



## TRIP AND PARKING GENERATION STUDY OF A MINI-WAREHOUSE

### Introduction

The Brigham Young University (BYU) Institute of Transportation Engineers (ITE) student chapter recently completed the 2011 Data Collection Project as proposed to the ITE Western District. The data for this project were collected at a local mini-warehouse facility, which corresponds to Land Use Code 151. This project was a great learning experience for our student chapter; the funds we receive will help student chapter members attend the Western District ITE meeting in Anchorage, Alaska.

Ryan Hales, P.E., PTOE, AICP, of Hales Engineering, provided mentoring support and project review for this data collection effort. Craig Wagner, from Econolite, provided our student members with training on the use of our traffic data collection trailer on January 19 and February 23, 2011 (see Figure 1). Dr. Mitsuru Saito Ph.D., P.E. and Dr. Grant Schultz Ph.D., P.E., PTOE, both of BYU, have provided invaluable help and support and data collection equipment for the project.

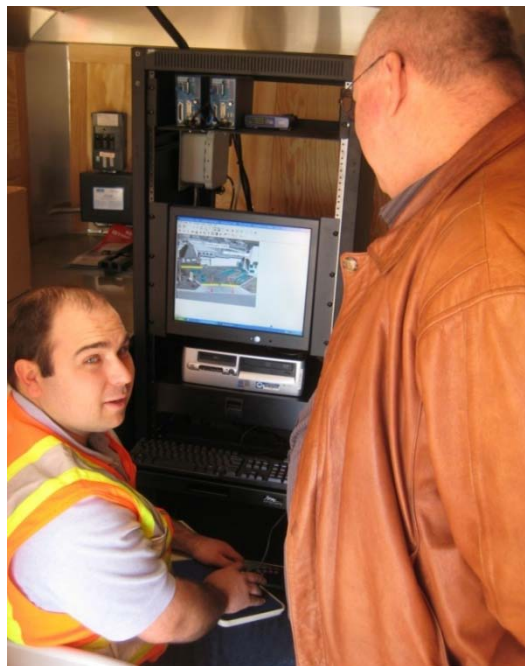


Figure 1: Data Collection training with Craig Wagner.

## Site Information

Data were collected on three different days at the mini-warehouse facility, shown in Figure 2. The facility is Hillside Storage, located at 2067 Ironton Blvd. in Provo, UT. The approximate square footage of the office building, number of employees, number of parking stalls, number of units, percent of units occupied, net rentable area, gross floor area, and total property area can be seen in Table 1. There are two parking areas at the site, one of which includes the entrance to the area that contains the storage units.

Table 1: Site Characteristics

Characteristic	Value
Number of Employees	4 (2 FT, 2 PT)
Number of Units	420
Occupied Units	60%
Net Rentable Area	56,476 ft <sup>2</sup>
Office Floor Space	1,700 ft <sup>2</sup>
Gross Floor Area	58,098 ft <sup>2</sup>
Property Area	3.44 acres
Number of Parking Stalls	6 (1 handicap)

