O. Traffic and Parking

100. Definitions

The objective of the traffic and parking analyses is to determine whether a proposed action can be expected to have a significant impact on street and roadway conditions and on parking facilities. In particular, it addresses the following major technical areas:

- *Traffic flow and operating conditions*, including the volume of traffic expected to occur in the future with the action and the impact of this volume on traffic levels of service. The purpose of this assessment is to evaluate the sufficiency of street and highway elements to adequately process the proposed action's expected traffic flow and operating condition changes.
- *Parking conditions*, including the occupancy levels of parking lots and garages (public and accessory) as well as curbside parking spaces. The purpose is to determine what effect the proposed action would have on parking resources in the area.
- *Goods delivery*, including the capacity of proposed loading areas to accommodate the expected volume of deliveries and their ability to do so without interfering with vehicular and pedestrian traffic.
- *Vehicular and pedestrian safety*, principally focused on the effect of the proposed action's generated demand at existing high-accident locations or at locations that may become unsafe due to the proposed action.

To analyze each of these technical areas, specific technical methodologies, databases, and procedures have been developed and are referenced in this chapter of the Manual. It is also important to note the relationship of these analyses with air quality and noise studies that may need to be conducted. Both the air quality and noise analyses may call for extensive traffic information that needs to be collected and formatted in a manner that can be easily used for air quality and noise analysis purposes. The interrelated needs of these three technical subjects should be kept in mind during the course of the data collection and analysis stages. It may also be necessary to assess traffic impacts on residential streets as part of the neighborhood character studies.

200. Determining Whether Traffic and Parking Assessment are Appropriate

It is possible that detailed traffic and parking analyses may not be needed for actions that would facilitate low- or low- to moderate-density development in particular sections of the City. Before undertaking any traffic or parking analyses, reference should be made to Table 3O-1 to determine whether *any* numerical analyses are needed.

If the proposed action would result in development greater than the levels shown in Table 3O-1 or if development does not fall in any of the categories in Table 3O-1, a preliminary trip generation analysis—and, possibly, traffic impact analysis—will likely be needed. (If the proposed action involves a mix of land uses, it is appropriate to use a weighted average in determining whether further analysis is needed.) For programmatic actions that would affect more than one area, the thresholds in Table 3O-1 may be considered on an area-by-area basis.

These development thresholds were determined by applying typical trip generation and modal split assumptions for the land uses cited in the table for each of the zones, up to a development density whose vehicle and transit trip generation would not likely cause significant impacts, based on a review of many traffic impact studies and EISs conducted previously under the CEQR process. The development densities cited in Table 3O-1 above generally result in fewer than 50 peak hour vehicle trips (with "trips" referring to trip ends), for which significant traffic impacts are generally unlikely.

If development expected under the proposed action is greater than the thresholds indicated in Table 3O-1, a preliminary trip generation analysis will generally be appropriate to determine the volume of vehicular trips expected during the peak hour. The methodologies available for use in determining vehicular trip generation are presented later in this chapter (Section 341). As described in that section, this involves either: (a) utilizing available trip generation rates for the type of land use proposed and available modal split characteristics for the site of the proposed action (Section 341.1 and 341.2); or (b) obtaining these data via new surveys at a comparable facility in the same (or

Table 3O-1

Minimum Development Densities Potentially Requiring Traffic Analysis

Development Type	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Residential (number of new dwelling units)	240	200	200	200	100
Office (additional 1,000 gsf)	115	100	100	75	40
Retail (additional 1,000 gsf)	30	20	20	10	10
Restaurant (additional 1,000 gsf)	20	20	15	15	10
Community Facility (additional 1,000 gsf)	25	25	25	15	15
Public Parking Facility (number of new spaces)	85	85	80	60	60

With the following zone definitions:

Zone 1: Manhattan, 60th Street and south

Zone 2: Manhattan north of 60th Street, including Roosevelt Island; Downtown Brooklyn

Zone 3: Long Island City; Downtown Flushing

Zone 4: St. George (Staten Island); all other areas located within one mile of subway stations (except in Staten Island)

Zone 5: All other areas

comparable) part of the City (Section 341.3).

In all areas of the City, if the proposed action would generate fewer than 50 peak hour vehicle trip ends, a need for further traffic analysis would be unlikely. It should be noted that an auto trip to a parking garage or lot is considered one trip, whereas a drop-off by auto is two trips (one in, one out). Similarly, most taxi trips are two trips as only one half of inbound full taxis are assumed to be available for outbound demand from the site, whereas all other taxi movements are empty taxis. (For programmatic actions, depending on the type of action and the areas that would be affected, more trips may be tolerated before doing a detailed analysis if there are multiple locations affected by the action.) However, it should be emphasized that proposed actions affecting congested intersections have at times been found to create significant traffic impacts when their trip generation is fewer than 50 vehicles in the peak hour. This is especially true for proposed actions that generate a significant volume of trucks and/or buses, since trucks and buses are considered to be "equivalent" to more than one car. The number of such vehicle trips should be converted to the equivalent number of passenger cars, Passenger Car Equivalents (PCEs), to determine if the 50 peak hour vehicle trip threshold is tripped. The following table lists PCEs for common vehicle types:

Vehicle Type	Vehicle Class	PCE Factor
Personal Auto	Passenger Car	1.0
Trucks with 2 Axles	Light Truck	1.5
Buses/Trucks with 3 or More Axles	Heavy Truck	2.0
Waste Collection Vehicles	Light Truck	1.5
Waste Transfer Trailers	Heavy Truck	2.0
Small School Vans	Passenger Car	1.0
Small School Buses	Light Truck	1.5
Large School Buses	Heavy Truck	2.0

If the combination of projected trip generation and site of the proposed action indicates the potential for significant traffic or air quality impact, further traffic analysis—including a quantification of traffic volumes, intersection capacities, and levels of service—may be appropriate, with assessment methods detailed in the following section. Consultation with the appropriate lead agency and New York City Department of Transportation (NYCDOT) may be advisable to determine whether such analyses are needed.

300. Assessment Methods

This part of the traffic and parking chapter provides background information on each of the key components of the analyses to be conducted, the reasons why the analyses are required and guidance regarding the extent of the analyses required, approaches to conducting the analyses, and specific methodologies available for use. A discussion of factors to be considered in determining significant impacts, the approach to identifying and evaluating appropriate mitigation measures, and approaches to developing and evaluating alternatives that reduce or avoid impacts follows. For some aspects of the analyses to be conducted, it is possible to be fairly specific about the methodologies to be used; for example, this is usually true regarding the selection of an appropriate capacity analysis methodology. For other aspects of the analyses, it is difficult to be very specific or provide definitive guidelines, so the Manual provides the framework for selecting appropriate analysis methodologies and more general guidelines; this is particularly true for defining the appropriate study area for analysis.

For proposed actions requiring the preparation of a traffic analysis, the study areas to be analyzed, assessment methodologies, and technical assumptions are outlined and documented as much as possible. Typically, such documentation outlines at least the following:

- The various study areas to be analyzed for potential traffic and parking impacts.

- The availability and appropriateness of existing data, and the expected need (if any) to collect new data via field surveys and counts. (See Section 730 for the availability of existing data.)

- The technical analysis methodologies to be used, and key technical assumptions such as trip generation rates, modal splits, average vehicle occupancies—including a preliminary projection of the volume of trips to be made by travel mode during the proposed action's peak travel hours—and a first-cut trip assignment that will help identify (preliminarily) potential significant impact locations.

The data assembly effort and the subsequent analyses should reflect the need for close coordination of traffic, air quality, and noise analyses.

310. STUDY AREA DEFINITION

The first step in preparing for and conducting the traffic and parking impact analyses is the definition of the specific physical locations to be studied including, but not limited to, streets, intersections, highway facilities, pedestrian and bicycle facilities, and parking facilities. The identification of which locations and facilities are to be studied and the extent of the coverage—e.g., one block, one-half mile, one mile, etc., from the site—is a function of the type of the proposed action, its geographical setting, and its size and scale. It could very well range from one block to an entire neighborhood or sub area of the City. The Manual presents guidelines for defining the appropriate study area because a precise definition is not possible—study area definition will call for considerable judgment. For some technical areas, there may be a need to define a primary study area and a secondary study area, with the primary area being the focus of intense analysis and the secondary area being the focus of a more targeted and less intense analysis. Guidelines follow.

311. Traffic Study Areas

Definition of an appropriate traffic study area is probably the single most critical decision to be made, and the one in which hard guidelines are most difficult to formulate. In this work element, it is important to cover *key* potential impact locations with the understanding that the study area should be appropriately sized to include all potential impact locations.

The Institute of Transportation Engineers (ITE), in its 1991 publication titled *Traffic Access and Impact Studies for Site Development*, indicates that all roads, ramps, and intersections through which peak hour site-generated traffic composes at least five percent of the existing capacity on an intersection approach, or roadway sections on which accident potential or residential traffic character is expected to be significantly impacted, should constitute the scope of the traffic impact study area. Traffic impact analyses in New York City have typically not been tied to this definition, but have considered several primary factors in defining the traffic study area, including the following:

- Approximately how many new vehicle trips would be generated or diverted by the proposed action in its peak hours? Since the magnitude of the projected trip generation is one guide to be considered in defining the extensiveness of the study area, a first-cut trip generation estimate is a useful tool at this stage of the analyses.

- What are the most logical traffic routes for access to the site (i.e., its "traffic assignment")? These are traced on a map and used to identify potential analysis locations along them. While these routes may change later during the trip assignment phase when more precise information may be available, a first-cut definition of potential impact locations can be made.

- What are the problem locations or potential problem locations along these routes or next to these routes that could be affected by traffic generated by the proposed action? It is useful to review information available from previous reports and databases regarding problem locations, and it is very important to drive or walk the area during peak travel hours to make an informed determination.

The traffic study area may be contiguous, or it may be a set of non-contiguous intersections combined into a study "area." The traffic study area could extend from a minimum of one to two blocks from the site to as much as one-half mile or more from the site. The study area need not have a particular shape; it could be rectangular, it could be a long and narrow area extending along a major route to the project site, etc. It is defined by the routes along which traffic proceeds to and from the site, and typically includes major arterials and streets along the most direct routes to the project site as well as significant alternate routes. Multilegged intersections and other problem locations along these routes should generally be incorporated into the traffic study area.

Although it is difficult to outline the number of analysis locations encompassed within the study area for a detailed traffic analysis, in most cases it would range from a low of 6 to 8 intersections or analysis locations to a high of about 30 or more such locations. The six-to-eight analysis location guideline reflects analyses at the four corners of a typical square block site plus one additional analysis location along each approach route to the site. The 30 or more analysis location guideline reflects the potential to cover two or three avenues or streets on each side of the site, as well. A small-scale action that would generate a modest volume of peak hour trips in a congestion-free area could require even fewer than the six-to-eight analysis location guideline. However, this should be based on the preliminary trip assignments. Similarly, a major development project in a congested section of the City could require significantly more than 30 analysis locations; "mega-projects" could encompass traffic study areas with 100 or more intersections. However, in the event that the study area appears to be very large and encompass significantly more than 30 analysis locations, care should be exercised that some of the intermediate locations within the area—but not on a direct route to the site—are not included unnecessarily. It is advisable to use a knowledgeable traffic expert and/or consult with NYCDOT to ensure that the traffic study area is appropriately defined.

The completion of the trip generation and preliminary traffic assignment steps first can provide a sound basis for defining the traffic study area. It is also possible to "screen out" several analysis locations at this stage of the work effort, providing that the preliminary trip generation estimates and the preliminary traffic assignments are close to their final versions. Generally, except for the intersections in the immediate vicinity of the proposed project site, intersections with fewer than 50 vph of project traffic can be screened out. It is also possible that once the full traffic impact analyses have been completed, the initially defined traffic study area may need to be enlarged to encompass other intersections. This is typically the case when several intersections at the outer edges of the study area are significantly impacted. However, the study area should only be expanded in consultation with the lead agency and NYCDOT.

Another screen may be considered based on significant impact guidelines that follow later in this traffic and parking chapter of the Manual. That is, if a proposed action would generate fewer than five peak hour vehicles through an intersection—*any* intersection—any impacts there would not be considered significant, because the incremental volume of trips would be imperceptible.

In addition to the above operation-based guidelines, the traffic study area should also consider intersections or locations that may be problematic from the safety viewpoint. High-accident locations, if any, should be identified with NYCDOT and the traffic study area should include these intersections. A high accident location is one where there were 5 or more pedestrian accidents in any year in the most recent 3-year period for which data is available. Appendix 1 provides a listing of the most recent high accident intersections.

For programmatic actions, there are alternative approaches to defining the traffic study area, depending on the nature of the programmatic action that is proposed and how much information exists about its implementation. A few case examples of how study area definitions have been made within CEQR until now illustrate this point.

For the Department of City Planning's (DCP) proposed Quality Housing Program Zoning Text Amendments, the sites that could be affected included some 4,000 blocks Citywide. For the environmental assessment, 30 neighborhoods were defined as representative neighborhoods for the action, and four intersections within each neighborhood were selected as representative critical analysis locations for those neighborhoods. Although it was possible that other neighborhoods could be affected, and that the four intersections might not have been the only intersections to be affected, the analyses were deemed to cover representative reasonable worst-case analysis locations Citywide.

For a programmatic action on a multiparcel site in which the total development density may be known but the block-by-block distribution is not, it is possible to define a set of analysis locations at which traffic impacts can be assumed to be most critical as well as other representative locations that will depict the proposed project's impacts at other sensitive, if not necessarily critical, impact locations. As with a site-specific proposed action, the analysis traces out the most likely arrival and departure routes to the boundary of the multiparcel site, and defines an appropriate set of analysis locations that could be significantly impacted along them. Representative potentially sensitive locations within the multiparcel site are also identified and included within the traffic study area.

312. Parking Study Area

An appropriately sized parking study area encompasses those facilities—i.e., parking lots and garages and on-street curb spaces—in which vehicular traffic destined for the site of the proposed action would likely park. The extent of the area corresponds to the maximum distance that someone driving to the site would be willing to walk. This walking distance is a function of several parameters, including the following:

- How much accessory and/or public parking would be provided on-site as part of the proposed action? Would it be sufficient or would project-generated vehicles need to park off-site? If on-site parking would be sufficient, there would be no need to define a parking study area unless the proposed action would eliminate a significant amount of available public parking.
- What is the nature of the site's surrounding area? Is the site centrally located within the surrounding street network or, for example, is it a waterfront site from which drivers cannot proceed in all four directions to find parking? Is the area somewhat desolate in peak project hours, thereby making drivers anxious about walking greater distances from their parked cars to the site? Is there an abundance of available parking in the area that affords the driver the opportunity to walk short distances and not require an analysis of parking sites more distant from the project site?

In general, about a ¼-mile walk is considered the maximum distance from primary off-site parking facilities to the project site, although it could be longer or shorter depending on the factors noted above. (Amusement parks, arenas, beaches, and recreational facilities are examples of land uses with parking demands that often extend beyond ¼ mile of the project site.) Should the parking spaces available within this distance of the site, along with whatever amount of parking is provided on-site, prove insufficient to accommodate the peak parking demand, consideration should be given to extending the study area to a maximum of ½ mile of the site. However, care should be exercised in noting that this is the extent to which drivers would have to go to find available parking, and it does not necessarily indicate that this extended parking study area supply is acceptable. It will merely constitute a piece of information to be disclosed to decision-makers and the public at large.

