

7 Instructions

The *Trip Generation Manual* provides three primary methods for estimating trips at an existing or proposed development:

1. **Graphic Plot**—A plot of trip ends versus the independent variable, used for rough visual estimation.
2. **Weighted Average Trip Rate**—A numerical estimate based on weighted averages (number of weighted trip ends per unit of the independent variable).
3. **Regression Equation**—A mathematical relationship between trip ends and the independent variable units.

Understanding the Methodologies

Selecting an appropriate trip estimation method requires the application of engineering judgment and a thorough understanding of the three methodologies listed above. The *Trip Generation Handbook*, Chapter 4, provides additional guidance, including a detailed, step-by-step approach for using the *Trip Generation Manual* data to estimate trips. Users are encouraged to reference this material. The *Handbook's* methodology is preferred over arbitrary policies because it accounts for data quality and is therefore more likely to yield accurate results.

Graphic Plot

The most fundamental display of available information is a plot of 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 sufficient data points exist within the range of the independent variable being considered. However, where data are sparse, or when interpreting “erratic” data points or interpolating between points, inconsistencies can arise, requiring analyst judgment.

Weighted Average Trip Rate

The traditional method of forecasting trips is to apply a weighted average trip rate. Trips are 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 weighted average trip generation rate—simplified as “average trip rate” in the data plots—is defined as the number of weighted trips per unit of the independent variable. This approach assumes a simple linear relationship between trips and the independent variable, having a slope equal to the rate and with the straight line passing through the origin. If the independent variable equals zero, then trip generation is also zero. Therefore, the number of trips can be estimated by multiplying the number of trips per unit of independent variable by the number of units of the independent variable associated with the study site. Every data plot contains a dashed line corresponding to the weighted average rate, extending between the lowest and highest values for the independent variable values among the study sites.

Weighted averages are used rather than the average of the individual rates for all development sites with data to minimize the influence of outlier sites with large variances from the mean. Calculation of weighted average rate is demonstrated in the *Trip Generation Handbook*, Appendix J.

If all data points correspond to the same independent variable value, no line is drawn; however, the weighted average rate is still listed. As an example, Land Use 944 (Gasoline/Service Station) has vehicle fueling positions as an independent variable. If all the data points have four fueling positions, a line corresponding to an average rate cannot be drawn. The weighted average rate would still be listed on the data page.

Regression Equation

Regression analysis develops a fitted curve equation that defines the mathematical relationship between trips and the independent variable.

Using the regression equation allows direct forecasting of trip ends without needing to interpolate between plotted points. Unlike the weighted average rate, the plotted regression curve does not necessarily pass through the origin, and the relationship may not be linear.

Key statistical measures include:

- **Correlation Coefficient (R)**—A measure of the degree of association or closeness between variables.
- **Coefficient of Determination (R²)**—The percent of variance in trip numbers associated with the variance in the size of the independent variable.

Thus, an R value of 0.8 results in an R² of 0.64, which means that 64 percent of the trip variance is accounted for by the variance in the size of the independent variable. The closer the R² value is to 1.0, the better the relationship between the number of trips and the size of the independent variable.

For additional information on regression equations, see the “Regression Analysis” section in Chapter 6.

Sample Problem

The following sample problem demonstrates the use of both the regression equation and the weighted average trip generation rate equations to calculate trip generation.

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 within/near a hospital campus.

Methods:

- **Weighted Average Rate** is 2.20 trip ends per 1,000 sq. ft. GFA
Vehicle trips for subject site:
 $T = 2.20 \times 60 = 132$ vehicle trip ends
- **Fitted Curve Equation** is $T = 2.26(X) - 2.57$
Vehicle trips for subject site:
 $T = (2.26 \times 60) - 2.57 = 133$ vehicle trip ends