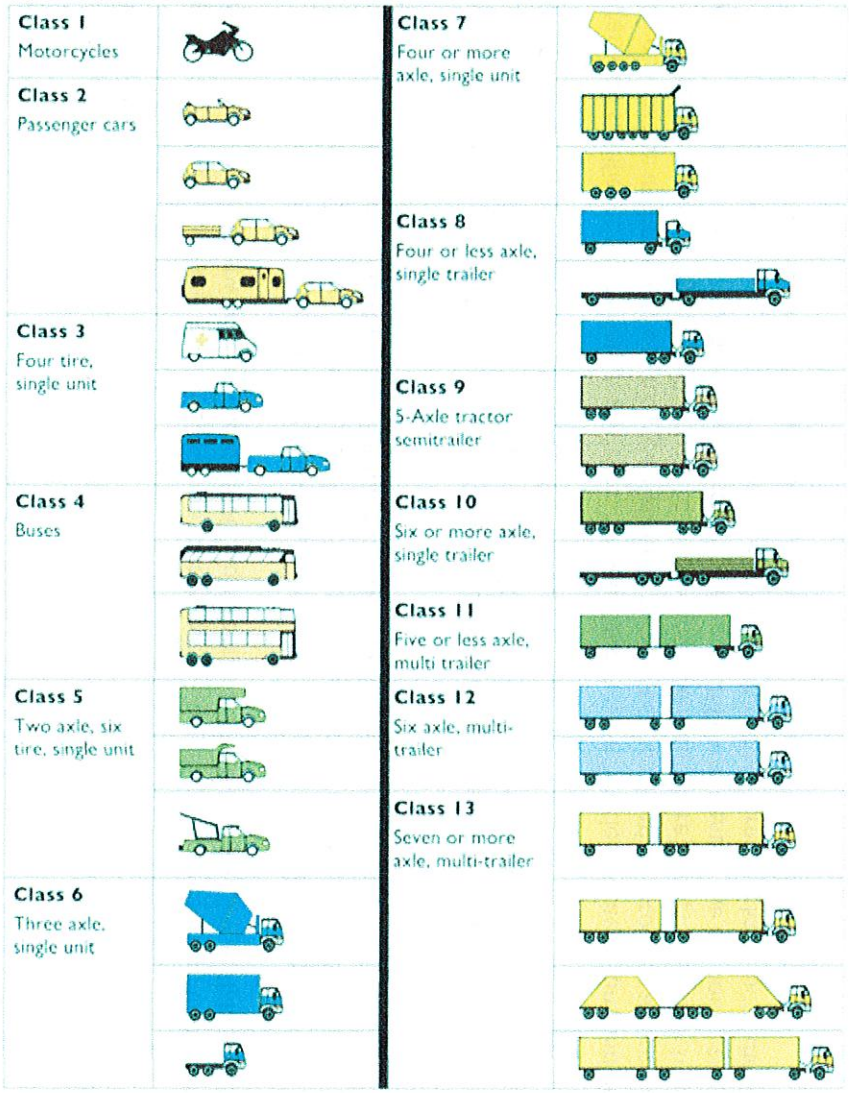
Truck Sizes – Truck size can vary significantly between similar sites. Sizes and types are a function of the origins and destinations of the goods processed at the facility (i.e., location in the supply chain). Local deliveries to business/residential customers are commonly made with smaller trucks (except warehouses that, for example, deliver bulky items to a home improvement store). Longer distance travel or deliveries at early stages in the supply chain are typically with larger trailers. For Cold Storage and Fulfillment Center, the outbound trucks are often smaller because of cargo weight and last-mile distribution needs. Intermediate hubs accommodate large trucks on both the inbound and outbound side (e.g., FedEx Ground). "Final delivery" hubs have small trucks on the outbound side (e.g., FedEx Overnight).

[5] Employee welfare area includes restrooms, locker rooms, and break rooms.

VEHICLE CLASSIFICATION FOR WAREHOUSE TRIP GENERATION DATA

The preferred vehicle classification scheme should satisfy both the ultimate needs for TIA and AQA analysis and comply with reasonable data collection capabilities and budgets. FHWA maintains a 13-category classification system for motorized vehicles (presented in Figure 1 and maintained at the following website: http://www.fhwa.dot.gov/policyinformation/tmguide/tmg_2013/vehicle-types.cfm).

Figure 1. FHWA Vehicle Classification Types



The vehicle types that enter and exit a HCW site can be separated to correspond to individual "markets:"

- Vehicles used for employee and facility service access (i.e., for goods and services consumed on site)
- Vehicles used for local delivery access (e.g., wholesale and retail delivery for consumption in the local metropolitan area)
- Vehicles used for high-volume transfer (e.g., long-distance freight, relay distribution to other distribution or warehouse facilities)

A simple and straightforward correlation between "markets" and the 13 FHWA classifications is as follows:

1. Facility Access: includes Classes 2 and 3 (passenger cars and light trucks), and Classes 1 and 4 (motorcycles and buses) if observed
2. Local Goods Movement: includes Classes 5 through 7 (two-, three-, and four-axle single-unit trucks)
3. Long Distance Goods Movement: includes Classes 8 through 13 (multi-unit trucks)

A significant limitation to this classification scheme is the growing disconnect between truck size and trip length over time. They do not correlate as well for many carriers as they did in the past. There is a wide range of practices in deliveries and many prominent retail chains currently use trucks in Classes 8 and 9, for example, for local deliveries. In other words, a Class 8-13 vehicle is not necessarily a long-distance truck trip.

The primary advantage of mapping these vehicle types to the FHWA classification scheme is that commercially available automated monitoring equipment is generally capable of reporting the FHWA vehicle classes without specialized data interpretation.

Encouraging agencies to develop local counts of these facilities will also be more successful if the agencies can use standard automated counters without specialized software, even at the expense of occasional misclassification relative to "ideal" categories for a warehouse trip generation study. Video detection could make more information available, but at greater expense for data processing.

It is also important to recognize that counting equipment manufacturers (and often representatives of a public agency) are able to reprogram automated counters to use an alternate classification scheme. For example, if there is a specific axle configuration commonly used for domestic container freight versus international container freight at a particular data collection site, it may be feasible to detect. Such schemes are relatively easy to share among agencies using the same types of equipment.

As noted above, the observed physical vehicle type based on a FHWA class may not provide sufficient information on its own to identify the "purpose" of the truck trip. The classification scheme may need to be adjusted to reflect the specific trip-making to and from a subject warehouse site. The following are examples of refinements that could be necessary given the particular characteristics of a warehouse site:

1. Even in a standard traffic monitoring application, the distinction between a passenger car (Class 2) and a light truck (Class 3: pickups, large SUVs, vans) has limited benefit and is difficult to establish decisively. For the warehouse trip generation application, the merging of these classes should improve overall accuracy.
2. Local goods movement may also include Class 3 vehicles (specifically two-axle vans). If separate driveways are used for goods movement and general facility access, the Class 3 vehicles in the goods movement driveway can be considered local goods movement vehicles.
3. It is sometimes difficult for automated equipment to distinguish between a Class 4 vehicle (bus) and a Class 5/6 truck. In the rare circumstance where a bus enters or exits a warehouse site driveway, a manual count or simple reference to a published transit service schedule may be necessary.
4. Class 5 vehicles include "dualie" pickups which may operate as personal vehicles for facility access or as larger panel trucks often used for local goods delivery. The presence of and use of separate driveways for goods movement and general facility access may be the only means to distinguish between the two types of uses.

DATA NEEDS FOR TIA AND AQA

Typical data requirements for TIA and AQA are listed in Table 3. Some measures are used to classify a building type. Some measures can be used as independent variables with a direct relationship to the quantity of vehicle trips generated by a site (by vehicle type).