320. ANALYSIS OF EXISTING CONDITIONS

Once the study areas have been defined, the analysis of existing conditions becomes the building block upon which all impact analyses are based. The objective of the existing conditions analysis is to determine existing volumes, traffic patterns, and levels of service as a description of the setting within which the proposed action would occur. It is important that existing conditions be defined precisely since this is a reflection of activity levels that actually occur today, and since existing conditions will serve as the baseline for future conditions analyses that require at least some projection.

The guidelines provided for the existing conditions analyses include traffic and parking guidelines in this chapter, and transit and pedestrian guidelines in the following chapter. In some cases, surveys to be conducted may overlap two or more of these technical areas, so if different individuals will be responsible for traffic, transit, and pedestrian analyses, for example, they should each be involved in understanding the nature and extent of surveys to be conducted and technical assumptions to be made so that there are no internal conflicts within the different analyses.

321. Existing Traffic Conditions

The analysis of existing traffic conditions entails three key steps: (a) the assembly and/or collection of traffic and pedestrian volume, and speed-and-delay data needed for the analyses; (b) the determination of volume-to-capacity ratios, average vehicle delays, and level of service at the traffic analysis locations within the study area; and (c) consideration of the traffic accident history in the study area.

321.1. Determination of the Peak Hour for Analysis Purposes

The first step in the analysis of existing conditions is the determination of the peak travel hours to be analyzed. For most proposed actions, the peak analysis hours will be the same as the peak travel hours already occurring on study area streets, i.e., specific one-hour periods within the morning home-to-work rush hour and the late afternoon/early evening return trip. For some projects, it will also include an analysis of midday traffic conditions if impacts during the midday period could be significant. AM, midday, and PM peak hour analyses will generally be needed for most office, commercial, residential, and major mixed-use projects, although midday analyses may not be required for some residential projects in areas where midday traffic conditions are not an issue.

Other types of proposed actions are more likely to require traffic analyses at other times of the day and/or on weekends. A major retail project, for example, may need to be analyzed for weekday midday conditions and on weekends. A proposed sports arena or concert hall may also require an analysis for a weeknight event, a Friday night or Saturday night event, and a weekend afternoon event. A solid waste facility may generate traffic during other off-peak hours—e.g., earlier in the morning and afternoon than the conventional peak commuter hours.

The setting of the proposed action also plays a role in determining the peak hours to be analyzed. For a movie theater located in the Manhattan central business district (CBD) may require a "conventional" weekday or Friday late afternoon/early evening analysis as well as a Friday night or Saturday night analysis, since even a moderate level of movie-going activity on a Friday at, say, 5:30 to 6:30 PM may overlap with background commuter travel peaks to create a significant impact.

The traffic analysis considers the peak activity hours for the proposed action, the peak hours for background traffic already existing in the study area, and which combinations of the two may generate significant impacts. It might be the busiest hours of the proposed action superimposed on light, moderate, or heavy traffic hours that already exist. It might be more moderate activity hours of the proposed action superimposed on the heaviest existing traffic hours. Or it might be both. The source of existing traffic volumes may either be available 24-hour automatic traffic record (ATR) machine counts or new counts obtained from ATR machines installed to determine prevailing peak hours in the study area.

One means of making this determination quantitatively rather than just qualitatively is to prepare a table showing existing hour-by-hour traffic volumes at a set of representative intersections within the area or at a cordon line around the area, side by side with hour-by-hour projections of the expected trip generation of the project. A comparison of the two sets of volumes would indicate: a) which travel hours are likely to be the busiest in the future; and b) at which hours would the influence, or impact, of the proposed action's trip making levels likely be the greatest. From this comparison, potential significant impact hours—and thus the peak traffic hours to be analyzed—can be identified.

In some cases, the peak hour of the project's trip generation would coincide with the existing peak hour, and it will be clear that this is the peak condition to be analyzed. In other cases, the two peak hours will be *very* close, and it may then be proper to use the existing peak hour and later—during the impact analysis stage—to superimpose the peak trip generation of the proposed project onto the peak existing condition. In yet other cases where the two peaks are not coincidental (or nearly coincidental), a screening analysis will be needed to determine which of the two peaks (the existing peak or the proposed action's peak) would reflect the worst impact condition, or whether both hours require detailed study.

321.2. Assembly and Collection of Traffic Volumes, Street Network Characteristics, and Speed-and-Delay Data

Use of Available Data. Once the peak analysis hours have been determined, the next step in the existing traffic conditions analysis is to define the volume of traffic operating within the study area, and to create traffic volume maps to be used in subsequently analyzing roadway and intersection capacities and levels of service. In starting this task, it may be helpful to review NYCDOT traffic volume data, particularly available ATR machine counts in the area (perhaps the count data used to determine the peak analysis hours), as well as intersection turning counts and vehicle classification counts (i.e., a breakdown of the total volume by auto, taxi, truck, bus, etc.).

A second source of data that can be reviewed very early in the analysis effort are completed CEQR documents—EISs, EASs, or other traffic impact studies conducted for projects in the study area that are on file at NYCDOT offices, or at the Mayor's Office of Environmental Coordination (OEC), NYCDCP, or Department of Environmental Protection (NYCDEP).

The most important criteria to be used in considering whether available traffic volume data can be used concerns the age of the volume data and the nature of changes, if any, in the street network, adjacent land uses, or traffic patterns, as discussed below:

- In many parts of the City, volume data that are more than three years old are generally inappropriate for use in traffic studies; only in unusual cases might such data be usable. Available volume data are usually most appropriate for an active part of the City if they are not more than three years old; it may be possible to use slightly older data for a section of the City that has undergone very little change in land use and/or activity levels since the data were collected. The key factor is whether available data are reasonably representative of existing conditions. It is also important that the data were collected at an appropriate time of year, for a typical day, and within a full peak hour (as opposed to spot counts). The older the data are, the more necessary it should be that they comply fully with the parameters that will follow below under "New Data Collection." Volume data available for a previous year may need to be increased to reflect conditions in the "existing" year of the study.

- Available data less than three years old are generally appropriate for analysis purposes if there have been no substantive changes in adjacent or nearby land uses that would affect traffic volumes or patterns within the study area. For example, if a major development project has been built within a few blocks of the site of the proposed action that has generated a significant amount of traffic during the peak travel hours, new traffic counts would likely be needed. If a nearby street has been converted from two-way operation to one-way operation, or has been closed, or if a new highway ramp has been built that affects traffic volumes or patterns in the study area, new traffic counts will also likely be needed. If the available traffic volumes were collected at a time when traffic patterns were atypical—for example, at a time when a nearby bridge or viaduct was closed or partially closed for reconstruction—new traffic counts will likely be needed, or the data collected will need to be adjusted to reflect typical conditions (it may be helpful to consult with NYCDOT regarding the adjustment of such volume data). These examples are not intended to be all-inclusive, but should indicate that if conditions at the time of analysis are materially different from those at the time available volume data were collected, new counts will likely be needed in lieu of the available data. Conditions in the study area at the time the available traffic counts were conducted, therefore, need to be researched.

To determine whether data older than three years are acceptable for use, the evaluation should consider whether the land use or traffic activity picture of the study area has changed over the time period in question. It is much more likely that older data will not be acceptable simply because conditions influencing traffic patterns or volumes are more likely to have occurred over this longer time frame. Therefore, such older data may be considered in only a limited number of sections of the City; also, it may be necessary to adjust these data for growth that occurred over this period.

New Data Collection. If the decision is made to collect new traffic volume data, several guidelines are presented below to help ensure that appropriate, representative traffic data are collected.

- Traffic counts should reflect typical conditions at the locations being analyzed. Traffic counts taken during periods of the year within which traffic volumes or patterns are unusually low or high will not provide representative traffic data. These periods usually include: the peak pre-Christmas and post-holiday shopping season, encompassing all of December and the first half of January (it is usually better to avoid the entire period from Thanksgiving through mid-January); the last half of June and all of July and August, when schools are closed and many people are away on summer vacation; and other holiday periods. Exceptions to this guideline may be considered if the peak trip generation of a proposed action coincides with one of these periods. For example, a proposed water park, marina, or amusement park *should* have its traffic counts taken during the summer months when traffic patterns are likely to be representative of future background conditions, or a development in a recreational area such as the Rockaways should be analyzed under summer conditions. It should be noted that the seasonal analysis precludes the need for a typical period analysis. On the other hand, a proposed office project should *not* have its traffic counts conducted during the summer months when many people tend to take vacation time from work and when traffic volumes are typically lower than during the remainder of the year.

  Although it is possible to adjust field-collected traffic counts for seasonal variation, it is noted here that such adjustments are not necessary if the traffic counts have in fact been collected on typical days within a typical period of the year for that land use. It usually is preferable to rely on typical day counts rather than on seasonally adjusted counts.

- Weekday traffic counts should generally not be taken on a Monday or Friday, since there is a tendency for volumes to be different on those days than on more typical weekdays, i.e., Tuesdays, Wednesdays, or Thursdays. Traffic counts should also not be taken on either the day before or day after a holiday, since people also tend to take an extra day off or leave work early on those days. Traffic counts should also not be taken on any holiday where traffic may historically be lower or higher than on typical days. National holidays such as Memorial Day, Labor Day, etc., are included here, as are others that are significantly observed in New York such as Martin Luther King, Jr. Day, and Rosh Hashanah (Jewish New Year), for example. Some judgment needs to be exercised for holidays that are not considered major. Traffic counts also should not be conducted during periods when extensive construction work in the area is significantly altering traffic patterns, unless reasonable adjustments to the count data can be made.

  Manual traffic counts should also not be conducted on days when inclement weather influences people's driving patterns. Traffic counts on snow days or on days for which snow has been predicted (even if it does not materialize), for example, should be avoided. Rainy day counts should also be avoided if possible, but if the counts are already under way once it has begun raining, the volumes collected can be considered acceptable since the weather has probably not influenced a significant number of people to drive or not to drive.

- Weekday traffic counts should be conducted over a sufficient number of days to be considered representative of a typical day. Historically, weekday traffic counts have generally been taken over a three-day period to ensure that a representative day is reflected in the traffic volume analyses, and so that any abnormality in a given day's worth of counts can be identified and adjusted (or discarded). For example, three days of counts can be taken in one of two ways: a) three days of manual counts that are subsequently averaged to reflect a typical day; or b) one day of manual counts collected concurrently with a seven-day 24-hour automatic traffic recorder (ATR) machine count, from which adjustments to the one-day manual count can be made. In the latter example, it may be reasonable to collect validation data at 1 to 3 control intersections on a second day.

  Before averaging several days of manual counts, or adjusting one day of manual counts to reflect several days of ATR counts, the entire body of data collected should be reviewed to make sure that there was no "event" going on at the time the counts were taken that would significantly alter the accuracy of the counts. Such events could include the malfunctioning of the ATR machine for a period of time, vandalism to the ATR machine, a street opening for utility repairs (for example) that would narrow the number of lanes available and therefore limit the volume of traffic that passed through the area, etc. This need not be a lengthy review providing that the proper agencies and/or news services have been contacted to determine that nothing unusual was planned for the count day or occurred on that day.

- Weekend traffic counts should be conducted for more than a single day to be considered reasonably representative of a typical weekend day. For those types of proposed actions with activities that extend at generally equal levels over several hours, and for which a particular peak hour is not easily discernible, the ATR count period should extend over all hours that could potentially comprise the peak hour for the study area and/or the proposed action.

- Manual traffic counts taken at study area locations for the purposes of determining the volume of through and turning traffic should be conducted over the course of the full peak hour, and not for a shorter period of time and then factored upward to reflect a full hour's worth of data. The counts should generally be taken over a minimum of 2 hours, overlapping the projected peak hour plus at least 30 minutes on each side of the peak (e.g., 7:30 to 9:30 AM for a projected 8 to 9 AM peak hour), to ensure capturing any peaking that could occur at the beginning or end of the peak hour. The additional 30 minutes of data on either side of the peak will allow confirmation that the peak hour has been covered.

- Manual traffic counts taken at study area locations for the purpose of identifying the mix of vehicles (autos, taxis, buses, trucks, etc.)—also referred to as "vehicle classification counts"—may be taken for less than the two hours discussed above because vehicle mixes at a given location are usually not subject to wide fluctuations over the peak hour. Usually, vehicle classification counts should be conducted per approach for a minimum of 20 minutes providing the sample count collected has about 100 vehicles recorded, to provide an adequate sample for statistical purposes.

- If an air quality or noise analysis is required, more detailed vehicle classification counts would be necessary. See Chapter 3Q "Air Quality," Section 321.1 and Chapter 3R "Noise," Section 332.1 for more details on the required classifications. NYCDEP may also be consulted. It should be noted that the peak hours of noise analysis may not coincide with the peak hours of traffic.

The traffic data collection task is one of the most important steps in the traffic analysis process because it is of paramount importance that existing conditions be accurately portrayed. It will usually take a week or more to define the scope of the traffic count program, organize it properly (including setting up the field data sheets), and plan for any potential contingencies. This is one step of the overall impact analysis process in which major errors that are not caught in time can cause nearly all subsequent work to be redone. Field survey crews should be adequately trained prior to conducting the counts, and monitored during the counting effort to ensure a high quality data collection effort.

Preparation of Peak Hour Traffic Volume Maps. Once all of the traffic volume data have been assembled/collected, the next step is to prepare traffic volume maps for each of the peak hours for which the proposed action will be evaluated. As described previously, the preliminary choice of peak hours to be analyzed is generally made at the very outset of the project when study areas are defined.

Once the data collection effort is complete, the analysis returns to the initial identification of the peak hours to be analyzed, reviews the data collected, and then determines the precise peaks to be analyzed. For traffic, these peak hours are usually identified to the nearest 15 minutes, i.e., 7:15 to 8:15 AM rather than simply 7 to 8 AM. Then, all of the peak hour volumes are plotted on a map of the study area, including all through and turning volumes at each location counted, to present a total picture of traffic volumes throughout the study area. These traffic volume maps can then be "balanced" so that volumes at adjacent intersections are consistent with one another. For example, if the northbound through volume on Sixth Avenue at 43rd Street in Manhattan is 2,000 vehicles per hour (vph) and there are 200 vehicles turning onto Sixth Avenue from westbound 43rd Street, the northbound volume on Sixth Avenue at 44th Street should be exactly 2,200 vph, providing there are no parking garage entrances or other places for vehicles to leave the street network between 43rd and 44th Streets.

These balanced traffic volume maps are key inputs for determining volume-to-capacity (v/c) ratios, average vehicle delays, and levels of service throughout the study area.

