TRAFFIC IMPACT STUDY MANUAL

JULY
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City of San Diego

TRAFFIC IMPACT STUDY MANUAL

FINAL

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TABLE OF CONTENTS

PREFACE

1. INTRODUCTION
Need and Purpose 1
Review Process 1
Objectives 1
Who Should Prepare Traffic Impact Studies? 1
Who Should Review Traffic Impact Studies? 2
Standard Review Times 2
Ethics and Objectivity 2

2. INITIATING TRAFFIC IMPACT STUDIES
Warrants for Studies 3
Extent of Study 3
Study Area 5
Staff Consultations 6
Screen Check Procedures 7

3. CONTENT AND FRAMEWORK
Selection of Horizon Years 9
Project Phasing 9
Peak Traffic Hours 9
Background Study Area Data 10
Field Reconnaissance and Data Collection 10

4. NON-SITE TRAFFIC
Build-up Method Using Specific Developments 11
Community Plan, Regional or Subregional Modeled Volumes 11
Trends or Growth Rates 11
Cumulative Analysis Due to Precedence Setting 11

5. SITE TRAFFIC GENERATION
General Procedure 12
Special or Unusual Generators 12
Driveway Rates Versus Cumulative rates 13
Adjustments for Developments Near Transit Stations 13
Adjustments for Mixed-Use Developments 14

6. SITE TRAFFIC DISTRIBUTION AND ASSIGNMENT
Trip Distribution 15
Trip Assignment 15
Pass-by Trips 16
Congestion Management Program Procedures 16

7. ANALYSIS
Total Traffic Estimate 17
Identification of Impacts and Deficiencies 17
Acceptable Level of Service 17
Levels of Significance 17
Signalized Intersection Analysis 17
Signal Warrant Analysis 18
Unsignalized Intersection Analysis 20
Arterial Analysis 20
Freeway Interchange Analysis 20

8. SITE ACCESS AND OFF-SITE IMPROVEMENTS
Recommendations 21
Project Phasing 21
Intersection Lane Configurations 21

9. ON-SITE PLANNING AND PARKING
Access Points 22
Vehicular Queuing Storage 23
Internal Vehicular Circulation 23
Service and Delivery Vehicles 23
Emergency Vehicle Access 24
Parking 24
Pedestrian, Transit and Bicycle Considerations 24

LIST OF FIGURES

Figure 1 – Traffic Impact Study Requirement Flow Chart 4

LIST OF TABLES

Table 1 – Allowable Increase in V/C 6
Table 2 – Roadway Classifications, Levels of Service and Average Daily Traffic 8
Table 3 – Recommended Trip Reductions at Transit Stations 13
Table 4 – Recommended Trip Reductions for Mixed-Use Developments 14
Table 5 – Significant Transportation Impact Measure 18
Table 6 – Inputs and Assumptions for Signalized Intersection Analysis 19

LIST OF APPENDICES

Appendix 1 – Screen Check 25
Appendix 2 – Ramp Meter Analysis 28
Appendix 3 – Parking Requirements 30
Appendix 4 – Intersection Lane Configurations 38

PREFACE

This manual was prepared and updated by the City's Transportation Development Section of the Land Development Review Division of the Development Services Center. Procedures addressed in this manual include:

- Procedure for determining the type of traffic impact study needed: computerized or non-computerized

- Requirements for performing traffic impact studies

The manual was originally prepared to replace Department Instructions formulated in 1987 regarding traffic impact study procedures. These instructions had become obsolete in many areas and had been replaced by unwritten practices that reflected changing legislation, updated analysis techniques and new staff with varying perspectives. This led to a sense of confusion among consultants. A meeting was held in November 1992 to solicit feedback from traffic consultants on City procedures and reviews. The lack of predictability was a universal complaint. It had become common for study preparers to throw together an incomplete draft study simply to determine staff requirements for their particular study. The City embarked on an organization-wide effort to improve the development review process. As part of this effort, Transportation Development Section staff began to rewrite the above mentioned Department Instructions. All area traffic consultants were invited to serve on a task force to provide input and direction to staff on the traffic impact study process. It was decided that the Department Instructions would be replaced with a Traffic Impact Study Manual that would be more user friendly and easily updated to reflect new methodologies and practices. The original Traffic Impact Study Manual was produced in August 1993.

Equally important to the clearly defined process is an aggressive commitment from the reviewers (the Transportation Development Section) to embrace a partnership with the landowner/developer and the preparer (traffic consultant) to produce a high quality document that adequately serves the needs of all parties. This will also enable the review process to be completed in an expeditious manner.

This 1998 update reflects revisions to the City's land development code and improvements in capacity analysis techniques and increases consistency with the City's overall California Environmental Quality Act (CEQA) review process.

1. INTRODUCTION

This manual describes the key elements required for preparing and reviewing traffic impact studies for new and expanding land developments in San Diego. Not all analysis described in this report will have application to each particular study. Applicable analysis will be determined by the Transportation Development Section staff, in consultation with the traffic study preparer. These procedures indicated in this text are not intended to cover every conceivable situation. New procedures and analysis techniques may be needed to evaluate unique situations.

Need and Purpose

The primary purpose of this manual is to provide guidance to consultants on how to prepare traffic impact studies in San Diego. It is intended to ensure consistency among consultants, predictability to the preparer, consistency among reviewers and conformance with all applicable City and state regulations. Every attempt was made to ensure consistency with national practices prescribed in TRAFFIC ACCESS AND IMPACT STUDIES FOR SITE DEVELOPMENT, Institute of Transportation Engineers, 1991 and current local practices. This manual generally memorializes current practices. Traffic Impact Studies are intended to identify the transportation impacts of proposed development projects and to determine the need for any improvements to the adjacent and nearby road system to maintain a satisfactory level of service, safety and the appropriate access provisions for a proposed development.

Review Process

Objectives

Ideally, the review process should be iterative and should begin when the development's planning is initiated, not after a development has been planned and a traffic study completed. This will ensure that City guidelines and requirements are met while allowing the landowner/developer's goals to be accomplished. It is recommended that the developer, study preparer and staff reviewer meet at the earliest possible point in the study process.

Who Should Prepare Traffic Impact Studies?

Traffic impact studies shall be prepared under the supervision of a qualified and experienced Traffic Engineer who has specific training and experience in traffic related to preparing traffic studies for existing or proposed developments. The ability to forecast and analyze traffic needs for both developments and roadway systems is essential. All traffic impact studies shall be stamped by a California Registered Traffic Engineer.

Who Should Review Traffic Impact Studies?

Traffic impact study reviews should be conducted or directed by properly trained transportation engineers, under supervision of a California Registered Traffic Engineer. In some cases, staff from other jurisdictions (cities, county, SANDAG, Caltrans or MTDB) should be included in the review process. Reviewers should have an understanding of the development process and an understanding of City transportation policies and practices. Reviewers should be competent and confident to be able to apply sound engineering judgement in the scoping and review of traffic impact studies. Reviewers should be open minded to be able to seek solutions to landowner/developer desires while ensuring that City standards and objectives are met.

Standard Review Times

The following standards have been set to ensure that traffic impact studies are reviewed quickly. The City's goal is to complete 90 percent of all studies at or before the review times shown.

Standard City Review Times

TYPE OF STUDY	**REVIEW TIME** (Working Days)
Traffic Study Screen Check	5 days
Small Traffic Studies	
a. First Submittal	15 days
b. Second and Third Submittals	10 days
Large Traffic Studies	
a. First and Second Submittals	20 days
b. Third Submittals	15 days
Complex Traffic Studies	
a. First Submittal	30 days
b. Second Submittal	20 days
c. Third Submittal	15 days

Ethics and Objectivity

Although study preparers and reviewers will sometimes have different objectives and perspectives, all parties involved in the process should adhere to established engineering ethics and conduct all analysis and review objectively and professionally.

2. INITIATING TRAFFIC IMPACT STUDIES

Warrants for a Traffic Impact Study

The need for a traffic impact study is based on estimated daily trip generation and conformance with the community plan land use and transportation element. This determination is usually made by the Transportation Development Section staff during the project scoping stages. **Figure 1** should be used to determine if a traffic impact study is needed and to determine the type of study required. In general, traffic impact studies may be required for developments that do not conform to the community plan and generate more than 500 daily trip ends. The threshold is 1,000 daily trip ends if a project conforms to the community plan. See page 4, **Figure 1** Flow Chart.

Extent of the Study

While the need for a traffic impact study is usually determined by City staff, the extent of a study should be shared by the preparer and reviewer of the study. **Figure 1** provides some guidance on the type of study, manual versus computerized. Computerized forecasts or select zone assignments are usually required for developments that generate more than 2,400 daily trip ends, per Congestion Management Program requirements. However, many projects and area specific details cannot be adequately addressed with a generalized flow chart. The following study details should be worked out between the preparer and the reviewer in a presubmittal conference:

- Which components of a full traffic impact study are needed to address issues associated with the site, proposed development, and the nearby transportation system?

- How will trip generation be determined? If rates other than City standard rates are proposed, staff concurrence must be obtained. Will pass-by reductions be applied?

- How large will the study area be?