Table 3. Data Needs for HCW Trip Generation Analysis

Vehicle Trip Data	TIA	AQA
Vehicle Trips by Vehicle Classification		
• 2 classifications – car, truck	√	
• 4 classifications – personal passenger vehicle, parcel delivery, single unit truck, tractor-trailer combination	*[6]	√
Vehicle Trips by Time-of-Day (by vehicle classification)		
• Directional 15-minute volumes on a weekday (typically Tuesday, Wednesday, or Thursday)		
o AM peak hour for generator	√	
o AM peak hour for adjacent street	√	
o PM peak hour for generator	√	
o PM peak hour for adjacent street	√	
• Non-directional 24-hour volume on a weekday		√
Vehicle Trips by Driveway (if employees and freight delivery use separate driveways)	√	√
Vehicle Trips within Context of Seasonal Variations		
• Daily Variations	√	√
• Monthly Variations		√
• Highest Day of Year		√
Independent Variable Data		
Building Size		
Building GSF[7] (total, office, retail, manufacturing/enhancements, storage/distribution)	√	√
Building Volume (cubic feet)	√	√
Building Shape (length-to-depth ratio)		√
Number of High-Loading docks	√	√
Building Function		
Cold Storage Provided	√	√
NAICS Industrial Code	√	√
Employees	√	√
Commodity type (retail, manufacturing, other)	√	√
Where in Supply Chain (parts, manufacturer/assembly, wholesale/distributor, retailer)		√
Site Size		
Site acres	√	√
Floor area ratio (FAR)	√	√
Parking spaces (employee/visitor, truck/trailer)	√	√
Site Context		
Area type (urban, suburban, rural)	√	√
Distance to port (seaport, intermodal center, regional air cargo)	√	√

[6] Some TIA may require truck classification information.

[7] GSF is gross square footage of the building.

ASSEMBLY AND CLASSIFICATION OF CURRENTLY AVAILABLE DATA

Data from the following studies were compiled and analyzed for possible use in the trip generation analysis for the High-Cube Warehouse study:

- Warehouse Truck Trip Study, Data Results and Usage, South Coast Air Quality Management District, Diamond Bar, CA 2014
- Trip Generation Analysis for High-Cube Warehouse Distribution Center, prepared for NAIOP by Kunzman Associates, Laguna Hills, CA 2011
- Trip Generation Characteristics of Discount/Home Improvement Superstores, Major Distribution Centers, and Small Box Stores, prepared for Florida Department of Transportation by Wilbur Smith Associates 2011
- Western Riverside County Warehouse/Distribution Center Trip Generation Study, prepared for NAIOP by Crain & Associates, Los Angeles, CA 2008
- Westside Industrial Park Warehouse Trip Generation, prepared for Premier Airport Park by King Engineering Associates, Jacksonville, FL 2008
- Trip Generation Study, Existing High-Cube Warehouse Facilities, Visalia CA, prepared for The Allen group by Peters Engineering Group, Clovis CA 2008
- Large-Scale Retail Distribution Centers, prepared for Walmart Sores, Inc. by Kimley-Horn and Associates, Tampa, FL 2007
- Trip Generation Study, High-Cube Warehouse Buildings, Fresno, California, prepared for Diversified Development Group by Peters Engineering Group, Clovis CA 2007
- Trip Generation Study, High Cube Warehouse, prepared by Schoor Depalma, Manalapan, NJ 2006
- San Bernardino/Riverside County Warehouse/Distribution Center Vehicle Trip Generation Study, prepared for NAIOP by Crain & Associates, Los Angeles, CA 2005
- Truck Trip Generation Study, prepared for City of Fontana (CA) by Transportation Engineering and Planning, Inc. 2003
- Trip Generation Analysis for High-Cube Warehouses, prepared for City of Livermore, CA by Fehr & Peers Associates, Lafayette, CA 1989

The data also includes site trip generation data provided by Texas A&M Transportation Institute (2008-2009), Randall Parker (2007), and Washington State Department of Transportation (2002).

The data were reviewed for their applicability and only acceptable sites with appropriate data are used in the analysis presented in the following section of this report. Some of the purported high-cube warehouses are instead standard storage warehouses or multi-building industrial parks. Some of the high-cube warehouse data for individual sites could not be used due to unexplained data characteristics (e.g., a significant imbalance in inbound and outbound daily vehicle trips).

The final current database of HCW sites contains 107 data records with varying degrees of vehicle classification data and of daily and peak hour traffic counts.

HIGH-CUBE WAREHOUSE TRIP GENERATION DATA ANALYSIS[8]

Classification of Individual Data Records

Each record in the database of HCW sites was classified as one of five building types, defined earlier in this report. The criteria used to classify the sites represent information that is likely to be available at the time of site development review.

The database includes one fulfillment center, one parcel hub, and nine HCWs with a significant cold storage component[9]. The remaining 95 HCWs were separated into transload and short-term storage HCW based on two building configuration criteria:

- A transload building is assumed to have a length-to-depth ratio of at least 2:1 and has loading docks on at least two sides (either opposite or adjacent); there are 56 transload data points
- The remaining HCW sites (i.e., those that are not considered transload, cold storage, fulfillment center, or parcel hub) are classified as short-term storage HCWs; they total 39 sites

Building configuration is known at the time of site development review but has the limitation of not necessarily being indicative of the function of the HCW activities. If additional characteristics can be identified that (1) are predictive of the HCW function and (2) are available at the time of site development review, the database can be reexamined and potentially reclassified and reanalyzed.

Key Findings – Cars vs. Total Vehicles

There is a significant correlation between the number of cars that enter and exit a HCW site and the total number of vehicles that enter and exit a HCW site.

Table 4 lists the weighted averages for cars as a percentage of the total site-generated traffic at the five types of HCW. At short-term storage, transload, and cold storage HCWs, nearly 68 percent of the total daily site-generated vehicle trips are cars. During the AM peak hour, the measured percentage of cars is markedly similar (69 percent) to the daily (68 percent). During the PM peak hour, the measured percentage of cars is significantly higher (78 percent) than the daily value. The higher car percentage (and therefore, the lower truck percentage) is likely due to truck operations avoiding the afternoon peak period.

The fulfillment center has a significantly higher percentage of cars during the AM and PM peak hours and daily (due largely to the significantly higher number of employees at a fulfillment center compared to the other types of HCWs). The parcel hub has a significantly lower percentage of cars (and therefore a higher percentage of trucks) during the AM and PM peak hours and daily.

Table 4. Weighted Averages for Percentage of Total Daily Vehicles that are Cars, by Type of HCW

Type of High-Cube Warehouse	Cars as Percentage of Total Vehicles		
	Daily	AM Peak Hour	PM Peak Hour
Short-Term Storage, Transload & Cold Storage (100)	67.8%	69.2%	78.3%
Fulfillment Center (1)	91.2	97.2	98.2
Parcel Hub (1)	62.3	50.3	70.7

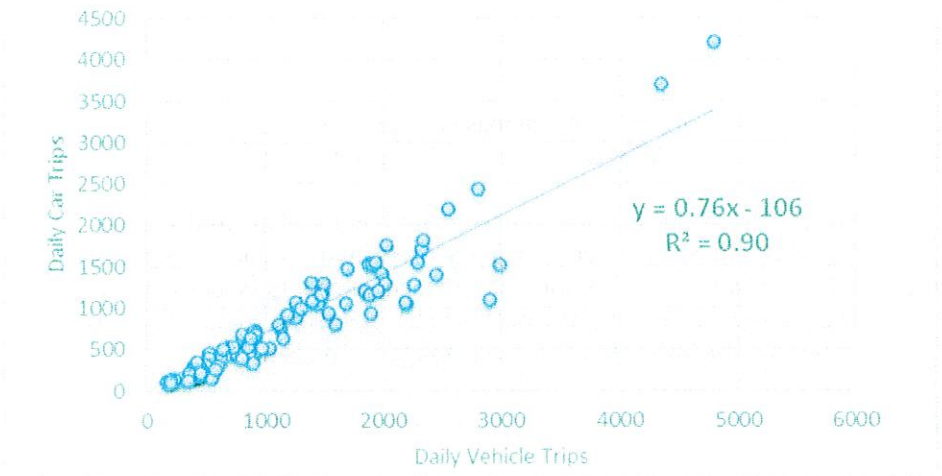
Note: The values in parentheses represent the number of data collection sites for HCW type.

[8] This section presents key analysis findings. Appendix A presents additional analyses of the HCW data.

[9] Sites were classified as cold storage either through self-categorization by data submitter (e.g., Walmart), by type of tenant (e.g., Ralphs, Publix), or by online site description (e.g., Americold, Millard Refrigeration Services).

Figure 2 is a plot of daily car trips versus daily vehicle trips generated at transload, short-term storage, and cold storage HCWs. The plot demonstrates strong correlation between the two trip-making characteristics of HCW sites. The data yields a linear fitted curve equation with an R^2 value of 0.90. The correlation between the daily truck trips and daily vehicle trips is not as strong and yields a linear fitted curve equation R^2 value that is less than the ITE acceptability threshold of 0.50.