Street Geometry and Physical Inventory. As part of the overall data assembly/data collection effort, information on the street network is needed. This provides a description of what the area's traffic network "looks like" and how it is sized to accommodate traffic flow. It also becomes an additional set of inputs to the determination of street capacity and traffic level of service. Data to be collected varies depending on the capacity analysis methodology used, but generally includes the following:

- The width, number of lanes, and direction of each street in the study area and along the major routes into the study area. For added clarity, the direction of streets should be presented graphically, while street width information may be presented in either graphic, tabular, or text format, whichever is clearer.

- Traffic control devices, such as traffic signals, stop signs, yield signs, turn prohibitions, etc., the locations of which are illustrated graphically. For signalized intersections, signal cycle lengths, phrasings, and timings will be needed for the capacity analyses to be conducted. Signal timing data can be obtained from NYCDOT and field-checked; consultation with NYCDOT is advisable should there be discrepancies between the two sets of timings.

- General on-street parking regulations in the area and on the blocks leading to and away from the intersections being analyzed (more detailed parking inventories will be needed for the parking analyses and are outlined later). This information may be presented either graphically, in tabular form, or in text within the analysis documentation. The presence of bus stops and fire hydrants is accounted for in the traffic and parking capacity analyses.

- General pavement or alignment conditions along the major roadways in the area that affect traffic flow, e.g., poor pavement conditions, difficult vertical or horizontal geometries that affect traffic flow, or other like conditions should be noted.

Travel Speed and Delay Data. Travel speed and delay data are generally collected for use in the mobile source air quality analyses, and should be collected concurrently with the traffic count program. In particular, the running speed of the traffic, stopped delay at intersections, vehicle classifications, roadway geometrics, and signal timing data will be required (see Chapter 3Q, Air Quality). These data are collected concurrently to correlate travel speeds to traffic volumes and calculated vehicle delays for air quality analysis purposes. If there is no need for travel speed data for air quality purposes, there will likely not be a need to collect these data at all. If air quality analyses do require this information, it is important to coordinate traffic and air quality analysis locations and their data needs (including the length of the corridor along which travel speed data are needed for the air quality analysis), so that the data collection process can be conducted more efficiently.

Travel speed and delay data are generally best collected via the "floating car technique," in which the survey car seeks to travel at the speed of a typical car in the traffic stream—by passing approximately the same number of cars as pass it. A driver and data recorder are dispatched in a car and travel a route (or routes) through each of the air quality analysis sites, recording speed and delay information for each approach to each site. Under the floating car technique, the driver is instructed to drive at the typical speed of other drivers, passing as many cars as pass the test vehicle.

For the purposes of the fieldwork, it is advisable to create a form noting the points along the route so that the elapsed time can be recorded and on which the location, extent, and type of delays can also be noted. By comparing the elapsed time it takes to go from point to point to the distance between the two points, actual travel speeds can be quantified. As noted above, the travel speed and delay runs should progress at the same time as the traffic counts, i.e., over the same time period and number of days. A total of at least six to nine runs per link are generally necessary to replicate typical conditions. At times, it may be necessary to dispatch more than one team to complete the required number of runs at the required number of air quality analysis sites.

321.3. Analysis of Roadway Capacity and Level of Service

After the preparation of balanced traffic volume maps, the determination of the capacity and level of service of the study area's roads and intersections is the next critical step in the overall traffic analyses. The key to evaluating urban area traffic conditions is the analysis of its intersections, since the capacity of an urban street is typically controlled by the capacity at its intersections with other streets. At times, the linkages between a highway and the study area street network may also play a critical role in the analysis. In general, the capacity of an intersection—i.e., the maximum number of vehicles that can pass through it—depends on several factors and can be evaluated by one of several available methodologies. Use of one of these methodologies produces the capacity of each of the approaches to the intersection and, when compared with the volume along the various approaches, the approach's operating conditions, expressed in terms of volume-to-capacity (v/c) ratio and/or level of service.

Highway Capacity Manual Methodology. The *Highway Capacity Manual (HCM)*, developed by the Transportation Research Board, is continually being updated and is used nationwide; it is also appropriate for use in New York City. The *HCM* contains different procedures for signalized and unsignalized intersections because of the nature of driver actions, and therefore capacity, at the two different types of intersections.

Signalized Intersections. According to the *HCM*, the capacities of *signalized intersections* are based on three sets of inputs: 1) geometric conditions, including the number of lanes, the length of storage bays for turns, the type of area the analysis locations are situated in (e.g., central business district, others), and the existence of parking or bus stop activity at the curb; 2) traffic conditions, including volumes by movement, vehicle classification, parking maneuvers, the nature of vehicular platooning in arrivals at the intersection, and pedestrian conflicts; and, 3) signalization conditions, including signal cycle length and timings, signal phasing, and the existence of signal actuation capabilities by either vehicles or pedestrians.

Based on all of these and other inputs, the *HCM* model then calculates the ratio of the volume on the street to the street's capacity (i.e., its volume-to-capacity, or v/c, ratios), average vehicle delays, and level of service, with the level of service defined in terms of the average delay encountered by vehicles along each intersection approach and even each individual movement along each approach (separately for left-turn lanes or designated through or right-turn lanes). According to the *HCM*, the conditions that the driver is likely to encounter at each level of service (LOS) for signalized intersections are as follows (the LOS table containing all of the definitions is included in Appendix 2):

- LOS A describes operations with very low delay. This occurs when signal progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all.

- LOS B describes operations with low but increased delay. This generally occurs with good progression and/or short cycle lengths. Again, most vehicles do not stop at the intersection.

- LOS C describes operations with moderate delay. These higher delays may result from fair progression and/or longer cycle lengths. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

- LOS D describes operations with heavy delay. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines substantially.

- LOS E describes very heavy delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios near capacity.

- LOS F typically describes ever increasing delays as queues begin to form. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios with cycle failures.

Poor progression and long cycle lengths may also be contributing to such delays.

The procedures to be used in conducting the *HCM* analyses are contained and fully detailed in that *Highway Capacity Manual* and within the computer software packages available for it. However, it should be noted that the *HCM* provides for two alternative means of obtaining selected inputs to the capacity analyses—either detailed surveys of inputs such as platooning, number of parking maneuvers, number of pedestrians, etc.; or use of "default" values (to be used in lieu of surveyed information) specified in the HCM. The conduct of surveys to obtain this information, rather than using the default values, will result in more accurate results. For proposed actions in settings where significant impacts would likely occur, such surveys may be appropriate, because more accurate results are achieved. Such surveys are typically performed for a representative period (minimum of 30 minutes) during the peak analysis hours. For proposed actions expected to generate a modest level of trip making in an area that is unlikely to be significantly impacted, use of the HCM's default values will generally suffice.

Unsignalized Intersections. Capacity analyses for *unsignalized intersections* are based on the use of "gaps" in a major traffic stream by vehicles crossing through or turning into that stream. At unsignalized intersections, "Stop" or "Yield" signs are used to assign the right-of-way to one street while controlling movements from the other street(s). This forces drivers on the controlled street—usually the "minor" street approach to the intersection—to use judgment when selecting gaps in the major street flow through which they can enter and turn into the intersection, or cross entirely through the intersection. The minor street traffic also has to yield to pedestrians in that approach.

The capacity analysis method used for unsignalized intersections under the *HCM* generally assumes that major street traffic is not affected by minor street flows. Left turns from the major street are assumed to be affected by the opposing, or oncoming, major street flow. Minor street traffic is obviously affected by all conflicting movements, vehicular and pedestrian.

In analyzing the ability of traffic to use gaps in the major street traffic flows, the *HCM* recognizes that certain movements are more able to use these gaps than others. Right turns from the minor street are most able to use available gaps, since they need to be concerned only with gaps in one direction of major street traffic. Left turns from the major street are the next movement most able to use available gaps, followed by through movements and then left turns from the minor streets (which must recognize and negotiate their way through gaps in two directions of major street flows, for a two-way street). This is important to understand because it reflects the frequent capacity shortages for vehicles seeking to make left turns from a minor street onto a major street.

The key input data required to analyze unsignalized intersections include geometric factors and volumes. Geometric factors include the number and use of lanes, channelization, percent grades, curb radii and approach angles, sight distances, and pedestrian flows. The capacity computations result in a determination of volume-to-capacity ratio and delays and levels of service (LOS). The LOS table containing all of the definitions is included in Appendix 2.

Any highway or highway ramp/local street merge or weave conditions should also utilize *HCM* procedures. All methodologies, data needs, and procedural steps are detailed in full in the *Highway Capacity Manual*. Since the inclusion of highway mainline analyses within a New York City traffic study is not generally commonplace, further explanations are not provided here within this Manual. The intersections of highway ramps with adjacent service roads and streets, however, would follow the procedures outlined above for signalized and unsignalized intersections.

Other Methodologies. Other methodologies may be employed only if they can be proved appropriate for use in their particular study area and only if they are compatible with air quality models used, as well. However, it should be emphasized that the concurrence of NYCDOT regarding the use of such models is strongly urged before they are employed.

321.4. Overview of Level of Service Determinations

The Manual sections appearing above present the definitions of the various levels of service and the criteria for determining whether a given intersection operates at level of service A, B, C, D, E, or F. Overall, according to generally accepted practice in New York City, LOS A, B, and C reflect clearly acceptable conditions; up to LOS mid-D reflects the existence of delays within a generally tolerable range; and E and F indicate congestion.

Once the capacity analyses have been completed, and levels of service have been preliminarily defined for each intersection approach and lane group, this finding should be reviewed and compared to conditions observed at the site, as well as to information that is also available from the travel speed and delay runs. It is often possible that the computed v/c ratios or levels of service do not accurately reflect field conditions. There are several examples of this.

For example, it is possible that major congestion at an intersection upstream of (i.e., "above") the intersection being analyzed does not allow traffic to proceed on to the next intersection in a normal manner. Perhaps there is a construction activity that narrows southbound Fifth Avenue at 45th Street, for example, to only two lanes as opposed to its normal five or six lanes. Therefore, only a small volume of traffic can pass through the 45th Street intersection, which then accelerates as it passes through a full-width Fifth Avenue at 43rd Street. Without observing this in the field and understanding this traffic action, an erroneously low volume could be used at 43rd Street that would lead to a determination that the intersection is operating at a clearly acceptable level of service, when under normal conditions at 45th Street, the intersection at 43rd Street would not operate that well.

It is also possible that the occurrence of double-parking activities or truck loading/unloading activities can create level of service conditions that are worse than those projected via the capacity analysis methodology employed. There are many such potential field conditions that should be understood and considered during the development of traffic volume maps, conduct of capacity analyses, and determination of an intersection's typical level of service. All available information should be weighed before finally determining level of service and defining which intersections operate in a problematic manner. These evaluations should generally be made by an individual with several years of experience in the traffic field.

322. Existing Parking Conditions

The objective of the existing parking conditions analyses is to document the extent to which public parking is available and utilized in the study area today. The analysis consists of an inventory of on-street and off-street (i.e., parking lot and garage) spaces, and a summary tabulation indicating the amount of parking spaces remaining available for potential future parkers in the area.

322.1. On-Street Parking Analyses

Typically, a parking analysis provides both a qualitative overview of parking in the area and quantified summaries of the nature and extent of parking that occurs. Qualitatively, it should include a general overview of the type of parking regulations that exist in the area. Is it generally an "alternate-side-of-the-street" type parking area with metered parking available along key retail streets (with those key streets specified by name)? Is it an area where curb parking is generally prohibited to allow maximum street frontage for commercial vehicle deliveries or for additional traffic capacity, as is the case in much of Midtown Manhattan? This overview provides an initial view of the overall nature of parking in the area.

Quantitatively, the analysis includes a tabulation of the number of legal on-street parking spaces that exist within the parking study area by the critical times of day for parking. For a conventional office or residential project, this would be at 8 to 9 AM when people arrive at work or leave their homes to go to work, at midday (usually between 12 noon and 2 PM) when parking in a business area is frequently at peak occupancy, and at any other times when parking regulations change significantly. This is generally most applicable in areas where alternate-side-of-the street parking regulations exist—typically from 8 to 11 AM or from 11 AM to 2 PM—and where curb occupancies change just before and just after the hours that the restrictions are in place. The number of spaces can be obtained by tabulating the length of curb space at which it is legal to park (i.e., excluding fire hydrants, driveways, restricted parking areas, etc.) and dividing by an average parking space length of 22 feet, or by counting the number of cars actually parked at the curb plus those that could fit within available gaps.

The analysis includes a tabulation of how many legal on-street parking spaces exist at the likely periods of lowest supply and highest demand, such as 8 AM, 11 AM, and 2 PM, since the peak times for parking activity and parking facility utilization often differ from the peak times for potential traffic impacts, as well as how many are occupied and how many vacancies exist. For proposed actions that have significant trip making activities at other times, those other peak times are also assessed. For example, this could include weekend or weeknight hours for a concert hall, sports arena, convention center, movie theater, etc.

It may also be advisable to include a more detailed map indicating the key parking regulations on the blockfaces of the project site and within a more convenient walking distance than the full parking study area. This is needed for two reasons: 1) to provide a better picture of actual conditions at the site; and 2) should a future parking shortfall be identified and additional on-street parking prohibitions be needed as mitigation for traffic impacts, it will facilitate the determination of the spaces to be taken.

322.2. Off-Street Parking Analyses

The location of all public parking lots and garages within the study area are inventoried and mapped. The licensed capacity of each (which, by regulation, must be posted at its entrance) is noted. Then, surveys of the occupancy levels of each parking lot and garage are undertaken to determine the extent to which each are occupied at a representative morning peak hour, such as 8 or 9 AM, and at a time of typical maximum occupancy, such as 12 to 1 PM, or 1 to 2 PM.

For specific types of actions that generate a significant amount of in and out parking activity, an hour-by-hour parking occupancy survey may be needed. Examples of this include shopping centers, multiplex movie theaters, and major mixed-use development projects. For several of these uses or others that generate parking activity at other times of the week, weekend and/or weeknight surveys may also be appropriate. For example, a proposed museum may be expected to generate traffic and parking activity weekdays from 10 AM to 8 PM and on weekends from 10 AM to 6 PM. For this proposal, parking occupancy surveys might be performed at 10 AM, when museum employees would come to work and look for nearby parking; at 12 noon or 2 PM, when visitor activity would build to an assumed maximum; perhaps at an evening hour, such as 7 PM, when there would be a significant amount of patronage and demand for parking in the area from other uses; and at a representative weekend peak hour, when visitor traffic is expected to be greatest and/or when parking facilities in the area are most fully utilized. Reasonable judgment will be needed here.

The tabulation of off-street parking availability typically indicates the name and location of each facility, its posted capacity, and the percentage utilization (or number of spaces occupied) for the representative critical hours identified, as discussed above. A summary statement of the overall extent to which such parking is available in the study area is included, noting any significant differentials by sub area. For example, it could be that only 65 percent of a study area's off-street parking supply is occupied at peak hours, but that the three facilities closest to the proposed project site are fully utilized because development density is greatest there. These important findings would be highlighted.