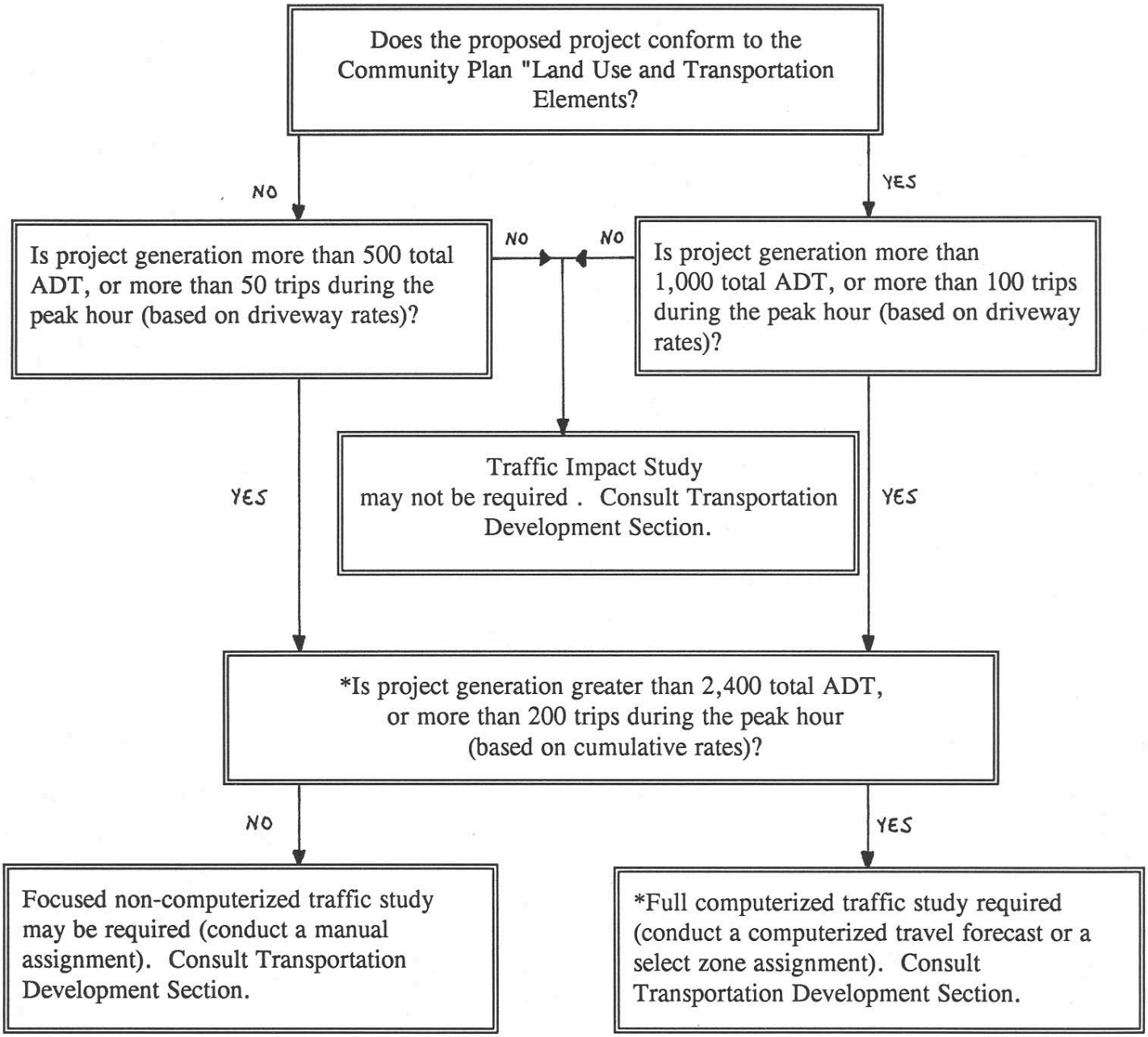
- How should adjacent developments be considered in the study?

- How should future traffic volumes be determined? Should an adopted community plan forecast be used, should a regional or subregional forecast be used, should growth factors apply, or should a new modeling effort be undertaken?

FIGURE 1 October 1997

TRAFFIC IMPACT STUDY

REQUIREMENT FLOW CHART



*To conform with the 1991 Congestion Management Program Enhanced California Environmental Quality Act (CEQA) review process for traffic analysis.

- How should planned or programmed transportation improvements be accounted for?
- Should the various stages of multi-planned developments be analyzed individually? If so, what horizon years should be used?
- Which trip distribution and assignment methods should be used?
- Which roadway sections and which intersections should be analyzed?
- Which capacity analysis technique should be used?
- Are other analyses needed, such as accident analyses, sight distance analyses, weaving analyses, gap analyses and queuing analyses?

In situations where Caltrans or another agency will review the study, staff from these agencies should be included in the presubmittal conference. This will foster improved coordination and reduce the potential for revisions to the study.

Study Area

The contents and extent of a traffic impact study depend on the location and size of the proposed development and the conditions prevailing the surrounding area. Larger developments proposed in congested areas obviously require a more extensive traffic impact study. Smaller sites may require only minimal analysis. An inappropriately large analysis area will unnecessarily increase costs and time to the developer, the study preparer and the reviewer. In addition, large volumes of meaningless analysis can obscure the real issues that need to be addressed. At a minimum, any traffic impact study must address site access and adjacent intersections, plus the first major signalized intersection in each direction from the site. Beyond this minimum requirement, all known congested or potentially congested locations that may be impacted by the proposed development should be studied. The following methodology based on Average Daily Traffic (ADT), project trip distribution and generalized daily roadway capacity has been prepared to offer some predictability to consultants bidding for jobs and to determine an initial study area to discuss with City staff. Knowledge of the area and judgement may cause the study area to be either expanded or contracted.

Procedure for Determining Initial Study Area

1. Calculate project trip generation based on driveway trip rates and standard City trip generation rates.
2. Determine an approximate project trip distribution and assign the project's ADT to the surrounding street system.

3. Obtain existing configurations and future street classifications for all facilities likely to have site traffic assigned to them.

4. Obtain existing and future ADT for the above mentioned streets.

5. Use the following levels of significance to determine if the project will add enough traffic to street segments for short-term and future conditions to warrant studying this location.

TABLE 1

LEVEL OF SERVICE WITH SITE TRAFFIC	ALLOWABLE INCREASE IN V/C* RATIO WITH SITE TRAFFIC ADDED
A	0.10
B	0.06
C	0.04
D	0.02
E	0.02
F	0.02

* Capacity at level of service E (see **Table 2**) should be used for calculating the volume to capacity ratio.

6. Using **Table 2**, determine the short-term and future level-of-service with and without site traffic, for each link.

In addition, the 1993 Guidelines for Congestion Management Program (CMP) Transportation Impact Reports (TIR) states the following for the study area:

The geographic area examined in the TIR must include the following as a minimum:

- All Regionally Significant Arterial system segments and intersections, including freeway on/off ramp intersections, where the proposed project will add 50 or more peak hour trips in either direction to adjacent street traffic.

- Mainline freeway locations where the project will add 150 or more peak hour trips in either direction.

Staff Consultation

It is critical that the study preparer discuss the project with the reviewing agency's staff engineer at an early stage in the planning process. An understanding as to the level of detail and the assumptions required for the analysis can be determined at this time. While a presubmittal conference is highly encouraged, it will not be a requirement for submitting work to the City. For straightforward studies prepared by consultants familiar with City procedures, a phone call followed by a fax verifying key assumptions may suffice.

Screen Check Procedures

As part of the first draft of a traffic impact study, the preparer must ensure that all required elements have been included. This procedure was implemented to reduce the number of submittals and to encourage earlier dialogue between the reviewer and preparer. The reviewer will check the study for completeness and return all incomplete submittals within five working days of receipt. **Appendix 1** contains the screen check list which the preparer must complete and submit along with the first draft of every traffic impact study. The screen check list should also be used during presubmittal conferences to determine which elements are not required for the proposed study.

Traffic studies shall not be resubmitted until all staff comments have been incorporated. Consultants are encouraged to contact the reviewer to seek clarification, if needed, on comments made to the traffic study. All comments and conditions are subject to appeal or modification.

TABLE 2
Roadway Classifications, Levels of Service (LOS)
and Average Daily Traffic (ADT)

			LEVEL OF SERVICE				
STREET CLASSIFICATION	LANES	CROSS SECTIONS	A	B	C	D	E
Freeway	8 lanes		60,000	84,000	120,000	140,000	150,000
Freeway	6 lanes		45,000	63,000	90,000	110,000	120,000
Freeway	4 lanes		30,000	42,000	60,000	70,000	80,000
Expressway	6 lanes	102/122	30,000	42,000	60,000	70,000	80,000
Primary Arterial	6 lanes	102/122	25,000	35,000	50,000	55,000	60,000
Major Arterial	6 lanes	102/122	20,000	28,000	40,000	45,000	50,000
Major Arterial	4 lanes	78/98	15,000	21,000	30,000	35,000	40,000
Collector	4 lanes	72/92	10,000	14,000	20,000	25,000	30,000
Collector (no center lane) continuous left-turn lane)	4 lanes 2 lanes	64/84 50/70	5,000	7,000	10,000	13,000	15,000
Collector (no fronting property)	2 lanes	40/60	4,000	5,500	7,500	9,000	10,000
Collector (commercial-industrial fronting)	2 lanes	50/70	2,500	3,500	5,000	6,500	8,000
Collector (multifamily)	2 lanes	40/60	2,500	3,500	5,000	6,500	8,000
Sub-Collector (single-family)	2 lanes	36/56	—	—	2,200	—	—

LEGEND:

XXX/XXX = Curb to curb width (feet)/right-of-way width (feet): based on the City of San Diego Street Design. Manual

XX/XXX= Approximate recommended ADT based on the City of San Diego Street Design Manual.

