

# Updating the Parking Generation Informational Report

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ITE's Trip Generation and Parking Generation reports are two of our institute's most widely known and utilized references. Understanding the potential of land use to generate either vehicle trips or parking demand is fundamental to understanding the transportation/land use nexus. In the early 1980's ITE expanded beyond the realm of vehicle trip generation in creating the Parking Generation Informational Report. Updated in 1987, this report has not been reissued or updated since, leaving the understanding of parking demand nearly two decades in the past. Since that time substantial parking data has been submitted to ITE. In the intervening 14 years since the last edition, the means of communication and sharing data have changed dramatically. Now the opportunity to not only update *Parking Generation* but to also revolutionize the means of sharing it with our profession is here.

## GOAL

The goal of the Parking Generation Task Force is:

*To build a comprehensive understanding of parking demand characteristics of various land uses by providing a process to easily expand the parking demand data set, continually updating information and reaching as many potential users, researchers and professionals as possible.*

## VISION

As chair of the Task Force, my vision is for ITE to become the data warehouse of parking demand information throughout the world. It is the objective of the Parking Generation Update to make it easier for users to utilize this warehouse than any files, boxes, reports or projects that any users may have individually. By sharing data in an open, accessible platform the profession can store data in the warehouse and retrieve it faster than they could in their own office. The best means of accomplishing this will be both publications and the world wide web.

## BACKGROUND

At the 1999 ITE Annual Meeting in Las Vegas, the update to the Parking Generation Informational Report began. Since that time all the historic data in ITE's files has been reviewed, the data has been organized into Excel spreadsheets and ways have been identified to utilize the web for data entry. A small Task Force was formed that met at the 2000 Annual Meeting in Nashville. The Task Force focused on means of collecting more data and how the data may best be presented.

Following that meeting, a group of professors at several universities were contacted to help supplement the existing parking data set through curriculum or Student Chapter activities. The objective of this effort was to open the door to continuous and incremental increases in the parking data set. Separately, ITE staff prepared a web-based data entry form that is available on

ITE web site at [www.ite.org](http://www.ite.org). Other parking groups have been contacted and encouraged to add parking demand data to the *Parking Generation* data set. In 2001, the updated informational report will be published and initial electronic tools for accessing parking demand data and locating/extracting summaries of the demand data will be completed.

To assure that updating information in the future will not again take over 14 years to accomplish, the organization of the data records and use of the web have been structured to minimize the administrative effort necessary to make new data accessible to the profession. Instead of 14 years, there will be potential to update information in less than a year, with a goal of semi-annual updates.

Additionally, the Task Force provided information on the services that a web site should provide to potential users. Three items have been commonly mentioned at the Task Force level and by various members include (these will require time to develop and implement, not likely in 2001):

- Having a web-based data entry form that can plot the individual's survey data results and compare it to the information in the data warehouse (for example a plot of parking demand ratio by hour of day for the individual's surveyed land use and a similar plot for selected land use(s) averaging data in the warehouse).
- Allow ITE membership annually purchase access to the web-based *Parking Generation* data base and analysis package as part of their annual dues payments.
- Encouraging submission of data by rewarding those that submit significant data with discounts toward the access to the *Parking Generation* data base.

## **THE DATA**

Thorough review of the existing parking demand data makes it clear that there are strengths and weaknesses in the existing data set. The strengths are that this data set is:

- the most comprehensive set of actual data relating land uses to parking demand
- the ability to evaluate parking by time of day or other variables.

Over 2,500 parking demand observations studies have been submitted to ITE through June 2001. These studies represent parking demand surveys where one or more hours of observations were conducted on a given day. Combined together, these studies represent over 6,000 individual hours of parking demand observations covering 78 land use categories. Compared to the 2<sup>nd</sup> Edition of *Parking Generation*, the updated informational report will have 30 more land use categories and about five times the number of parking observation data points – a substantial increase. While the majority of data is from the 1980's, significant new parking survey data has been added in the 1990's and from the past few years based upon the Parking Generation Task Force's request for new data in 2000 and 2001.

The weaknesses are that:

- many land uses have limited data
- historically all the information has focused suburban sites.