Occupancy surveys can be taken in one of several ways. The most accurate procedure is to physically count the number of vehicles parked at the lot or garage. At times, however, this may not be permitted by the lot's owner or manager. In these cases, it is also possible to interview the lot manager or an attendant and ask to what extent the facility fills up by time of day, or to make a visual judgment that a parking lot is, say, two-thirds occupied. For some facilities, it may be possible to obtain computer records of daily occupancy. It may also be necessary to conduct counts of the number of entering and exiting vehicles for air quality analysis needs—coordination is suggested prior to doing these surveys.

330. FUTURE NO ACTION CONDITION

The future no action condition accounts for general background traffic growth within or through the study area, plus trip making expected to be generated by major proposed projects that are also likely to be in place by the proposed action's build year. Background growth rates typically used in conducting the technical analyses are presented in this chapter of the Manual, as are the methodologies used in accounting for trips from expected development projects.

331. Background Growth Rates

The development of background growth rates follows the general trends in traffic and growth prevalent through various sections of the City over a number of years. It reflects the general long-term trend rather than quick deviations from the general trend. Several sources of information are generally used to develop this projection, including bridge and tunnel volume counts that are collected and monitored by NYCDOT, as well as general development trends throughout the City. Such information, and land use and population data, are available from the New York City Department of City Planning.

For traffic and parking analysis purposes, the following annual growth rates are recommended in CEQR documents:

▪ Manhattan	0.50%
▪ Bronx	0.50%
▪ Downtown Brooklyn	0.50%
▪ Other Brooklyn	1.00%
▪ Long Island City	0.50%
▪ Other Queens	1.00%
▪ St. George (Staten Island)	1.00%
▪ Other Staten Island	1.50%

Note: For Air Quality Conformity analyses, the New York Metropolitan Transportation Council (NYMTC) growth rates should be used.

Since traffic growth is influenced by market conditions, modal split changes, auto ownership rates, and other factors, these rates may change over time. It is helpful to consider those factors when determining a suitable growth rate. Further, it should be noted that these growth rates above reflect peak travel hour expectations rather than daily figures. In some areas, daily traffic growth may in fact be significantly greater or less than the rates above, while peak hour growth is constrained by the presence of traffic capacity bottlenecks during the peak periods. It should also be noted that these are *recommended* rates; other rates can be researched, calculated, and used if there are data to substantiate them (documentation of the assumptions and/or data used to make these calculations is suggested). This will be especially true for proposed actions with peak travel hours at non-peak times, such as a concert hall or amusement park that is to be active on weekends and/or during summer months. The future no action parking analyses typically use the same background growth rates as the traffic analyses because, in general, the growth of traffic and parking are closely linked.

332. No Action Development Project Trip Making

In addition to the background growth rate that is applied evenly throughout the study area (i.e., at all intersections for the traffic analysis), the analysis also accounts for trips to and from major development projects that are not assumed to be part of an area's general growth. Here, too, the determination of whether a proposed no build project should be considered part of the general background or superimposed on top of the general background growth will call for considerable judgment. At a minimum, it is advisable to consult the NYCDCP, Environmental Assessment and Review Division or MOEC for a full project listing.

Another means of determining whether or not proposed no build development projects would be appropriately considered as part of the background is to calculate the total amount of peak hour trip making expected from all of the projects and then calculate the percentage increase in traffic this constitutes within the study area. If the calculated percentage is less than the recommended growth rates enumerated above, it can generally be assumed that each of the developments fall within the background growth rate and do not need to be superimposed on it.

There are several ways to determine the amount of trip making associated with a no build project. The best way is to use the trip projections cited in that project's traffic impact analysis, if such an analysis exists. If such trip projections are not available, the methodologies described in the next section of the Manual on trip generation and trip assignment for build analyses can be used. This second means of determining no action trip making will entail additional work beyond just using available projections.

If it is necessary to conduct independent trip making estimates of no build projects, and there are just one or two such projects, the same procedures cited in the build analysis section below can be used. However, if there are several no build development projects, the build trip generation methodologies are followed but it is possible to use a condensed method of assigning the traffic trips to the street network. The analysis can determine the total volume of new vehicle trips expected, compare that volume with the existing volume at a representative "cordon line" around the study area, determine the percentage increase from the new trips, and then ascribe that percentage to all intersection and roadway links to be analyzed. This process could also be used for assigning parking trips.

333. Preparation of Future No Action Volumes and Levels of Service

Balanced traffic volume maps, traffic level of service analyses, and parking utilization projections are prepared to reflect no action conditions, adhering to the same methodologies outlined in the existing conditions analyses. Text and tables provide a full description of future no action conditions and include text and tabular comparisons of how conditions are expected to change from existing conditions in the future no action scenario.

This assessment accounts for any programmed street or highway changes that could affect traffic flow or levels of service. As an example, this includes any mitigation measures that are incorporated in the approvals for a development project considered in the no action condition. As another example, if NYCDOT has programmed the widening of a particular street in the study area by the proposed action's build year, changes to intersection capacity and the resulting level of service would be included as part of the no action analysis. Other examples may include street direction changes, street closures, and possibly even major changes outside of the study area (such as a permanent viaduct closure) that would affect travel within the study area. These would be confirmed with NYCDOT.

340. FUTURE ACTION CONDITION

The objective of these analyses is to determine projected future conditions with the proposed action in place and fully operational. These future action conditions are then compared with the future no action scenario to determine whether or not the proposed action would have a significant impact on the study area's traffic and parking facilities and require mitigation.

The assessment of projected future action conditions consists of a series of analytical steps, namely:

- *Trip generation*. The determination of the volume of trips generated by a project on a daily basis and during peak travel hours. The hourly distribution of a project's generated trips is also referred to as its "temporal distribution."
- *Modal split*. The determination of the percentage of all generated trips that would occur by travel mode. That is, how many trips would be made by auto, taxi, subway, bus, walk, bicycle or other modes. For traffic and parking analyses, part of this step is to determine the volume of vehicular traffic generated by accounting for the average occupancy of autos and taxis.
- *Trip assignment*. The routing, or "assignment," of trips by each travel mode to specific streets and highways, parking facilities, subway lines and stations, bus routes, and sidewalks en route from their origin to their destination.
- *Capacity and level of service analysis*. The evaluation of conditions within the study area with project-generated trips superimposed on the future no action condition, as a representation of the projected future action condition.

Once these steps have been completed, a determination of significant impacts—based on a comparison of future build conditions with no action conditions and with thresholds of acceptability—can be made.

The text and tabular sections that follow provide the technical guidelines needed to make each of these analyses and determinations.

341. Trip Generation

The trip generation analyses provide the estimated volume of *person* trips expected to be generated by the proposed action over the course of the entire day as well as during peak analysis hours. The classification of a proposed action's daily trips by hour of the day is also referred to as its temporal distribution. There is a significant body of data available within previous EISs, traffic studies, and professional literature (most notably, the Institute of Transportation Engineers' *Trip Generation Manual*), some of which relate trip generation rates as daily numbers, while others relate the information as hourly numbers. It may also be necessary—and in many cases advisable—to conduct original surveys to determine an appropriate trip generation rate to be used.

341.1. Use of Previously Researched Trip Generation Rates

There has been considerable trip generation analysis work done in the City to date as part of EISs and other studies, so rates for certain specific land use types in specific parts of the City have been defined and approved for use on previous projects. Table 3O-2 presents a partial list of previously researched trip generation rates that may be used, providing the proposed action being analyzed matches the building(s) or land uses surveyed.

Table 3O-2

Examples of Previously Researched Trip Generation Rates

(Typical Weekday)

Land Use and Location	Daily Person Trips	Peak Hour Percentage AM	Peak Hour Percentage Midday	Peak Hour Percentage PM
Office, Manhattan (multi-tenant type building)	18.0 per 1,000 gsf	12	15	14
Office, Manhattan (corporate headquarters-type building)	13.0 per 1,000 gsf	15	17	15
Residential (Citywide, Typical Apartment)	8.075 per DU	10	5	11
Boutique Retail, Manhattan	205 per 1,000 gsf	1	22	10
Restaurant, Manhattan	173 per 1,000 gsf	1	17	8

Note: An expanded list is provided in Appendix 3.

For example, several different trip generation rates and temporal distributions have been researched and used in previous EISs and traffic impact studies regarding office space in Midtown Manhattan. One of the primary sources of this information, Pushkarev & Zupan's *Urban Space for Pedestrians*, reports three different trip generation rates for office buildings in Manhattan, ranging from 13 to 18 person trips per 1,000 square feet of space per day with different percentage breakdowns by hour of the day. These rates reflect trip generation for different types of office buildings with different peaking characteristics.

There may also be a special nuance to the specific proposed action being analyzed that makes its trip generation expectations significantly different from those listed in Table 3O-2. For example, the trip generation rate cited for Midtown office space may not be appropriate for back-office space outside of Manhattan or even within Manhattan, since back-office space generally does not generate the same volume of visitor and business trips as does general office space.

Should the proposed action being analyzed be different from those land uses with previously researched trip generation rates, two courses of action are available. One would be to review similar land uses in the ITE *Trip Generation Manual* and modify those rates for the local New York City setting of the proposed action. The second, and preferable, route would be to conduct trip generation surveys of the same land use in a comparable setting of the City. Additional guidelines follow in Sections 341.2 and 341.3 below.

It is also generally appropriate to determine the volume of truck and van deliveries generated by a proposed action separately from the trip generation/modal split analyses detailed above. There are not as many sources for this information. Two sources of truck trip generation rates have typically been used: Wilbur Smith and Associates' *Motor Trucks in the Metropolis* and the Federal Highway Administration's *Curbside Pick-up and Delivery Operations and Arterial Traffic Impacts*. These sources report daily truck trip generation rates (truck stops) of 0.05 per dwelling unit, 0.20 per 1,000 square feet of office space, and 0.35 per 1,000 square feet of retail space, which would also be subject to a temporal distribution analysis to ascertain peak hour truck trips. It is also possible, in some cases, to review delivery vehicle logs or interview prospective operators of a facility regarding the expected volume of deliveries for a specific, more unique, type of land use, such as supermarkets, hotels, or others. For actions that predominantly generate heavy vehicles, such as trucks and/or buses, the Passenger Car Equivalent should be applied to find the number of new vehicle trips (see Section 200 for these rates). Examples of these actions would be a warehouse, waste transfer facility, freight or bus terminal, etc.

341.2. Use of the ITE Trip Generation Manual

The *ITE Trip Generation Manual* is a very comprehensive and continuously updated body of information based on surveys conducted in national settings that are often very dissimilar from New York City and that therefore may not be fully appropriate for use in many parts of the City. It is generally based on surveys in places with lesser density and, most often, with little or no available public transportation service. In using the ITE data, which are usually presented as *vehicle* trip generation rates rather than as *person* trip generation rates, the data are adjusted for local modal split characteristics in the proposed action's study area. It may be possible to contact ITE to determine the specific locale in which its surveys were conducted, and even (at times) to contact the particular individual at the agency or consulting firm who was responsible for the actual surveys themselves, to make a more precise comparison of modal splits between the locale surveyed and the site of the proposed action.

For example, if the ITE *Trip Generation Manual*'s rate for AM peak hour vehicle trips at hospitals is 0.35 per bed, this is generally appropriate for settings characterized by no nearby bus or subway routes, and it can be assumed that the auto share of hospital arrivals is probably close to 100 percent. A proposed hospital in a section of far eastern Queens that is also unserved by public transportation could, therefore, use the same trip generation rate. A proposed hospital along Queens Boulevard in central Queens where only half of the trips made are likely to be made by auto or taxi would therefore be presumed to have a *vehicle* trip generation rate that is half of the rate cited in the ITE Manual, providing it can be assumed that the average vehicle occupancy is the same for both the ITE setting as well as the Queens Boulevard setting. However, it is recommended that the lead agency be contacted before using the ITE *Trip Generation Manual*.

341.3. Conduct of Original Surveys

It is often preferable or appropriate to conduct original surveys of the same type of land use in a setting comparable to the site of the proposed action. Although this seems rather straightforward, it may call for considerable judgment. For example, in the case of the proposed hospital along Queens Boulevard, it may be possible to find another hospital along the same corridor that is equivalently sited with regard to bus and subway service. On the other hand, there may very well not be a hospital similarly sited to the proposed hospital in eastern Queens elsewhere in the borough. However, there may be such a hospital located in another neighborhood that can be assumed to have similar modal split characteristics to those of the proposed action, and that can be surveyed.

Even so, a number of other factors need to be considered. For example, is the hospital to be surveyed of a comparable size to that of the proposed action, or will there have to be a proportioning of the findings of the survey to the size of the proposed facility to be analyzed? Does the hospital being surveyed have functions and health care facilities generally comparable to the one being proposed? If one is a teaching hospital while the other is not, the former may generate more or fewer trips during key periods of the day.

In general, it will not be easy, nor should it be necessary, to find a survey target that is perfectly comparable to the proposed action in its study area. There are many factors to consider in choosing a survey site and, later, in using the survey data wisely. Once again, in general, these factors include the following:

- Is the facility being surveyed comparable to the proposed facility?
- Is the site of the facility to be surveyed comparable in its transit service availability and its modal split characteristics to the site of the proposed action?
- Is the size of the site to be surveyed comparable to that of the proposed action, and does any difference play a role in trip making to and from the site?
- Are the hours that the survey site is open and active similar to those of the proposed action?

It may also be necessary or advisable to survey more than one facility deemed potentially comparable to the proposed action, and then weigh the survey data obtained and make a reasoned judgment as to where the proposed action would fit within the range of data available.

If usable trip generation rates are not listed in Table 3O-2 and not available from other surveys, the conduct of original surveys in comparable settings would be deemed a desirable analytical tool. In conducting a trip generation survey, there are several important considerations to keep in mind:

- The surveys should be conducted during the peak periods for the type of facility being surveyed.

- All entry and exit points should be covered, not just the main entrance/exit location, so that *all* trips are recorded.

- All entries and exits should be recorded, including people who say they are using the facility that day but hardly (or never) on any other days.

- Entries and exits should be recorded separately, since they will eventually be translated into arriving and departing vehicle trips.

- Weather conditions should be noted along with any other occurrences that could be affecting the volume of tripmaking on the survey day, since adjustments may be needed afterward.

The survey methodology, hard data, and significant findings and assumptions used should all be summarized in a brief technical memorandum, so that this body of information will serve as backup documentation for the analyses and can subsequently be used by others.

342. Modal Split

Modal split analyses provide information on which travel modes are likely to be used by persons going to and from the proposed action, including autos, taxis and car services, subways, buses, ferries, commuter rail, bicycles, and walking. These modes are considered in terms of percentages—i.e., what percent of the total number of people traveling to and from the site would be via that mode. The modal split percentages are then applied to the hourly trip generation estimates to determine the volume of persons traveling to and from the site by each mode for each of the analysis hours. A subsequent step applies an average vehicle occupancy factor to the number of persons using autos or taxis/car services to determine the volume of vehicles that the proposed action would generate.