NOTES:

1. The volumes and the average daily level of service listed above are only intended as a general planning guideline.

2. Levels of service are not applied to residential streets since their primary purpose is to serve abutting lots, not carry through traffic. Levels of service normally apply to roads carrying through traffic between major trip generators and attractors.

3. CONTENT AND FRAMEWORK

This chapter discusses the selection of horizon years, time periods to be analyzed and study data needs.

Selection of Horizon Years

The following scenarios should be evaluated in each traffic impact study:

- Existing Conditions
- Existing Conditions with Approved Projects (when applicable)
- Existing Conditions with Approved Projects and Site Traffic
- Buildout Community Plan Conditions
- Buildout Community Plan with Additional Site Traffic
  (if project deviates from the Community Plan)
- Cumulative Analysis Due to Precedence Setting
  (if a land use change will likely encourage other property owners to seek similar land use changes)

Project Phasing

If the project is a large multi-phased development in which several stages of development activity are planned, a number of horizon years may be needed to coincide with each major stage of development or increment of area transportation system improvements. Smaller developments may need to phase themselves to transportation improvements that others are providing, yet are crucial to their accessibility.

Peak Traffic Hours

In general, the traditional morning and afternoon peak hour of the street system should be evaluated in each impact study. The peaking of the adjacent street system can usually be determined by reviewing traffic count data. The time periods that provide the highest cumulative directional traffic demands should be used to assess the impact of site traffic on the adjacent street system and to define the roadway configurations and traffic control measure changes needed in the study area.

In rare cases, weekend and other typically off-peak traffic periods should be studied. These situations may occur with large retail uses, recreational uses, stadiums and theme parks.

Background Study Area Data

All pertinent transportation system and land development information, both short- and long-range, prepared in the last five years or considered to be current by the Transportation Development Section should be reviewed. Any development that has been approved but not yet occupied should be considered for use as background traffic. Average daily traffic counts and peak hour turning movements can frequently be obtained through the City's Traffic Safety Information and Research Section in the Traffic Engineering Division.

The count data used in traffic impact studies should be no more than two years old. If recent traffic data is not available from the City, current counts must be made by the consultant.

Field Reconnaissance and Data Collection

The assembly of available data should be accompanied by a detailed reconnaissance of the project site, area roadways and the surrounding vicinity. Current data should also be collected as necessary to supplement that information already available. These data frequently include some or all of the following:

- Peak period turning movement counts
- Machine counts
- Primary traffic control devices
- Signal timing and phasing
- Roadway configurations, geometric features and intersection lane configurations
- Parking regulations and usage
- Driveways serving sites across from or adjacent to the site
- Transit stops
- Adjacent land uses

4. NON-SITE TRAFFIC

Estimates of non-site traffic are required to complete an analysis of horizon year conditions. These estimates characterize the base conditions (without site traffic). There are a number of methods for developing non-site traffic; the appropriate method depends largely on the availability of data.

Build-up Method Using Specific Developments

This method is used when other projects in the area have been approved, but are not yet occupied. This concept consists of projecting peak hour traffic to be generated by approved developments in the study area, and assigning it to the projected street system. This method is used for the "Existing Conditions with Approved Projects" scenario. A list of "other" projects can be obtained from the City's Transportation Development Section.

Community Plan, Regional or Subregional Modeled Volumes

The adopted community plan should be used for 20-year or buildout area wide conditions, when reliable information exists. Often times, this information is out-dated and its use would render unreasonable results. In these cases, regional or subregional models conducted by SANDAG should be reviewed for appropriateness.

When justified, and particularly in the case of very large developments or new community plans, a transportation model should be run, with and without the new development to show the net impacts on all parts of the area's transportation system.

Trends or Growth Rates

Trends or growth rates should be used only in situations where a transportation model does not exist, no new major transportation facilities are planned for the area, and the area's growth rate has been stable. Average daily traffic volumes from the past five to ten years should be used to develop these growth rates. If other major new developments are expected in the area, a combination of the growth rate and build-up method should be considered.

Cumulative Analysis Due to Precedence Setting

Often times, a land use change on one property may have the effect of encouraging other property owners to ask for the same zoning or intensification, particularly if the change has an appreciable impact on property values.

The Transportation Development Section in consultation with other City staff, decides if a cumulative analysis should be conducted and which properties should be included in the analysis. The Transportation Development Section in consultation with the traffic consultant will decide the appropriate methodology for developing these non-site traffic volumes.

5. SITE TRAFFIC GENERATION

One of the most critical elements of the traffic impact study is estimating the amount of traffic to be generated by a proposed development. This is usually done by using trip generation rates or equations.

Rates are commonly expressed in trips per unit of development. Equations provide a direct estimate of trips based upon development units being multiplied in a mathematical relationship. Trips are defined as a single or one-directional travel movement with either an origin or destination of the trip inside the study site. The outcome of the entire traffic impact study can depend solely on the question of appropriate trip generation estimates. Trip generation estimates must be determined carefully and must be defensible using a combination of available data and professional judgement.

General Procedure

The following basic steps should be followed in determining the appropriate trip generation estimates:

- Check the City of San Diego's Trip Generation Manual for trip generation rates of similar land use types. If rates other than those included in this manual are proposed, the consultant should obtain concurrence from the study reviewer prior to submitting a study.

- If City data does not exist, check for appropriate SANDAG data or national data, typically contained in SANDAG's “Traffic Generators” publication or the ITE Trip Generation Manual or ITE Journal articles.

- If local or sufficient national data do not exist, conduct trip generation studies at sites with characteristics similar to those of the proposed development.

- Determine any adjustments that may be applied to trip rates to account for specific characteristics of the development in question (high transit usage or true mixed-used developments).

- Select the most appropriate and defensible trip generation rate or equations and document the basis for selection if the rates vary from standard City rates.

Special or Unusual Generators

Some unique land uses have never been studied for trip generation characteristics. In these cases, it may be necessary to conduct a trip generation study on a similar use to

determine the appropriate trip generation rate for that use. In some instances, it may be acceptable to assume a trip rate, based on comparisons to other uses. In either case, the Transportation Development Section should be consulted.

Driveway Volumes Versus Traffic Added to the Adjacent Streets

It is usually assumed that all trips entering and exiting a new development are new trips that were not made to or through the area prior to the development being completed. However, a portion of these trips may be “captured” from trips already being made to other existing developments on the adjacent street system. Any commercial real estate agent will confirm that the three most important factors in a successful retail business are location, location and location. This phenomenon has been verified by limited studies of commercial sites. The City's Trip Generation Manual has recommended a percentage reduction in driveway trip generation rates for numerous retail uses. These recommendations are based on local and national trip generation studies, as well as SANDAGS’s Travel Behavior Study conducted in 1985. The pass-by reduction includes true pass-by trips that were on an adjacent street and a portion of the linked trips that were diverted off a nearby route. The report must clearly indicate the new trips and the pass-by trips for the site. All site access points should be evaluated using the higher driveway rates, whereas far off intersections will be evaluated using the reductions for pass-by trips. The next chapter provides guidance on how to distribute and assign pass-by trips.

Refer to the City's “Trip Generation Manual” for driveway and cumulative trip rates for various land uses.

Adjustments for Developments Near Transit Stations

Most trip generation data are from suburban locations where little or no public transportation exists. Since San Diego has an expanding mass transit system, with opportunities for land use/transit interaction, adjustments to the standard trip generation rates may be necessary. The following trip rate reductions are allowable for development planned within a walking distance of 1,500 feet from a transit station:

TABLE 3
Recommended Trip Reductions at Transit Stations

LAND USE TYPE	DAILY	A.M. PEAK	P.M. PEAK
Residential	5%	9%	6%
Industrial	5%	6.5%	5.5%
Commercial Office	3%	5.5%	2%
Commercial Retail	N/A	N/A	N/A

Adjustments for Mixed-Use Developments

Most of the trip generation rate data available have been developed from measurements at isolated single-use developments. When uses are combined, simply adding the single-use estimates together can result in a total trip generation estimate that is too great for the site. The following trip generation rate reductions are allowable for mixed-use projects:

TABLE 4
Recommended Trip Reductions for Mixed-Use Developments
Which Include Commercial Retail

LAND USE TYPE	DAILY	A.M. PEAK	P.M. PEAK
Residential	10%	8%	10%
Industrial	4%	5%	5%
Commercial Office	3%	5%	4%
Commercial Retail	*	*	*

Source: Kris Berg - Kimley Horn

NOTES:

* The commercial retail reduction equals the sum of the total mixed-use reduction in residential, industrial and commercial office.

- These reductions apply to commercial retail of a minimum of 100,000 square feet which is predominantly neighborhood-oriented.

6. SITE TRAFFIC DISTRIBUTION AND ASSIGNMENT

Traffic expected to be generated by a development project must be distributed and assigned to the roadway system so that the impacts of the proposed project on roadway links and intersections within the study area can be analyzed. The trip distribution step produces estimates of trip origins and destinations. The assignment step produces estimates of the amount of site traffic that will use each access route between origins and destinations.

Trip Distribution

One way to determine a trip distribution for a site is to use data from a computerized travel forecast model. SANDAG, the regional planning agency for San Diego County, maintains a regional travel forecast computer model to project future traffic volumes. The City also prepares "community plan" level forecast models. The City models usually provide a more detailed street system than does SANDAG's latest regional model. Raw modeled results should never be directly applied. A thorough review for reasonableness should first be undertaken.