Figure 2. Correlation between Daily Cars and Total Daily Traffic at Transload, Short-Term Storage and Cold Storage HCW Sites



Key Findings – Daily Trip Generation

Table 5 compares daily trip rates for the five different types of HCWs. The table includes weighted average rates for all vehicles, cars, trucks, and 5-or-more-axle trucks. The table also includes the weighted average rate for daily vehicle trips contained in ITE *Trip Generation Manual* 9th Edition, for high-cube warehouses (land use code 152). The single fulfillment center count was taken during a holiday shopping season when activity would be expected to be higher than an annual average.

Table 5. Weighted Average Rates for Daily Trips at High-Cube Warehouses

Type of High-Cube Warehouse	Weighted Average for Daily Trips per 1,000 GSF[10]			
	All Vehicles	Cars	Trucks	5+ Axle Trucks
Transload & Short-Term Storage (91)	1.432	1.000	0.454	0.233
Cold Storage (9)	2.115	1.282	0.836	0.749
Fulfillment Center (1)	8.178	7.461	0.717	0.242
Parcel Hub (1)	10.638	6.631	4.007	0.982
ITE *Trip Generation Manual* – 9th Edition	1.68	--	--	--

Note: The values in parentheses represent the number of data collection sites for HCW type.

[10] The weighted average rates for cars and trucks may not sum to match the "all vehicle" rates because some data sources collected total vehicle trips and did not separate cars and trucks.

Fulfillment Center and Parcel Hub

Based on data from single data points, it is likely that vehicle trip generation rates for fulfillment centers and parcel hubs are significantly different from those at other HCW sites.

The single fulfillment center has a substantially higher vehicle trip generation rate than transload, short-term storage, and cold storage HCW sites. The higher rate is due both to a higher number of passenger cars (i.e., employees) entering and exiting the site and to the count being conducted in December during the holiday shopping season.

The single parcel hub HCW has a rate that is higher than even the fulfillment center for all vehicles. The rate for trucks (both total and 5+ axle) is substantially higher than for the other HCW types.

Cold Storage

For the relatively small number of data points in the HCW database that are classified as cold storage facilities, there is a strong correlation between vehicle trips and building gross square footage.

Figure 3 is a plot of daily total vehicle trips versus building gross square footage at all cold storage facilities in the database. The data yields a linear fitted curve equation with an R^2 value of 0.69. As recommended in ITE *Trip Generation Handbook* 3rd Edition, the fitted curve should be considered acceptable only within the building site size range in the dataset[11]. The weighted average rate (shown above in Table 5) is 2.115 total vehicles per 1,000 GSF for a cold storage HCW site.

Figure 3. Correlation between Daily Total Vehicles and Cold Storage GSF (All Sites)

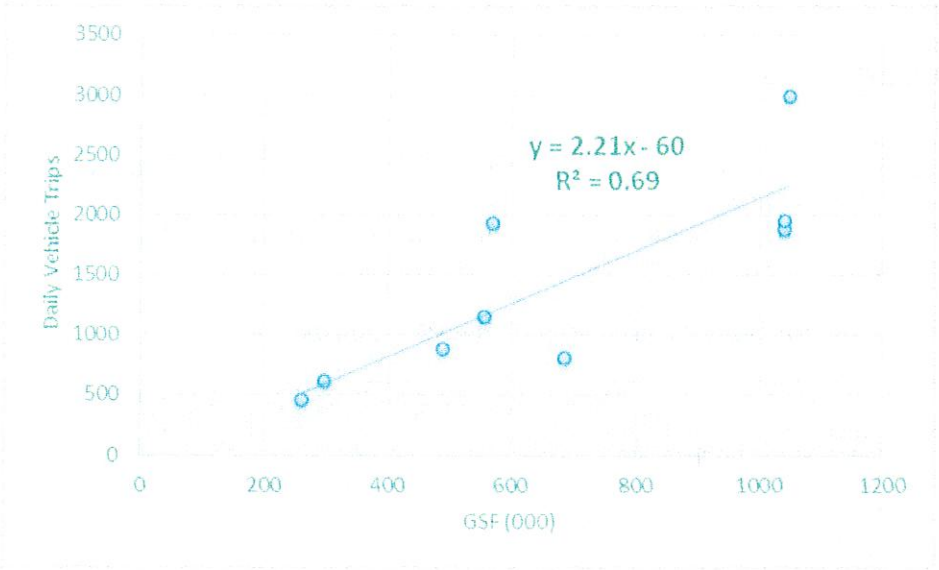
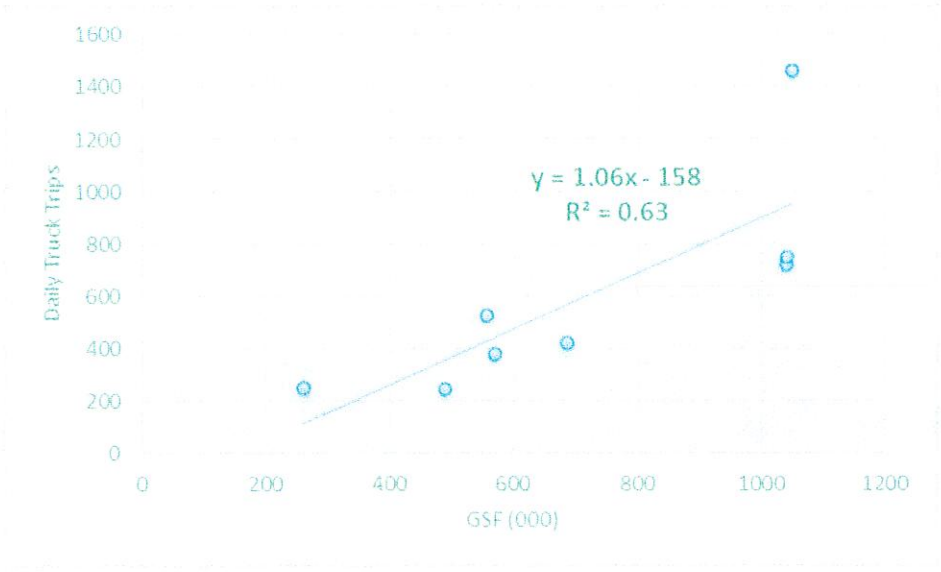


Figure 4 presents the data plot for daily trucks. The plot includes a fitted curve equation with an acceptable R^2 value. The weighted average rate for daily trucks at a cold storage HCW is 0.836 trucks per 1,000 GSF.

[11] The best correlation is found for sites with gross square footage of 500,000 or less, with greater data scatter for larger buildings. Nevertheless, there are several sites with gross square footage of more than 500,000 that have daily vehicle trip generation rates that mirror the small sites.

Figure 4. Correlation between Daily Trucks and Cold Storage GSF (SCAQMD & NAIOP Sites)



Transload and Short-Term Storage

It would be expected that a transload site could generate a different number of vehicle trips than a short-term storage HCW. But, as currently classified in this report, the sites that fall into the two categories show very little difference between the two. Therefore, the two types are analyzed together in this report. If an appropriate building characteristic can be identified at the time of site development review, the sites in the database can be re-examined and potentially reclassified and the trip-generating characteristics reanalyzed.

For this combination of HCW types, the relationship between building gross square footage and vehicle trips does not produce an acceptable level of correlation to develop a fitted curve equation. Figure 5 presents a plot of daily vehicle trips against building square footage.

The weighted average rate for transload and short-term storage HCW sites is 1.432 daily vehicle trips per 1,000 GSF (listed earlier in Table 5). As a point of comparison, this rate is lower than the weighted average rate of 1.68 provided in ITE *Trip Generation Manual* 9th Edition, for the High-Cube Warehouse land use.

The transload and short-term storage HCW dataset is much larger than the other HCW datasets. This larger dataset exhibits much greater scatter than the smaller datasets. This circumstance suggests that more data for the other HCW facility types are necessary to determine if the small dataset high correlations are accurate and justified.