The determination of a proposed action's modal split may also need to recognize that a percentage of its trip generation may be considered "linked trips;" that is, that trips within the area of the project site may be linked with other modes or nearby destinations. For example, a proposed shopping mall in downtown Brooklyn or downtown Flushing would be expected to generate person trips to it on the basis of its expected trip generation rate, yet a portion of these trips may not be newly generated into the area, but rather by the downtown and highly pedestrian nature of the area. Therefore, some of the walk-in trips to its retail components may be trips already made to the area and that may now include an additional walk "link" to it. This phenomenon can be reflected in the analyses via either a higher "walk" modal split percentage for the proposed action, or by dividing the project's overall trip generation into "linked" and "non-linked" components and assigning them separately to the study area network.

Similar to the previous discussion on trip generation, there is a significant body of data available within previous EISs and other databases, including the U.S. Census. The U.S. Census provides substantial data on mode choice for journey-to-work trips in different parts of the City and is very useful for analysis of both residential and commercial-office uses. For many combinations of land use types and geographical locations within the City, there are previously researched modal splits available for use. For other combinations, there are either sources of information that can be investigated, or the conduct of original surveys will be needed.

342.1. Use of Previously Accepted Modal Splits

Because there has been a considerable amount of survey and analysis work done on previous transportation studies, previously researched modal splits are available for use for various combinations of proposed actions in certain parts of the City. Table 3O-3 presents a list of previously accepted modal splits that may be used, unless there is some special aspect of the proposed action that calls for its modal split to be significantly different from those listed.

There are not many examples of such unique cases, but one is presented for illustrative purposes. Modal splits have been surveyed for high-rise residential buildings in Midtown Manhattan. Should a proposed action call for a similar type of building, but be intended as the residence of foreign consuls or diplomats—in which case a significantly higher use of taxis, car services, and limousines would be expected vs. minimal use of mass transit—it may be appropriate to make modifications in the modal split of Table 3O-3. While such circumstances are likely to be fairly rare, they point to the need to think through the proposed action's expected travel behavior as opposed to merely using the rates shown.

342.2. Use of U.S. Census Data

Another important source of modal split information is the U.S. Census, which contains data on journey-to-work trips by mode for each census tract in the City. Therefore, modal split percentages can be readily obtained for residential projects for any study area. It is also possible to obtain *reverse* journey-to-work information for a census tract, which would provide information on how people travel to a workplace in a particular census tract. This can be helpful in determining modal split characteristics for, say, commercial space proposed in a given area. The New York City Department of City Planning has census information. This information can also be obtained by contacting the New York Metropolitan Transportation Council (NYMTC), which will tabulate the information for a fee. The U.S. Census transportation data is also available from the Bureau of Transportation Statistics. Other data is available on the U.S. Census website (www.census.gov and more specifically venus.census.gov/cdrom/lookup).

342.3. Conduct of Original Surveys

It will often be appropriate to conduct original surveys of modal split for the same type of land use as the proposed action in the same setting or in a comparable one. When the proposed action is similar to land uses that currently exist in the same study area, this is a very straightforward task. If not, a similar study area—that is, one with similar travel characteristics and mass transit availability—is identified to prepare an appropriate modal split study. This is generally the case when a proposed action includes a land use that is either unique overall (e.g., an amusement park) or just unique to the proposed action's study area (e.g., a hotel in the downtown section of St. George, Staten Island). If either of these two situations are the case, much of the discussion on trip generation surveys is again appropriate here. It will be necessary to find either a similar land use to survey within the proposed action's study area, the identical (or nearly identical) land use located in a generally comparable area of the City that can be compared to the proposed action's study area.

In conducting modal split surveys, it may be important to determine the mode of travel both to *and* from the site being surveyed. For several land uses, there may be a tendency for people to travel there by one mode and leave by another. As an example, a proposed restaurant, concert hall, or entertainment facility in Midtown Manhattan may cater to a primarily transit and walk-in populace as they arrive at 6 PM or 7 PM, but be significantly more taxi-oriented for departures later at night. The same facility may also have different modal split and vehicle occupancy characteristics by time of day. For the same Midtown eatery/entertainment facility cited above, the heavy walk-in trade during the daytime might be replaced by a significantly higher auto-oriented clientele at nighttime. Daytime arrivals by taxi may be oriented to single individual arrivals, while nighttime arrivals may be more couples or parties of four. The surveys consider the nature of the facility being surveyed and how its activity patterns, clientele, and surrounding area and transit services change by time of day for the analysis hours being studied.

Many of the same guidelines cited for the selection of traffic count days are again appropriate for trip generation and modal split surveys. Days typical for that facility are chosen for survey.

Some other factors to keep in mind when preparing for and conducting modal split surveys include the following:

- The positioning of survey staff should not bias the findings of the survey. For example, if people traveling to a particular building by subway typically approach the building from its, say, west side, positioning survey staff on the east side of the entrance to the building may result in their missing several or many subway trips.

- All entry and exit points should be covered. Although a building's rear door may look inconspicuous, it may in fact be used by a substantial number of people who get off the subway on that side of the building, or people who park in a garage on that street.

- Weather conditions should be noted since they may play a significant role in the decision of how to travel to work, particularly on days with inclement weather.

Table 3O-3

Examples of Previously Accepted Modal Splits for Transportation Analyses

(Typical Weekday AM or PM Peak Hour)

Land Use and Location	Percentage of All Trips by Mode						
	Auto	**Taxi**	**Subway/ Rail[1]**	**Express/ Local Bus**	**Ferry**	**Walk**	**Other**
Office, Midtown Manhattan	6	7	60	10	--	Varies	Varies
Office, Lower Manhattan	3	1	64	11	17	--	--
Office, Downtown Brooklyn	12	1	77	6	--	4	--
Office, Long Island City	32	1	60	5	--	2	--
Residential, Midtown Manhattan	10	10	45	15	--	20	--
Residential, Long Island City	23	1	63	3	--	10	--
Retail, Midtown Manhattan	2	3	20	5	--	70	--

Note: [1] - For sites located near commuter rail stations this should be separated into subway and commuter rail modes.

Modal split percentages above are *examples*. Specific values vary by location within an area and by proximity to transit services.

- Survey staff should be directed not to approach people selectively, i.e., to avoid a tendency to approach people based on their age, race, or sex, since this could bias the findings of the survey. One proper strategy is to approach every second or third person so as to preclude statistically biasing the survey.

It is also often advisable to conduct the trip generation surveys and modal split surveys concurrently. This helps provide an understanding of whether the particular modal split characteristics surveyed represented a particularly busy day or light day at the site. It is possible that for major trip generators, choice of travel mode can be influenced by patrons' expectations that travel to the site and to the area will be congested or not.

Studies have found that some people would use bicycles to travel to work if bicycle facilities were available at their place of work instead of using other modes, such as driving. These facilities would include: bicycle storage areas (racks, bicycle lockers, storage room), locker rooms, and showers. Use of bicycles would be dependent on the distance that the person must travel. Many New Yorkers with less than five mile commuting distances already use bicycles.

342.4. Determination of the Volume of Trips by Travel Mode

Once the modal split characteristics of a proposed action have been determined on a percentage basis, the volume of trips by mode can be determined by multiplying the volume of person trips to be generated in each analysis hour by the modal split percentage. This yields the volume of persons traveling by each mode for bus, subway, and walk modes and, for certain projects in unique settings, by rail or ferry. To determine the volume of vehicles—i.e., autos and taxis—generated in the analysis hours, an average vehicle occupancy factor is applied. This factor will differ for different land uses and in different parts of the City. As one example, average auto and taxi occupancies of 1.65 and 1.40, respectively, have most often been used for office and residential projects in Midtown Manhattan.

At the conclusion of this analysis element, it is advantageous to summarize in a table the volume of vehicular trips by mode—auto, taxi, and truck—for each of the analysis hours, both to document the volume of trips generated and to facilitate the subsequent trip assignment task. For projects requiring an air or noise analysis, further categories of vehicles would be needed.

343. Trip Assignment for Traffic and Parking

This element of the build analysis entails the routing, or "assignment," of vehicle trips to and from the project site and its parking facilities via streets and highways. To estimate which streets and highways are likely to be used and the extent to which each will receive vehicular traffic, origin-and-destination studies should be used. Prevailing traffic volume patterns in the area should be reviewed and can be used as a guide in developing the origin-destination patterns.

343.1. Trip Origins and Destinations

The first step in the traffic assignment process is to determine the extent to which trips to the project site will be made from various parts of the metropolitan region. The best source of this information, if available, is origin-and-destination (O&D or O/D) data, or information about the location where a trip began and the location where it will end. For certain parts of the City that have been studied or surveyed before, such data may be readily available. An example of this is Midtown Manhattan office space, for which there exists a body of information on what percentage of Midtown's employees typically come from Manhattan residences, the other boroughs, New Jersey, Long Island, etc. This information has been derived from the U.S. Census or other O&D surveys. The U.S. Census also contains information on where residents of individual census tracts work, which gives the same information for home-to-work trips, and which can be used.

It is also possible to survey O&D patterns of a comparable type of site, similar to the types of surveys outlined regarding trip generation and modal split. Such surveys would ask travelers where their trip originated from (say, for surveys conducted at a work site for a commercial project) or where their trip was destined to (say, for surveys conducted at a residential building for people en route to their work places). The survey would also ask the trip purpose, since there may be important differences identified between work trips and recreational, educational, or other trips.

Many of the same survey guidelines discussed previously are followed, such as finding and surveying a similar type of facility in the same study area as the site of the proposed action. In this case, it will obviously be necessary that O&D data to be obtained and applied to a proposed residential building in Flushing be obtained via surveys of a residential building in Flushing and not in, say, Astoria since the choice of traffic routes will be different. On the other hand, a more unique type of proposed action such as, for example, an amphitheater in the Coney Island area of Brooklyn may not have a comparable survey location in the same area. In this case, information could be drawn from other similar types of facilities elsewhere in New York or for other different types of recreational/entertainment facilities in Brooklyn or Queens to make a reasonable and reasoned judgment for the specific proposed action being analyzed.

For certain projects, the sponsors or developers of the project may have conducted market studies that indicate the likely distribution of its users, and which can be used as a surrogate for new O&D studies. Once such O&D or market analysis data have been obtained, these can be used as the basis for the more specific traffic assignments that follow, which are presented below.

As part of many larger regional transportation studies, travel models have been developed that simulate the routes expected to be used by projected future projects. These studies may use one of several models that are currently in use nationally. The objective of these models is to define mathematically the travel characteristics of individual links in the regional roadway network to simulate how people decide to use specific routes and, thus, to predict how future trips will likely be made.

However, most of these traffic simulation models are very time-consuming and costly to develop, and do not necessarily provide more accuracy at an intersection-by-intersection level. They are generally beyond the means or required scope of the type of analyses covered in this Manual, unless the proposed action's sponsor/analyst team independently chooses to develop such a model. The analyst may, however, consider contacting NYCDOT, NYSDOT, NYCDCP or NYMTC to identify whether any recent studies have such modeled O&D information available for public use.

343.2. Study Area Traffic Assignments

Once the regional trip origins and destinations have been established, the assignment of vehicular trips to specific streets and through specific intersections within the traffic study area can proceed.

First, the major highway routes available to approach or depart the study area from each of the major trip origins or destinations are identified. For example, if the proposed action is a shopping center in downtown Flushing and available O&D sources indicate that 30 percent of the traffic will likely come from Long Island, the westbound Long Island Expressway and Grand Central Parkway would be identified as the major highway routes available to these travelers.

Next, the traffic assignment process identifies the "target" for which motorists would aim for parking their cars. If this is an on-site parking garage, the most direct routes to it would be identified for each arriving vehicular component. In some cases, there may be a single desirable route to the site, while for other cases there may be two or more reasonably equivalent alternatives. The site-generated traffic would be assigned to each of these likely routes to the extent (percentage-wise) deemed appropriate.

A proposed action may have multiple parking facilities available to it, both on-street and off-street. In this case, the analysis would consider how specific arrival routes could link up with the different parking sites via a reasoned judgment as to where motorists coming from different directions are likely to park. If a site has multiple parking facilities available to it, more cars cannot be assigned to any of them than its capacity can accommodate. If the proposed action were a corporate headquarters office space, for example, there may be assigned parking spaces, or employees may be expected to "learn," for example, that after 8:30 AM the closest garage always fills up and that those arriving at 8:45 or 9 AM do not touch the site but, in fact, go directly elsewhere to park. Also note that parking lots and garages that are occupied at 95 to 100 percent of their capacity or that have fewer than 50 vacant spaces in a lot with more than approximately 1,000 spaces in the existing or future no action condition may be considered to be at capacity and therefore unable to attract new parkers.

There are a multitude of such factors to consider very carefully with the motorists' point of view in mind. This traffic assignment step is the major determinant of whether and where a proposed action could have significant impacts. Again, factors for consideration include, but are not limited to, the following:

- Where are trips to the site of the proposed action expected to come from? Where will return trips go to?

- What are the major highway and arterial routes expected to be used by these motorists from their individual trip origins (and to their respective destinations)?

- Which streets are most likely to be used by motorists in getting to the project site from the major highways and/or arterials? How do they link to the facilities at which project-generated trips will park?

- Will traffic destined for the project site be accommodated at the site's one or primary parking facility, or will it be necessary for project-generated trips to circulate through the study area in search of hard-to-find parking? How can such a travel pattern be "modelled" in the traffic assignment?

The definition of vehicular traffic assignments may also account for pass-by trips and diverted-linked trips, in addition to a site's primary trips. The incorporation of an adjustment factor in the analyses to account for these phenomena is generally most applicable for major retail projects. Primary trips are trips made for the specific purpose of visiting the trip generator. Pass-by trips, on the other hand, are made as intermediate stops on the way from an origin to a primary trip destination. They are attracted to the site from traffic passing the site on an adjacent street that contains direct access to the generator. Diverted-linked trips are trips attracted from streets near the site but that require some diversion from one street to another to gain access to the site. The ITE *Trip Generation Manual* presents an excellent elaboration on accounting for these trips, including a range of pass-by and diverted-linked trip percentages surveyed at shopping centers and other land uses across the country. The estimates of the percentages to be used should reflect the extent of retail activity already in the vicinity of the site and volumes on adjacent and nearby roadways. In general, the combination of pass-by trips and diverted-linked trips to retail uses, restaurants, gas stations, and selected other uses can generally be assumed to be 25 percent. Documentation for any assumptions beyond that range should be provided.

In addition to auto trip assignments, taxi and truck trips are also assigned to the street network. It is important to note that project-generated *taxi* and *truck* trips may have a very different assignment than auto trips, especially in Manhattan where most taxi trips are local. It is also important to note that all taxi trips assigned "in" to the site should also be assigned away or "out" from the site, regardless of whether they are occupied or unoccupied.

Project-generated *truck trips* are routed on designated truck routes, as per NYCDOT guidelines and regulations. These regulations require trucks to use specific routes for the majority of their trips, i.e., until they must move onto local streets to reach their destination. NYSDOT regulations also preclude trucks and commercial traffic from using certain regional highways—generally those designated as "Parkways" or "Drives."

At the conclusion of these trip assignment steps for autos, taxis, and trucks, the analysis will have a percentage-assignment of the project's trip generation by each mode by highway and street in the study area network. At this point, these percentage assignments are reviewed to determine whether they reasonably represent expected traffic patterns to the site, and also whether there are any locations that would be likely to receive a significant amount of project-generated trips and that could be significantly impacted that were not included within the original study area. If so, they are added at this time and analyzed through each of the steps identified up to this point.