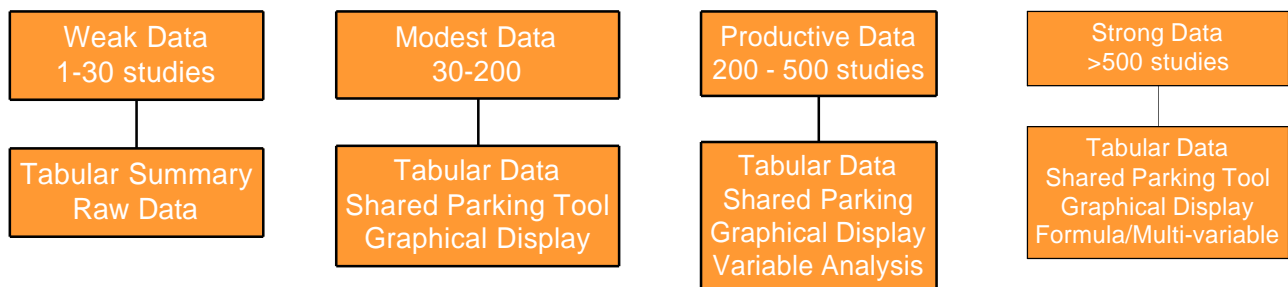
A recent critical review of *Parking Generation* by Donald Shoup points out these weaknesses in more detail<sup>1</sup>. There is a wide range of data available for the various individual land use categories. In analyzing the data, the data can be group into four sets:

1. Strong data where extensive survey information exists within a land use type (over 500 studies have been submitted. There is only one land use that would fall into this category (820 – shopping centers has nearly 1,000 studies available).
2. Productive data where between 200 and 500 studies have been submitted. There is only one land use category with this level of data (710 – office has almost 400 studies available).
3. Modest data where between 30 and 200 studies have been submitted. Almost half the land use categories where data have been submitted fall into this group.
4. Weak data where less than 30 studies have been submitted.

Table 1 provides a summary of the numbers of studies for each land use category in the updated *Parking Generation Informational Report*. We in the profession can solve these weaknesses by submitting all parking demand surveys that we undertake from this day forward. A tremendous wealth of information rests in ITE’s files but many of you have data and studies that have not yet made it to the data set. By improving the data forms (web access) we are taking steps to make it easier for professionals to help strengthen the data warehouse in the future. It is time for every ITE member to submit their historic parking demand studies.

The updated *Parking Generation Informational Report* provides guidelines for what analysis is possible with the various groups of data. Examples are:

- **Strong data** – extensive analysis and formulas are possible relating land use and parking demand. Multi-variable analysis will be possible in the future through use of the web and data base functions (such as variations by month of year, day of week, size of independent variable, area, age of data, ...).
- **Productive data** – very reliable for parking demand estimation, but may not statistically support formulas, multi-variable assessment or regression analysis. Good for estimation of peak demand and variation over time of day, weekday vs weekend or general relationships to the size of independent variable.
- **Modest data** – provides a reasonable planning level indication of maximum parking demand needs and some background regarding variability over the course of a day.
- **Weak data** – provides an initial indication of parking demand but should be supported by additional site surveys (which should be submitted to ITE).
- **No data** – these land uses should be surveyed before estimating parking demand needs.



