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Institute of Transportation Engineers
1627 Eye Street, NW, Suite 600
Washington, DC 20006 USA
Phone: +1 202-785-0060
E-mail: ite_staff@ite.org
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<td>948</td>
<td>Automated Car Wash</td>
</tr>
<tr>
<td>949</td>
<td>Car Wash and Detail Center</td>
</tr>
<tr>
<td>950</td>
<td>Truck Stop</td>
</tr>
<tr>
<td>970</td>
<td>Wine Tasting Room</td>
</tr>
<tr>
<td>971</td>
<td>Brewery Tap Room</td>
</tr>
<tr>
<td>975</td>
<td>Drinking Place</td>
</tr>
</tbody>
</table>
Preface

_Trip Generation Manual, 11th Edition_ (TGM) is a publication of the Institute of Transportation Engineers (ITE). TGM is an educational tool for planners, transportation professionals, zoning boards, and others who are interested in estimating trip generation at a proposed development.

TGM includes a complete set of searchable electronic files including land use descriptions and data plots for all available combinations of land uses, time periods, independent variables, and settings. Data contained in TGM are presented for informational purposes only and do not include ITE recommendations on the best course of action or the preferred application of the data. The information is based on trip generation studies submitted voluntarily to ITE by public agencies, developers, consulting firms, student chapters, and associations.

TGM provides access for users to the ITETripGen web app. This desktop application allows electronic access to the entire trip generation dataset with numerous filtering capabilities including site setting (i.e., rural, general urban/suburban, dense multi-use urban, center city core), geographic location, age of data, and development size. Instructions for using ITETripGen are included within the app.

Additional data are needed from the profession to create a data-rich environment for trip generation analysis. ITE will continue to prepare updates to TGM.

User comments on TGM are invited. ITE continually seeks ways to increase the value of this document and requests that users provide recently collected data for the land uses presented in TGM or any other land uses for inclusion in future editions and updates.

Although this report provides a powerful tool to better understand site-generated vehicle and person trips, it contains information that can also be easily misinterpreted without sound professional judgment. Users are cautioned to use professional judgment in applying all data contained in this report. They also need to be cognizant of site and area characteristics that can affect trip generation (e.g., availability of transit services, demand management strategies, parking pricing) and of the continued need for additional data. Lack of appreciation of these factors may lead to an inaccurate estimate of vehicle and person trip generation and ultimately the improper design of person and vehicle site access.
Trip Generation Manual, 11th Edition is a result of a concerted effort by dedicated volunteers, contactors, and ITE Headquarters staff.

ITE volunteers contributed many hours of timely review and feedback to this project. ITE is particularly appreciative of the efforts put forth by the Trip Generation Review Panel members whose dedicated service, expertise, and insight contributed immensely to the completion of this resource.

Kevin G. Hooper (F), Kevin Hooper Associates, served as the technical lead for the project and was responsible for assembling and analyzing all data received, conducting statistical analyses and validation, and composing new text to define new or refined land uses for the 11th Edition.

Lisa M. Fontana Tierney (F), ITE Traffic Engineering Senior Director, served as project manager for the publication and assisted in the development and review of the technical content for the report.

ITE Technical Publications Manager Deborah Rouse edited and managed the production of the publication.

Blue House Design Company provided production services for this publication.

Special thanks are extended to Transoft Solutions for providing programming support that enabled modifications to the existing ITETripGen web app.

Finally, ITE expresses its appreciation to the many agencies, firms, students, and other individuals who have provided data to this effort.
The following members of the Trip Generation Review Panel provided technical guidance and review of this publication content:

Alison Felix, Metropolitan Area Planning Council
Brad Yarger, Yarger Engineering, Inc.
Brian Dempsey (F), Provident Design Engineering
Chris Brehmer (M), Kittelson & Associates
Cole Piechotta (M), City of Calgary
Dan Hardy (M), Renaissance Planning Group
Darlene Danehy Yellowhair (M), Psomas
Debbie Dantin (M), Dantin Consulting
Diane Zimmerman (M), Zimmerman Traffic Engineering
Eric Tripi (M), GHD
Fede Puscar (M), Bunt & Associates
Gina Bonyani, FDOT
John Gard (M), Fehr & Peers
Justin Barrett (M), JCB Engineering
Kenneth Cram (F), Bayside Engineering
Lisa Schletzbaum (M), MassDOT
Mike Workosky (M), Wells and Associates
Nadereh Moini (M), New Jersey Sports and Exposition Authority
Paul Basha (M), Summit Land Management
Paul Villaluz (F), Westwood Professional Services
Peter Terry (F), Benchmark Civil Engineering
Randy McCourt (F), ITE Past President
Tony Voigt (M), Voigt Associates
Wes Guckert (F), The Traffic Group

(Letters in parentheses indicate ITE member grade: M—Member, F—Fellow, H—Honorary)
Introduction

Purpose
The purpose of *Trip Generation Manual* is to present a summary of trip generation data that have been voluntarily collected and submitted to ITE. This manual represents the 11th full edition and incorporates data from the previous 10 editions and various supplements. As additional trip generation data become available, they will be distributed through the periodic update of this resource.

*Trip Generation Manual* contains text, tables, data plots, and statistics that describe current state-of-the-practice understanding of the relationship between walk, bicycle, transit, motor vehicle, and truck trip generation and characteristics associated with an individual development site or land use. *Trip Generation Manual* presents land use descriptions and data plots for combinations of available land uses, time periods, independent variables, and settings contained in the ITE database.

Data contained in *Trip Generation Manual* are presented for informational purposes. Guidance on the proper interpretation and application of trip generation data is provided in the ITE recommended practice, *Trip Generation Handbook*.

Contents
ITETripGen is the web app that provides electronic access to all the *Trip Generation Manual* content, including Trip Generation Handbook, land use descriptions, and appendices that present time-of-day distributions, pass-by trip percentages, and modal information. The app also provides access to the entire ITE trip generation dataset (i.e., all data presented in the 11th Edition). The web app enables an analyst to reproduce the data plots and statistics presented in the 11th Edition.

A hard copy version of the 11th Edition is also available.

Organization
*Trip Generation Manual*, 11th Edition is organized in five volumes plus associated appendices posted on-line and within the ITETripGen web app. Volume 1 is the Desk Reference and contains Chapters 1 through 9.

Chapter 2 presents a discussion on the potential trip generation impacts of the COVID pandemic.