Figure 5. Daily Vehicle Trips at Transload and Short-Term Storage HCW

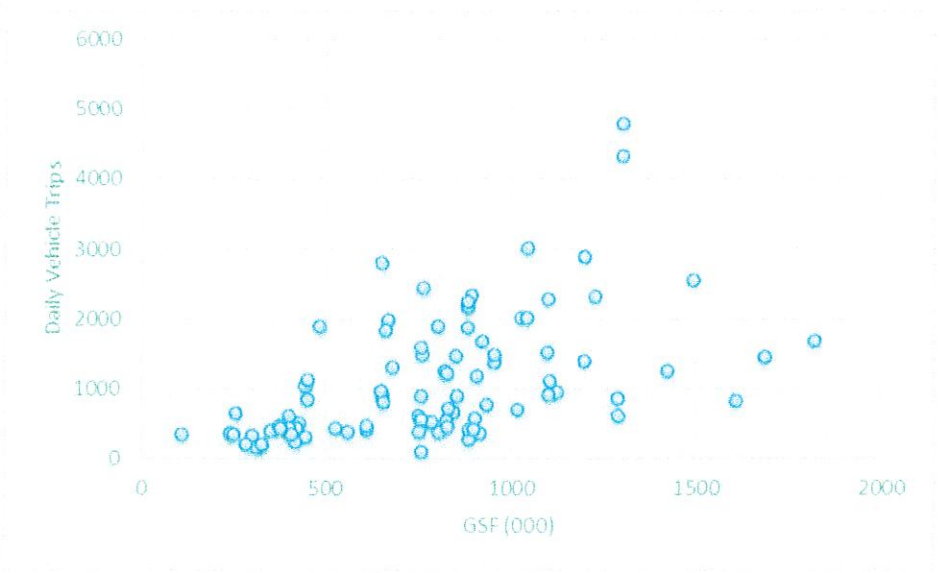
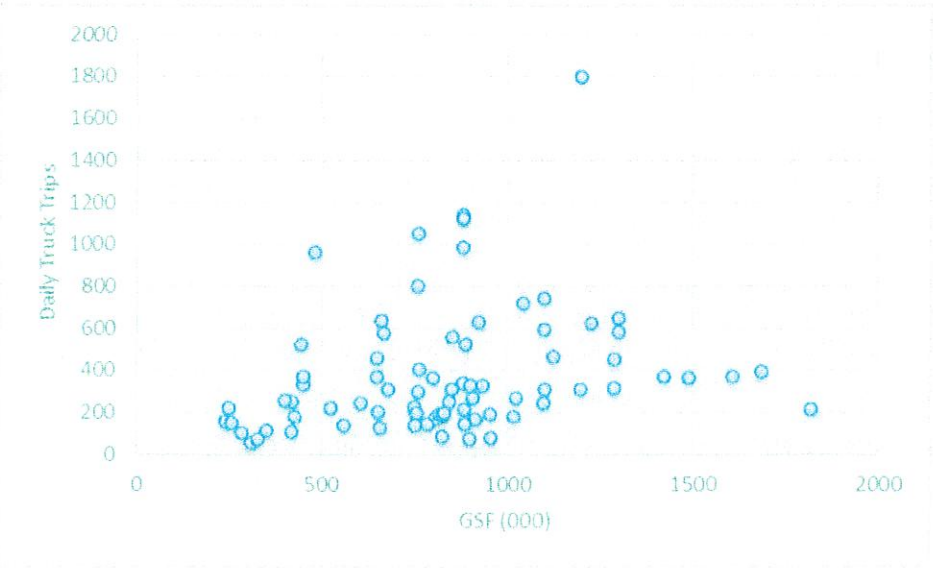


Figure 6 presents a plot of daily truck trips against building square footage at transload and short-term storage HCW. For trucks, the weighted average rate is 0.454 trucks per 1,000 GSF.

Figure 6. Daily Truck Trips at Transload and Short-Term Storage HCW



Key Findings – Peak Hour Trip Generation

Tables 6 and 7 list the weighted average rates for the AM and PM peak hours, respectively, for the five types of HCWs. The tables also include the weighted average rate for peak hour vehicle trips contained in ITE *Trip Generation Manual* 9th Edition, for high-cube warehouse (land use code 152).

Table 6. Weighted Average Rates for AM Peak Hour Trips at High-Cube Warehouses

Type of High-Cube Warehouse	Weighted Average for AM Peak Hour Trips per 1,000 GSF			
	All Vehicles	Cars	Trucks	5+ Axle Trucks
Transload & Short-Term Storage (94)	0.082	0.057	0.024	0.015
Cold Storage (9)	0.103	0.061	0.038	0.027
Fulfillment Center (1)	0.841	0.818	0.023	0.009
Parcel Hub (1)	0.851	0.428	0.423	0.041
ITE *Trip Generation Manual* – 9th Edition	0.11	--	--	--

Note: The values in parentheses represent the number of data collection sites for HCW type.

Table 7. Weighted Average Rates for PM Peak Hour Trips at High-Cube Warehouses

Type of High-Cube Warehouse	Weighted Average for PM Peak Hour Trips per 1,000 GSF			
	All Vehicles	Cars	Trucks	5+ Axle Trucks
Transload & Short-Term Storage (95)	0.108	0.086	0.023	0.010
Cold Storage (9)	0.129	0.087	0.042	0.031
Fulfillment Center (1)	1.979	1.944	0.035	0.013
Parcel Hub (1)	0.803	0.568	0.235	0.009
ITE *Trip Generation Manual* – 9th Edition	0.12	--	--	--

Note: The values in parentheses represent the number of data collection sites for HCW type.

Fulfillment Center

The single surveyed fulfillment center HCW has a significantly higher rate for passenger cars during both the AM and PM peak hours (as is the case for daily trips at the fulfillment center). The single fulfillment center count was taken during the December holiday shopping season.

The single surveyed parcel hub HCW has significantly higher rates for both cars and trucks during both the AM and PM peak hours (as is the case for daily trips at the fulfillment center).

Cold Storage

For cold storage HCW, fitted curve equations can be developed for estimating total vehicles during the AM and PM peak hours. The equations are:

- AM peak hour: $y = 0.17x - 40$ ($R^2 = 0.82$)
- PM peak hour: $y = 0.17x - 35$ ($R^2 = 0.83$)

The cold storage HCW weighted average rates during the AM and PM peak hours are, respectively, 0.103 and 0.129 total vehicle trips per 1,000 GSF. Both rates are close to the ITE *Trip Generation Manual* 9th Edition rate for all high-cube warehouses (land use code 152).

Transload and Short-Term Storage

Data plots for the AM and PM peak hours (not presented in this report) are comparable to the daily plot in terms of data scatter and little correlation. The weighted average rates for the AM and PM peak hours are:

- 0.082 total vehicles per 1,000 GSF during the AM peak hour
- 0.108 total vehicles per 1,000 GSF during the PM peak hour

As points of comparison, these rates are lower than the AM and PM weighted average rates of 0.11 and 0.12, respectively, provided in ITE *Trip Generation Manual* 9th Edition for the High-Cube Warehouse land use.

The weighted average rates for truck trips at transload and short-term storage HCWs during the AM and PM peak hours are:

- 0.024 trucks per 1,000 GSF during the AM peak hour
- 0.023 trucks per 1,000 GSF during the PM peak hour

RECOMMENDATIONS

The preceding analysis of available HCW trip generation data identified significant weaknesses in the ability to forecast vehicle trips with confidence. The following recommendations present a plan of action for quantifying necessary vehicle trip estimates to an acceptable level of precision for all types of HCWs.

Fulfillment Center HCW

The single available data point indicates that the trip generation characteristics (total vehicle trips and trips by vehicle type) for a fulfillment center HCW are significantly different from those for all other types of HCWs. A targeted data collection effort should be undertaken (as described below) to achieve a total of at least six sites. Included should be circulation of a Call for Data by ITE that specifically requests data for fulfillment centers. If future analysis reveals an unacceptable level of stability in the trip generation relationships, data should be collected at additional sites.

Parcel Hub HCW

The single available data point indicates that the trip generation characteristics (total vehicle trips and trips by vehicle type) for a parcel hub HCW are significantly different from those for all other types of HCWs. It is recommended that ITE circulate a Call for Data that specifically requests data for parcel hubs. A targeted data collection effort should be undertaken (as described below) to achieve a total of at least six sites. If future analysis reveals an unacceptable level of stability in the trip generation relationships, data should be collected at additional sites.

Cold Storage HCW

The limited data available for cold storage facilities produce acceptable levels of statistical precision for the estimation of vehicle trips. However, vehicle trip generation rates based on recently collected data are higher than those derived from data collected at least 10 years ago. It is recommended that (1) further investigation be made into the existing data and (2) additional data be collected.

The cold storage sites in the database are classified as such based on the interpretation of the data submitter. Confirmation of the applicability of the cold storage classification can be completed through determination of the proportion of the HCW building space devoted to cold storage. This information will also help in the development of a clear definition of cold storage facilities and their characteristics.

If some of the cold storage sites are reclassified, a targeted data collection effort should be undertaken (as described below) to achieve a total of at least six sites. Included should be circulation of a Call for Data by ITE that specifically requests data for cold storage facilities. If future analysis reveals an unacceptable level of stability in the trip generation relationships, data should be collected at additional sites.