Frequently, computerized travel forecast model data are not available or may not be up to date. In these cases, manual estimates based on traffic volumes, experience, judgement, and knowledge of the area are appropriate. Previous traffic impact studies conducted for other projects in the area should also be considered in estimating trip distributions.

Regardless of the trip distribution methodology used, it is crucial that the traffic consultant and the reviewer of the study agree on the proper distribution prior to the preparation of detailed analysis to avoid having to rework the analysis.

Trip Assignment

Trip assignment should be made considering logical routings, available capacities, left turns at critical intersections, and projected (and perceived) minimum travel times. Multiple paths should often be assigned between origins and destinations to achieve realistic estimates, rather than assigning all trips to the route with the shortest travel time.

The assignment should reflect the horizon year(s) and should consider land use and road improvements at that time. Assignments may vary between morning and afternoon peaks. The assignment should be carried out through external site access points and, in larger projects, the internal roadways.

Assignments may be performed manually or by a computer model. For large sites, with large study areas, it may be advantageous to use a computer model to assign site traffic. This allows some matching of trip origins and destinations within the study area, rather than assigning all site trips externally.

Pass-by Trips

As mentioned in the previous chapter, trip generation analysis yields the number of vehicle trips that a site is expected to generate at its driveways, and retail sites don't add as much traffic to the community street system since a portion of their trips are simply diverted from vehicle trips already on the roadway system. If a reduction for pass-by trips is to be applied, the cumulative trip generation rates identified in the City's Trip Generation Manual should be used as follows:

- For the peak hour being analyzed, determine the percentage of pass-by trips. Split the total trip generation into new trips and pass-by trips.

- In addition to estimating normal trip distribution (for new trips), also estimate the distribution for pass-by trips (giving strong consideration to the commuting work trip).

- Perform two separate trip assignments, based on the two trip distributions. Pass-by assignment percentages should not automatically be applied to two-way traffic since an outbound pass-by trip may use a different route than an inbound pass-by trip. Also, the pass-by procedure implies subtracting trips from some existing movements and assigning to other movements. Care must be taken not to subtract a relatively large movement from a low volume facility. For this reason, the pass-by reduction on any given facility shall be no more than ten percent of the volume on that facility. It would be unreasonable to assume that more than one out of ten drivers would divert to a site on a daily basis.

- Combine the results of the "new trips" and "pass-by" assignments.

Congestion Management Program Procedures

The Congestion Management Program (CMP) requires that a regional travel forecast model be used to assign site traffic to the CMP roadway system. This applies to all developments generating more than 2,400 daily trips or 200 pm peak hour trips. For these developments, it is necessary to perform a select zone traffic assignment for site traffic to identify the project's impact on the CMP roadway system.

7. ANALYSIS

This chapter describes the analytical techniques used to derive the study findings, conclusions, and recommendations. This recognizes current methodologies. However, other techniques may be considered once they are developed or unique problems are encountered. This chapter attempts to provide guidance on the proper analysis technique to be applied; it does not attempt to document any particular analysis technique or preclude the use of any technique not specifically mentioned. Analysis techniques should be discussed by the preparer and reviewer of the traffic impact study prior to beginning the study.

Total Traffic Estimate

For each analysis period being studied, a projected total traffic volume must be estimated for each segment of roadway system being analyzed.

Identification of Impacts and Deficiencies

Acceptable Level of Service

The standard used to evaluate traffic operating conditions of the transportation system is referred to as level of service. This is a qualitative assessment of the quantative effect of factors such as speed, volume of traffic, geometric features, traffic interruptions, delays and freedom to maneuver. The acceptable level of service standard for roadways and intersections in San Diego is level of service D. However, for undeveloped locations, the goal is to achieve a level of service C.

Levels of Significance

To determine if a project contributes enough traffic to a transportation facility to consider mitigation measures, a level of significance threshold is used. **Table 5** identifies the levels of significance for several analysis techniques at varying levels of service. If the project causes a change greater than the level shown, the developer is considered to be responsible for all or part of the improvements required to mitigate the site traffic to the level previously held on the facility prior to the project's traffic impacts.

Signalized Intersection Analysis

The measure of effectiveness for signalized intersections is average stopped delay per vehicle. The current Highway Capacity Manual's signalized intersection operational methodology is the basis for determining intersection delay. The Highway Capacity Software (HCS), based on the HCM methodology, is acceptable except in cases of extreme congestion, where alternative software must be used to obtain average

seconds of delay. Alternative acceptable software includes TRAFFIX, SIGNAL 94 and NCAP. These methodologies require numerous inputs and assumptions. To ensure consistency among consultants (and City staff), the City has developed input guidelines shown in **Table 6**. These guidelines are not intended to be absolute, but any proposed deviations should first be discussed with City staff.

TABLE 5
Significant Transportation Impact Measure

LEVEL OF SERVICE WITH PROJECT	ALLOWABLE INCREASE/DECREASE DUE TO PROJECT IMPACTS*		
	INTERSECTIONS	ROADWAY SECTIONS	
	DELAY (SEC)	V/C	SPEED (MPH)
A	N/A	0.10	5
B	6	0.06	3
C	4	0.04	2
D**	2	0.02	1
E**	2	0.02	1
F**	2	0.02	1

NOTES:

* If a proposed project's impact exceed the values shown in the table, then the impacts are deemed "significant." The project applicant shall identify "feasible mitigations" to bring the facility back to the level previously held by the facility prior to the project's traffic impacts.

** The acceptable level of service standard for roadways and intersections in San Diego is level of service D. However, for undeveloped locations, the goal is to achieve a level of service C.

KEY: DELAY = Average stopped delay per vehicle measured in seconds
V/C = Volume to Capacity Ratio [capacity at level of service E should be used (Use Table 1.)]
SPEED = Arterial speed measured in miles per hour
N/A = Not Applicable

Signal Warrant Analysis

If new intersections are being created by a development or if a development adds traffic to existing unsignalized intersections, traffic signal warrant analyses must be performed. The Caltrans Traffic Manual should be consulted for procedures on conducting signal warrant analysis. Typically, the warrant based on Estimated Average Daily Traffic is used. For selected locations, the School Crossing Traffic Signal Warrant should be considered.

TABLE 6
Inputs and Assumptions for Intersection Capacity Analysis
Using the Highway Capacity Manual (HCM) Method

- Arrival Type = 3-5
- Cycle Length © = 60-120 seconds (or observed at existing locations)
- Ideal Saturation Flow Rate for HCM software = 1,900 pcphpl
- Minimum Green for each phase = 5-10 seconds
- Yellow Interval:

85% Approach Speed (mph)	*Yellow Interval (seconds)
35 or less	3.0
40	3.5
45	4.0
50	4.5
55	5.0
60	5.5

*Add 1 second for an all-red interval at all intersections.

- Minimum Heavy Vehicles = 2-4%
- Peak Hour Factor (PHF) = 0.80-0.95
- Minimum Pedestrians = 10/hour/approach

The following factors are used to convert daily volumes to peak hour volumes:

- Directional Factor (D) = 0.55-0.75
- Design Hour Factor (K) = 0.07-0.11
- Peak Hour Peak Direction = 0.05-0.08

NOTES:

1. Arrival Type 4 or 5 should be used for intersection approaches which are part of a coordinated arterial system.
2. Ideal Saturation Flow rate inputs may be higher than 1,900 pcphpl for individual movements at intersections with very high traffic volume. The use of higher saturation flow rate must be identified.
3. Level of Service F is not acceptable for intersection approaches except for side streets on an interconnected arterial system.
4. The 85% speeds can be obtained from the City's Traffic Engineering Division, Traffic Safety Information and Research Section.

When a new signal is proposed on a major arterial where a coordinated signal progression system exists or may exist, the impacts of adding a new signal on progression should be thoroughly analyzed, The software recommended for this analysis is PASSER II, Synchro or TRANSYT-7F.

Unsignalized Intersection Analysis

The measure of effectiveness for unsignalized intersections is average total delay per vehicle. Total delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line. This methodology is described in Chapter 10 of the current Highway Capacity Manual. This methodology should be used for unsignalized intersections, yield and T-intersections.

Arterial Analysis

All arterials within the study area should be evaluated using the Daily Level of Service matrix shown in **Table 2** (shown in Chapter 2 of this manual). The results of this analysis may not accurately reflect actual peak hour operation of the street, but is intended as a guide to help determine arterial classification and sizing.

The Congestion Management Program arterials must be analyzed in greater detail. These arterials must be evaluated using the peak hour analysis contained in Chapter 11 of the current Highway Capacity Manual. This methodology uses the results of signalized intersection analyses, the arterial classification and free flow speed to calculate an average travel speed. The average travel speed is used to determine the arterial level of service. The HCS computer software may be used to determine arterial level of service.

Freeway Interchange Analysis

Since all freeways are on the Congestion Management Program system, their interchanges must be evaluated using CMP analysis techniques. All signalized intersections of freeway ramps with arterials should be evaluated using the Highway Capacity Manual signalized intersection operational method. For diamond interchanges, the timing and phasing of the two signals must be coordinated to ensure queue clearances. The software package recommended for this analysis is Passer III-90.