Chapter 4 provides a glossary of terms used in the 11th Edition. Definitions are presented for trip types and modes, various settings used to classify study site locations, time periods for which trip generation is reported, and independent variables for which a relationship to trip generation
is plotted. Terms used on the land use description pages and in the data plots are also defined in Chapter 4.

Chapter 5 describes the ITE trip generation database. The data included in the 11th Edition were voluntarily collected and submitted to ITE by public agencies, developers, consulting firms, student chapters, and associations. The data represent person (either total or by travel mode) and vehicle (either total or by vehicle classification) trip generation studies for which at least one hour of counts were conducted on a given day.

Chapter 6 describes the generic contents of the trip generation data plots and their associated statistics. The chapter also presents guidance on the proper understanding of the data presented in the manual.

Chapter 7 presents instructions for reading the trip generation data plots and provides a sample problem and solution that uses the 11th Edition data plots.

Chapter 8 presents the procedure ITE uses to update the trip generation database and associated data plots and statistics.

Chapter 9 lists the sources for all data presented in the 11th Edition.

Volume 2 includes the land use description pages and data plots for all land uses with urban data. The land use description pages and data plots for all land uses with suburban and rural data are presented in Volume 3 (Land Uses 000-399), Volume 4 (Land Uses 400–799), and Volume 5 (Land Uses 800–999).

In addition to the contents of the four data volumes, the 11th Edition also includes over 900 supplemental data plots providing truck trip plots for all land uses for which data are available and individual modal and person trip plots for non-urban settings. All person and modal trip plots for urban land uses remain within Volume 2. These additional data plots can be accessed through the ITETripGen web app or a secure ITE trip generation website [www.ite.org/tripgenappendices](http://www.ite.org/tripgenappendices).

The technical appendices provide supporting information on time-of-day distributions, modal trip percentages, and pass-by trip percentages. The appendices can be accessed through either the ITETripGen web app or the trip generation resource page on the ITE website [https://www.ite.org/technical-resources/topics/trip-and-parking-generation/](https://www.ite.org/technical-resources/topics/trip-and-parking-generation/).

**Land Use Descriptions and Trip Generation Data Plots**

For each land use code, the standard reporting format starts with one or more pages of text and tables that describe the characteristics of the development sites in the given land use code. Following the text are one or more pages that contain data plots and associated statistics for the study sites in the land use code database.

Under the heading **Land Use Description**, a summary description is provided for the sites where the data were collected.
The section under the heading **Additional Data** presents several potential pieces of information as follows:

- The decades during which trip generation data were collected
- The states and provinces for the study sites that comprise the land use code data points
- Caution statements regarding specific application of the land use data

The section under the heading **Sources** lists the source numbers for the data points that comprise the database for the land use. Chapter 9 provides a complete source name for each source number.

For all land use description pages, no matter their setting, the listings for decades, states/provinces, and sources represent the entire database for that land use and land use subcategory. The lists are not split into their urban and suburban components.
The COVID-19 pandemic has had immediate and significant impacts on the North American economy and on many elements of personal and business trip-making. Some of these effects, still ongoing as of this writing, are expected to be long lasting. The extent to which these impacts will have long-term impacts on ITE Trip Generation rates remains unknown.

All data plots and statistics presented in Trip Generation Manual (TGM) are based on data collected prior to the pandemic. ITE recognizes that some TGM data plots and statistics may need to be updated once post-pandemic conditions stabilize. ITE does not know with certainty which data plots and statistics will need to be updated until future study site data are collected and analyzed. Nevertheless, ITE has identified several land uses for which measurable changes in trip generation characteristics may occur.

Industrial (100s)—The shift to greater reliance on e-commerce and delivery services has resulted in an increase in trip-making at high-cube warehouses and related facilities. Whether this increased demand is satisfied with more trips generated at current sites or an increase in the numbers of warehouses and delivery sites or some combination thereof, remains to be seen.

Residential (200s)—The proportion of the overall labor force that will be permitted to and will choose to work from home is expected to remain higher than it was pre-pandemic. This shift will likely result in an overall reduction in weekday peak period commuting trips. Individuals working from home may also experience shifts in trip patterns resulting in home-based trips being spread more broadly throughout the day. Additional impacts on residential land use trip generation may also result from pandemic-led increases in home-based delivery of e-commerce packages, groceries, and restaurant/food services.

Recreational (400s)—During the pandemic, trip-making to parks and other recreational open spaces increased dramatically. This increased trip-making may stabilize but may remain higher than pre-pandemic levels.

Institutional (500s)—Prior to the pandemic, the use of the school bus for student transportation to and from primary and secondary schools was lessening. Post-pandemic this trend may continue, especially with an increase in the number of work-from-home caregivers who are available for student transportation.

Medical (600s)—The medical services landscape was evolving pre-pandemic, partly in response to an aging general population and partly in response to increasing demand for tele-medicine services. These trends, particularly the dramatic increase in tele-medicine appointments, have been further impacted by COVID. As a result, the overall demand for medical office space may diminish post-COVID.
Office (700s)—The immediate impact of an increased share of office workers transitioning to either full or partial work-from-home results in decreased trip generation rates per building GFA. In the long term, employers/lessors are likely to reduce the necessary space for operations and office space may be consolidated.

Retail (800s)—Increased consumer reliance on e-commerce has reduced the numbers of customer trips made to brick-and-mortar stores and increased the numbers of home delivery trips. In a similar vein, delivery service trips to some brick-and-mortar stores have increased as their proprietors shift to serve more online customers (both for local delivery and long distance delivery).

Services (900s)—Restaurants have expanded dining space outdoors on sidewalks, patios, on-street and off-street parking spaces, and closed streets. Short term post-pandemic conditions have also resulted in an increase in carry out service, staffing shortages, and fewer restaurants open for business with more limited hours of service.

Conclusion

During this period of uncertainty, ITE recommends a cautious approach when using the TGM historical data as they apply to potential post-pandemic conditions. It is not known whether the many potential pandemic-related trip impacts will result in long-term changes to trip rates or whether the impacts will subside with time and remain within the existing data scatter.

Current local data can be used to supplement TGM data and may be helpful as decisions are made on how to best estimate site-generated trips during this continually-evolving period. As trip generation characteristics begin to stabilize, ITE will document these changes for specific land uses based on actual data counts and will replace historical data where necessary. ITE asks that users continue to submit current counts (particularly at sites that were counted pre-pandemic) as feasible. ITE will continually review and analyze data submitted and provide updated guidance on this topic as conditions indicate.