The last step in the trip assignment process is to multiply the project's expected total vehicle trip generation by the percentages assigned to each link and intersection in the network to determine the volume of vehicular trips likely to use the study area's street network. These volumes are then added to the future no action traffic volumes to prepare balanced future action traffic volume maps for each analysis hour.

The traffic assignments will also determine the volume of peak hour trips that are attracted to and depart from each of the parking facilities within the study area. The analysis would confirm that these peak hour trips to each parking facility do not exceed the number of spaces identified as available there at that time of the day. In fact, if the traffic assignment process indicates that the peak hour arrivals at a parking facility are even close to its capacity, further scrutiny of the trips assigned would be exercised, since parking lots and garages typically take more than just the peak hour or even two consecutive hours to fill up.

344. Preparation of Future Build Volumes and Levels of Service

Balanced traffic volume maps are prepared for action conditions, using the same methodologies outlined previously. It is important that these traffic volume maps balance, and that there are no unexplainable increases or decreases in traffic volume from one block to the next.

Capacity and level of service analyses are then completed as part of the assessment of future action traffic conditions, as are future action occupancy analyses of study area parking lots and garages. The methodologies to be used are the same as described previously, with certain special considerations.

Within the traffic analyses, the traffic assignment process may, for example, result in significant increases in the percentage of turns at specific intersections, so it may be necessary to recompute any capacity analysis input factors that could change. Should there be a shortage of parking spaces in the area, some project-generated traffic may need to be assumed to recirculate through the area in search of available parking.

Also, as part of the proposed action, changes may be proposed for specific streets that produce changes in their capacities, which would also be checked. Should a street closure, for example, be a part of the proposed action, the traffic assignment would not only encompass the routing of new project-generated trips to the site, but also the diversion of future no action trips to alternative streets.

The future action analyses culminate with the preparation of balanced traffic volume maps and a full set of capacity and level of service analyses (including v/c ratios and average vehicle delays for each lane group) for traffic conditions, as well as occupancy findings for parking facilities. Findings are presented in a clear tabular format that facilitates the subsequent comparison of no action and action conditions as part of the determination of significant impacts.

345. Assessment of Construction Phase Impacts

In addition to the assessment of impacts when the project is fully operational in its build year, the transportation analyses may also address projected impacts during a proposed action's construction phase. Multiphased projects may need to have construction impacts addressed for each of their phases. Because construction phase impacts are temporary in nature, they are typically analyzed in a primarily qualitative manner. Therefore, the determination of construction phase impacts entails an abbreviated version of the impact assessment framework described above. It focuses on depicting the key locations that are likely to be impacted and the general magnitude and duration of the impacts expected, rather than on all potential impact locations analyzed within the regular action analyses. However, construction phase impacts that last for extended periods may need to be addressed quantitatively, since such a construction period is often not considered temporary.

The construction phase impact assessment presents the anticipated *construction schedule*, indicating the *extent and duration of streets and roadway closures* (if any) by time of day and day(s) of the week. Such closures could entail the complete closure of a street 24 hours a day, the taking of one curb lane 24 hours a day to accommodate construction vehicles or field offices parked at the site, the closure of a lane or lanes during parts of the day, or other combinations or construction scenarios. The analysis comments on the extent to which these lane or street closures would impact on traffic flow in a qualitative, yet detailed, manner. This qualitative assessment considers whether the capacity losses and/or full street closures would affect traffic patterns, create traffic diversions, cause backups, and generally cause a significant deterioration in local or regional traffic flow.

The construction phase impact assessment also reviews any *impacts on parking supply* caused by the taking of lanes or the removal of parking spaces in on-site or nearby parking lots and garages, especially in active retail or residential areas where such losses may be deemed significant by store owners, shoppers, and residents. It considers the number of spaces lost during critical parking hours in the area over an extended period and, by comparing the reduction with the parking occupancy analyses previously conducted, determines whether this loss is likely to be significant or not.

The construction phase impact assessment should also *estimate the volume of vehicular traffic expected to be* generated during the critical time span of the construction schedule for very large projects only. This includes an estimate of the volume of autos bringing construction workers to the site during the peak travel periods, and the volume of trucks or other construction vehicles expected to access the site during those periods. This discussion also indicates what portion of the construction vehicle demand would occur at the same as peak commuting or background traffic conditions in the area. For example, the analyses might note that during the peak construction period approximately 10 to 15 trucks and 50 autos are expected to bring construction workers to the site during the 7 to 8 AM peak arrival hour for construction-related activity, and 3 to 5 trucks and 15 autos are expected to do likewise during the 8 to 9 AM peak travel hour in the study area today.

Lastly, the construction phase impact assessment addresses the likely significance of any such impacts on the study area street network. Quantitatively, this could include an evaluation of expected levels of service at a small representative sample of intersections in the study area that would be affected by construction traffic, or an assessment that peak hour trips are likely to be small enough not to have significant impacts on levels of service, v/c ratios, or average vehicle delays. The impact assessment also indicates the routes that heavy construction vehicles would use to approach and depart the site and whether or not any residential streets would be used.

346. Assessment of Vehicular and Pedestrian Safety Impacts

While the large majority of proposed actions will not require a detailed analysis of safety impacts, for some actions, they may need to be addressed. Such actions may include the presence of sensitive land uses in the vicinity of the proposed project, such as with hospitals, schools, parks, nursing homes, or elderly housing, that could be affected by traffic volumes generated by the proposed project.

Another case could include the proposed project's proximity to a roadway that either has high accident rates or a design that makes it difficult for pedestrians to traverse safely. One example would be a new school where a principal access path transverses a high accident location. The absence of controlled pedestrian crosswalks at key access points leading to/from a proposed project, crossing locations with difficult sight lines, etc., may all serve as indicators of current or future problems, and the potential for significant impacts associated with the proposed project. The key issue to be resolved in safety analyses is the extent to which vehicular and pedestrian exposure to accidents may reasonably be expected to increase with the proposed action in place.

The analysis of the proposed action may also consider potential safety effects on bicycle activity. For example, does the proposed action affect bicycle routes or paths, where the number of bicyclists is substantial? A quantitative analysis should be conducted indicating the number of bicycle accidents at the location, and may be combined with the evaluation of pedestrian safety.

The determination of significant impact potential will likely involve the experienced judgment of an individual knowledgeable in the traffic field. The assessment of impacts can generally be made at a qualitative level, but should indicate the nature of the impact, the volumes affected by or affecting such impacts (including the types of vehicles, including trucks; and the age group of pedestrians, such as children or the elderly), and the likelihood of its severity, if possible. Increased pedestrian crossings at already-documented high-accident locations would result in increasingly unsafe conditions. In addition, generating measurable pedestrian crossings at non-controlled locations, midblock or intersection, especially for sites generating young pedestrians, such as schools, parks and other similar locations also leads to unsafe conditions. The types of measures to improve traffic and pedestrian safety should be identified and coordinated with NYCDOT (also, see Chapter 3P Section 530, Pedestrian Mitigation).

Summary accident data for the most recent three-year period is available from NYCDOT, and a database containing all accident data from 1990 to the present is also available at NYCDCP offices, Transportation Division at 2 Lafayette Street. In addition, the following reference material may be helpful in addressing these issues: a)accident records at New York Police Department offices at One Police Plaza in Lower Manhattan; b) periodic reports may be available at NYCDOT offices at 40 Worth Street; and c) New York State Department of Transportation (NYSDOT) CLASS data available in its Albany offices.

400. Determining Impact Significance

The comparison of expected conditions in the future with and without the proposed action in place determines whether any impacts, or changes in future conditions, are to be expected. Whether or not an impact should be considered significant has not been defined with any universal concurrence in the traffic field. Nationally, there are no hard federal or industry wide standards in use. Each municipality, county, or state agency responsible for traffic operations and/or site plan approvals has either developed its own local set of standards, or responds to development proposals more qualitatively based on their sense of whether the proposal's trip generation is likely to be significant.

The differences between the hours of operation of different types of actions, the differences in the location of the actions Citywide, and the differences in the types of travel modes generated by the proposed action all play a role in determining whether or not an action's impacts are deemed significant. For example, two proposed actions, one of which would generate its trips during the conventional peak travel hours and the other of which would generate its traffic during non-peak hours, would not have the same effects on a community. With the same amount of trip generation or even the same resultant level of service, one's impacts may be significant while the others may not. In another example, if two proposed actions would generate the same volume of traffic, but one would be situated in a commercial area and the other on a quiet residential street, it is possible that only one of these actions would have significant impacts.

The determination of significant impacts must respond to several important questions:

- Would generated vehicle trips likely cause a noticeable change in volumes on study area streets?
- Would generated vehicle trips likely cause traffic delays considered unacceptable?
- Would generated vehicle trips likely create significant hardships for pedestrians crossing the affected streets?
- Would generated pedestrian trips likely cause noticeable delays and congestion to vehicular traffic?

- Would the location and use of truck docks or other goods delivery areas create significant problems for vehicles or pedestrians?

The sections that follow present recommended guidelines for determining impact significance in the areas of traffic operations and parking.

410. DETERMINATION OF SIGNIFICANT TRAFFIC IMPACTS

Different municipalities and agencies around the country use different definitions of a significant traffic impact. There is no industry wide standard for the definition of a significant traffic impact. In general, however, there is agreement that deterioration in level of service within the clearly acceptable range (LOS A through LOS C) is not considered significant.

In several municipalities, deterioration in level of service of one level or more—i.e., from LOS C to D, or from D to E, or from E to F—is considered significant. Other municipalities/regions use this same definition and add to it that deterioration within LOS E or F—e.g., from a "low-end" v/c ratio or average vehicle delay to a "high-end" v/c or delay within the same level of service category—is significant, although there is often no specificity of the increment of v/c or delay required to define significant. There are also variations on this basic criterion. For example, deterioration from LOS D to E may be considered a significant impact, while deterioration from LOS C to D is not, presumably because LOS D is often considered acceptable in densely traveled urban settings.

The following set of guidelines is appropriate in determining whether or not the traffic impacts of a proposed action being evaluated are significant:

- Build Condition intersection level of service deteriorating within clearly acceptable ranges (LOS A through LOS C) should not be considered a significant traffic impact. The level of service changes, however, would be disclosed and may, in fact, constitute significant impacts on neighborhood character, should they occur on residential streets (refer to Chapter 3H, "Neighborhood Character"). Levels of service that deteriorate from acceptable LOS A, B, or C in the future no action condition to marginally unacceptable mid-LOS D or unacceptable LOS E or F in the future build condition would be considered significant impacts.

- For any signalized intersection lane group with future no action levels of service of LOS D, an increase in projected delays of five or more seconds in a lane group should be considered significant if the Build delay exceeds mid-LOS D. For no action LOS E, 4 seconds of delay should be considered significant. For no action LOS F, 3 seconds of delay should be considered significant. However, if the no action LOS F condition already has delays in excess of 120 seconds, 1.0 second or more of delay should be considered significant, unless the proposed action would generate fewer than five vehicles through that lane group in the peak hour. These significant impacts would require mitigation.

  The sliding scale of significant delays, noted above by level of service at signalized intersections, is premised on the assumption that up to a 5-second delay can be accepted by motorists at currently acceptable levels of service (including marginally acceptable LOS D), and that at "stop-and-go" conditions where delays are greater than 120 seconds, delays of even 1 second should not be tolerated, and that mitigation should be required.

- For unsignalized intersections the same criteria as for signalized intersections would apply. For the minor street to trigger significant impacts, 90 passenger car equivalents must be identified in the future build condition in any peak hour.

- Highway or ramp sections being analyzed—including main line capacity sections, weaving areas, and ramp junctions—should not deteriorate more than one-half of a level of service between no action and build conditions when no action level of service is in the D, E, or F ranges.

For programmatic actions, it may be appropriate to extrapolate significant traffic impact findings for a representative set of intersections analyzed to the larger set of potentially affected intersections in a neighborhood. For example, for a set of four representative intersections in a neighborhood, a finding of no significant impact could possibly be extrapolated to a more general finding that no location in the neighborhood would be likely to be significantly impacted. Should the analysis indicate that one of the four locations would incur a significant impact, it may be possible to extrapolate that some percentage of the 40 intersections in the neighborhood that could be affected would possibly incur significant impacts.

This may be a difficult extrapolation to make and should be made with care. The analysis considers how representative or how critical the intersections analyzed are relative to other potentially affected locations in the area, the extent to which the analyzed intersections would be affected to a lesser or greater extent than other intersections not analyzed, etc. It should seek to provide some indication of what the analysis at the intersections studied mean overall.

420. DETERMINATION OF SIGNIFICANT PARKING IMPACTS

The build analysis culminates with an assessment of the impact of the proposed project on the study area's or neighborhood's available parking supply. Should the proposed action generate the need for more parking than it provides, this shortfall of spaces may constitute a significant impact on the area's resources. The availability of off-street and on-street parking spaces within a convenient distance (usually considered to be about a 5-minute, or ¼-mile, walk) is considered in making this determination. For example, should the amount of available parking spaces within this distance from the project site be ample to accommodate the project's parking shortfall, there would not be a significant impact. On the other hand, should the available parking supply just barely be able to accommodate the proposed action's shortfall, there would be an impact, but not necessarily a significant impact. In this case, the local parking supply would be sufficient to accommodate the proposed action's shortfall on a typical day but at the cost of usurping all of the adjacent area's supply, which may not be desirable in certain areas, particularly residential areas.

- For proposed actions within the Manhattan Central Business District (CBD) (the area south of 61st Street), the inability of the proposed action or the surrounding area to accommodate projected future parking demands would generally be considered a parking shortfall, but is not deemed to be a significant impact. The unsatisfied demand for parking spaces would result in vehicles parking outside of the immediate area and motorists' perhaps walking extended distances to their destination or taking mass transit or a taxi for the final "leg" of their trip. Or, it is possible that, in time, this demand will shift to an alternative travel mode.

- For proposed actions in other CBDs or outlying business districts (OBDs), such as downtown Brooklyn, downtown Jamaica, and downtown Flushing, a parking shortfall that exceeds more than half the available on-street and off-street parking spaces within ¼ mile of the site may be considered significant, since the need for parking in these areas is often critical to businesses in the area.

- For residential areas outside the Manhattan CBD, a parking shortfall that exceeds the number of off-street parking spaces and more than half the available on-street spaces within ¼ mile of the site may be considered significant. It is also possible that very small shortfalls may be deemed insignificant.

One other evaluation can be considered outside the Manhattan CBD, namely whether there is sufficient available parking within ½ mile (rather than ¼ mile) of the project site to accommodate the projected shortfall. If there is—and it should be noted that ½-mile may be considered a less-than-convenient walk for many motorists—parking impacts may not necessarily be significant, and this information would be provided for decision-makers. Even if there is sufficient parking available within this extended distance from the project site, there is a possibility that project parkers would find spaces to park in closer to the site and thus force others who arrive later or live in the area to park farther away from their destinations, thereby still creating an overall significant impact. A similar approach would be used for programmatic actions.