If ramp metering is to occur, the effects of metering should be analyzed. Inputs to this analysis are peak hour demands, flow rates, and ramp geometrics. The flow rates and ramp configurations are usually available from Caltrans. Outputs are excess demand, delay and queue length. This methodology is explained in **Appendix 2**.

8. SITE ACCESS AND OFF-SITE IMPROVEMENTS

Recommendations

During the final phase of the study, all analyses are reviewed and reassessed to best respond to the actual transportation needs of the project and the adjacent area. It is important that recommendations be made at each of the scenarios identified in Chapter 3, so that the responsibility for the improvements can be clearly established. All necessary improvements should be displayed on a study area map. A table shall be prepared identifying which improvements are needed, when they are needed and who is responsible for the improvements.

Project Phasing

In situations where an improvement is the responsibility of someone else or a joint responsibility, it may be necessary for the proposed development to be phased or for the developer to front the entire cost of an improvement(s). At the developer's option, a reimbursement district can be established. Where multiple improvements are needed, it may be advantageous to phase a development and associated improvements over time, to avoid large up front mitigation expenses. Appropriate analyses are required to permit projects to be phased.

Intersection Lane Configurations

Diagrams of typical intersection lane configurations are shown in **Appendix 4**. There are a number of lane configurations that can be used depending on the intersecting streets. Additional left-turn lanes, dual left-turn lanes and separate right-turn lanes will be based on the intersection turn volumes and level-of-service.

9. ON-SITE PLANNING AND PARKING

An integral part of an overall traffic impact study relates to basic site planning principles. Internal design will have a direct bearing on the adequacy of site access points.

Access Points

Access points should be designed with the same perspective as public streets. Site access points should be located and designed in accordance with the San Diego Regional Standard Drawings and the following guidelines:

- Driveways should align with opposing streets and driveways, if no raised center median exists on the cross street.

- If not aligned, adequate spacing should be maintained from adjacent street and driveway intersections. Distance between driveways and adjacent street intersections should be sufficient to minimize driveway blockage by queues from adjacent intersections.

- If the driveway is proposed to be signalized, it should be located to facilitate traffic progression past the site. A signal progression analysis may be required in such a situation. Curb return type access is allowed for signalized driveways.

- Access driveways should intercept traffic approaching the site as efficiently as possible; adequate inbound and outbound capacity should be provided.

- Adequate driveway capacity should be provided. The number of driveways should be compatible with site access capacity needs and should minimize adverse impacts on adjacent roads. A capacity analysis, gap check or lane adequacy check should be conducted for each driveway. Joint access should be considered where several adjacent properties have relatively short frontages or where low-volume driveways would otherwise result.

- Two-way driveways should intersect adjacent roadways at 90-degree angles, wherever possible.

- The capacity of on-site intersections should be sufficient to prevent traffic entering the site from backing up on the adjacent street.

- Traffic safety aspects of all proposed site access facilities should be reviewed to ensure adequate sight distance and other applicable factors.

- Deceleration and acceleration lanes may be required on the City street at the access driveway.

Vehicular Queuing Storage

Provision for appropriate vehicular exit queuing should be made at all access drives for a development. For small developments, parking areas and access points should be designed so drivers waiting to exit can align their vehicles perpendicular to the off-site roadway system. For large developments, queuing areas should be sufficient so that vehicles stored at exits do not block internal circulation and so that drivers enter a signalized intersection at minimum headways to achieve maximum flow rates. The queue storage just inside a parking facility should be sufficient to allow vehicles to enter the parking facility and come to a complete stop without blocking or hampering internal circulation and without causing traffic to back up on the off-site roadway.

Drive-through developments such as banks, car washes and fast food restaurants, should be provided with adequate capacity to accommodate normal peak queues.

Internal Vehicular Circulation

Internal circulation roadways should permit access between all areas in a manner which is safe, has adequate capacity, and is clearly understandable to the driver.

Service and Delivery Vehicles

Service and delivery vehicles require separate criteria for movement to and from site:

- Vehicle turning paths should be sufficient to accommodate the largest vehicles anticipated to travel on the site.

- Access points anticipated to be used by service vehicles should have turning paths sufficient to allow service to enter and exit the site without encroaching upon opposing lanes or curbed areas.

- There should be sufficient separation between external and internal circulation roads so large vehicles can be queued on entry or exit without blocking access to parking spaces or internal roadway circulation systems.

- Service vehicle routes should be as direct as possible.

- The number of loading berths provided should be sufficient to accommodate anticipated service and delivery activity.

Emergency Vehicle Access

- Entrance curb to curb widths must be 20 feet minimum.
- An emergency vehicle only access shall be restricted with a chain, gate or bollard, and properly signed to the satisfaction of the Fire Department.
- Extra aisle widths may be required adjacent to fire hydrants.
- “No Parking - Fire Lane” signs may be required on-site.

Parking

Adequate parking should be provided to meet site generated demands. On-site parking should be provided in accordance with the Transportation Development Section's recommended parking ratios shown in **Appendix 3**. Minimum parking requirements may vary where superseded by the San Diego Municipal Code. Parking should be dispersed throughout the site for convenience to destinations. The Municipal Code addresses parking lot design considerations.

Shared parking is a valid approach to the determination of total parking needs of any mixed use development. Close building proximity and efficient internal circulation systems and access drives are necessary for shared parking to be successful. **Appendix 3** also contains procedures for reducing parking requirements for mixed-use developments.

For major developments, bicycle parking should be provided at a ratio of two spaces per 100 auto parking spaces.

The location of bicycle parking and carpool or vanpool parking should be in close proximity to the building entrances.

Pedestrian, Transit and Bicycle Considerations

The overall site plans should also consider public transportation, pedestrians, and bicyclists. Appropriate public transportation facilities and shuttle bus staging areas should be accommodated adjacent to service drives and entrance areas, at key locations along circulation drives or at major pedestrian focal points along the roadway system. Pedestrian connections between these facilities, public sidewalks and the site buildings should be integrated in the overall design of the project. Proper design of pedestrian facilities can reduce the use of motor vehicles for trips within a development and between nearby developments.

APPENDIX 1

SCREEN CHECK

CITY OF SAN DIEGO
TRANSPORTATION DEVELOPMENT SECTION
TRAFFIC IMPACT STUDY
SCREEN CHECK

To be completed by City Staff:
Date Received _____
Reviewer _____
Date Screen Check ____

To be completed by consultant (including page #):
Name of Traffic Study _____
Consultant _____
Date Submitted _____

Indicate Page # in report:		Satisfactory YES	NO	NOT REQUIRED
pg. ___	1. Table of contents, list of figures and list of tables.	☐	☐	
pg. ___	2. Executive summary.	☐	☐	
pg. ___	3. Map of the proposed project location	☐	☐	
	4. General project description and background information:			
pg. ___	a. Proposed project description (acres, dwelling units....)	☐	☐	
pg. ___	b. Total trip generation of proposed project.	☐	☐	
pg. ___	c. Community plan assumption for the proposed site.	☐	☐	
pg. ___	d. Discuss how project affects the Congestion Management program.	☐	☐	
pg. ___	5. Parking, transit and on-site circulation discussions are included.	☐	☐	
pg. ___	6. Map of the Transportation Impact Study Area and specific intersections studied in the traffic report.	☐	☐	
pg. ___	7. Existing Transportation Conditions:			
	a. Figure identifying roadway conditions including raised medians, median openings, separate left and right turn lanes, roadway and intersection dimensions, bike lanes, parking, number of travel lanes, posted speed, intersection controls, turn restrictions and intersection lane configurations.	☐	☐	
	b. Figure indicating the daily (ADT) and peak hour volumes.	☐	☐	
	c. Figure or table showing level of service (LOS) for intersections during peak hours and roadway sections within the study area (analysis sheets included in the appendix).	☐	☐	
	8. Project Trip Generation:			
pg. ___	Table showing the calculated project generated daily (ADT) and the peak hour volumes.	☐	☐	
pg. ___	9. Project Trip Distribution using the current TRANPLAN Computer Traffic Model (provide a computer plot) or manual assignment if previously approved. (Identify which method was used.)	☐	☐	
	10. Project Traffic Assignment:			
pg. ___	a. Figure indicating the daily (ADT) and peak hour volumes.	☐	☐	
pg. ___	b. Figure showing pass-by-trip adjustments, if cumulative trip rates are used.	☐	☐	☐
	11. Existing + Other Pending Projects:			
pg. ___	a. Figure indicating the daily (ADT) and peak hour volumes.	☐	☐	
pg. ___	b. Figure or table showing the projected LOS for intersections during peak hours and roadway sections within the study area (analysis sheets included in the appendix).	☐	☐	
pg. ___	c. Traffic signal warrant analysis for appropriate locations (signal warrants included in the appendix).	☐	☐	