For additional guidance on impacts of COVID-19 on travel demand, ITE has developed a COVID-19 resource web page that presents a wide variety of technical resource material to help provide an understanding of anticipated short- and longer-term impacts of COVID-19 on the transportation system and trip making characteristics. See [https://www.ite.org/about-ite/covid-19-resources/](https://www.ite.org/about-ite/covid-19-resources/) for more information. Of particular relevance is the ITE report titled “What a Transportation Professional Needs to Know about Counts and Studies during a Pandemic.” The report can be accessed through the ITE website: [https://ecommerce.ite.org/IMIS/ItemDetail?IProductCode=IR-148-E](https://ecommerce.ite.org/IMIS/ItemDetail?IProductCode=IR-148-E).
3 Changes Since 10th Edition

The 11th Edition of *Trip Generation Manual* has undergone several significant changes in content when compared to the 10th Edition. New land use classifications were added and a re-examination of existing data resulted in several changes to land use codes, independent variables, and land use descriptions. The content and data plots were also reorganized to facilitate use of the 11th Edition. Significant changes are summarized in this chapter.

The first volume of *Trip Generation Manual*, 11th Edition (Desk Reference) includes the chapter content that establishes the format, framework, and content of the overall 11th Edition. Volume 2 includes the land use description pages and data plots for sites in an urban setting. Volumes 3 through 5 contain the land use description pages and data plots for sites in either a suburban or rural setting. In the 10th Edition, data plots by setting were com mingled for each individual land use. Further, the 11th Edition includes over 900 additional data plots accessible through the ITETripGen web app or a secure ITE trip generation website [www.ite.org/tripgenappendices](http://www.ite.org/tripgenappendices). These supplemental plots include truck trip plots for all land uses for which data are available and individual modal trips and person trips for non-urban settings.

The ITETripGen web app menus now enable selection of the site setting immediately after selection of a land use code. By promoting this selection to earlier in the web app data plot definition process, potential errors in the mixing of urban and suburban data plots are minimized for the analyst.

The 11th Edition removes occupied dwelling units as an independent variable for all residential land uses in the 200s, occupied beds for several group quarters land uses (254, 255, 571, 620), and occupied GFA for office buildings. In all cases, the total number of units is considered a more accurate and reliable independent variable and has been retained. The 11th Edition retains occupied units as independent variables for all lodging uses (the 300s), mini-warehouse (151), campground/recreational vehicle park (416), and park-and-ride lot with bus or light rail service (090).

The 11th Edition has added subcategories to several land uses as described below. These subcategories provide, in essence, additional land uses as subsets of current land uses.


In an effort to continually provide data that accurately reflect the composition of each land use, some data were reassigned to other land uses, corrected from previous editions, or removed from the database. Several new land uses were added as a result of the receipt of new data and re-classification of existing land uses. Several land uses were also renumbered to facilitate a more logical grouping of related land uses.
Industrial Land Uses (100s)
Marijuana Cultivation and Processing Facility (Land Use 190) was added as a new land use.

Residential Land Uses (200s)
The term vehicles was removed as an independent variable for Single-Family Detached Housing (Land Use 210). Dwelling units was retained as the preferred and more accurate independent variable.

A new land use for Single-Family Attached Housing (Land Use 215) was added.

The number-of-floors threshold between Multifamily Housing (Low-Rise) (Land Use 220) and Multifamily Housing (Mid-Rise) (Land Use 221) was revised; low-rise sites are now defined as having three or less floors and mid-rise sites have between four and 10 floors.

The proximity of a residential site to a rail transit station was added as a subcategory for all multifamily housing land uses (Land Uses 220, 221, and 222).

Off-Campus Student Apartments were divided into low-rise, mid-rise, and high-rise land uses (Land Uses 225, 226, and 227).

Multifamily Residential with 1st-Floor Commercial land uses (Land Uses 231 and 232) have been renamed Multifamily Residential with Ground-Floor Commercial and have been split into Low-Rise, Mid-Rise, and High-Rise (Land Uses 230, 231, and 232) using the same number-of-floors thresholds as Land Uses 220, 221, and 222.

Commercial gross floor area has been removed as an independent variable for the Multifamily Residential with Ground-Floor Commercial land uses (Land Uses 230, 231, and 232) because it is much better suited to function as a land use subcategory.

Senior Adult Housing–Detached (Land Use 251) and Senior Adult Housing–Attached (Land Use 252) have been combined into a new Senior Adult Housing—Single-Family (Land Use 251) that includes both detached and attached housing. New data have been used to create Senior Adult Housing—Multifamily (Land Use 252).

Recreational Land Uses (400s)
Movie Theater (Land Use 444) and Multiplex Movie Theater (Land Use 445) were combined into a single land use Movie Theater (Land Use 445) that now contains all movie theater data.

Arena (Land Use 450) was removed as a land use after reexamination of the single study site in the database indicated the site may not conform to the land use description.

The primary independent variable for Snow Ski Area (Land Use 466) was revised from the number of slopes to the number of lifts.

Casino/Video Lottery Establishment (Land Use 473) was renamed Casino (Land Use 473) because it now includes full-service casinos as well as the smaller video lottery establishments.
Institutional Land Uses (500s)

Several school land uses were reorganized to provide a more logical numbering sequence. The public school land uses were reorganized within the 520-528 range. High School (Land Use 530) was renumbered as Land Use 525 and School District Office (Land Use 538) which consists entirely of facilities for public schools was recoded as Land Use 528.

The private school land uses were reorganized within the 530-534 range. Private School (K-8) (Land Use 534) was renumbered as Land Use 530, Private School (K-12) (Land Use 536) was renumbered as Land Use 532, and Private High School (Land Use 534) was added as a new land use.

The charter school land uses were reorganized within the 536-538 range; Charter Elementary School (Land Use 537) was renumbered as Land Use 536. Charter School (K-12) (Land Use 538) was added as a new land use.

Prison (Land Use 571) was renamed Adult Detention Facility (Land Use 571) because it includes both jails and prisons.

Office Land Uses (700s)

The description of a Small Office Building (Land Use 712) was changed from a single tenant office with less than or equal to 5,000 gross square feet in size to a single tenant office with less than or equal to 10,000 square feet. The description for Office Building (Land Use 710) was also adjusted accordingly.

Land use subcategories were added to the Medical-Dental Office Building (Land Use 720) sites to indicate whether the sites were stand-alone or located within or adjacent to a hospital campus.

Government Office Complex (Land Use 733) was removed because its single data point consists of a mixed-use site and not a single land use. The data is of limited value due to the uniqueness of the site.