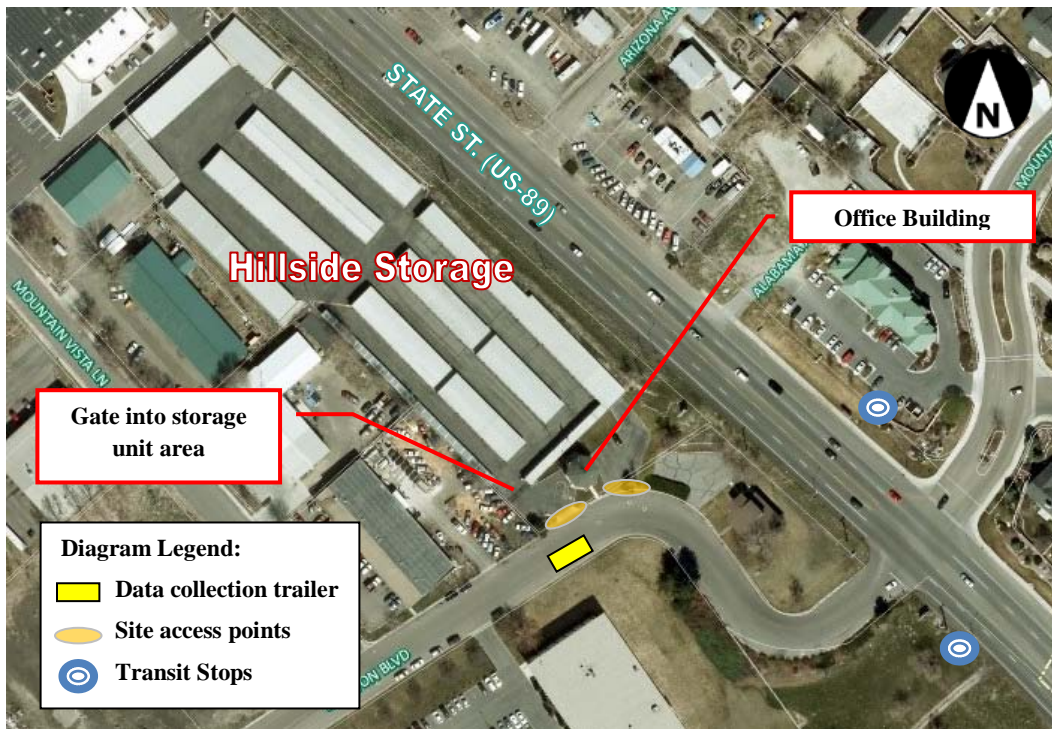


Figure 2: Site layout.

## Methodology

Data were collected on Saturday, February 26, 2011; Sunday, February 27, 2011; and Tuesday, March 1, 2011. As stated in the proposal, trip generation was counted between the hours of 7am and 7pm on each day. The BYU Traffic Data Collection Trailer, shown in Figure 3, was used to collect data at the site.

The trailer is equipped with two video cameras that recorded each entrance to the site during the specified hours. These videos were then used to manually count vehicles entering and exiting the site through each access. The counts for the two driveways were totaled for each hour. The results of the trip generation are summarized in the attached Trip Generation Data Forms. Parking demand data were also collected every hour, on the hour, from 7am to 7pm. The parking data are attached in the Parking Demand Survey Forms.



**Figure 3: BYU traffic data collection trailer at the site.**

## Results

The trip data for the morning peak period, the afternoon peak period, and the peak hour of generator are shown in Table 2, Table 3, and Table 4, respectively. Data about vehicle occupancy was not collected during this study. Furthermore, no pedestrian, bicycle, or transit trips were observed during the study. The trip rates shown are rates per occupied unit and per 1000 square feet of gross floor area (GFA). Table 5 shows a summary of trips counted for each day of the study.

**Table 2: Morning Peak Period Trip Data for the Mini-Warehouse**

<b>Variable</b>	<b>Saturday 2/26/11</b>	<b>Sunday 2/27/11</b>	<b>Tuesday 3/1/11</b>
Peak Hour	8:00-9:00 AM	8:00-9:00 AM	8:00-9:00 AM
All Vehicles	1	1	0
Trucks	0	0	0
Total Trips	1	1	0
Trip Rate (Occ. Units)	0.004	0.004	0.00
Trip Rate (GFA)	0.017	0.017	0.00
% Entering	100.0%	0.0%	0.0%
% Exiting	0.0%	100.0%	0.0%

**Table 3: Afternoon Peak Period Trip Data for the Mini-Warehouse**

<b>Variable</b>	<b>Saturday 2/26/11</b>	<b>Sunday 2/27/11</b>	<b>Tuesday 3/1/11</b>
Peak Hour	5:00-6:00 PM	5:00-6:00 PM	5:00-6:00 PM
All Vehicles	3	0	4
Trucks	0	0	2
Total Trips	3	0	4
Trip Rate (Occ. Units)	0.012	0.00	0.016
Trip Rate (GFA)	0.052	0.00	0.069
% Entering	66.7%	0.0%	50.0%
% Exiting	33.3%	0.0%	50.0%

**Table 4: Peak Hour of Generator Trip Data for the Mini-Warehouse**

<b>Variable</b>	<b>Saturday 2/26/11</b>	<b>Sunday 2/27/11</b>	<b>Tuesday 3/1/11</b>
Peak Hour	11:00-12:00 PM	9:00-10:00 AM	5:00-6:00 PM
All Vehicles	4	2	4
Trucks	0	0	2
Total Trips	4	2	4
Trip Rate (Occ. Units)	0.016	0.008	0.016
Trip Rate (GFA)	0.069	0.034	0.069
% Entering	50.0%	100.0%	50.0%
% Exiting	50.0%	0.0%	50.0%

**Table 5. Summary of Daily Trip Data**

<b>Saturday (2/26/11)</b>			<b>Sunday (2/27/11)</b>			<b>Tuesday (3/1/11)</b>		
<b>Entering</b>	<b>Exiting</b>	<b>Total</b>	<b>Entering</b>	<b>Exiting</b>	<b>Total</b>	<b>Entering</b>	<b>Exiting</b>	<b>Total</b>
13	12	25	4	4	8	11	8	19

Trip rates generated from this study have been calculated and are shown in Table 6 alongside average trip rates from *ITE Trip Generation, 7<sup>th</sup> Edition*. The actual number of trips for each analysis period is shown alongside the number of trips predicted from ITE trip rates in Table 7.