		Satisfactory YES	NO	NOT REQUIRED
	12. Existing + Other Pending Projects + Project (short term cumulative):			
pg. ____	a. Figure or table showing the projected LOS for intersections during peak hours and roadway sections with the project (analysis sheets included in the appendix).	☐	☐	
pg. ____	b. Figure showing other projects that were included in the study, and the assignment of their site traffic.	☐	☐	
pg. ____	c. Traffic signal warrant analysis for appropriate locations (signal warrants in the appendix).	☐	☐	
	13. Build-out Transportation Conditions (if project conforms to the community plan):			
pg. ____	a. Build-out ADT and street classification that reflect the community plan.	☐	☐	☐
pg. ____	b. Figure or table showing the build-out LOS for intersections during peak hours and roadway sections with the project (analysis sheets included in the appendix).	☐	☐	☐
pg. ____	c. Traffic signal warrant analysis at appropriate locations (signal warrants included in the appendix).	☐	☐	☐
	14. Build-out Transportation Conditions (if project does not conform to the community plan).			
pg. ____	a. Build-out ADT and street classification as shown in the community plan.	☐	☐	☐
pg. ____	b. Build-out ADT and street classification for two scenarios: with the proposed project and with the land use assumed in the community plan.	☐	☐	☐
pg. ____	c. Figure or table showing the build-out LOS for intersections during peak hours and roadway sections for two scenarios: with the proposed project and with the land use assumed in the community plan (analysis sheets included in the appendix).	☐	☐	☐
pg. ____	d. Traffic signal warrant analysis at appropriate locations with the land use assumed in the community plan (signal warrants included in the appendix).	☐	☐	☐
pg. ____	15. A summary table showing the comparison of Existing, Existing + Other Pending Projects, Existing + Other Pending Projects + Proposed Project, and Buildout, LOS on roadway sections and intersections during peak hours.	☐	☐	
	16. Transportation Mitigation Measures.			
pg. ____	a. Table identifying the mitigations required that are the responsibility of the developer and others. A phasing plan is required if mitigations are proposed in phases.	☐	☐	
pg. ____	b. Figure showing all proposed mitigations that include: intersection lane configurations, lane widths, raised medians, median openings, roadway and intersection dimensions, right-of-way, offset, etc.	☐	☐	
pg. ____	17. The traffic study is signed by a California Registered Traffic Engineer.	☐	☐	
pg. ____	18. The Highway Capacity Manual Operational Method or other approved method is used at appropriate locations within the study area.	☐	☐	
pg. ____	19. Analysis complies with Congestion Management requirements.	☐	☐	☐
pg. ____	20. Appropriate freeway analysis is included.	☐	☐	☐
pg. ____	21. Appropriate freeway ramp metering analysis is included.	☐	☐	☐

THE TRAFFIC STUDY SCREEN CHECK FOR THE SUBJECT PROJECT IS:

_____ Approved

_____ Not approved because the following items are missing:

_____

_____

_____

_____

_____

APPENDIX 2

RAMP METER ANALYSIS

APPENDIX 2. RAMP METERING ANALYSIS

Ramp metering analysis should be performed for each horizon year scenario in which ramp metering is expected. The following table shows relevant information that should be included in the ramp meter analysis (calculations are shown in the footnotes):

LOCATION	DEMAND[1] (veh/hr)	METER RATE[2] (veh/hr)	EXCESS DEMAND[3] (veh/hr)	AVERAGE DELAY[4] (veh/hr)	AVERAGE QUEUE[5] (feet)
I-5/Carmel Mountain Road (SB/AM Peak)	985	788	197	15.0[6]	4,925
I-5/Carmel Mountain Road (SB/PM Peak)	510	1,000	0	0	0

Notes:

[1] DEMAND is the peak hour demand expected to use the on-ramp.

[2] METER RATE is the peak hour capacity expected to be processed through the ramp meter. This value is usually available from Caltrans.

[3] EXCESS DEMAND = (DEMAND) – (METER RATE) or zero, whichever is greater

[4] AVERAGE DELAY = $\frac{\text{EXCESS DEMAND}}{\text{METER RATE}}$ * 60 minutes/hour

[5] AVERAGE QUEUE = (EXCESS DEMAND) * 25 feet/vehicle

[6] Ramp meter delays above 15 minutes are not acceptable.

APPENDIX 3

PARKING REQUIREMENTS

Transportation Development Section
Parking Rates Used for Discretionary Review

LAND USE	RATE
RESIDENTIAL USES	
Single-family Residential	2 per dwelling
Multifamily Residential	
Resident Portion	
Studio	1.00 per dwelling unit
One bedroom	1.25 per dwelling unit
Two bedroom	1.50 per dwelling unit
Three or more bedrooms	1.75 per dwelling unit
Supplemental Portion	
General	Add 30% of resident portion*
Beach or Campus impact area	Add 50% of resident portion*
Transit Reductions*	
Transit Corridor	0.10 of supplemental
Nodal Corridor/Transfer Node	0.20 of supplemental
Transit Node	0.30 of supplemental
Transit Hub	0.60 of supplemental
Density Reductions*	
42-72 units per acre	0.10 of supplemental
73-142 units per acre	0.20 of supplemental
143 or more units per acre	0.30 of supplemental
Commercial Use Reductions*	
4% to 8.9% gross floor area	0.10 of supplemental
9% to 12.9% gross floor area	0.20 of supplemental
13% or more gross floor area	0.30 of supplemental
Common Area Portion	In planned urbanizing areas only, 20% of resident and supplemental spaces must be located in a common area

(see next page for additional land uses)

NOTES:

- These parking rates are subject to change.

* If a PDO exists, parking requirements may vary from the above rates.

OTHER LAND USES

Hotel	1 per guest room
Restaurant	
Free-standing building	1 per 60 gross sq. ft.
Combined in project	1 per 80 gross sq. ft.
Banquet Room	1 per 80 gross sq. ft.
Retail	1 per 200 gross sq. ft.
Medical Office	1 per 250 gross sq. ft.
Commercial Office	1 per 300 gross sq. ft.
Scientific Research and Development	1 per 400 gross sq. ft.
Library	
With high meeting room use	1 per 175 gross sq. ft.
Without high meeting room use	1 per 200 gross sq. ft.
Daycare Center	
Staff	1 per each adult (1 per 6 students)
Loading/unloading area	Add 1 per 12 students
Hospital	
With transit	1.75 per bed
Without transit	2 per bed
Convalescent Hospital	1 per 3 beds
Theatre	
1-3 screens	1 per 3 seats
4 or more screens	1 per 3.3 seats
Church	1 per 3 seats
Health Club	1 per 200 gross sq. ft.
Marina	1 per 3 boat slips
General Aviation Airport	
Parking in hangars/tiedowns	9 per 100 hangars/tiedowns
No parking in hangars/tiedowns	27 per 100 hangars/tiedowns
Industrial	1 per 400 gross sq. ft.
Warehousing	
Storage area	1 per 1,000 gross sq. ft.
Office area	1 per 300 gross sq. ft.

NOTES:

- These parking rates are subject to change.
- If a PDO exists, parking requirements may vary from the above rates.

§ 142.0540 Cont'd Footnote to Table 142-05G

(1) The City Engineer will determine whether a *lot* has adequate *alley* access according to accepted engineering practices.

(b) Exceeding Maximum Permitted Parking. Development proposals may exceed the maximum permitted automobile parking requirement shown in Tables 142-05D, 142-05E, and 142-05F with the approval of a Neighborhood Development Permit, subject to the following:

(1) The *applicant* must show that the proposed parking spaces are required to meet anticipated parking demand, will not encourage additional automobile trips, and will not result in adverse site design impacts; and

(2) The number of automobile parking spaces provided shall not be greater than 125 percent of the maximum that would otherwise be permitted.

(c) Varying From Minimum Parking Requirements. Development proposals may, at the applicant's option, vary from the minimum parking requirements of this division with the approval of a Transportation Demand Management (TDM) Plan and Site Development Permit decided in accordance with Process Three, subject to the following requirements.

(1) The TDM Plan shall be designed to reduce peak period automobile use with such techniques as carpooling, vanpooling, transit, bicycling, walking, telecommuting, compressed work weeks, or flextime.

(2) To compensate for a reduction in parking, the TDM Plan shall specify only those measures that would not otherwise be required by this division.

(3) In no case shall the number of automobile parking spaces provided be less than 85 percent of the minimum that would otherwise be required.

(4) The *applicant* shall show that the TDM Plan adequately mitigates the proposed reductions in automobile parking.

(5) The owner shall set aside land for a parking facility or allow for future construction or expansion of a structured parking facility that is sufficient to provide additional parking spaces equal in number to the number reduced.

(6) In the event of noncompliance with the TDM Plan, the City Manager shall require the owner to construct additional parking spaces equal in number to the spaces originally reduced.

§ 142.0545 Shared Parking Requirements

(a) Approval Criteria. In all zones except single unit residential zones, *shared parking* may be approved through a Building Permit subject to the following requirements.

(1) *Shared parking* requests shall be for two or more different land uses located adjacent or near to one another, subject to the standards in this section.

(2) All *shared parking* facilities shall be located within a 600-foot horizontal distance of the uses served.

§ 142.0545 Cont'd

(3) Parties involved in the shared use of a parking facility shall provide an agreement for the shared use in a form that is acceptable to the City Attorney.

(4) *Shared parking* facilities shall provide *signs* on the *premises* indicating the availability of the facility for patrons of the participating uses.

(5) Modifications to the *structure* in which the uses are located or changes in tenant occupancy require review by the City Manager for compliance with this section.

(b) Shared Parking Formula. *Shared parking* is based upon the variations in the number of parking spaces needed (parking demand) over the course of the day for each of the proposed uses. The hour in which the highest number of parking spaces is needed (peak parking demand) for the proposed *development*, based upon the standards in this section, determines the minimum number of required *off-street parking spaces* for the proposed *development*.

