Kimley»Horn

MEMORANDUM

7/16/2021

To:	Ms. Jo Ryan Carvana, LLC
From:	Emma Albers, P.E., PTOE Kimley-Horn and Associates, Inc.
Date:	July 16, 2021
Subject:	Trip Generation for Carvana Vending Machine/Fulfillment Center with Sell to Carvana (STC) Program Skokie, Illinois

This memorandum describes the estimated vehicle trip generation associated with the proposed Carvana Vending Machine/Fulfillment Center (VM/FC) located in Skokie, Illinois. The following sections describe the proposed land uses, the estimated trip generation based on activity data at existing VM/FCs, and a comparison with the standard trip generation source, Institute of Transportation Engineers (ITE) *Trip Generation Manual, 10th Edition*.

Carvana Vending Machine/Fulfillment Center

Carvana is an online automobile retailer from which customers can search, evaluate, and purchase their vehicles via the Carvana website. Customers can get their cars in one of three ways:

- The vehicle can be delivered directly to the buyer's driveway
- The buyer can pick up the vehicle at a curbside location
- The vehicle can be delivered to a Carvana VM/FC where it can be picked up by the buyer
  - Customers picking up a vehicle from a VM/FC are scheduled by appointment only

BUILDING DESCRIPTION

The proposed Carvana VM/FC has a total building footprint of approximately 7,960 sq. ft. Approximately 4,150 square feet (52 percent) of the building's footprint is comprised of office space, a customer welcome center, restrooms, storage, a conference room, and employee spaces (work/break rooms). The remaining building footprint includes the base of the vending machine tower (mechanical shuttle system), two vehicle delivery bays, and vehicle detail prep area. The proposed ground floor plan is provided as an attachment to this memo.

The Carvana VM/FC tower is a vertical glass and steel parking and exhibition structure that utilizes an automated storage and retrieval system to move vehicles in and out of the tower. The VM/FC allows vehicles to be stacked temporarily in a vertical configuration until they are retrieved for the customer. Only cars that were sold online and are scheduled for pick-up are loaded into the Vending Machine tower. The tower's mechanical shuttle and storage/display areas should not be considered in the trip generation calculations because these areas are considered ancillary to the tower and would not generate additional traffic.

Trip Generation

In order to estimate site-generated trips for the proposed VM/FC, operational data was provided by Carvana for three existing VM/FC facilities. This data was used to estimate site-generated traffic for the proposed development. The operational-based trip generation was then compared to ITE data.

EXISTING CARVANA VM/FC

Three types of trips occur at a Carvana facility. The trip generation estimates consider the sum of these types of trips.

- Employee Trips - Each VM/FC has 6-9 employees per shift and a total of 12 to 20 employees per day. The VM/FC's maintain the same operations during weekdays and weekend days, from 9:00 AM to 7:00 PM. Each employee would generate two commute trips per day: arrival and departure.
- Deliveries to Vending Machine - There are 2 to 4 truck trips per day at each VM/FC to deliver vehicles to stock the Vending Machine tower.
- Customer Pick-Up - Carvana customers arrive at the site to pick up their vehicle and drive off in their newly purchased vehicle. These trips are pre-scheduled with typically 2 to 3 customer pick-ups per hour. Each vehicle pick-up results in two trips: arrival and departure.

A summary of the activity data from three existing Carvana VM/FC facilities are listed in **Table 1**.

Table 1. Existing Carvana VM/FC Activity

Location	Customer Trips[1]				Employees		Deliveries per day
	Weekday			Weekend			
	AM Peak Hour	PM Peak Hour	Daily	Daily	Employees per shift	Shifts per day	
Tempe, AZ	10	10	25	31	7	2	3
Houston, TX	5	4	15	30	9	3	4
Philadelphia, PA	4	3	12	24	8	3	2

[1]Sum of customer trips to and from the site
Source: Carvana, LLC., 2019

The total daily trips are calculated as the sum of trips from all types of activities as follows:

- Total Daily Trips = Daily Customer Trips + 2 x Employees per Shift x Shifts per Day + 2 x Deliveries

The total daily trip generation is presented in **Table 2** on the following page.