**Table 1**  
**Extent of Parking Data In *Parking Generation* by Land Use Category**  
 Through April 2001

<b>Land Use Category</b>	<b>Number of Studies Submitted*</b>	<b>Number of Hours Observed**</b>
012 - Airports	2	2
093 – LRT Stations	11	154
093 - Terminals	2	2
110 – General Light Industrial	29	72
130 – Industrial Park	10	32
140 – Manufacturing	8	16
150 – Warehouse	18	67
151 – Mini-warehouse	6	47
210 – Single Family detached	6	6
221 – Apartment	70	85
222 – High-Rise Apartment	13	25
224 – Rental Townhomes	7	140
230 – Condominiums	43	43
233 – Luxury Condominiums	3	15
250 – Retirement Community	18	37
253 – Senior Housing Attached	17	35
310 – Hotel	56	300
312 – Business Hotel	3	3
320 – Motel	15	26
330 – Resort Hotel	1	1
420 – Marinas	5	5
430 - Golf Course	14	16
431 - Miniture Golf	2	6
444 - Movie Theater/Cinema with Matinee	24	24
465 - Ice Skating Rink	2	2
480 - Amusement Park	1	1
491 - Tennis Courts	22	93
492- Racquet Clubs	4	10
493 - Health Club	54	65
494 - Bowling Alley	25	56
495 - Recreational Community Center	8	28
496 - Billiards Hall	1	1
Snow Skiing Area	4	4
520 - Elementary School	15	39
530 - High School	8	29
540 - Junior/Community College	7	23
541 - Technical College	1	1
550 - University/College	9	39
560 - Church	33	50
590 - Library	3	13
610 - Hospital	36	200
620 - Nursing Home/Assisted Living	51	112
630 - Clinic	46	58
710 - General Office Building	226	368
714 - Corporate Office Headquarters	13	42

Land Use Category	Number of Studies Submitted*	Number of Hours Observed**
715 - Single Tenant Office Building	33	77
720 - Medical/Dental Office	34	146
730 - Government Office	10	23
732 - Post Office	7	12
Courthouse/Jails/Corrections	2	11
750 - Office Park	32	50
760 - Research and Development Center	15	15
812 - Lumber	6	23
815 - Discount Pad	51	133
816 - Hardware Store	4	8
820 - Shopping Center	940	1997
831- Quality Restaurant	56	115
832 - Hi-Turnover Restaurant	32	80
833 - Fast Food no Drive-thru	22	32
Pizza	8	9
Chicken	6	27
Taco	10	31
Burger	48	136
848 - Tire Store	1	1
850 - Grocery Store	29	65
851- Mini Market	7	10
854 - Discount Market	11	176
861 - Discount Club	2	2
862 - Home Improvement	12	12
863 - Electronics Store	4	10
Rec Sports	3	17
870 - Apparel Store	8	22
880 - Pharmacy	7	34
890 - Furniture Store	19	80
Liquor Store	2	11
911 - Bank (Walk-in)	6	24
912 - Bank (Drive-in)	39	108
<b>TOTAL</b>	<b>2,418</b>	<b>5,890</b>

\* - A study is defined as a day when parking observations were made. If parking demand was observed for several hours on each day Monday through Friday, it would represent five studies.

\*\* - This is the number of individual hours of observations collected (for example, observations at 10 AM, 2 PM and 6 PM would equal three hours observed)

In surveys conducted by ITE in the 1990's the lack of adequate data was the most common complaint regarding the 2<sup>nd</sup> edition of *Parking Generation*. It is obvious that more data is necessary – professionals should not assume that just because an average ratio is published in the new report that new data for ANY land use is no longer needed. The opposite is true. More and more data – more current data – more thorough data is absolutely needed now and FOREVER. Our profession MUST collect more data as projects are undertaken and build *Parking Generation* into the data rich environment we all desire. But for now, this is the best set of data that exists on parking demand and it will not get better by complaining – just keep the data rolling in.

## NEW APPROACHES

One of the key differences between the new approach to Parking Generation and its predecessor is that parking demand data is being tracked by hour of day, day of week and month of year. This information will allow users to profile the demand for parking over the course of the day and allow for shared parking analysis. Additionally, new data is also being requested for sites with mixed use, shared parking, parking cost and/or significant transit characteristics – as compared to recommending surveys of isolated suburban sites.

Several site features are being requested that will allow querying of the data for research purposes. Questions regarding area (suburban, central city, downtown, rural), transit presence, TDM effectiveness, bicycle parking, parking costs and mixed uses will become possible in the future with these data.

Data will be presented in the update to *Parking Generation* based upon the availability of data. All land use categories will have a summary provided which provides the number of data points, average parking ratios for key independent variables, standard deviation, maximum data point and minimum data point. Table 2 provides a sample of the data format that will be provided for all land use categories with data.