(1) The *shared parking* formula is as follows:

A, B, C	=	proposed uses to share parking spaces
PA	=	parking demand in the peak hour for Use A
PB	=	parking demand in the peak hour for Use B
PC	=	parking demand in the peak hour for Use C
HA%	=	the percentage of peak parking demand for Use A in Hour H
HB%	=	the percentage of peak parking demand for Use B in Hour H
HC%	=	the percentage of peak parking demand for Use C in Hour H
P(A, B, C)	=	peak parking demand for Uses A, B and C combined

Formula:

$P(A, B, C) = (PA \times HA\%) + (PB \times HB\%) + (PC \times HC\%)$,
where H = that hour of the day (H) that maximizes P(A, B, C)

(2) Table 142-05G contains the peak parking demand for selected uses, expressed as a ratio of parking spaces to *floor* area.

(3) Table 142-05H contains the percentage of peak parking demand that selected uses generate for each hour of the day (hourly accumulation curve), in some cases separated into weekdays and Saturdays. The period during which a use is expected to generate its peak parking demand is indicated as 100 percent, and the period during which no parking demand is expected is indicated with "-".

(4) The parking demand that a use generates in a particular hour of the day is determined by multiplying the peak parking demand for the use by the percentage of peak parking demand the use generates in that hour.

(5) The parking demand of the proposed *development* in a particular hour of the day is determined by adding together the parking demand for each use in that hour.

§ 142.0545 Cont'd

(6) The minimum number of required *off-street parking spaces* for the proposed *development* is the highest hourly parking demand.

(7) Uses for which standards are not provided in Tables 142-05H and 142-05I may nevertheless provide *shared parking* with the approval of a Neighborhood Development Permit, provided that the *applicant* shows evidence that the standards used for the proposed *development* result in an accurate representation of the peak parking demand.

(c) Single Use Parking Ratios. *Shared parking* is subject to the parking ratios in Table 142-05H.

Table 142-05H
Parking Ratios for Shared Parking

Use	Peak Parking Demand (Ratio of spaces per 1,000 square feet of floor area unless otherwise noted. Floor area includes gross floor area plus below grade *floor* area and excludes floor area devoted to parking)	Transit Area[1]
Office (except medical office)		
Weekday	3.3	2.8
Saturday	0.5	0.5
Medical office		
Weekday	4.0	3.4
Saturday	0.5	0.5
Retail sales	5.0	4.3
Eating & drinking establishment	15.0	12.8
Cinema 1-3 screens 4 or more screens	1 space per 3 seats 1 space per 3.3 seats	1 space per 3 seats 1 space per 3.3 seats
Visitor accommodations	1 space per *guest room*	1 space per *guest room*
Conference room	10.0	10.0
Multiple dwelling units	(see Section 142.0525)	

Footnote for Table 142-05H

(1) *Transit Area*. The *transit area* peak parking demand applies in the *Transit Area* Overlay Zone (see Chapter 13, Article 2, Division 10).

(d) Hourly Accumulation Rates. Table 142-05I contains, for each hour of the day shown in the left column, the percentage of peak demand for each of the uses, separated in some cases into weekdays and Saturdays.

§ 142.0545
Cont'd

Table 142-05I
Representative Hourly Accumulation by Percentage of Peak Hour

Hour of Day	Office (Except Medical Office)		Medical Office		Retail Sales		Eating & Drinking establishment.		Cinema	
	Weekday	Saturday	Weekday	Saturday	Weekday	Saturday	Weekday	Saturday	Weekday	Saturday
6 a.m.	5%	-	5%	-	-	-	15%	20%	-	-
7 a.m.	15	30%	20	20%	10%	5%	55%	35%	-	-
8 a.m.	55	50	65	40	30	30	80	55	-	-
9 a.m	90	80	90	80	50	50	65	70	-	-
10 a.m.	100	90	100	95	70	75	25	30	5%	-
11 a.m.	100	100	100	100	80	90	65	40	5	-
Noon	90	100	80	100	100	95	100	60	30	30%
1 p.m.	85	85	65	95	95	100	80	65	70	70
2 p.m.	90	75	80	85	85	100	55	60	70	70
3 p.m.	90	70	80	95	80	90	35	60	70	70
4 p.m.	85	65	80	50	75	85	30	50	70	70
5 p.m.	55	40	50	45	80	75	45	65	70	70
6 p.m.	25	35	15	45	80	65	65	85	80	80
7 p.m.	15	25	10	40	75	60	55	100	100	90
8 p.m.	5	20	5	5	60	55	55	100	100	100
9 p.m.	5	-	5	-	45	45	45	85	100	100
10 p.m.	5	-	5	-	30	35	35	75	100	100
11p.m.	-	-	-	-	15	15	15	30	80	80
Midnight	-	-	-	-	-	-	5	25	70	70

Hour of Day	Visitor Accommodations					
	Guest Room		Eating & Drinking Establishment		Conference Room	Exhibit Hall and Convention Facility
	Weekday	Saturday	Weekday	Saturday	Daily	Daily
6 a.m.	100%	90%	15%	20%	-	-
7 a.m.	95	80	55	35	--	-
8 a.m.	85	75	80	55	50%	50%
9 a.m	85	70	65	70	100	100
10 a.m.	80	60	25	30	100	100
11 a.m.	75	55	65	40	100	100
Noon	70	50	100	60	100	100
1 p.m.	70	50	80	65	100	100
2 p.m.	70	50	55	60	100	100

§ 142.0545 Cont'd

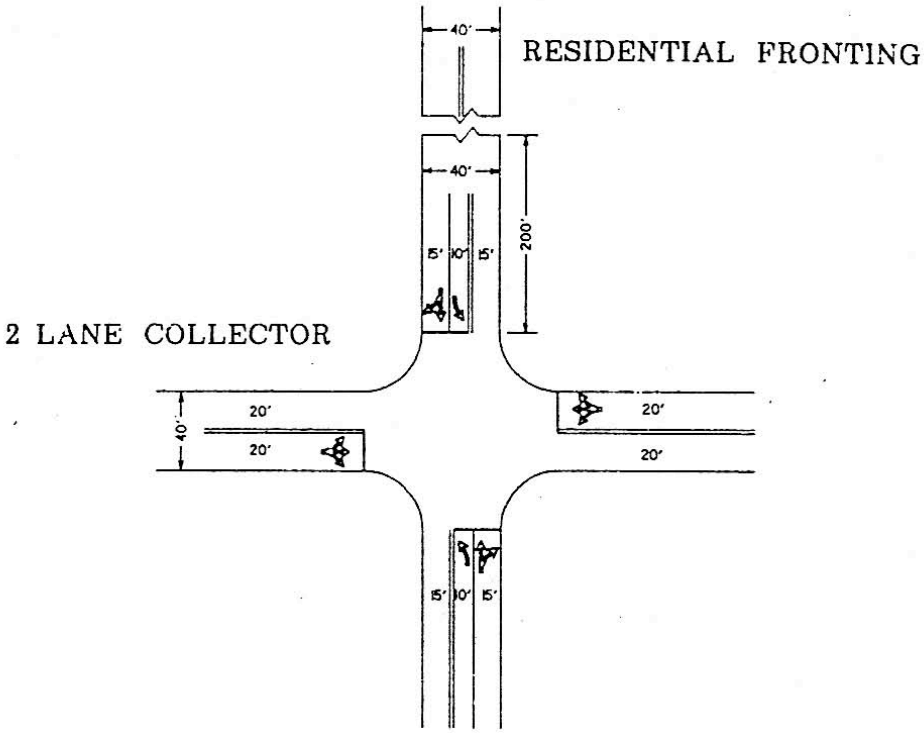
Hour of Day	Visitor Accommodations					
	Guest Room		Eating & Drinking Establishment		Conference Room	Exhibit Hall and Convention Facility
3 p.m.	60	50	40	60	100	100
4 p.m.	65	50	30	50	100	100
5 p.m.	60	60	45	65	100	100
6 p.m.	65	65	65	85	100	100
7 p.m.	75	70	55	100	100	100
8 p.m.	85	70	55	100	100	100
9 p.m.	90	75	45	85	100	100
10p.m.	90	85	35	75	50	50
11p.m.	100	95	15	30	-	-
Midnight	100	100	10	25	-	-

Hour of Day	Residential	
	Weekday	Saturday
6 a.m.	100%	100%
7 a.m.	80	100
8 a.m.	60	95
9 a.m	50	85
10 a.m.	40	80
11 a.m.	40	75
Noon	40	70
1 p.m.	35	65
2 p.m.	40	65
3 p.m.	45	65
4 p.m.	45	65
5 p.m.	50	65
6 p.m.	65	70
7 p.m.	70	75
8 p.m.	75	80
9 p.m.	85	80
10 p.m.	90	85
11 p.m.	95	90
Midnight	100	95