Table 2. Existing Carvana VM/FC Daily Trip Generation

Location	Weekday			Weekend		
	In	Out	Total	In	Out	Total
Tempe, AZ	30	29	59	33	32	65
Houston, TX	39	38	77	46	46	92
Philadelphia, PA	32	32	64	38	38	76

Source: Kittelson & Associates, 2020

PROPOSED CARVANA VM/FC – SKOKIE, IL

Per coordination with the Carvana team, the proposed VM/FC in Skokie will also include a Sell to Carvana (STC) program that provides customers the ability to sell their existing vehicle to Carvana on site. As a result of the STC program at this location, Carvana is expecting the highest number of customer activities from the existing sites to double at the proposed Skokie facility. Additionally, the proposed Skokie VM/FC with STC is expected to have a maximum of 10 employees per shift, 3 shifts per day, and 4 truck deliveries. It is expected that employee shift changes and truck deliveries will occur during off-peak hours. The expected activity associated with the Skokie VM/FC is provided in **Table 3**.

Table 3. Proposed Carvana VM/FC with STC Activity (Skokie, IL)

Location	Customer Trips[1]				Employees		Deliveries per day
	Weekday			Weekend			
	AM Peak Hour	PM Peak Hour	Daily	Daily	Employees per shift	Shifts per day	
Skokie, IL	20	20	60	62	10	3	4

The total daily trips are calculated based on the total daily trip formula. The trips during the morning and evening peak hour are expected to be customers only, as the employee shift changes and deliveries will occur outside the peak hours. The site-generated trip estimates for the proposed Skokie VM/FC are presented in **Table 4**.

Table 4. Proposed Carvana VM/FC with STC Trip Generation – Skokie, IL

Location	Weekday							Weekend			
	AM Peak Hour			PM Peak Hour			Daily	Peak Hour			Daily
	In	Out	Total	In	Out	Total		In	Out	Total	
Skokie, IL	10	10	20	10	10	20	128	16	16	32	130

ITE TRIP GENERATION

For comparison, site-generated trips for the proposed VM/FC were estimated using data provided in ITE's *Trip Generation Manual, 10th Edition*. Land Use Code 841, Automobile Sales (Used), is considered the most comparable to a Carvana VM/FC and was used for the trip generation calculations. The ITE rates for LUC 841 are either based on number of employees or building area square footage. The ITE manual does not provide data for the weekend. The trip generation rates for LUC 841 are provided in **Table 5**.

Table 5. ITE Trip Generation Rates for LUC 841

Land Use	Unit	Weekday		
		AM Peak Hour	PM Peak Hour	Daily
Automobile Sales (Used)	1,000 sq. ft.	T = 2.13X 76% in/24% out	T = 3.75X 47% in/53% out	T = 27.06X 50% in/50% out
	Employee	T = 1.16Y 76% in/24% out	T = 1.73Y 47% in/53% out	T = 12.48Y 50% in/50% out

T Number of Trips
X 1,000 square feet of gross floor area
Y Employees

The proposed Carvana VM/FC is expected to operate with a maximum of 30 employees (10 employees per shift with 3 shifts per day). The total building area is 7,960 square feet. Using the rates provided in Table 5, the site-generated trip estimates are provided in **Table 6**.

Table 6. ITE Trip Generation Summary for LUC 841

Land Use	Unit	Weekday								
		AM Peak Hour			PM Peak Hour			Daily		
		In	Out	Total	In	Out	Total	In	Out	Total
Automobile Sales (Used)	7,960 sq. ft.	13	4	17	14	16	30	108	108	216
	30 employees	27	8	35	24	28	52	187	187	374