**Table 2**  
**Sample Parking Data Format**

		PARKING DEMAND RATIO AVERAGES (stalls per 1,000 SF)													
		Morning (AM)								Noon	Afternoon (PM)				
		1-5	6	7	8	9	10	11	12	1	2	3	4	5	
Number of Studies =	<b>6</b>					<b>1.8</b>	<b>2.0</b>	<b>1.2</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	<b>2.0</b>	<b>1.1</b>	<b>1.8</b>	
Hours of Observation	<b>24</b>					<b>2.4</b>	<b>2.6</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>2.3</b>	<b>1.7</b>	<b>1.8</b>	
<b>Average Demand</b>						<b>1.5</b>	<b>1.9</b>	<b>0.9</b>	<b>1.4</b>	<b>1.4</b>	<b>1.4</b>	<b>1.8</b>	<b>0.7</b>	<b>1.8</b>	
<b>85th Percentile</b>															
<b>33<sup>rd</sup> Percentile</b>															
Number of Studies		0	0	0	0	2	3	3	3	3	3	2	4	1	
Standard Deviation						1.14	1.02	0.78	0.38	0.52	0.52	0.59	0.64		
High Point						2.60	2.70	2.13	1.88	1.88	1.88	2.38	1.88	1.75	
Low Point						0.98	0.84	0.63	1.12	0.90	0.90	1.55	0.50	1.75	

Additionally the 85% ratio and 33% ratio are shown. Some designers have indicated that the 85% ratio rather than the 50% (average) should be considered in parking demand analysis. The 85% and 33% ratios may be of assistance to planners in consideration of maximum and minimum parking ratios.

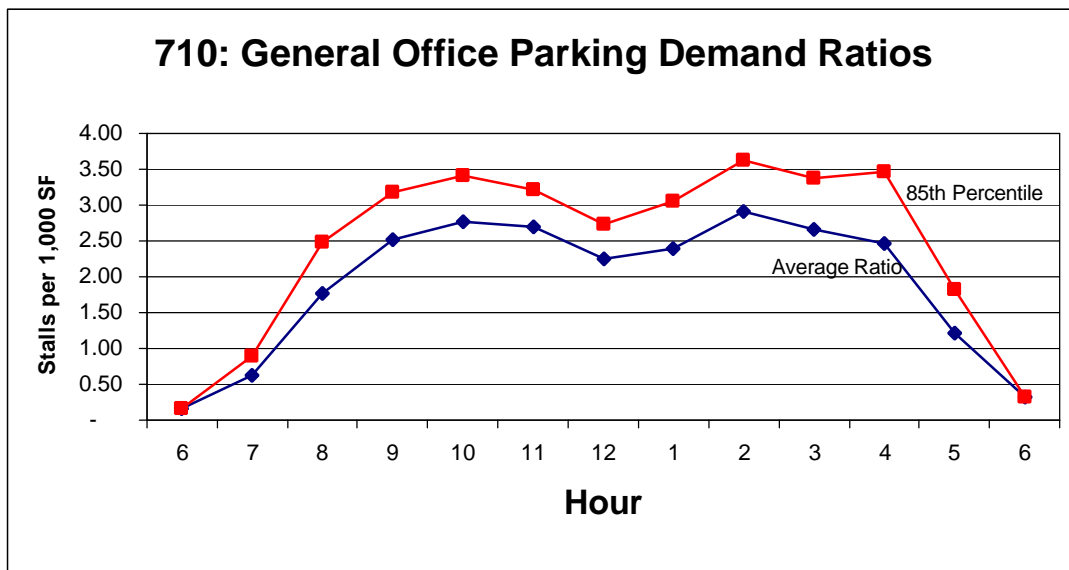
Figures 1 and 2 summarize parking demand ratios for office and shopping centers, showing the variation in demand by time of day and for the average and 85% ratios. Figure 3 shows the variation in the number of observations by hour of the day for office and shopping center uses. (Note: these figures are samples and should not be used for analysis. The Parking Generation Update will have the information for analysts to use for these land uses. These graphics do not break out downtown from rural, ample transit from no transit or month of year – they just provide representative samples of how the data will be presented in *Parking Generation* for those

uses with modest to strong data). This graphical presentation of data will be provided for land uses with good to strong data and some modest data uses. For those with strong or good data, some additional summaries regarding will be provided regarding day of week, month of year and formulas relating the independent variable to parking demand ratio, include statistical parameters (such as r squared).