Retail Land Uses (800s)

Shopping Center (Land Use 820) was divided into three separate land use codes: Shopping Center (>150k) (Land Use Code 820) for sites with more than 150,000 square feet GLA, Shopping Plaza (40-150k) (Land Use Code 821) for sites between 40,000 and 150,000 square feet GLA, and Strip Retail Plaza (<40k) (Land Use 822) for sites with less than 40,000 square feet GLA.

Land use subcategories were added to the new land use Shopping Plaza (40-150k) (Land Use 821) to indicate whether the plaza includes a supermarket.

Convenience Market (Land Use 851) was renamed Convenience Store (Land Use 851).

The data from the existing Discount Supermarket (Land Use 854) was reclassified. The large discount supermarkets were merged into the overall Supermarket (Land Use 850). Discount Supermarket (Land Use 854) was removed as a land use.
**Services Land Uses (900s)**

Quality Restaurant (Land Use 931) was renamed Fine Dining Restaurant (Land Use 931).

Gross Floor Area was removed as an independent variable and replaced by the number of drive-through lanes for the following two land uses:

- Fast-Food Restaurant with Drive-Through Window and No Indoor Seating (Land Use 935)
- Coffee/Donut Shop with Drive-Through Window and No Indoor Seating (Land Use 938)

Examination of the study sites that comprise Bread/Donut/Bagel Shop without Drive-Through Window (Land Use 939) and Bread/Donut/Bagel Shop with Drive-Through Window (Land Use 940) revealed that the sites included in these land uses fit the definition and trip generation characteristics of the existing coffee/donut shop land uses. Therefore, land uses 939 and 940 were removed and the study sites were re-assigned to the appropriate coffee/donut shop land uses (Land Uses 936 and 937).

Convenience Market with Gasoline Pumps (Land Use 853), Gasoline/Service Station with Convenience Market (Land Use 945) and Super Convenience Market/Gas Station (Land Use 960) were re-assigned to a single new land use Convenience Store/Gas Station (Land Use 945). Multiple subcategories were added to this land use to allow for multi-variable evaluation with single-variable data plots. Convenience Market with Gasoline Pumps (Land Use 853) and Super Convenience Market/Gas Station (Land Use 960) were removed as land uses.

The trips recorded in the Truck Stop (Land Use 950) land use were modified to include only truck trips. Data plots now use the commercial VFP as the independent variable rather than site gross floor area.

Three service land uses with a focus on the consumption of alcoholic beverages were updated and are now grouped in the 970s. Winery (Land Use 970) was renamed as Wine Tasting Room (Land Use 970) to better reflect the data contained in this land use. Brewery Tap Room (Land Use 971) was added as a new land use. Drinking Place (Land Use 925) was renumbered as land use 975.

**Technical Appendices**

The technical appendices in the 11th Edition now provide access to pass-by trip percentages (previously in the *Trip Generation Handbook*) as well as time-of-day distributions and modal trip percentages. The appendices can be accessed either through the ITETripGen web app or through the trip generation resource page on the ITE website ([https://www.ite.org/technical-resources/topics/trip-and-parking-generation/](https://www.ite.org/technical-resources/topics/trip-and-parking-generation/)).
4 Definition of Terms

The definitions presented in this chapter are intended for use in *Trip Generation Manual*. The terms are grouped as follows:

- Trip Types and Trip Modes
- Setting/Location
- Time Periods
- Independent Variables
- Data Page Terms

**Trip Types and Trip Modes**

**Bicycle Trip**—an inbound or outbound person trip where the greatest distance between the trip origin and trip destination is traveled by a bicycle or any pedal-powered vehicle.

**Person Trip**—a trip made by any mode of travel by an individual person from an origin to a destination. Every trip made anywhere by a person is a person trip. If three people leave a development site in a single vehicle, this is counted as three separate person trips.

**Personal Passenger Vehicle**—includes (1) any automobile, van, SUV, motorcycle, moped, or light truck driven by a private individual for personal use; (2) taxi, paratransit, or vanpool (including airport shuttle); and (3) pick-up truck not being used for commercial purposes.

**Transit Trip**—an inbound or outbound person trip that crosses the site cordon line in a transit vehicle or where the greatest distance between the trip origin and trip destination is traveled by transit vehicle. Transit includes the following modes: bus, heavy rail (metro, subway, rapid transit), light rail (streetcar, tramway, trolley), commuter rail (regional rail), monorail, ferry boat, trolleybus, cable car, automated guideway transit (personal rapid transit), aerial tramway, and inclined plane. A taxi, paratransit vehicle, or vanpool is considered a personal passenger vehicle and not transit.

**Trip or Trip End**—a single or one-direction person or vehicle movement with either the origin or the destination (exiting or entering) inside a study site. In technical terms, a trip has an origin and a destination at its respective ends (known as trip ends). Each trip end is a part of a trip. For site trip generation, the analyst is usually interested in trips entering and exiting a single site.

**Truck Trip**—the movement of a commercial cargo transport vehicle that transports cargo across a site cordon line. A vehicle parked off-site that is loaded or unloaded with cargo destined from or to a study site is considered a truck trip generated by that site. Commercial cargo is typically
transported in either medium-duty or heavy-duty trucks. A service vehicle entering or exiting a site is not considered a truck trip.

**Vehicle Trip**—the movement of a personal passenger vehicle or truck that transports a person across the site cordon line. A person can cross the cordon line as a passenger in a vehicle or as a pedestrian having been transported to the site in a vehicle. For example, if a person drives a personal passenger vehicle from home, parks off-site, and walks from the parking facility to an office building, the trip is considered an entering vehicle trip generated by the office building (as well as an exiting vehicle trip at the place of residence). However, if a person is transported to the vicinity of a site in a bus or rail transit and walks the remainder of the distance to the site, the trip represents a transit trip and not a vehicle trip.

**Walk Trip**—an inbound or outbound person trip where the greatest distance between the trip origin and trip destination is traveled on foot or on any type of assistive device (including wheelchair, scooter, skates, or skateboard).

**Walk+Bike+Transit Trip**—an inbound or outbound person trip that is either a walk trip, bicycle trip, or transit trip.

**Setting/Location**

**Center City Core**—the downtown area for a major metropolitan region at the focal point of a regional light- or heavy-rail transit system. This area type is typified by multi-storied buildings, a wide range of land uses, an extensive pedestrian sidewalk network, and shared and priced parking both on-street and in structured garages or surface lots. The area typically has more jobs than residents and therefore is typically an employment destination. The area also includes the immediate vicinity of the commercial core.