**Table 6. Comparison of Calculated and ITE Trip Generation Rates**

Independent Variable	Analysis Period	Saturday 2/26/11		Sunday 2/27/11		Tuesday 3/1/11	
		Calculated	ITE	Calculated	ITE	Calculated	ITE
Occupied Units	Full Day	0.099	0.250	0.032	0.180	0.075	0.280
	Peak Hour of Generator	0.016	0.040	0.008	0.030	0.016	0.030
Gross Floor Area	Full Day	0.430	2.330	0.138	1.780	0.327	2.500
	Peak Hour of Generator	0.069	0.400	0.034	0.300	0.069	0.290

**Table 7. Comparison of Actual and Predicted Trips**

Independent Variable	Analysis Period	Saturday 2/26/11		Sunday 2/27/11		Tuesday 3/1/11	
		Actual	Predicted	Actual	Predicted	Actual	Predicted
Occupied Units	Full Day	25	63	8	45	19	71
	Peak Hour of Generator	4	10	2	8	4	8
Gross Floor Area	Full Day	25	135	8	103	19	145
	Peak Hour of Generator	4	23	2	17	4	17

The trip rates calculated from this data collection study are substantially lower than the average trip rates provided by ITE. The difference between the trip rates is much larger when using gross floor area as the independent variable. This is due to gross floor area including both the space of the occupied units and unoccupied units. At the time of collection about 40% of the units were unoccupied. One reason the calculated rates are lower than the average rates provided by ITE may be that the storage units are usually used for long term storage rather than short term storage. Some of the storage units are being occupied by Brigham Young University for long term storage, which results in a lower number of trips being made for these units. Sunday trip rates may further be impacted by the demographics of the area as a large proportion of the nearby population believes that work and business activities should be avoided on Sunday. Finally, some of the difference in trip rates could be due to the timing of the study. Temperatures in Utah during February and March are often cool and accompanied by precipitation in the form of rain and snow. Cooler weather affects the behavior of mini-warehouse clients, resulting in less trips being made.

Figure 4, Figure 5, and Figure 6 show the hourly counts of vehicles entering and exiting the site, as well as the parking demand for the specified hour, for the Saturday, Sunday, and Tuesday dates, respectively.

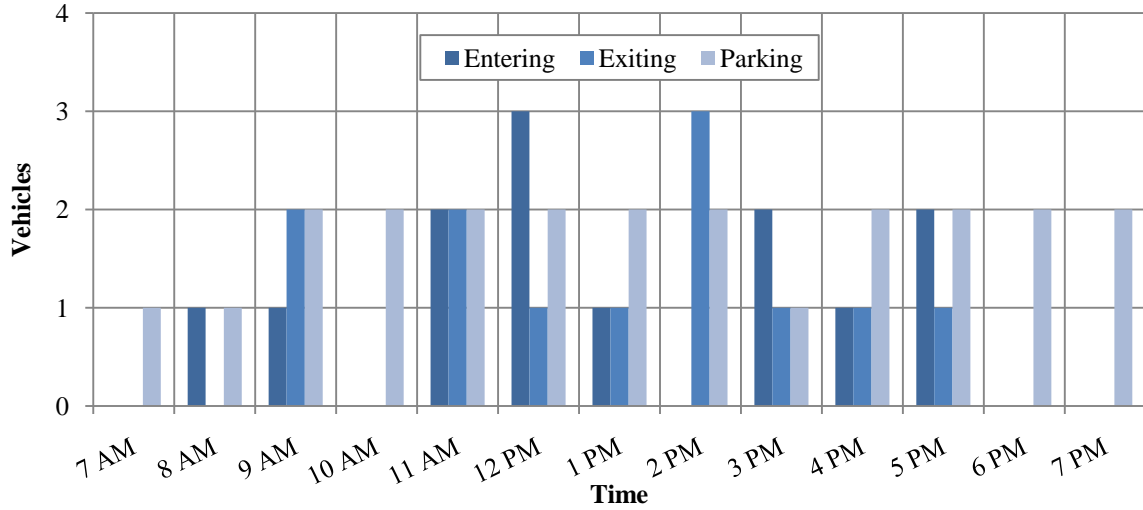


Figure 4: Counts for Saturday, February 26, 2011.