### WHAT YOU CAN DO TO MAKE MORE DATA AVAILABLE

The ability of *Parking Generation* to be comprehensive and be able to answer your parking generation questions depends upon you. Sharing data is a two way street. As members of the profession, we need to collectively submit data we have typically left in project files or office data banks and utilize the new web data entry form to enter new data we will be collecting in the coming months and years. Entering the data into ITE’s web based data form is as easy or easier than having to create spreadsheets and tables. It only takes a few minutes to enter a significant amount of data.

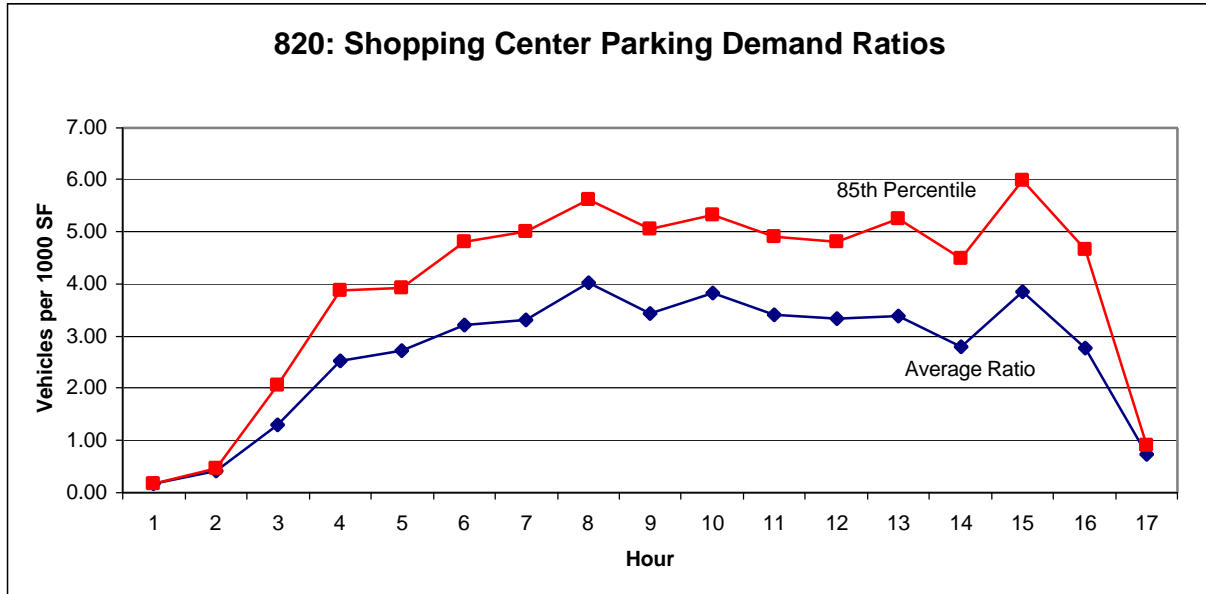
**Figure 1 – Variation in Office Parking Demand Ratios over the Day**