**Dense Multi-Use Urban**—a fully-developed area (or nearly so), with diverse and interacting complementary land uses, good pedestrian connectivity, and convenient and frequent transit. This area type can be a well-developed urban area outside a major metropolitan downtown or a moderate size urban area downtown. The land use mix typically includes office, retail, residential, and often entertainment, hotel, and other commercial uses. The residential uses are typically multifamily or single-family on lots no larger than one-fourth acre. The commercial uses often have little or no setback from the sidewalk. Because the motor vehicle still represents the primary mode of travel to and from the area, there typically is on-street parking and often off-street public parking. The complementary land uses provide the opportunity for short trips within the Dense Multi-Use Urban area, made convenient by walking, biking, or transit. The area is served by significant transit (either rail or bus) that enables a high level of transit usage to and from area development.

**General Urban/Suburban**—an area associated with almost homogeneous vehicle-centered access. Nearly all person trips that enter or exit a development site are by personal passenger or commercial vehicle. The area can be fully developed (or nearly so) at low-medium density with a mix of residential and commercial uses. The commercial land uses are typically concentrated at intersections or spread along commercial corridors, often surrounded by low-density, almost entirely residential development. Most commercial buildings are located behind the parking area or surrounded by parking. The mixing of land uses is only in terms of their proximity, not in terms of function. A retail land use may focus on serving a regional clientele whereas a service land use may
target motorists or pass-by vehicle trips for its customers. Even if the land uses are complementary, a lack of pedestrian, bicycling, and transit facilities or services limit non-vehicle travel.

**Rural**—agricultural or undeveloped except for scattered parcels and at very low densities.

### Time Periods

**Friday, Peak Hour of Generator**—the hour with the highest volume of vehicle trips (or person trips, as appropriate) entering and exiting a site on a Friday. It may occur during either the AM or PM.

**Friday, Peak Hour of Adjacent Street Traffic**—the one hour within the morning and evening commuter peak periods when the combination of site-generated vehicle traffic and the traffic on the adjacent street is the highest on a Friday. If the adjacent street traffic volumes are unknown, the peak hour of the adjacent street is assumed to be the one hour when the highest hourly vehicle trips are generated by the site during the commuter peak periods between 7:00 and 9:00 a.m. or 4:00 and 6:00 p.m.

**Saturday, Midday Peak Hour of Generator**—the hour with the highest volume of vehicle trips (or person trips, as appropriate) entering and exiting a site on a Saturday between 11 a.m. and 1 p.m.

**Saturday, Peak Hour of Generator**—the hour with the highest volume of vehicle trips (or person trips, as appropriate) entering and exiting a site on a Saturday. It may occur during either the AM or PM.

**Sunday, Peak Hour of Generator**—the hour with the highest volume of vehicle trips (or person trips, as appropriate) entering and exiting a site on a Sunday. It may occur in either the AM or PM.

**Weekday**—a continuous 24-hour period during Monday through Thursday. The period can bridge two days.

**Weekday, Peak Hour of Adjacent Street Traffic**—the one hour within the morning and evening weekday commuter peak periods when the combination of site-generated vehicle traffic and the traffic on the adjacent street is the highest (typically from data collected Monday through Friday). If the adjacent street traffic volumes are unknown, the peak hour of the adjacent street is assumed to be the one hour when the highest hourly vehicle trips are generated by the site during the weekday commuter peak periods between 7:00 and 9:00 a.m. or 4:00 and 6:00 p.m. Recent studies have indicated that these peak periods have expanded in some heavily populated areas.

**Weekday, Peak Hour of Generator**—the hour of highest volume of vehicle trips (or person trips, as appropriate) entering and exiting the site during the AM or PM on a weekday (typically from data collected Monday through Thursday). It may or may not coincide with the peak hour of the adjacent street traffic.

### Independent Variables

**Acre**—a unit of measurement equal to 43,560 sq. ft. and for the purpose of *Trip Generation Manual* used to quantify the total gross area of a development site (including land dedicated to public agencies). The distinction between total acres and total developed acres is not always clearly defined in the site acreage reported to ITE. Therefore, caution should be used with this variable.
When submitting data, the analyst should indicate the percent of developed acreage and the total acreage of the property.

**AM/PM Peak Hour Traffic on Adjacent Street**—the highest hourly volumes of traffic on the adjacent streets during the AM and PM commuter peak periods, respectively (see **Peak Hour of Adjacent Street Traffic** under **Time Periods**). The value includes all traffic on streets abutting the site that have direct access to the development site. Where the site is serviced by some form of service roadway, the adjacent street definition includes any street that leads to the service road and thus may not actually be contiguous to the site. Traffic on travel lanes where road features physically restrict direct access to the development site is excluded.

**Attendee**—a person who is present on a given occasion, during a given event or at a given place.

**Bed**—a designated place to sleep for a group quarters resident or medical facility patient.

**Bedroom**—a designated room for sleeping with one or more beds.

**Berth**—a designated place where a boat can anchor at a marina or wharf.

**Bowling Lane**—a single lane available for the purposes of bowling.

**Cage**—a designated location available for the purpose of a single person hitting baseballs or softballs within a contained area.

**Car Wash Tunnel**—an enclosed series of stationary car wash components that can process a single row of motor vehicles, typically with the aid of a conveyor system.

**Daily Customer**—a person who visits a building to conduct personal business at any time during a single day.

**Daily Trail User**—a person who visits a park and walks along a designated trail at any time during a single day.

**Drive-In Lane**—an individual lane at a banking facility used for financial transactions. A lane used only for Automated Teller Machine (ATM) transactions is included.

**Drive-Through Lane**—a travel lane at a restaurant that enables a series of motorists to pick-up food or beverages without leaving their vehicles. A single pick-up window fed by dual order lanes is considered a single drive-through lane.

**Dwelling Unit**—a residential location such as a house, apartment, condominium, townhouse, mobile home, or manufactured home in which people may live.

**Employee**—a full-time, part-time, or per diem/contract worker. The number of employees refers to the total number of persons employed at a facility, not just those in attendance at the hour or day the data are collected.

**Family Members**—the total number of family members who are considered members of a specific worship facility. **Member** is a similar term.

**Field**—any area constructed, equipped, and/or marked for outdoor activities and sports.
**Food Cart**—a mobile kitchen that enables its operator to market and sell cooked food to customers.