Transload and Short-Term Storage HCW

The current database of sites for this subset of HCW types has been separated in accordance with building and dock configurations specified earlier in this report. To use a metaphor, it is possible that instead of separating the sites into apples and oranges, the sites have been separated into two sets that each contain both apples and oranges. The result is a pair of databases that (1) are not significantly different from each other in terms of trip generation and (2) do not yield satisfactory levels of correlation between building gross square footage and vehicle trips. It is possible that a more accurate allocation of the available data points between the two types of HCWs could produce better predictive relationships.

It is recommended that an analysis and evaluation of potential stratifications be undertaken and an appropriate set of data (along with a weighted average rate) be selected for use as interim rates until further study is complete (as described below).

Overall

It is recommended that a targeted data collection plan be undertaken in an attempt to further define and identify relationships between potential independent variables and vehicle trips generated at each type of HCW. A six-step process is presented below.

Step 1: Select 15 Sites[12] with Similar Characteristics for Data Collection and Further Analysis

- For each site, compile the data specified earlier in Table 3
- If the Table 3 data are available for the sites at which SCAQMD or NAIOP collected data, these sites and their data can be considered part of the initial 15
- Limit sites to one or two metropolitan regions. Preference should be given to a region with an existing freight model that disaggregates truck trips and commodity flow to the county or traffic analysis zone level, for cross-referencing purposes.

Step 2: Collect Data at the Initial 15 Sites

- Collect the vehicle volume data specified in Table 8

Step 3: Analyze Complete Data for Consistency and Correlation with One or More Independent Variables

- If consistency and correlations are found, skip to Step 5

Step 4: Identify 15 Additional Sites and Undertake Data Collection

- Summarize and analyze results, assessing consistency
- The results will set an approximate expectation for future data. They may be described statistically and/or in other clear terms.
- If variability is still considered significantly high by ITE standards, assess probable causes, further partition data into more subgroups, and reanalyze data. Use results to determine how to classify warehouse types for future data collection.

Step 5: Identify 15 Sites and Collect Data for Next Priority HCW Classification

- 15-30 sites (including usable existing data) in at least two metropolitan regions (may be selected to reflect funding sources)
- 3 year-long counts
- Compare year-long counts from second HCW type with those from first HCW type to determine if additional year-long counts are needed to show variability in different types of HCWs

[12] For a database with substantial uniformity in the characteristics that influence trip generation, a relatively small number of sites can produce predictive relationships with excellent statistical reliability (for example, perhaps the cold storage facilities). However, for sites with substantial variability, a database total of approximately 30 sites is typically recommended based on the central limit theorem. The theorem states that the sampling distribution of the means will approach that of a normal distribution with that quantity of data points even if the population being sampled is not normally distributed.

Step 6: Summarize and analyze data for each type of HCW, developing rates and equations where correlation is suitable. Identify patterns, trends, and other findings relevant to estimating HCW trip generation for use in TIAs and AQAs. Assess how many HCW types are needed/justified.

Table 8. Minimum Data Collection for Each HCW Type

• 15 sites including those for which there are usable existing data
• One or two metropolitan regions – preference should be for a region with an existing freight model that disaggregates truck trips and commodity flow to the county or TAZ level, for cross-referencing purposes
• Similar site characteristics (to minimize variability of results (desirably most common in metro region where data to be collected)
• 1-2 NAICS industrial codes – we may need to loosen this requirement in order to find 15 acceptable sites in a single metropolitan area; we may need to use data from sites in multiple metropolitan areas; should be used in site selection process, not as a prescriptive requirement
• Year-long count at 3 sites
• All counts by video; all files to be retained for possible future use; examine via simultaneous video and tube counts what the discrepancy rates might be for purpose classification based physical vehicle types and standard FHWA classes versus actually seeing the trucks on video
• All counts to follow ITE site trip generation count procedures with counts being made directionally by vehicle classification and recorded by driveway, by direction, and by 15 minute period so they can be checked (and reconstructed if necessary)

APPENDIX A. SUPPLEMENTAL DETAILED DATA ANALYSIS

Data Analysis Process

The database of 106 HCWs with vehicle trip generation data consists of one fulfillment center, one parcel hub, nine cold storage, 56 transload, and 39 short-term storage.

For each data record, a range of traffic count data is available.

- For many records, a daily count is provided. For many records, AM and PM peak hour traffic counts are provided.
- For some data records, the count data is reported simply as total vehicles. In some records, the vehicle counts are classified as cars or trucks. In some records, the vehicle counts are classified as cars and trucks, disaggregated by number of axles.

The data were disaggregated and aggregated in a variety of ways to help determine the effects of certain potential variables on vehicle trip generation.

- The entire database for each facility type
- Only the recent SCAQMD-sponsored data collection sites
- Only the recent NAIOP-sponsored data collection sites
- The combination of the recent SCAQMD- and NAIOP-sponsored data collection sites
- All data except for the recent SCAQMD- and NAIOP-sponsored data collection sites
- Sites with at least 500,000 gross square footage
- Sites with at least 800,000 gross square footage
- Sites with at least 1 million gross square footage
- Sites with data collected prior to 2007
- Sites with data collected after 2006
- Sites with data collected prior to 2010
- Sites with data collected after 2009
- Only California sites
- Only sites with close proximity to major port facilities

The vehicle count data were analyzed separately for the fulfillment center, parcel hub, cold storage, transload, and short-term storage HCWs.

- The results for fulfillment center, parcel hub, and cold storage are distinctly different from each other and are addressed separately below
- The results for transload and short-term storage HCWs are not substantially different from each other and are treated in combination below

The database enabled the compilation of over 1,500 subsets of HCW trip generation data that reflect:

- 7 different combinations of building types,
- 6 different sets for individual vehicle classifications or combinations,
- 13 different subsets of the database, and
- 3 different time periods (daily, AM, PM)

Weighted averages of vehicles per 1,000 gross square feet in the building were computed for each subset. Data plots with best fit linear curves were prepared for each subset. Examination of the data yields very few definitive relationships between site characteristics and vehicle trip generation. Key findings from these analyses are presented below.

Cars vs. Total Vehicles

Table A1 presents the weighted averages for cars, trucks, and 5+ axle trucks as a percentage of total daily vehicles measured at HCW sites. Separate calculations are presented for the entire database and for13 different subsets. When the complete set is included, the overall average is approximately 68 percent cars and 32 percent trucks of the total daily vehicles. There is minimal variation between the most recent data sources (SCAQMD and NAIOP) or between different building sizes. However, the more recent average data (post-2006 and post-2009) has a higher proportion of cars than does the older data collection sites.

Table A1. Weighted Averages for Percentage of Total Daily Vehicles for Cars and Trucks

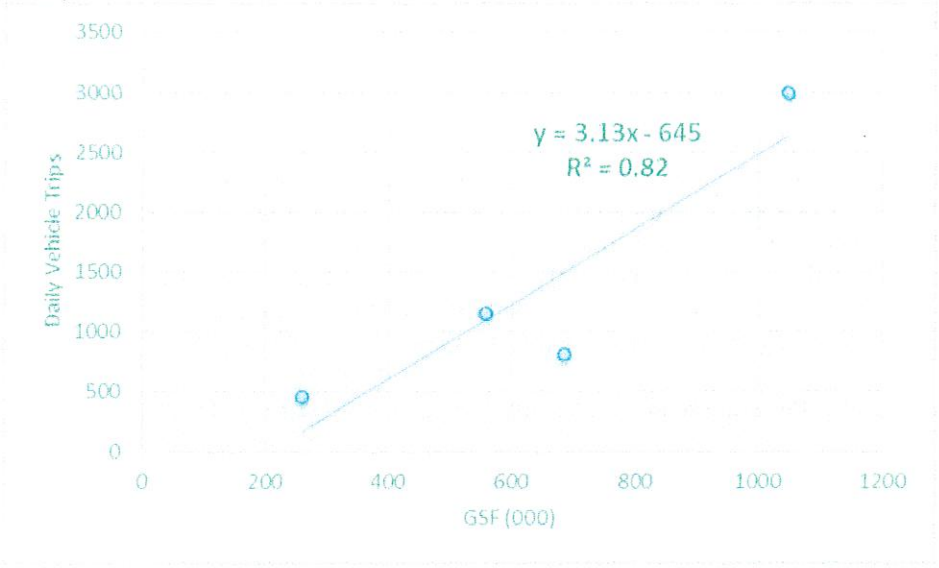
Data Site Subset	Percentage of Total Daily Vehicles		
	Cars	Trucks	5+ Axle Trucks
All	67.8%	32.2%	19.4%
SCAQMD	69.0	31.0	17.7
NAIOP	68.6	31.4	21.8
SCAQMD & NAIOP	68.8	31.2	19.0
Non-SCAQMD or NAIOP	66.6	33.4	---
More than 500,000 GSF	68.7	31.3	19.2
More than 800,000 GSF	69.4	30.6	18.5
More than 1,000,000 GSF	70.3	29.7	21.2
Pre-2007	62.1	37.9	---
Post-2006	70.1	29.9	19.5
Pre-2010	60.9	39.1	28.2
Post-2009	70.7	29.3	19.0
California Only	67.6	32.4	18.9

Cold Storage HCW

If the cold storage HCW data are restricted to only include data collected under sponsorship of SCAQMD and NAIOP within the past eight years, the correlation between daily total vehicles and site gross square footage can be improved beyond the full dataset correlation. Figure A1 presents the data plot and associated fitted curve[13]. As recommended in ITE *Trip Generation Handbook* 3rd Edition, the fitted curve should be considered acceptable only within the building site size range in the dataset.