500. Developing Mitigation

The identification of significant impacts leads to the need to identify and evaluate suitable mitigation measures, i.e., measures that mitigate the impact or return projected future conditions to what they would be if the proposed action were not in place, or to acceptable levels (for future no action LOS mid-D, E, or F, mitigation back to the no action condition is required; for future no action LOS A, B, or C, mitigation to mid-LOS D is required). In general, the analysis begins by identifying those measures that would be effective in mitigating the impact at the least cost and then proceeds to measures of increasingly higher cost only if the lower cost measures are deemed insufficient. In doing so, care should be exercised that the implementation of a given measure not mitigate impacts in one area—either geographic or technical—only to create new significant impacts or aggravate already projected significant impacts elsewhere.

For example, one commonly recommended traffic mitigation measure is to retime existing traffic signals to provide increased green time—and thus increased capacity—to the intersection approach that is significantly impacted. Not only should the traffic analysis make sure that other intersection approaches that would lose green time could afford to do so, and that existing signal progression along an important arterial not be unduly impacted, but also that pedestrians crossing the street still have sufficient green time for them at crosswalks losing pedestrian green time. The same concern is apparent with respect to parking, where the prohibition of curbside parking along an intersection approach that requires an additional travel lane could reduce the supply of parking spaces by an amount large enough to trigger a parking shortfall. Other examples indicating trade-offs between traffic and transit issues, and transit and pedestrian issues, are described in Chapter 3P, Transit and Pedestrians. Also, traffic mitigation analyses need to consider potential implications on air quality, noise, and, possibly, neighborhood character analyses.

The separate transportation services and facilities need to be considered as a system, wherein changes in one could impact activity patterns and/or levels of service in another. This is a very important point that needs to be viewed comprehensively. It is possible that recommendation of a major new transit service—such as institution of ferry service at a new waterfront site—that is generally viewed as a major overall access benefit, would also have secondary impacts that need to be evaluated as to whether they are significant and themselves require mitigation. Would pedestrian flows to and from the ferry landing cause impacts? If buses are rerouted to connect with the ferry, would intersection capacity be affected? Would there be sufficient parking for ferry users? This does not mean that broader, more effective or desirable mitigation measures should not be considered, but rather that a comprehensive look and evaluation is needed.

There are two alternative approaches to the mitigation analyses for a programmatic action. The first entails a detailed quantitative analysis of mitigation measures similar to that done for site-specific actions, with the advisory note that the traffic analysis may need to extrapolate the findings to more than just the sample intersections analyzed.

The other approach entails a qualitative evaluation of whether the impacts of a programmatic action can be mitigated and by what level of mitigation measure (low-cost, moderate-cost, high-cost, enforcement, or travel demand management). This can be done but will generally require considerable judgment of an individual with at least several years of experience in the traffic field. For example, it would be necessary for this individual to look at the signal timing at a particular intersection and at the relative levels of service of an intersection's approaches and determine whether a simple green time reallocation would be sufficient to mitigate significant impacts, or whether parking regulation modifications are sufficient, or whether a higher level of mitigation costs will be needed. The basis for such judgmental determinations should be clearly explained in the analyses.

Once the mitigation analyses have been completed, it is necessary to review the required mitigation measures with NYCDOT and gain its approval, since NYCDOT is the agency responsible for their implementation. For EISs, it is preferable to do this prior to the draft EIS stage; in any case, it must be concluded before finalizing the final EIS.

510. TRAFFIC MITIGATION

The range of traffic mitigation measures can be viewed as encompassing five categories: a) low-cost, readily implementable measures; b) moderate-cost, fairly readily implementable measures; c) higher capital cost measures; d) enforcement measures; and, e) trip reduction or travel demand management measures. Some discussion of the benefits and issues associated with each of these types of measures is presented below.

511. Low-Cost, Readily Implementable Measures

These mitigation measures typically include signal phasing and timing modifications, parking regulation modifications, lane restriping and pavement marking changes, and turn prohibitions, street direction changes, and other traffic-signage-oriented changes. NYCDOT approval is required for the acceptance and implementation of these measures.

- *Signal phasing and timing modifications.* The goal of signal timing modifications, which is often the first traffic mitigation measure considered, is to shift green time from the approaches to an intersection that have clearly sufficient capacity to those that need additional green time to accommodate their traffic demand. Signal phasing modifications are considered typically when a specific movement at an intersection requires exclusive time for its movement to be completed. For example, northbound left turns at an intersection may often proceed together with all other north- and southbound traffic. Provision of a separate signal phase for left turns will generally allow them to move conflict-free and, thus, at a better level of service. Care should always be exercised that provision of such an exclusive phase not significantly impact other traffic movements at the intersection.

  Signal phasing modifications need not only be the provision of a separate phase for a particular left turn volume. It could also be an advance phase for an entire approach to an intersection, or a combination of different movements that do not conflict, etc. Phasing and timing modifications may also be helpful in mitigating pedestrian crossing problems at particular intersections. Application to NYCDOT must be made for signal phasing and/or timing modifications.

  Evaluation of these measures also considers their implication on pedestrian crossings and waiting areas, as well as on the overall signal progression along a corridor or through a CBD area.

- *Parking regulation modifications.* The goal of this measure is to restrict, remove, or relocate curb parking (including bus stops) along streets where additional travel lanes are needed for traffic capacity reasons, or to reduce conflicts between cars involved in parking maneuvers and through traffic. In adding capacity by removing on-street parking, the analysis also evaluates whether there is sufficient parking space within the study area to accommodate those parked cars that have been displaced.

- *Lane restriping and pavement marking changes.* The objective of these measures is to make more efficient use of a street's width, either in providing an exclusive turning lane, restriping the lane markings to give greater width to those movements that need them, etc. For example, an intersection approach characterized by a very heavy left-turn movement and low to moderate through and right-turn lanes may currently provide a 10-foot left-turn lane and three 12-foot lanes for the other movements. Restriping the approach to provide a 13-foot left-turn lane and three 11-foot for the other movements may provide left-turning vehicles with the capacity they need. One other objective would be to improve pedestrian safety by widening crosswalks at critical intersections.

- *Street direction and other signage-oriented changes.* At times, it may be advisable, or necessary, to convert a two-way street to one-way operation or vice versa, or convert a pair of two-way streets into a pair of one-way streets. This tends to provide greater traffic capacity since it removes conflicts typically inherent in two-way traffic, particularly from left turns vs. oncoming traffic movements at high volume intersections. Any street direction changes require re-analysis of all potentially affected intersections in the study area (and outside the area, if appropriate), pursuant to the methodologies described in Section 200 of this chapter.

  Other traffic mitigation measures here include the prohibition of left turns or right turns, or signage that requires all vehicles in a given lane to turn left or right or to only proceed through the intersection. Since it generally takes more time and capacity for vehicles to make turns than to proceed straight through an intersection, these measures often offer substantial capacity benefits. Again, the traffic analysis would need to assess carefully the diversions of traffic to other streets and their impacts there.

512. Moderate-Cost, Fairly Readily Implementable Measures

These measures typically involve a level of capital costs somewhat higher than those defined above, yet which are generally considered moderate overall, such as intersection channelization improvements, traffic signal installation, and others.

- *Intersection channelization improvements.* Channelization improvements are intended to provide traffic movements with greater clarity or ease of movement. They may include minor widening of the approach to an intersection to provide an increased curb radius for right-turning vehicles, a median separating the two directions of traffic flow on a two-way street, or islands for pedestrian refuge or to delineate space for turn movements through an intersection.

Channelization improvements may also be needed to offset a roadway's centerline so that one of the lanes available to traffic can be used in one direction in, say, the AM and the other direction in the PM, to make more efficient use of the total roadway width available to traffic. If this type of channelization is accomplished via traffic cones, it is really an enforcement-type of mitigation (discussed later). If it involves overhead signage, it is generally a moderate cost measure.

- *Traffic signal installation.* At times, it may be necessary to propose the installation of a traffic signal where an unsignalized intersection does not possess sufficient capacity to process cross-street traffic volumes or where it would mitigate vehicular or pedestrian safety impacts. Recommendation of this mitigation measure also requires the completion of a signal warrant analysis—this is a set of volume and safety evaluations needed to determine whether a signal is warranted. NYCDOT would accept such a measure at the EAS or EIS stage.

There are NYCDOT, New York State, and federal government guidelines on the conduct of signal warrant analyses. The NYCDOT guidelines should be consulted and a *preliminary* warrant analysis conducted to determine the likelihood that an intersection's volumes will warrant a signal. A final warrant analysis is usually conducted by NYCDOT only *after* a proposed project is built and operational; except for vary large projects (e.g., regional shopping centers); NYCDOT has generally chosen not to authorize installation of a new signal until volumes and conditions projected in a proposed action's traffic study actually occur.

513. Higher-Cost Mitigation Measures

In general, this category of mitigation measures includes street widenings, construction of new streets, construction of new ramps to or from an existing highway, implementation of a sophisticated computerized traffic control system, and other measures that are typically physically oriented and not readily implementable.

- *Street widenings.* When implementation of capacity improvements such as signal phasing and timing changes, curb parking prohibitions, bus stop relocations, and others are not sufficient to provide the required capacity within the existing street width, it may be possible to widen the street, to provide wider travel lanes or additional travel lanes. The effect on pedestrian movements in the area would be jointly analyzed with this mitigation measure.

- *Construction of new streets.* At times, it may be advantageous to either reopen a closed, or demapped, street or construct a new street leading to a development site. This access improvement could thus potentially provide a new access route to the site and alleviate projected congestion on existing routes. It is a relatively uncommon measure that is occasionally available to large projects in settings where existing street access is rather limited.

- *Construction of new highway ramps.* The objective of this measure is to provide an additional means of access from the primary regional route(s) leading to a project site. When access to the site is via an existing highway ramp that leads to an already congested local street en route to the site, construction of a new ramp could relocate traffic to another street better able to accommodate it. Since many of the City's highways are under NYSDOT jurisdiction, coordination and approval from that agency, in addition to NYCDOT, may be required.

514. Enforcement Measures

These measures generally involve costs that accrue to the City over a period of time, rather than as one-time construction costs, and include the deployment of traffic enforcement agents (TEAs), parking enforcement agents (PEAs), or certain types of physical improvements that are variable by time of day.

- *Traffic enforcement agents.* TEAs are often deployed by NYPD at critical locations where it is important to minimize spillback through an intersection, and thus avoid potential gridlock. By virtue of their being stationed at busy intersections, the TEAs are also able to manually override the traffic light's signal timing patterns, and allocate the amount of green time to each approach of traffic that minimizes queues and delays. The recommendation of deploying TEAs at a significant impact location may be appropriate where: a) an intersection is unsignalized and a TEA could ensure that minor street traffic gets the green time needed to pass into or through the intersection; or b) an intersection requires several different timings to function optimally at different times of the day (e.g., during peak exit periods from a sporting event).

- *Parking enforcement agents.* PEAs may be deployed by NYPD to ensure that on-street parking regulations are obeyed and that the required number of moving travel lanes—and thus capacity—is maintained during critical time periods. Within the traffic analyses, it may be insufficient to assume that the mere replacement of an existing curb parking regulation with a more restrictive one will automatically ensure that the curb lane is fully free of parked cars at times when its capacity is needed for moving traffic. At critical locations, the deployment of PEAs will assist in ensuring that the lane's capacity will be available.

It should be noted that the use of enforcement agents as mitigation is not a preferred measure due to their recurring annual cost. Historically, enforcement agents have been considered only for City-sponsored projects as a matter of City policy. However, for construction-related impacts that are temporary in nature, enforcement agents may be an appropriate measure.

515. Trip Reduction or Travel Demand Management Measures

Trip reduction or travel demand management (TDM) measures seek to either reduce the volume of vehicular trips generated by a project, divert them to higher-occupancy vehicles than single-occupant autos, or divert them to hours that are not as critical as the hours for which significant impacts were identified. These measures include carpooling or vanpooling, staggered work hours or flextime programs, new transit services or transit subsidies, telecommuting, and a range of other actions.

- *Carpooling and vanpooling.* The objective here is to promote the formation of carpools or vanpools that will draw people out of their single-occupant vehicles or otherwise increase the average occupancies of all vehicle traffic generated by the site.

- *Staggered work hours and flextime programs.* The objective of these actions is to stagger the times at which people drive to and leave their workplace so as to reduce the volume of vehicular traffic on the road during the affected area's peak commuting hours. With staggered work hours, employees work somewhat different shifts; under flextime, employees are free to arrive at work at any time within a given range (say, 7:30 to 9:30 AM) and leave within a given range (say, 4 to 6 PM).

- *New transit services.* This action may include provision of a company shuttle bus linking the workplace with the nearest mass transit stop, initiating shuttle bus or jitney service for noontime trips to local retail areas, or the extension of existing bus routes to the site, with the objective of promoting transit usage to the maximum extent possible.

- *Telecommuting.* With telecommuting, employees may work a specified number of days per week or per month either at a telecommuting center where they can complete their assignments on a centralized set of computers or work stations, or at employer-provided installations in their home. The objective is to reduce the volume of trips being made.

- *Bicycle facilities.* The objective of this action is to promote the use of bicycles as a mode of travel to work by providing bicycle facilities such as secure indoor bicycle storage areas, locker rooms, and showers. Studies have shown that up to 3.9% of those who would normally use an automobile or taxi to travel to work would use a bicycle if bicycle facilities were available. If it is found through surveys that the projected users of the site would use bicycles instead of automobiles, then the number of projected automobile person-trips could be reduced by up to 3.9% for sites such as offices and industrial workplaces.

Although the measures described above may be implemented individually, their implementation as a collective menu of trip reduction options—referred to as TDM—is a relatively new concept in mitigation. Often, employers are required to implement a TDM plan with a specified mandatory trip reduction—say, reduction of peak hour vehicle trips by 15 percent—with each of several TDM action options available to employees, as long as the overall goal is met.

Again, the definition of the mitigation needs of the proposed action would typically start with the low-cost, readily implementable measures and proceed to the higher cost measures. TDM actions can be considered concurrently with the low-cost measures and may, in fact, be more desirable since they reduce auto dependency. It should be noted, however, that embracing TDM as mitigation will mean that the project developer, sponsor, and/or tenant will need to make a firm commitment to actions that may to some degree affect the way their business is conducted (e.g., altering work schedules, commitment to vanpools, etc.).

520. PARKING MITIGATION

The range of measures that could generally be considered to mitigate significant parking impacts include the following:

- Provision of additional parking spaces as part of the proposed action, including such provision off-site but within a convenient walking distance from the site.

- Modification of existing on-street parking regulations in an appropriate manner—for example, where a less restrictive parking regulation would not affect the capacity of the street to process adjacent vehicular traffic demands.

- Implementation of new transit services (e.g., bus routes or bus route extensions) or trip reduction initiatives that would change the projected modal split or reduce the number of vehicles traveling to (and parking at) the project site. The addition of bicycle facilities such as indoor secure storage areas, locker rooms and showers would encourage the use of bicycles to travel to the workplace.