**Gaming Position**—an individual seat at which a person may engage in a gaming activity at a slot machine.

**Gross Floor Area (GFA)**—the sum of the area of each floor level of a building (expressed in square feet), including cellars, basements, mezzanines, penthouses, corridors, lobbies, stores, and offices, that are within the principal outside faces of exterior walls, not including architectural setbacks or projections. Included are all areas that have floor surfaces with clear standing head room (6 ft. 6 in. minimum) regardless of their use. With the exception of buildings containing enclosed malls or atriums, GFA is equal to gross leasable area and gross rentable area. If a ground-level area, or part thereof, within the principal outside faces of the exterior walls is not enclosed, this floor area is considered part of the overall GFA of the building. However, unroofed areas and unenclosed roofed-over spaces, except those contained within the principal outside faces of exterior walls, should be excluded from the area calculations. For the purpose of trip generation calculation, the floor area of all parking garages within the building should not be included in the GFA of the entire building. The majority of land uses in *Trip Generation Manual* use GFA as an independent variable.

**Gross Leasable Area (GLA)**—the total floor area designed for tenant occupancy and exclusive use, including any basements, mezzanines, or upper floors, expressed in square feet and measured from the centerline of joint partitions and from outside wall faces. For the purpose of trip generation calculation, the floor area of all parking garages within the building should not be included within the GLA of the entire building. GLA is the area for which tenants pay rent; it is the area that produces income for the property owner. Leased space that is not in productive use is not considered occupied. In the retail business, GLA lends itself readily to measurement and comparison and it has been adopted by the shopping center industry as its standard for statistical comparison. Accordingly, GLA is used in *Trip Generation Manual* for shopping centers. For specialty retail centers, strip centers, discount stores and freestanding retail facilities, GLA usually equals GFA.

**Hole**—a single combination of a tee, fairway, and green on a golf course.

**Lift**—a mechanism used to transport skiers up a ski area slope and is commonly in the form of seats or benches attached to an overhead cable.

**Member**—an individual who belongs to a group or organization. Family Member is a similar term.

**Member Family**—a family that belongs to a group or organization.

**Movie Screen**—a room within a movie theater that contains seats and the presentation of a movie.

**Municipal Population**—a count of all persons having their primary residence within the municipality.

**Net Rentable Area**—the sum of floor square footage for all storage units in a self-storage facility. The term is currently used only for Land Use Code 151 (Mini-Warehouse).

**Occupied Campsite**—a place used for an overnight stay in the outdoors. An occupied campsite is a campsite that is currently being used.
Occupied Parking Space (see Parking Space)

Occupied Room (see Room)

Occupied Storage Unit (see Storage Unit)

Parking Space—an individual stall within a parking lot or garage designated for the use of a parked private motor vehicle. An occupied space is a parking space in which a vehicle is parked.

PM Peak Hour Traffic on Adjacent Street (see AM/PM Peak Hour Traffic on Adjacent Street)

Resident—a person who resides in the given dwelling unit.

Rink—an enclosed area for skating.

Room—the partitioned part of the inside of a building used for lodging such as a hotel or motel. An occupied room is a room that is rented by a lodging guest.

Seat—a place on which an individual can sit; multiple seats may be present on a bench or pew.

Service Bay—the location within an automobile servicing facility, building, or care center where a vehicle can be parked to be inspected and/or repaired.

Servicing Position—a location within a quick-lubrication vehicle shop or other vehicle repair shop at which a vehicle can be serviced. For example, if a quick-lubrication vehicle shop has one service bay that can service two vehicles at the same time, the number of servicing positions is two.

Storage Unit—a vault rented for the storage of goods in what is typically referred to as a self-storage facility. An occupied storage unit is one that is rented. Unit is a similar term with a different definition.

Student—a person enrolled in an institution such as a school, college, or day care center on either a full-time or part-time basis. The number of students refers to the total number of persons enrolled at a facility, not just those present at the time the study is conducted.

Tee/Driving Position—a designated position from which a golf ball is struck for practice.

Tennis Court—an indoor or outdoor facility specifically designed for an individual tennis match.

Unit—a group of rooms intended for dwelling within Land Use Code 255 (Continuing Care Retirement Community). Storage Unit is a similar term with a different definition.

Vehicle Fueling Position—is defined by the number of vehicles that can be fueled simultaneously at a service station. For example, if a service station has two fuel dispensing pumps with hoses on each side of each pump, where only one vehicle can be fueled at a time on each side, the number of vehicle fueling positions is four.

Vendor—a single person or company offering something for sale.

Wash Stall—a location within either a self-service or automated car wash where a vehicle can be parked to be washed.
Data Page Terms

**Average Number of [Independent Variable]**—the average value of the independent variable for data presented on the specific data page.

**Average Rate (or Weighted Average Rate or Average Trip Rate)**—the weighted average number of vehicle or person trips entering or exiting a development site per one unit of the independent variable. It is calculated by dividing the sum of all trips for all contributing data point sites by the sum of all independent variable units for all contributing data point sites. The weighted average rate is used rather than the average of the individual rates because of the variance within each data set or generating unit. Data sets with a large variance will over-influence the average rate if they are not weighted. The data plot includes a dashed line corresponding to the weighted average rate, extending between the lowest and highest independent variable values for data points.

**Trip Ends, T**—vehicle or person trips, the dependent variable in the data plot; shown on the y-axis.

**Coefficient of Determination (R²)**—the percent of the variance in the number of trips associated with the variance in the independent variable value. If the R² value is 0.75, then 75 percent of the variance in the number of trips is accounted for by the variance in the size of the independent variable. As the R² value approaches 1.0 the better the fit; as the R² value approaches zero, the worse the fit.

**Directional Distribution**—the percent of total trips entering and exiting a site during the indicated time period.

**Fitted Curve and Fitted Curve Equation**—the single-variable regression analysis of the independent and dependent variable expressed in an optimal mathematical relationship. If the variables are related linearly, the equation has the following format: \( T = aX + b \). In a logarithmic relationship, the equation has the following format: \( \ln(T) = a \ln(X) + b \). The data plot includes a solid line corresponding to the equation, extending between the lowest and highest independent variable values for data points.

**Independent Variable, X**—a physical, measurable, and predictable characteristic that describes the study site or baseline site (for example, gross floor area) and that has a direct relationship to the variation in the number of trips generated by a land use. The term “explanatory variable” is also used.

**Number of Studies**—the total number of studies reported on the specific data page.

**Range of Rates**—the minimum and maximum trip generation rates from all the studies reported.

**Standard Deviation**—a measure of data dispersion relative to the calculated average. The lower the standard deviation, the less data dispersion there is in the data and the better the data fit to the average rate. In *Trip Generation Manual*, the reported standard deviation is based on the weighted average, not the mean.