[13] Granted, the improved correlation in Figure A3 is due in part to requiring correlation to only four data points.

Figure A1. Correlation between Daily Total Vehicles and Cold Storage GSF (SCAQMD & NAIOP Sites)



Correlation is also exhibited for cars, trucks, and 5+ axle trucks for daily traffic generated at cold storage facilities. Figures A2, A3, and A4 present the data plots for cars, trucks, and 5+ axle trucks, respectively. As recommended in ITE *Trip Generation Handbook* 3rd Edition, the fitted curves should be considered acceptable only within the building site size range in the dataset.

Figure A2. Correlation between Daily Cars and Cold Storage GSF (SCAQMD & NAIOP Sites)

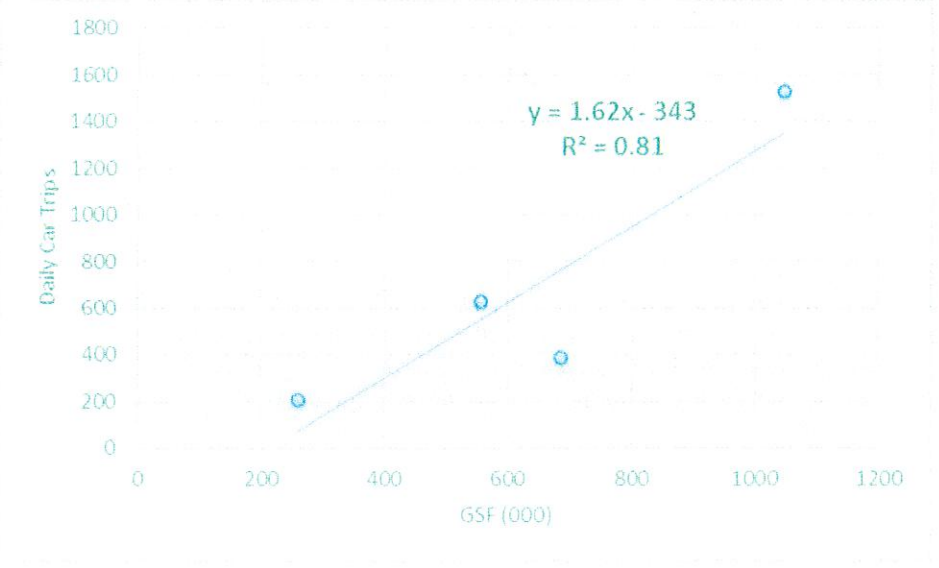


Figure A3. Correlation between Daily Trucks and Cold Storage GSF (SCAQMD & NAIOP Sites)

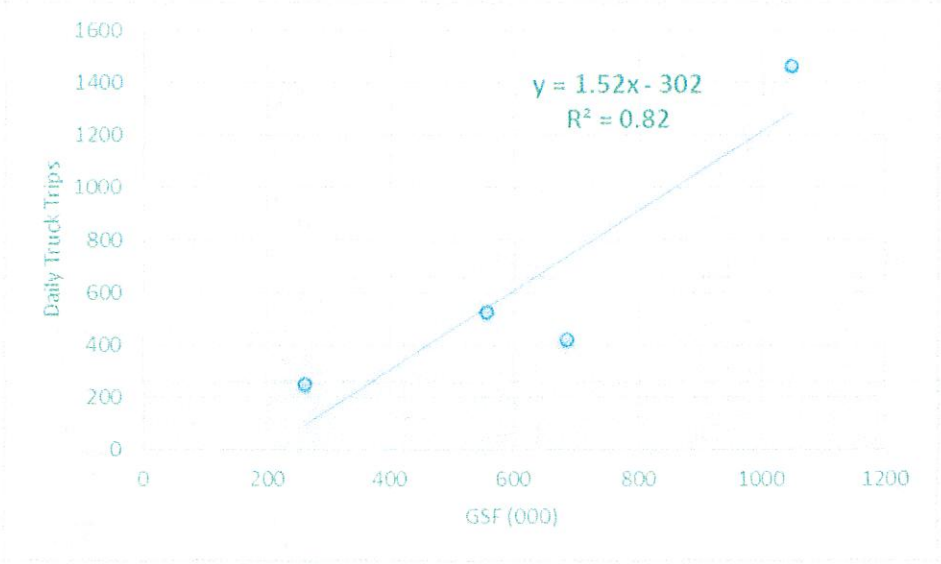


Figure A4. Correlation between Daily 5+ Axle Trucks and Cold Storage GSF (SCAQMD & NAIOP Sites)

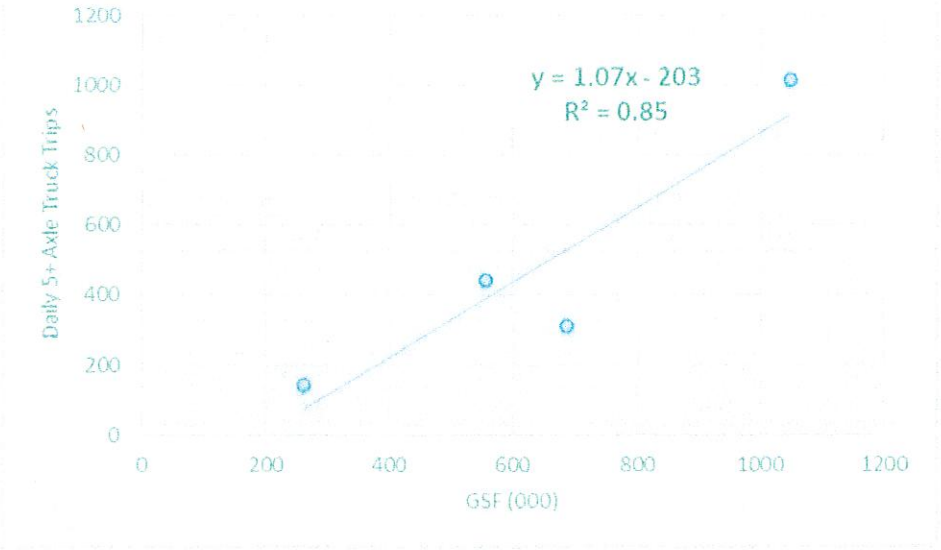


Table A2 presents the weighted average rates for all vehicles, cars, trucks, and 5+ axle trucks per 1,000 GSF at cold storage sites. Separate calculations are presented for the complete database plus 13 different subsets. When the complete set is included, the overall weighted average rate for all vehicles is 2.12. The rate is nearly identical whether calculated with only the SCAQMD and NAIOP data or with the other data points in the complete dataset.

Another observation from the table is that newer data (post-2006 and post-2009) have higher rates than do the older data, sometimes substantially higher. The newer and older datasets are comprised of relatively small numbers of data points, 6 and 3, respectively. Additional data points would be helpful to derive a more reliable estimate of cold storage HCW trip generation.

Table A2. Weighted Average Rates for Daily Trips at Cold Storage Facilities

Data Site Subset (Cold Storage)	Weighted Average for Daily Trips per 1,000 GSF			
	All Vehicles	Cars	Trucks	5+ Axle Trucks
All (9)	2.115	1.282	0.836	0.749 (4)
SCAQMD (3)	2.466	1.265	1.201	0.858
NAIOP (1)	1.179	0.564	0.615	0.455
SCAQMD & NAIOP (4)	2.120	1.077	1.043	0.749
Non-SCAQMD or NAIOP (5)	2.111	1.449	0.667	---
More than 500,000 GSF (5)	2.009	1.121	0.888	0.772
More than 800,000 GSF (3)	2.179	1.242	0.938	0.968
More than 1,000,000 GSF (3)	2.179	1.242	0.938	0.968
Pre-2007 (3)	1.868	1.134	0.706	---
Post-2006 (6)	2.278	1.368	0.910	0.749
Pre-2010 (3)	1.868	1.134	0.706	---
Post-2009 (6)	2.278	1.368	0.910	0.749
California Only (5)	2.114	1.077	1.043	0.749
Port Only (5)	2.114	1.077	1.043	0.749

Note: The values in parentheses represent the number of data collection sites for that particular subset of cold storage sites.