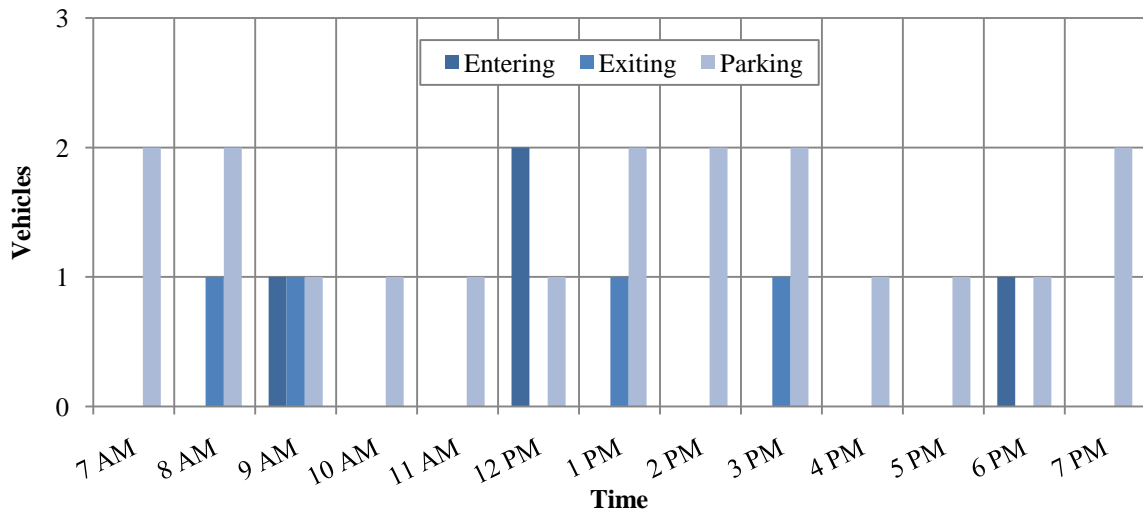


Figure 5: Counts for Sunday, February 27, 2011.

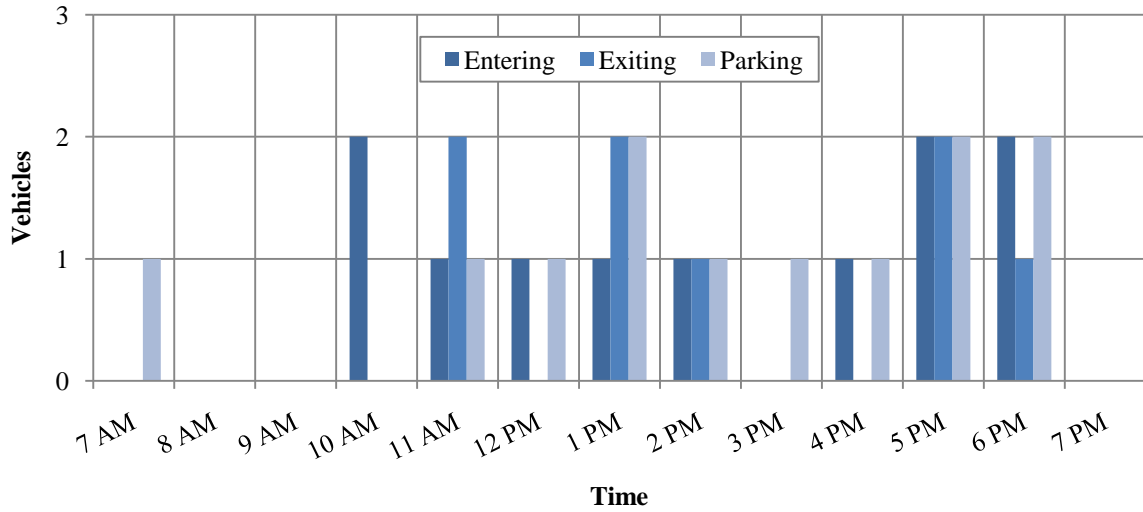


Figure 6: Counts for Tuesday, March 1, 2011.

## Level of Effort

Many different BYU ITE student members were involved in this project. BYU ITE student chapter officers especially spent a lot of time organizing and carrying out the data collection efforts. A summary of hours spent on the project by student members is shown in Table 8.

Table 8: Level of Effort

Task	Number of Students	Hours per Student	Total Hours
Training	6	5	30
Data Collection	4	4	16
Data Reduction and Analysis	6	5	30
Writing and Revision	4	3	12
Total:			88