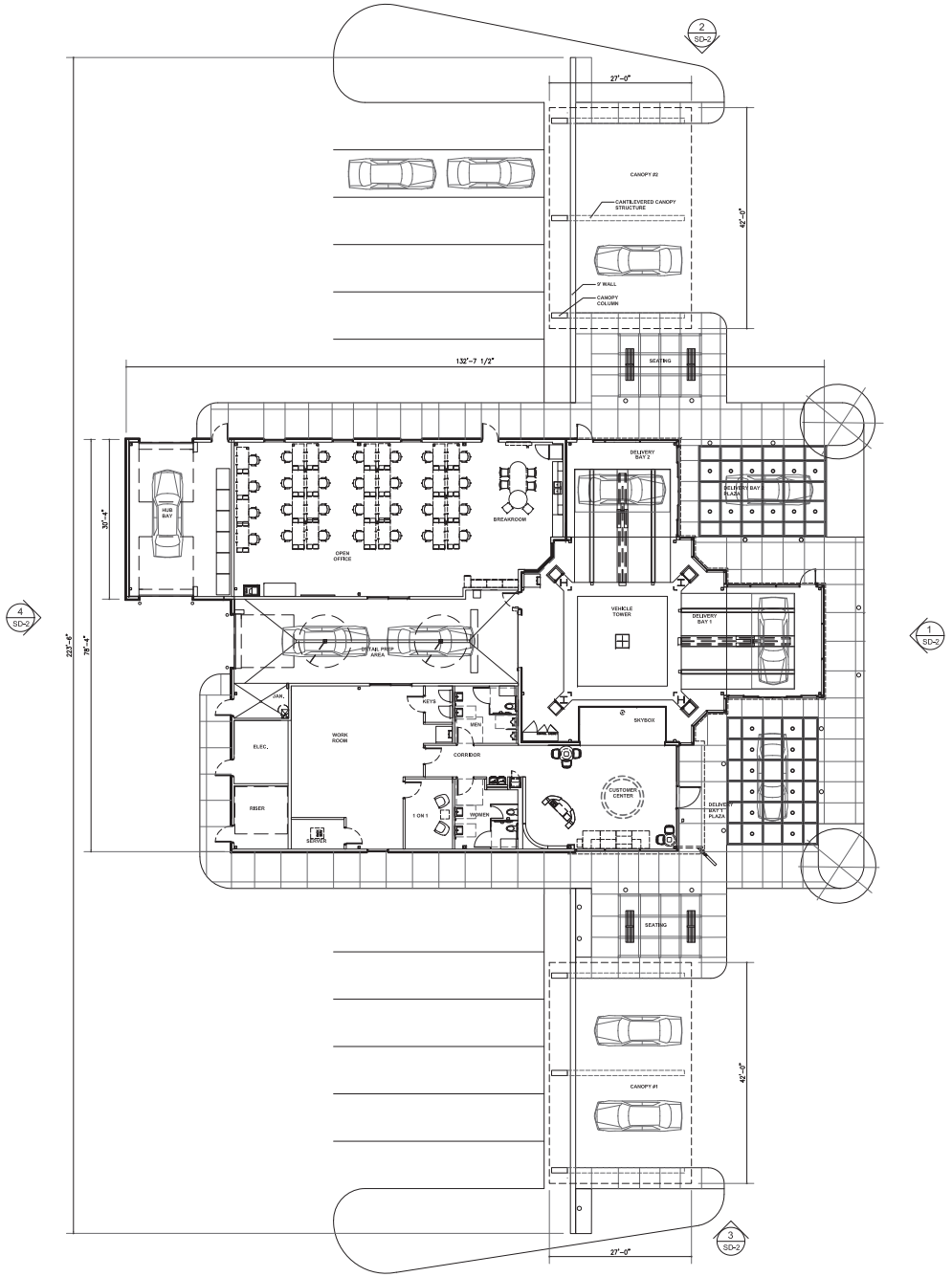
The estimated trips from the ITE *Trip Generation Manual,* based on the amount of gross floor area and number of employees, are higher than the trips expected for the proposed Carvana VM/FC in Skokie. The trip generation estimated for the Skokie site are based on data collected at existing Carvana VM/FC facilities and anticipated operational characteristics (e.g., employee headcount, shifts, sales activity, truck trips).

Conclusion

The trip generation rates from the ITE *Trip Generation Manual* reflect data obtained from traditional automobile sales facilities and do not accurately represent the trip generation characteristics of a Carvana facility. A typical auto dealership includes significant customer interactions onsite. Carvana is an online automobile retailer from which purchasers can search, evaluate, and purchase their vehicles via the Carvana website, and many vehicles are delivered directly to customers. A traditional auto dealer conducts most interactions onsite with drop-in customers, while Carvana completes the car purchase online. Carvana customers arrive onsite at a pre-scheduled appointment time (2 to 3 per hour) to retrieve their vehicle, which takes approximately 20 to 30 minutes.

Another source of difference with traditional auto dealerships is onsite service/repair facilities, which can generate a significant number of trips independent of the auto sales activities. Carvana VM/FC facilities do not provide onsite vehicle service/repair departments.

Trip generation estimations that are based on analysis of existing Carvana facilities are the preferred method for calculating the trip generation of the proposed Carvana VM/FC with STC in Skokie, Illinois. Based on this preferred method, during a typical weekday, the proposed Skokie facility is expected to generate 128 trips per weekday, 20 trips during the morning peak hour (10 inbound, 10 outbound), and 20 trips during the evening peak hour (10 inbound, 10 outbound). During the weekend, the Skokie facility is anticipated to generate 130 daily trips with 32 trips during the weekend peak hour (16 inbound, 16 outbound).



1 SD-1 PRELIMINARY OVERALL FLOOR PLAN
3/32" = 1'-0"

PRIMARY BUILDING FOOTPRINT = 7,958 SF

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2.

3.

4.

5.

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Sheet Title

SD-1

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