In general, where a significant impact has been identified, a proposed action should strive to provide the amount of parking it needs as part of the proposed action rather than relying on available off-site parking supplies.

600. Developing Alternatives

610. DEVELOPMENT OF ALTERNATIVES

The alternatives analysis of the EIS is intended to depict and analyze alternatives to the proposed action that are likely to eliminate or reduce significant impacts expected to be generated by the proposed action. Since traffic impacts are often among those determined to be significant, there are attributes of a proposed action that, if changed, can result in a reduction of expected impacts. Guidance regarding the development of such alternatives follows.

611. Reductions in Size

The first and most logical alternative is a scaling down of the size of the proposed action, e.g., reducing the amount of proposed square footage to reduce its overall trip generation. This approach will generally lead to a proportional reduction in the amount of trips generated, but not necessarily in the magnitude of the impacts that would occur.

612. Different Uses

A second type of alternative involves replacement of a high trip-generating land use component of the proposed action with a lesser trip generator. For example, residential uses are generally much lower generators of trips than are office buildings or shopping centers. Care would be needed to make sure that the times in which trips are reduced are those times at which significant impacts are expected. For example, potential replacement of office space with retail space may reduce the volume of trips generated by auto in the AM when retail activity is light, but not at midday when retail uses are very active. Should the preceding build analyses determine that there would be a significant traffic impact in only the midday peak hour, this replacement alternative would not be beneficial.

Consideration of this category of alternative must also recognize that different types of land uses may tend to have different modal splits as well, and that a land use that has a lower overall trip generation rate may not necessarily generate fewer trips by *all* modes. For example, framing an alternative that responds to a significant traffic impact under the proposed action with a less-intensive overall trip generator that has a higher auto-plus-taxi use percentage may not result in a removal of the impact. The alternatives analysis would consider the type of impact found significant and consider alternatives that reduce *that* impact during the specific significant impact hour.

613. Changes in Access and Circulation

Another type of alternative revolves around physical site changes that do not necessarily reduce the overall volume of trips generated or the number of trips generated during a specific impact hour, but that affect access and circulation patterns and effectively move traffic to locations or routes that would not be significantly impacted. There are several examples of this.

Relocation of a project's proposed parking facility or the facility's entrance may positively affect traffic patterns and divert traffic away from significant impact locations. Provision of parking—or additional parking—can reduce the undesirable circulation of vehicles on-street in search of hard-to-find parking spaces. This is especially true for proposed actions that either do not include parking as part of their project, or where the amount of parking is appreciably short of the demand. For major projects that include large parking garages (e.g., 500 or more parking spaces), it may be advantageous to split the parking into two sites rather than one, to disperse traffic to different routes rather than having all of it concentrated at a single entrance and exit location and a single primary access route.

Relocation of a project's main entrance can also alter access patterns for both vehicular, transit, and pedestrian access. A proposed action that generates a substantial volume of vehicular drop-offs, such as a hotel in Midtown Manhattan, for example, could potentially shift its main entrance to a location on the site that reduces significant traffic impacts at critical locations or that minimizes conflicts between vehicles engaged in picking up or dropping off passengers and other vehicles driving past the site. Such "front door" relocation may also make pedestrian access from nearby subway stations more convenient or reduce congestion at key crosswalks or corner reservoir spaces in the affected area.

Relocation of a project's loading docks, or their reconfiguration, could also have similar benefits in moving the goods delivery function to a location that does not significantly impact traffic or pedestrian flow. Reconfiguration of a proposed loading dock from a back-in operation to one in which the trucks can pull directly into the delivery area would also relieve pressure on traffic and pedestrian movements. It should also be noted that NYCDOT has indicated a strong preference for front-in and front-out truck operations.

614. Other Alternatives

There may be other alternatives that are tailored to a specific proposed action at a specific site that could be developed. In general, to be effective, they should either reduce the overall level of trip making, shift trip making to noncritical hours or to noncritical modes, or alter the physical design of a project to relocate trips away from identified significant impact locations. However, all alternatives must be approved by the lead agency.

620. EVALUATION OF ALTERNATIVES

In evaluating the impacts of the alternatives relative to the impacts previously determined for the proposed action, it is generally not necessary to conduct a full analysis of the traffic and parking systems conducted as part of the build analyses. However, regardless of the technical approach taken, conclusions made from the analyses of alternatives must have a degree of confidence reasonably comparable to that for the analysis of the proposed action.

For alternatives that reduce the size but not the land use mix of the proposed action, it may be possible to scale down the proposed action's trip generation projection and then pro-rate the findings of the traffic and parking analyses accordingly. Yet, while the scaling down of volumes may be appropriate, the pro-rated evaluation of vehicle delay time and other level of service analyses may not. It is generally possible to reanalyze just the locations determined to have significant impacts under the proposed action and report these findings along with the overall trip reduction that would occur under the alternative.

A more comprehensive approach would be to evaluate a set of analysis locations that includes several or all significant impact locations and report the number and percentage of significant impacts likely to be avoided. This may be especially appropriate for proposed actions with extensive study areas and with a substantial number of projected significant impacts. For example, a proposed action with a study area encompassing 100 traffic intersections analyzed for two different build years within a multiphase build-out, which is determined to have 45 significant impact locations in one build year and 30 in the other, need not reanalyze all of the 75 significant impact conditions. It may be possible to analyze a smaller, yet representative, set of significant impact locations (say, the most impacted 15 of the locations), reanalyze those for the two build years, and project the findings into the likely number of significant impacts that would remain overall under the alternative.

For alternatives that alter the mix of land uses within the proposed action or replace a more intensive trip generator with another less intensive trip generator, it would generally be necessary to first quantify the magnitude of changes in the projected trip generation by travel mode for the peak analysis hours, and then determine the likelihood that new impacts could be created from those determined for the proposed action. Afterwards, the technical analysis approach could follow the guidelines provided immediately above.

For alternatives that contain physical design changes that alter access and circulation patterns, the analysis would evaluate the likely access routes expected under the alternative, and where these changes would positively and adversely affect traffic conditions. If this review indicates that traffic increases would occur along routes and at locations that likely will not be significantly impacted, this evaluation is documented. If it encompasses locations that have not been analyzed earlier in the EIS, and it is readily apparent that conditions there are not currently problematic nor are they likely to be problematic, that evaluation would suffice but is reported. If this evaluation cannot be made with a reasonable degree of certainty, other available sources of data would be sought to make a preliminary evaluation. If this preliminary evaluation indicates that problematic levels of service currently exist, or that significant impacts may occur in the future with background growth and the project-generated trips factored in, these findings would be documented based on the data at hand.

In general, the evaluation of alternatives documents the following:

- Would the alternative result in increased or decreased trip making by travel mode during the peak analysis hours? This finding is typically quantified.

- Would the alternative result in the reduction or elimination of significant impacts, and by what amount? It is preferable to determine whether all significant impacts would be avoided or reduced under the alternative, but for very large-scale proposed actions a representative set of significant impact locations may suffice as long as the technical analysis can present its conclusions in a comparably confident manner to that of the proposed action. An assessment of the implications of the analyses on this representative set of locations is presented for the overall study area.

- Would any new significant impacts be expected to occur under an alternative? This would be especially germane for alternatives that alter travel patterns within the study area.

700. Regulations and Coordination

710. REGULATIONS AND STANDARDS

There are no specific regulations governing the conduct of traffic and parking analyses. Therefore, the procedures and methodologies that are described in this Manual are intended to provide assistance in the structuring and conduct of EIS and EAS transportation impact analyses.

720. APPLICABLE COORDINATION

Lead agencies should be aware that it is necessary to seek approvals for mitigation measures from agencies that would be responsible for implementing those measures. In these instances, the lead agency should confer with the appropriate agencies. These agencies include the NYCDOT for traffic, parking, and goods delivery analyses. It is also advisable to confer with the DCP regarding its policy guidelines. It is also important to note that coordination with the analytical needs of other environmental categories (e.g., air quality, noise, neighborhood character) may be needed; other chapters of this Manual should be referred to regarding those needs.

730. LOCATION OF INFORMATION

Much, but certainly not all, of the information needed to conduct the traffic and parking analyses may be available within the technical libraries and files maintained by City and state agencies. Although it is likely that a significant amount of data will need to be collected via field surveys and traffic counts, contact should be made with OEC, NYCDOT, DCP, and other agencies that may possess information that would be helpful and could save time and resources. In some cases, the traffic analyses may be improved through the use of a specific set of available data, rather than new counts or surveys. This may be true, for example, where a recent similar study has been completed in the same or neighboring area, and it is important for the data and findings of that study and the analysis of the proposed action to be consistent.

An initial listing of the location of primary sources of available traffic and parking data is presented below, and followed with an indication of those technical areas in which original research or surveys are often required. This list may be revised or augmented from time to time.

731. Sources of Available Traffic Data

- EISs and EASs that contain original volume or survey data that are reasonably recent enough to be valid for the area surveyed. It is strongly preferred that traffic count data not be more than three years old at the time the draft EIS is certified as complete. It may be possible to use somewhat older data, but only for areas that have undergone very little change and for which the data still validly represent conditions in the area.

  Sources: OEC, 100 Gold Street, 2nd Floor, Manhattan, NY 10038; DCP, Environmental Assessment and Review Division, 22 Reade Street, Manhattan, NY 10007 (website: www.nyc.gov/planning); DEP, Office of Environmental Planning, 59-17 Junction Boulevard, Elmhurst, Queens, NY 11373 (website: www.nyc.gov/dep); and NYCDOT, Traffic Planning Division, 40 Worth Street, Manhattan, NY 10013 (website: www.nyc.gov/calldot).

- Traffic studies with original volume or survey data that satisfy the guidelines above.

  Sources: NYCDOT, Traffic Planning Division, 40 Worth Street, Manhattan, NY 10013 (website: www.nyc.gov/calldot); or NYCDCP, Transportation Division, 2 Lafayette Street, Manhattan, NY 10007 or Environmental Assessment and Review Division, 22 Reade Street, Manhattan, NY 10007 (website: www.nyc.gov/planning).

- NYCDOT 24-hour automatic traffic recorder (ATR) counts or other intersection counts, with the same time frames noted above.

  Sources: NYCDOT, Traffic Planning Division, 40 Worth Street, Manhattan, NY 10013 (website: www.nyc.gov/calldot); or NYCDCP, Transportation Division, 2 Lafayette Street, Manhattan, NY 10007 or Environmental Assessment and Review Division, 22 Reade Street, New York, NY 10007(website: www.nyc.gov/planning).

- Bridge and tunnel volume information, including peak hour volumes and growth trends, which may help in developing trend line projections and understanding seasonal fluctuations in traffic volumes.
  Source: NYCDOT, Traffic Planning Division, 40 Worth Street, Manhattan, NY 10013 (website: www.nyc.gov/calldot).

- NYCDOT Truck Regulations, which define the designated truck routes to be used for traffic analyses.

  Source: NYCDOT, Traffic Planning Division, 40 Worth Street, Manhattan, NY 10013 (website: www.nyc.gov/calldot).

- NYCDOT signal operations information, which provides signal phasing and timing information needed to conduct the traffic analyses.

  Source: NYCDOT, Signals Division, 34-02 Queens Boulevard, Long Island City, Queens, NY 11101 (website: www.nyc.gov/calldot).

- NYCDOT parking regulations inventory, which provides a computer listing of all approved parking regulation signs throughout the City, for use in the traffic analyses should field surveys indicate that signs have been vandalized or stolen.

  Source: NYCDOT, 28-11 Queens Plaza North, Long Island City, Queens, NY 11101 (website: www.nyc.gov/calldot).

- Institute of Transportation Engineers (ITE) *Trip Generation Manual* (Latest Edition), which provides a comprehensive summary of trip generation rates for determining the volume of trips that a proposed action will generate. These rates are based on nationwide, rather than local, surveys which may not be appropriate for New York City conditions in many cases.

Sources: NYCDOT, Traffic Planning Division, 40 Worth Street, Manhattan, NY 10013 (website: www.nyc.gov/calldot); ITE Headquarters, 1099 14 Street, NW, Suite 300, Washington, DC 20005 (website: www.ite.org); or NYCDCP, Transportation Division, 2 Lafayette Street, Manhattan, NY 10007 or Environmental Assessment and Review Division, 22 Reade Street, NY 10007 (website: www.nyc.gov/planning).

- Trip generation and temporal distribution data published in *Urban Space for Pedestrians* by Pushkarev & Zupan (1975).

  Sources: NYCDOT, Traffic Planning Division, 40 Worth Street, Manhattan, NY 10013 (website: www.nyc.gov/calldot); or NYCDCP, Transportation Division, 2 Lafayette Street, Manhattan, NY 10007 or Environmental Assessment and Review Division, 22 Reade Street, NY 10007 (website: www.nyc.gov/planning).

- The following publications provide bicycle data and research:
  NYCDOT, *Traffic Congestion and Pollution Relief Study* (1991).
  NYCDOT, *New York City Bicycle Master Plan* (1997).
  NYCDOT, *New York City Bicycle Statistics* (Regular Updates).
  NYCDCP, *Greenway Plan for New York City* (1993).
  NYCDCP, *New York Bicycle Lane and Trail Inventory* (Regular Updates).

It is also possible that additional surveys or original research will be needed to provide either the most up-to-date representation of conditions where available data are too old to be used or where the data required simply are not available. Moreover, recently collected original survey data are typically preferred, providing they are obtained in a proper manner and reflect the specific nature and geographical setting of the proposed action.

732. Sources of Available Parking Data

- EISs or EASs that contain parking inventory or occupancy information that is reasonably representative of current conditions.
  Sources: OEC, NYCDCP, NYCDEP, or NYCDOT, as cited above.

- Parking studies that contain such data.

  Sources: NYCDOT, Traffic Planning Division, 40 Worth Street, Manhattan, NY 10013 (website: www.nyc.gov/calldot); or NYCDCP, Transportation Division, 2 Lafayette Street, Manhattan, NY 10007 or Environmental Assessment and Review Division, 22 Reade Street, NY 10007 (website: www.nyc.gov/planning), as cited above.

- NYCDOT parking regulations inventory.

  Source: NYCDOT, 28-11 Queens Plaza North, Long Island City, Queens, NY 11101 (website: www.nyc.gov/calldot).

- ITE *Parking Generation Manual*, which provides the maximum parking supply needed to serve a proposed land use. As discussed earlier for trip generation data, it should be noted that data contained in the *Parking Generation Manual* is based on nationwide sources of survey data that may not be fully appropriate in New York City.

  Sources: NYCDOT, Traffic Planning Division, 40 Worth Street, Manhattan, NY 11101 (website: www.nyc.gov/calldot); or ITE headquarters, 1099 14 Street, NW, Suite 300, Washington, DC 20005 (website: www.ite.org).

- Parking capacities and licensing information.

  Sources: New York City Department of Consumer Affairs, 80 Lafayette Street, Manhattan, NY 10013 (website: www.nyc.gov/consumers); or NYCDCP, Transportation Division, 2 Lafayette Street, Manhattan, NY 10007 or Environmental Assessment and Review Division, 22 Reade Street, NY 10007 (website: www.nyc.gov/planning).