Tables A3 and A4 repeat the information presented in Table A2, but for the AM and PM peak hours, respectively.

Table A3. Weighted Average Rates for AM Peak Hour Trips at Cold Storage Facilities

Data Site Subset (Cold Storage)	Weighted Average for AM Peak Hour Trips per 1,000 GSF			
	All Vehicles	Cars	Trucks	5+ Axle Trucks
All (9)	0.103	0.061	0.038	0.027
SCAQMD (3)	0.124	0.070	0.054	0.026
NAIOP (1)	0.071	0.039	0.032	0.029
SCAQMD & NAIOP (4)	0.110	0.062	0.048	0.027
Non-SCAQMD or NAIOP (5)	0.098	0.061	0.030	---
More than 500,000 GSF (5)	0.092	0.054	0.038	0.028
More than 800,000 GSF (3)	0.099	0.058	0.041	0.030
More than 1,000,000 GSF (3)	0.099	0.058	0.041	0.030
Pre-2007 (3)	0.084	0.046	0.025	---
Post-2006 (6)	0.115	0.070	0.045	0.027
Pre-2010 (3)	0.084	0.046	0.025	---
Post-2009 (6)	0.115	0.070	0.045	0.027
California Only (5)	0.116	0.062	0.048	0.027
Port Only (5)	0.116	0.062	0.048	0.027

Note: The values in parentheses represent the number of data collection sites for that particular subset of cold storage sites.

Table A4. Weighted Average Rates for PM Peak Hour Trips at Cold Storage Facilities

Data Site Subset (Cold Storage)	Weighted Average for PM Peak Hour Trips per 1,000 GSF			
	All Vehicles	Cars	Trucks	5+ Axle Trucks
All (9)	0.117	0.080	0.037	0.029
SCAQMD (3)	0.129	0.087	0.042	0.031
NAIOP (1)	0.089	0.050	0.039	0.026
SCAQMD & NAIOP (4)	0.118	0.077	0.041	0.029
Non-SCAQMD or NAIOP (5)	0.117	0.083	0,034	---
More than 500,000 GSF (5)	0.106	0.069	0.037	0.029
More than 800,000 GSF (3)	0.116	0.079	0.037	0.029
More than 1,000,000 GSF (3)	0.116	0.079	0.037	0.029
Pre-2007 (3)	0.097	0.058	0.037	---
Post-2006 (6)	0.131	0.093	0.038	0.029
Pre-2010 (3)	0.097	0.058	0.037	---
Post-2009 (6)	0.131	0.093	0.038	0.029
California Only (5)	0.117	0.077	0.041	0.029
Port Only (5)	0.117	0.077	0.041	0.029

Note: Values in parentheses represent the number of data collection sites for that particular subset.

Transload and Short-Term Storage HCW

Weighted average rates for daily trips at transload and short-term storage HCWs are listed in Table A5 for four vehicle classifications (all vehicles, car, truck, and 5+ axle truck) and for the complete database plus 13 subsets. One observation about the data is that the more recent data sites have, on average, lower daily trip generation rates (for all vehicle types) than the older sites[14]. This relationship is also found for the AM and PM peak hours presented in Tables A6 and A7.

Table A5. Weighted Average Rates for Daily Trips at Transload and Short-Term Storage HCW

Data Site Subset (Transload & Short-Term Storage)	Weighted Average for Daily Trips per 1,000 GSF			
	All Vehicles	Cars	Trucks	5+ Axle Trucks
All	1.432	1.000	0.454	0.233
SCAQMD	1.412	1.006	0.406	0.217
NAIOP	1.069	0.749	0.339	0.276
SCAQMD & NAIOP	1.275	0.901	0.374	0.221
Non-SCAQMD or NAIOP	1.701	1.183	0.603	---
More than 500,000 GSF	1.433	1.008	0.431	0.223
More than 800,000 GSF	1.417	0.978	0.405	0.200
More than 1,000,000 GSF	1.493	1.044	0.392	0.257
Pre-2007	1.653	1.203	0.732	---
Post-2006	1.397	0.994	0.402	0.233
Pre-2010	1.621	1.097	0.708	0.614
Post-2009	1.347	0.970	0.377	0.221
California Only	1.226	0.871	0.388	0.221
Port Only	1.258	0.871	0.388	0.221
ITE *Trip Generation Manual* – 9th Edition	1.68	--	--	--

[14] A decline in HCW auto traffic is likely because of a reduction in employee density as HCWs have become more automated. The reduction in truck trips does not have a clear explanation. Continued data collection is recommended to enable the development of current trip generation rates that do not need to rely on older data.

Tables A6 and A7 list the weighted average rates for the AM and PM peak hours, respectively.

Table A6. Weighted Average Rates for AM Peak Hour Trips at Transload and Short-Term Storage HCW

Data Site Subset (Transload & Short-Term Storage)	Weighted Average for AM Peak Hour Trips per 1,000 GSF			
	All Vehicles	Cars	Trucks	5+ Axle Trucks
All	0.082	0.057	0.024	0.015
SCAQMD	0.073	0.049	0.024	0.013
NAIOP	0.060	0.040	0.019	0.016
SCAQMD & NAIOP	0.068	0.046	0.022	0.014
Non-SCAQMD or NAIOP	0.100	0.075	0.028	0.022
More than 500,000 GSF	0.078	0.055	0.023	0.014
More than 800,000 GSF	0.074	0.050	0.022	0.014
More than 1,000,000 GSF	0.078	0.049	0.025	0.022
Pre-2007	0.110	0.087	0.032	0.016
Post-2006	0.079	0.057	0.022	0.015
Pre-2010	0.101	0.073	0.032	0.022
Post-2009	0.072	0.051	0.021	0.014
California Only	0.067	0.045	0.023	0.014
Port Only	0.071	0.046	0.023	0.014
ITE *Trip Generation Manual* – 9th Edition	0.11			

Table A7. Weighted Average Rates for PM Peak Hour Trips at Transload and Short-Term Storage HCW

Data Site Subset (Transload & Short-Term Storage)	Weighted Average for PM Peak Hour Trips per 1,000 GSF			
	All Vehicles	Cars	Trucks	5+ Axle Trucks
All	0.108	0.086	0.023	0.010
SCAQMD	0.081	0.060	0.021	0.010
NAIOP	0.091	0.075	0.016	0.010
SCAQMD & NAIOP	0.085	0.066	0.019	0.010
Non-SCAQMD or NAIOP	0.135	0.117	0.028	0.015
More than 500,000 GSF	0.108	0.087	0.022	0.010
More than 800,000 GSF	0.110	0.087	0.022	0.009
More than 1,000,000 GSF	0.120	0.097	0.019	0.010
Pre-2007	0.145	0.133	0.031	0.012
Post-2006	0.107	0.086	0.020	0.010
Pre-2010	0.141	0.122	0.031	0.015
Post-2009	0.091	0.072	0.019	0.010
California Only	0.082	0.063	0.019	0.010
Port Only	0.086	0.065	0.019	0.010
ITE *Trip Generation Manual* – 9th Edition	0.12			

Tables A5, A6, and A7 also include the ITE *Trip Generation Manual* 9th Edition, weighted average rate for high-cube warehouses (land use code 152). The data analyzed in this report generally produce lower rates than contained in *Trip Generation Manual*.