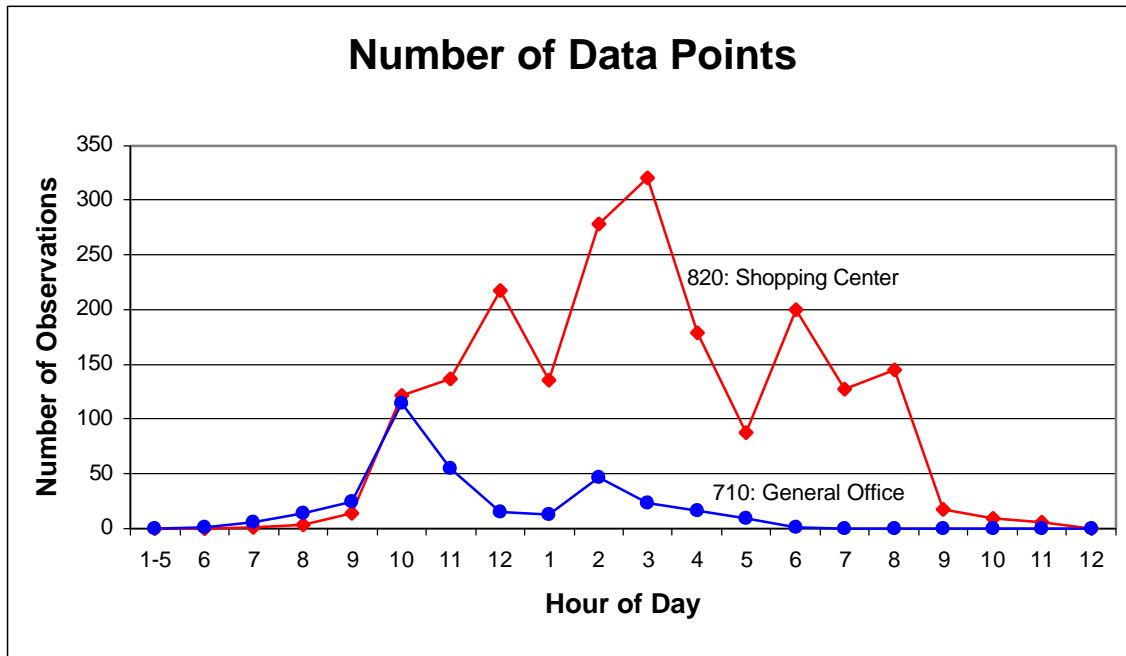
The Parking Generation committee identified the following areas to focus data collection in 2001 and 2002:

- Grocery Stores (small - 7/11, medium - IGA and large-Albertson's)
- Elderly Housing (senior housing - attached or detached, nursing homes, assisted living, congregate care)
- Big Box Retail (Costco, Home Depot, Target, Toys-r-us, K-Mart,....)
- Restaurants (quality restaurants to high turnover to fast food)
- Civic Facilities (library, city hall, recreation centers, fire/police stations)
- Warehouses
- .com businesses
- Large Theaters (16 to 30 screens)

**Figure 2 – Variation in Shopping Center Parking Demand Ratios over the Day**



**Figure 3 – Number of Observations by Hour of the Day**



The Task Force is considering incentives to encourage professionals to submit complete and usable data. These will be discussed further in 2001. Examples could include funding limited surveys of "high interest" land uses through grants, providing ITE members that submit data increased access to *Parking Generation*, providing sessions at conferences regarding parking demand research, partnering with other parking organizations in their research of parking demand, providing student chapters bonus points in their annual report competition and/or increasing recognition of professionals that submit information to the data warehouse.

As material rolls out on to the ITE website, we would like to hear from you any suggestions for improving the parking generation website. There will be a comment email address on the forms and information as you use the site, so you can simply send your suggestions to ITE.

All these steps have been taken with the goal of improving understanding of parking demand and expanding our ability to share information in the profession. But the strength of the parking generation data will depend upon each of you. The source data will only be as good as the data the profession puts into it. We are heading into a new horizon of information sharing and the *Parking Generation Informational Report* will be a great reference for all professionals - but only if you help by sharing your data.

**Ransford S. McCourt, P.E., PTOE** , is the chair of the Parking Generation Task Force. A principal of DKS Associates in Portland, OR, he has been engaged in transportation engineering and planning for over 22 years. He received his B.S. from Oregon State University and M.S. from the University of California, Berkeley. Mr. McCourt has been a member of ITE since 1976 and currently is a Fellow of ITE.

**Parking Generation Task Force:** Brian Bochner, Mary Smith, Robert Jurasin, Chris Luz, Allen Swanson, Steve Colman, Steve Smith, Jerry Wentzel, Nazir Lalani, Bill Alroth, Robert Dunphy, Dan Benson.

Finally, I would personally like to thank Paul Box whose data represents a large share of that on file. His efforts toward sharing parking demand data, over numerous states and sites, is a model of his profession.

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<sup>1</sup> Donald C. Shoup, "The High Cost of Free Parking," *Journal of Planning Education and Research*, Vol. 17, No. 1, Fall 1997, pp. 3-20.