**Study Site**—a data point plotted on the graph based on a study performed for the specific land use code.
The data analyzed in this document were contributed on a voluntary basis by various state and local governmental agencies, consulting firms, individual transportation professionals, universities and colleges, developers, associations, local sections, districts, and student chapters of ITE. In many cases, the data were originally contained in published reports or unpublished analyses conducted by such groups. The sources of these reports or analyses are listed in Chapter 9. ITE Headquarters has conducted no original field surveys.

The amount of data submitted for an individual site varies from as little as one peak-hour volume to seven days of directional hourly volumes. All data are combined to maximize the size of the database for each land use and each time period. Data received are initially examined by ITE staff for validity and reasonableness before being entered into the comprehensive database.

**Data Collection**

Some of the data submitted were collected using automatic counters configured to count vehicular traffic entering and exiting a site. The sites selected for counting did not include through traffic. Counts were taken on driveways of sufficient length to avoid the double counting of turning vehicles. In some cases, counts were non-directional and therefore did not distinguish between entering and exiting vehicles. Manual counts often supplemented the automatic counts to obtain vehicle occupancy and classification, to check the reliability of the automatic counters, and to obtain directional counts during peak periods when a non-directional automatic count was being conducted. In other cases, only manual counts of vehicles or persons were conducted during peak periods. For some sites, the count data were supplemented by intercept surveys to determine travel modes of persons that enter or exit the site on foot.

Additional information regarding site characteristics was obtained through Internet searches, personal interviews, actual measurements, or telephone conversations.

**Data Analysis and Storage**

Each study site data record is stored in the ITE trip generation database with all or most of the following information:

- Name, address, and contact information for the contributor
- Site name and address (street address, municipality, state/province)
- Date of the trip generation count (month/day/year; day of the week)
• General site characteristics (to classify the site to an appropriate land use code and land use subcategory)

• Specific site characteristics that correspond to the land use independent variables

• Trips by type by time period

Additional data records are regularly added to the in-house database. No changes (other than corrections that are documented in a published errata) are made to the database that produces 11th Edition data plots unless explicitly announced to all purchasers.

Data Age
The current database contains data extending back to the year 1980. The ITETripGen web app enables a user to create a customized data plot and associated statistics using only data filtered to a user-specified time period. This ability to filter the data by its age may provide useful insights. However, the analyst should exercise caution when interpreting a data subset. The data subset does not necessarily constitute a balance of potential land use characteristics across the database. As the database is filtered and the database size diminishes, the less likely the possibility that a reasonable cross-section is achieved.

Variations in the Statistics
Variations in trip generation characteristics for specific land uses are reflected in the range of rates, standard deviation, and coefficient of determination (R²) value. (See Chapter 5, “Description of Data Plots and Reported Statistics,” for additional details on these topics.) These variations may be due to a small sample size, individual marketing of the site, economic conditions of the business market, geographic location of the sites studied, or unique characteristics of the specific site. Accordingly, judgment must be exercised in the use of the statistics in this manual.

Other sources of variation include different lengths of traffic count duration and the time of year the traffic volumes were counted; that is, daily and seasonal variations may exist for some land uses. Further, variations may also exist based on geographic location. The ITETripGen web app allows users to examine filtered sets of data based on geographic location by regions within the U.S. as well as filtering both U.S. and Canadian sites.

Limitations of the Data Plots
The plots presented in the Trip Generation Manual cover only the range of independent variable values for which data are available. Caution should be used if extrapolating the data beyond the ranges provided because no information has been supplied to document trip generation characteristics beyond the given ranges.

It should also be noted that in some cases, because of the limited sample size and variation in the data received, the projected trip generation estimate for the peak hour of the adjacent street traffic exceeds the trip generation estimate for the peak hour of the generator; by definition, this is impossible. In these isolated cases, knowledge of the project site and professional judgment should be used to select the appropriate trip generation approximation.
Data Plot Organization

For every land use, statistics and data plots are presented for at least one independent variable and for at least one time period. For each land use, the data plots are organized in the following manner:

• First by setting

• Then by land use subcategory, if applicable

• Then by trip type

• Then by independent variable

• Then by time period

Data Plot Content

Data plots provide a fundamental display of the variance within the database. It should be emphasized that the data points represented on the plots are not trip generation rates. Rather, they are the observed number of trips, plotted against the size of the independent variable.

Each data plot corresponds to a specific trip travel mode for a single combination of land use, land use subcategory, independent variable, time period, and setting. The standard data plot layout identifies each factor that defines the layout including the trip type. To supplement the trip type designation on the data plot, an image depicting the trip travel mode is included as a lightly-shaded watermark on the data plot.

For many land uses, the analyst can have strong confidence in the trip generation relationships presented in the 11th Edition. For some land uses, a small data set may provide only an initial indication of trip generation. Each data plot with five or fewer data points displays the statement “Caution–Small Sample Size” above the plot area.

Some plots generated through the ITETripGen web app may also have the statement “Caution–Incomplete Data Set” printed above the plot area. This statement is displayed if the dataset used in the plot includes only a subset of the entire database based on the filtering criteria provided in the ITETripGen web app.
Reported Statistics

Average Trip Rate

The average trip generation rates displayed in the data plots are calculated on the basis of a weighted **average trip rate**. The weighted average trip rate is used rather than the average of the individual rates because of the variance found within each data set. Sites with a large variance from the mean can over-influence the average rate if they are not weighted.

Standard Deviation for the Weighted Average Trip Rate

The **standard deviation** is a measure of how widely dispersed the data points are around the calculated average. The lower the standard deviation—meaning less dispersion in the data—the better the data fit. As stated above, the statistics reported are based on a "weighted average," not an "arithmetic average." Therefore, the reported standard deviation is an approximation and not statistically precise.

Regression Analysis

As noted above, each data plot (for every combination of land use, land use subcategory, independent variable, time period, setting, and trip type) contains the weighted average rate and a dashed line that corresponds to the rate. For each plot containing at least four data points, the web app examines the potential for developing a regression relationship between trips and an independent variable. A curve with the best (i.e., highest) coefficient of determination ($R^2$) is determined for each data plot. If the $R^2$ value is at least 0.50, the regression curve is posted on the data plot along with the fitted curve equation and its coefficient of determination. The coefficient of determination is defined as the percent of the variance in the number of the trips associated with the variance in the size of the independent variable. If the $R^2$ value is 0.75, then 75 percent of the variance in the number of trips is accounted for by the variance in the size of the independent variable. As the $R^2$ value increases toward 1.0, the better the fit; as the $R^2$ value decreases toward 0, the worse the fit.