Trio Investment Properties LLC
85 Felt Rd # 504
S. Windsor, CT 06074
860-796-5618
info@reagne.com

Exhibit D

Attention: Mr. Bart Pacekonis, Chairman of South Windsor Planning and Zoning Commission

Re: Proposed Planning and Zoning Regulations

Dear Chairman Pacekonis,

In August 2022, Trio Investment Properties LLC purchased industrial lot #8 at Constitution Landing at 75 Connecticut Avenue. The goal is to develop this lot for a mixed use application for small and growing businesses. We also were hoping to build some cold storage buildings for boats, RV's, car enthusiasts and other users. As the town of South Windsor is in the process of modifying Planning and Zoning Regulations, we are requesting that Table 4.1.1A be modified to allow storage facilities in Industrial Zones and storage be added to Section 4.5.1 Purpose and Intent. For clarity, this modification to Table 4.1.1A is shown below:

Table 4.1.1A Permitted Commercial and Industrial Uses

P = Permitted SE = Special Exception SP = Site Plan ZP = Zoning Permit Blank = Not Permitted	Zones DC = Design Commercial GC = General Commercial I = Industrial RC = Restricted Commercial RO = Restricted Office TS = Route 5 Travel Services						Additional Provisions
Use	DC	GC	I	RC	RO	TS	
Storage Facilities (Self Storage)		SP/SE	SP/SE				SE approval if use abuts a residential zone. Commission may determine hours of operation.
		SE		SE			

The facility we propose to build solves several problems that towns have been encountering in recent years ,benefitting all stakeholders in South Windsor – industrial property owners, residential neighbors and government officials. It is becoming more common for towns to discourage home owners from parking extra cars, RV's and boat trailers at their homes. Additionally, towns often discourage small businesses from using their home for business purposes. Our plans help mitigate both of these issues. Our facility is also an excellent neighbor to a residential zone. The traffic at the facility will be very low, the hours of use are primarily during the day and the noise levels are very low. Also, all buildings proposed at this site are under 27' tall, which is almost 10' less than a two story colonial home.

In addition to allowing storage facilities in industrial zones, we'd like to propose a change regarding buffers, screening and landscaping. The existing 50' buffer is more than adequate for new construction. In cases like ours where we have a mandated buffer and the residential neighbors have no buffer, we would prefer to allow for a 10' easement on the perimeter of the industrial landto allow the neighbors

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access and the right to plant trees and shrubs of their choise so as they can have greater privacy from the industrial property. On a property of this size 50' is sufficient for a buffer.

Upon reading the new regulations, we were surprised by how much new language had been added. At a time when so many businesses are leaving our state, we had assumed the changes would have been a removal of language, a streamlining of rules and the empowerment of the design engineers for property owners to have more flexibility in how they approach the design process. The trend is opposite of that. Some added regulations that add substantial cost with little benefit for this project are as follows:

1. Section 4.1.5 adding language for additional traffic requirements. That is not needed at this parcel.
2. Section 4.5.8 has onerous language about environmental and noise issues. Environmental should not require a written assessment for items which "may potentially" emit pollutants. For noise vehicles running should only apply to area in the 50' buffer.
3. Section 4.5.10 Protection of Natural Diversity is something the town should take care of and not the property owner.
4. There is much language in the new rules regarding fence, buffers, berms, plantings and buffer width. Our site has a wooded buffer of 50'. The neighbors have no buffer. In several cases they have encroached on our property. A fair solution is to let them plant, fence or construct a buffer on the first 10' of our property at their cost and under the approval of the town.

In general, there are numerous proposed modifications to the existing regulations that will impose significant cost additions to business owners hoping to build new facilities. As such, we are requesting a delay in the implementation of these new regulations. When we purchased this property, the proposed changes were not available to us. They are not minor either. The proposed rules are expensive to the owner, require more design time, and in general, require more government oversight in every aspect of the construction process, which makes it more expensive for the town as well.

We request that any new rules be implemented with conditions in place allowing property owners currently in the design phase to continue under existing regulations. As a suggestion, if a property owner can prove that they have hired a site designer to begin work on a new facility design prior to June 1, 2023, then compliance with the modifications to the regulations are not needed.

We appreciate the difficult task ahead for the Planning and Zoning Commission and understand the importance of the work being done. Thank you in advance for the consideration of all items outlined in this letter.

Exhibit E

My name is Don Cusson, owner of Cusson Automotive, located at 29 Mascolo road here in South Windsor.

24 years ago, I stood right here in front of the Planning and Zoning board to ask for the ability to take a vacant run-down building and turn it into an Automotive repair facility. My business at that time was 6 years old, had 5 employees and renting 5000 sqf at 49 Mascolo rd. I told this board of my ambition to be able to grow my business. Not just add employees, but as important become a respected and welcomed business owner in South Windsor. Ultimately the many boards that I stood in front of did support our request and needs to allow Cusson Automotive to grow to the business that we are today. Our current building after one other small office addition, is over 17,000 sqf with 15 employees.

So here I am today finding myself in a very similar situation. My company has grown out of our current space and need to expand. For 2 years we have been looking for the right move to support our needs. Last June 2022 I had conversation with Michele Lipe and Jeff Dolittle regarding a parcel of commercial land that that I considered building on. At that time, I gave a lot of specific details that would be involved, Both Michele and Jeff said they would support our project. Since that time, I have been working the past 9 months to learn the steps and process I must go through to confirm that I am allowed to expand my business on this property. I never realized how complicated the process had become. Recently I found out that I have another

obstacle in the way that may have a significant impact on my project, and that is the new and expanded industrial development regulations being proposed.

I've had a contract in place for almost 7 months to buy the property, however I can't close till I know for certain that the town of South Windsor will allow me to build on this parcel.

To date I've spent tens of thousands of dollars on bank application fees, environmental reports, site designers, concept plans and other costs. I had to explain to the seller why this land purchase needs to be pushed back. The seller has been gracious in extending my due diligence period, If these up front requirements are to require much more procedures I may find myself purchasing a parcel of land with a change in zoning but yet still needing to have a building approved for our expansion. All this activity on a parcel of land that has never had a building on it. The property is currently hidden and surrounded by all commercial businesses on three sides and abuts wetlands backing up to farm fields on the fourth side.

These Regulations will have a large effect on my expansion project. I now have my engineer working on this required zoning change before anything else. Through more research we find out that any residential property abutting commercial or industrial must now have much larger setbacks and buffer landscaping, set hours of operation among other changes that all add cost.

Ladies and Gentleman, As a small business owner in the Town of South Windsor, I work Monday through Friday, long hours and often on Saturdays. I don't have time to see if new land use regulations are happening, I rely on the designers, engineers and General contractors to know if there are items that are going to affect me. Never mind the average person, to include our local customers or small business owners knowing about these regulation changes. My Engineers and GC didn't know of these changes until we were told by town staff in January that they were in the works.

I am here tonight not just for myself but perhaps representing other small businesses that don't know of these sweeping changes that could affect them.

I am asking the board for three items:

1) Any small business (not mega box or large franchise) that are amid a contractual land purchase or expansion, that these transactions and expansions can fall under the current/old regulations.
2) Can these sweeping changes be put on hold for 90 days from today to allow both residential and business people alike learn of them and better understand them.
3) If the Town wants small business to stay in South Windsor Please take another look at the proposed regulations and perhaps fine ways to lessen the financial burdens they will impose on anyone that wants to build or expand their current business. The cumulative effect of added cost

impose plus our current burden of high inflation, high interest rates on loans, supply chain issues, labor shortages and weakening economy cumulatively make it very difficult and expensive to move forward on such a project.

This is truly the most expensive investment of my entire life. I thank the board for listening and considering my thoughts.

Respectfully,

Don Cusson, President

Cusson Automotive, inc

29 Mascolo Rd,

South Windsor, 06074

860-289-2389

Exhibit F

Oneil, Caitlin

From: Lipe, Michele
Sent: Wednesday, February 15, 2023 4:02 PM
To: Oneil, Caitlin
Subject: FW: [External]Zoning Text Amendment

For our warehouse public hearing file

Thanks,
Michele

Michele M. Lipe, AICP
Director of Planning
Town of South Windsor
1540 Sullivan Ave.
South Windsor, CT 06074
(860) 644-2511, ext. 2252

From: Derrick Butler <dbutler@siracusamoving.com>
Sent: Wednesday, February 15, 2023 1:49 PM
To: Lipe, Michele <Michele.Lipe@southwindsor-ct.gov>
Subject: [External]Zoning Text Amendment

Good afternoon Michele. I have been reviewing the updated version and could tell the committee has worked hard on this with excellent results. This updated version will provide needed protection to the Town and residents that we previously did not have. I am pleased to say it looks like the bases are covered with the updates.

I would like to suggest some additional text in 4.1.5 Traffic requirements.

To provide clarity would it make sense to add in the language " To provide safe flow for the public and eliminate conflicts on the site, and inbound and outbound traffic flow to and from the site,
the applicant must adhere to the ASHTO turning ratios for both WB62 and wb67 class vehicles".

This would be for sites using tractor trailers . This would prevent a misleading developer from stating their site is adequate for WB62 class vehicles , when today the majority of the highway fleets are WB67. (Longer , Wider).

Derrick Butler
VP Commercial Services