The following two general forms of fitted curve equations are considered:

Linear

$$T = aX + b$$

Logarithmic

$$\ln(T) = a\ln(X) + b$$

Within the data plots, there are several instances when the regression curve results in an equation with a large y-intercept. Use of the equation may produce an illogical trip-end estimate for independent variable values that are significantly less than the average-sized value. For such a case, use caution in applying data and refer to Chapter 3, “Process for Estimating Trips Generated by a Study Site,” of the *Trip Generation Handbook*, 3rd Edition for additional guidance.
Variations in the Statistics

Variations in trip generation characteristics for specific land uses are reflected in the range of rates, standard deviation, and coefficient of determination ($R^2$) value. These variations may be due to a small sample size, individual marketing of the site, economic conditions of the business market, geographic location of the sites studied, or unique characteristics of the specific site. Accordingly, judgment must be exercised in the use of the statistics in this manual.

Other sources of variation include different lengths of traffic count duration and the time of year the traffic volumes were counted; that is, daily and seasonal variations may exist for some land uses. Further, variations may also exist based on geographic location. The ITETripGen web app allows users to examine filtered sets of data based on geographic location by regions within the U.S. as well as filtering both U.S. and Canadian sites.

Cautions

The plots presented in the Trip Generation Manual cover only the range of independent variables for which data are available. Caution should be used if extrapolating the data beyond the ranges provided because no information has been supplied to document trip generation characteristics beyond the given ranges.

Even if the data plot is based on only a single data point, the data are provided as a reference point. Extreme caution should be used in applying relationships derived from a single record. ITE hopes that inclusion of even the smallest dataset may stimulate new data collection and submission, further filling the gaps in the current database.
Trip Generation Manual provides the user community with the following three methods of estimating trips at an existing or proposed development:

1. A plot of trip ends versus size of the independent variable for each study, which can be used to graphically obtain a rough estimate of trips.

2. The weighted average trip generation rate (number of weighted trip ends per unit of the independent variable).

3. A regression equation, relating trip ends to the independent variable units.

Understanding the Methodologies

Selecting an appropriate method for estimating trips requires the use of engineering judgment and a thorough understanding of the three methodologies listed above. The methodologies are briefly explained in the following sections. A more detailed explanation of selecting the most reasonable method of estimating trips can be found in Chapter 4, “Trip Generation Manual Data,” of Trip Generation Handbook, 3rd Edition.

Graphic Plot

The most fundamental display of available information is a plot of the total trip ends versus a related independent variable. This plot can be used to predict the number of trip ends generated for a given independent variable based on the existing data points. This method is reasonably accurate if there are sufficient data points within the range of the independent variable being used to define a relationship between the two variables. Otherwise, the need for interpreting the data (for example, discarding “erratic” data points) and for interpolating between data points may result in inconsistent interpretations of the data.

Weighted Average Trip Rate

The traditional method of forecasting trips has been to apply a weighted average trip rate. For example, the number of trips can be estimated by multiplying the number of trip ends per unit of independent variable by the number of units of the independent variable associated with the proposed development.

The standard deviation provides a measure of how widely dispersed the data points are around the calculated average; the less the dispersion (the lower the number), the better the approximation. The approximated standard deviations are provided for plots with three or more data points.
Graphically, use of the weighted average rate assumes a linear relationship passing through the origin with a slope equal to the rate.

**Regression Equation**

Regression analysis provides a tool for developing an equation that defines the line that “fits best” through the data points.

Use of the regression equation allows a direct forecasting of trip ends based on the independent variable of the proposed development, thus eliminating differences of opinion arising from interpolating a plot of individual data points. Unlike the weighted average rate, the plotted equation does not necessarily pass through the origin, nor does the relationship have to be linear.

The correlation coefficient ($R$) is a measure of the degree of association or closeness between variables. The coefficient of determination ($R^2$) is the percent of the variance in the number of trips associated with the variance in the size of the independent variable. Thus, an $R$ value of 0.8 results in an $R^2$ of 0.64, which is to say that 64 percent of the variance in the number of trips is accounted for by the variance in the size of the independent variable. The closer the $R^2$ value is to 1.0, the better the relationship between the number of trips and the size of the independent variable.

**Sample Problem**

The methods of calculating trip generation through the use of either a regression equation or the weighted average trip generation rate are illustrated in the following sample problem.

Estimate the number of vehicle trips generated by a medical-dental office building (Land Use 720) during the weekday afternoon peak period of adjacent street traffic. The site GFA is 60,000 square feet and the site is located in a general urban/suburban setting adjacent to a hospital campus. Refer to Chapter 5 for an explanation of how data plots are organized in *Trip Generation Manual*.

The weighted average rate and regression equation are listed below:

- **Weighted Average Rate**: 2.84 trip ends per 1,000 sq. ft. GFA
  - Vehicle trips for subject site: $T = 2.84 \times 60 = 170$ vehicle trip ends

- **Fitted Curve Equation**: $T = 3.05(X) - 7.38$
  - Vehicle trips for subject site: $T = (3.05 \times 60) - 7.38 = 176$ vehicle trip ends
ITE has established a procedure for updating the data summarized in this manual and invites all interested parties to collect data from one or more sites and submit the data to ITE Headquarters.

This procedure will result in a continual, uniform method of obtaining and summarizing the current trip generation data for all land uses. ITE will do the following:

- Store all trip generation data
- Encourage ITE district and section technical committees, ITE student chapters, governmental agencies, and private consultants to collect additional data
- Distribute trip generation data forms in hard copy and electronic formats
- Maintain a database for trip generation analyses and summarization
- Maintain (and modify when necessary) a uniform procedure for collecting data
- Summarize trip generation data
- Conduct special trip generation analyses when appropriate
- Revise trip generation rates, equations, plots, and text based on additional data
- Identify data collection needs in areas where deficiencies exist or where little information is available

An electronic data collection system is available for submission of trip generation data to ITE. The site address is www.itedatasubmission.org. Hard copy Trip Generation data collection forms are also available on the ITE website at: http://www.ite.org/tripgeneration. Data may also be submitted through direct transmittal of electronic files to the ITE Trip Generation email address presented below.

Completed forms should be returned to ITE at the following address:

Institute of Transportation Engineers
1627 Eye Street, NW, Suite 600
Washington, DC 20006
Telephone: +1 202-785-0060
www.ite.org
email: tripgen@ite.org
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<td>LEA Consulting, Markham, ON, 2019.</td>
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