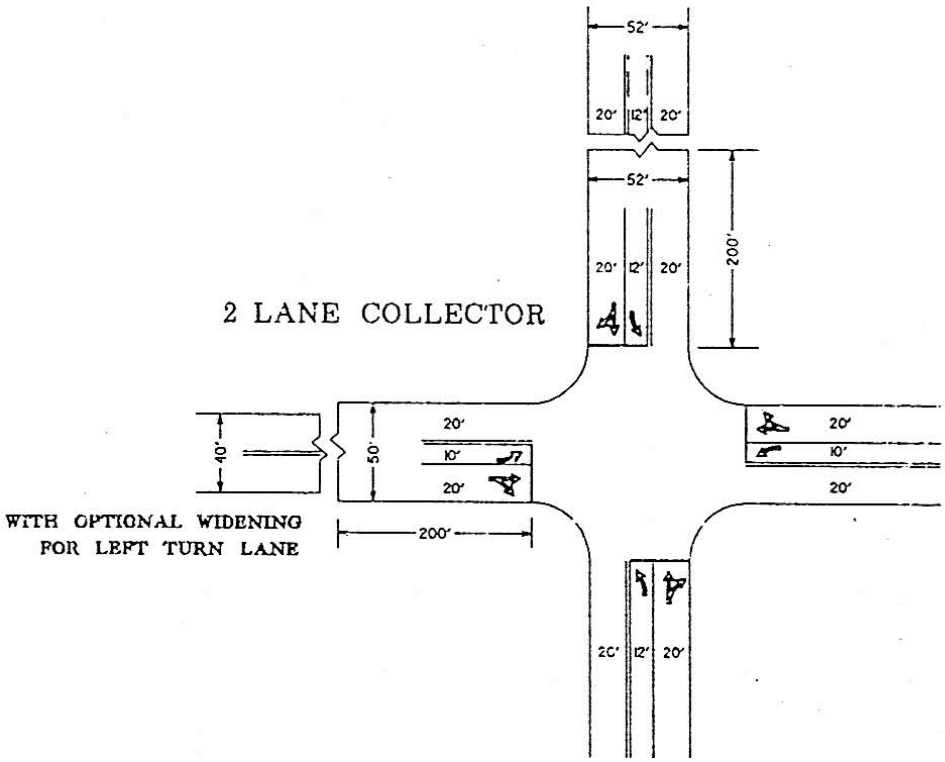
APPENDIX 4

INTERSECTION LANE CONFIGURATIONS

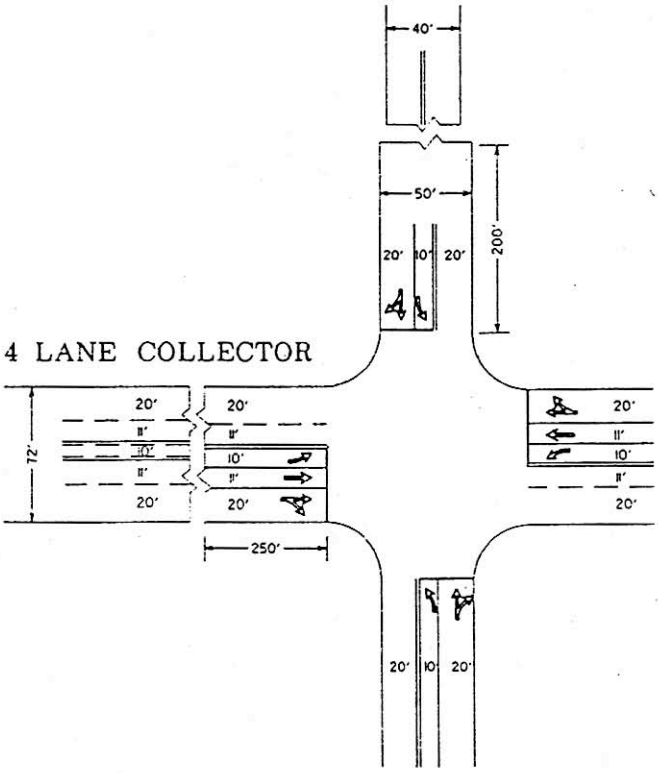
2 LANE COLLECTOR



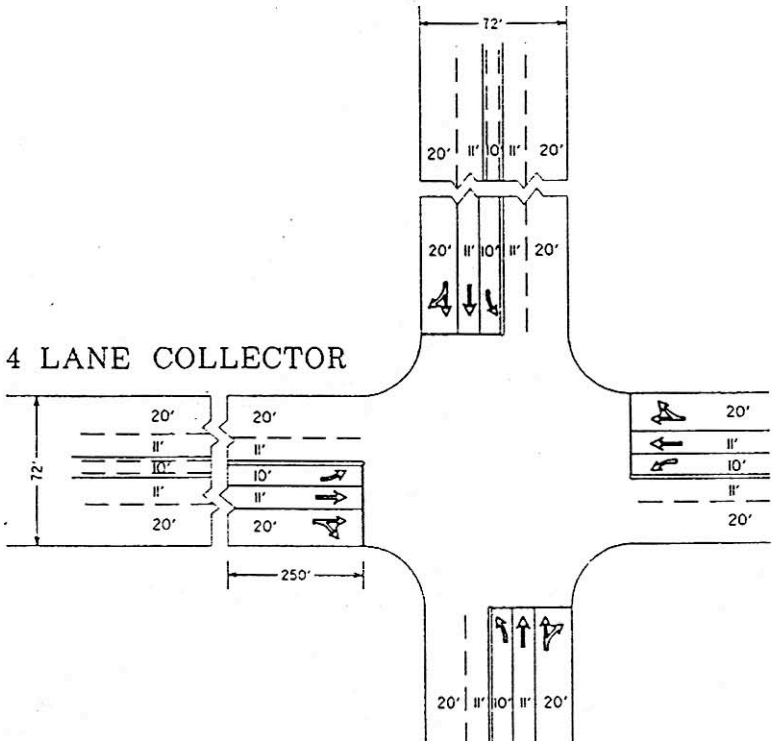
2 LANE COLLECTOR WITH CONTINOUS TWO-WAY LEFT-TURN LANE



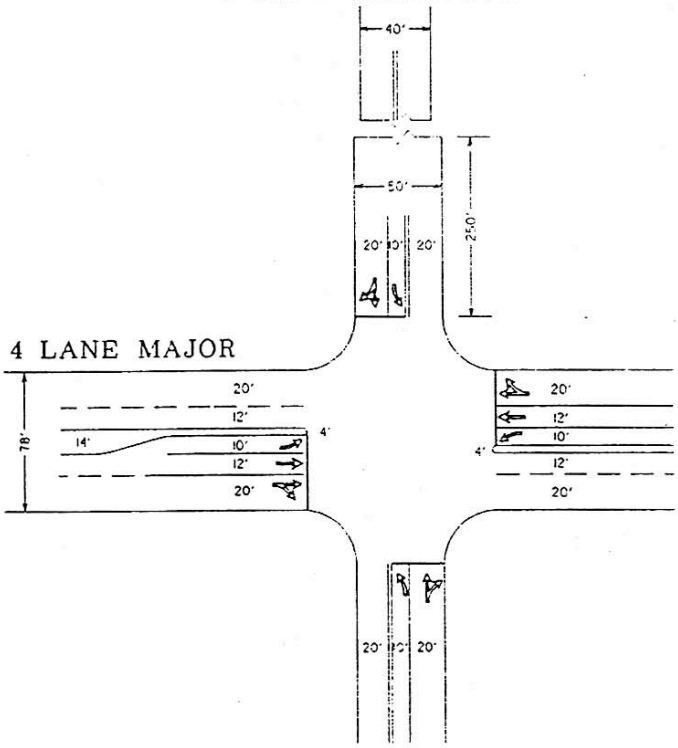
2 LANE COLLECTOR



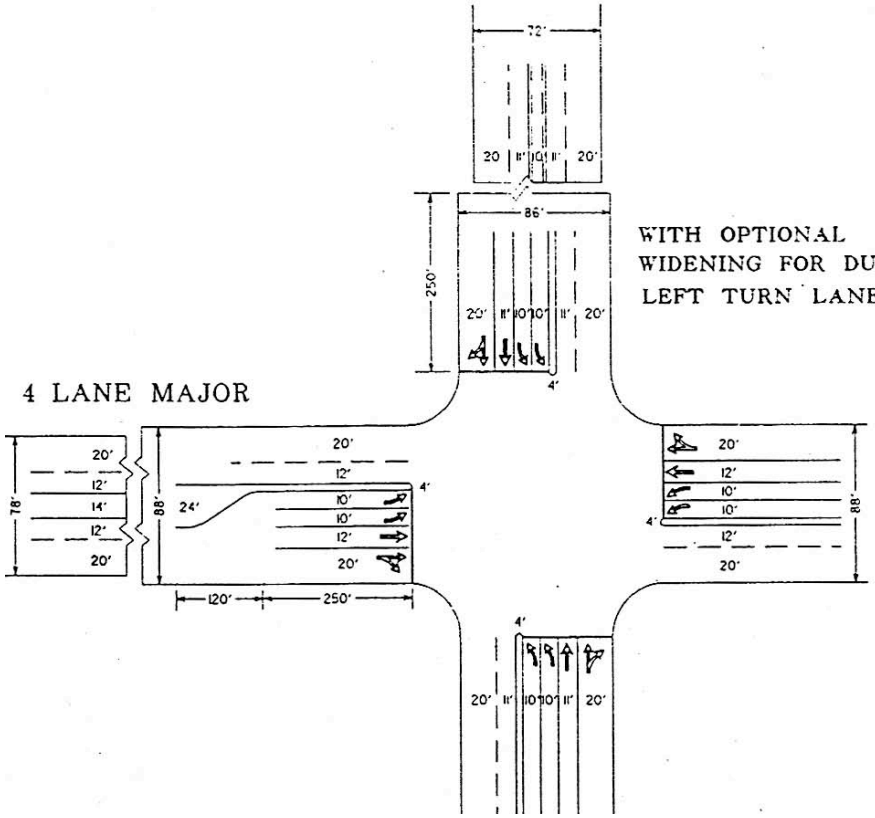
4 LANE COLLECTOR



2 LANE COLLECTOR

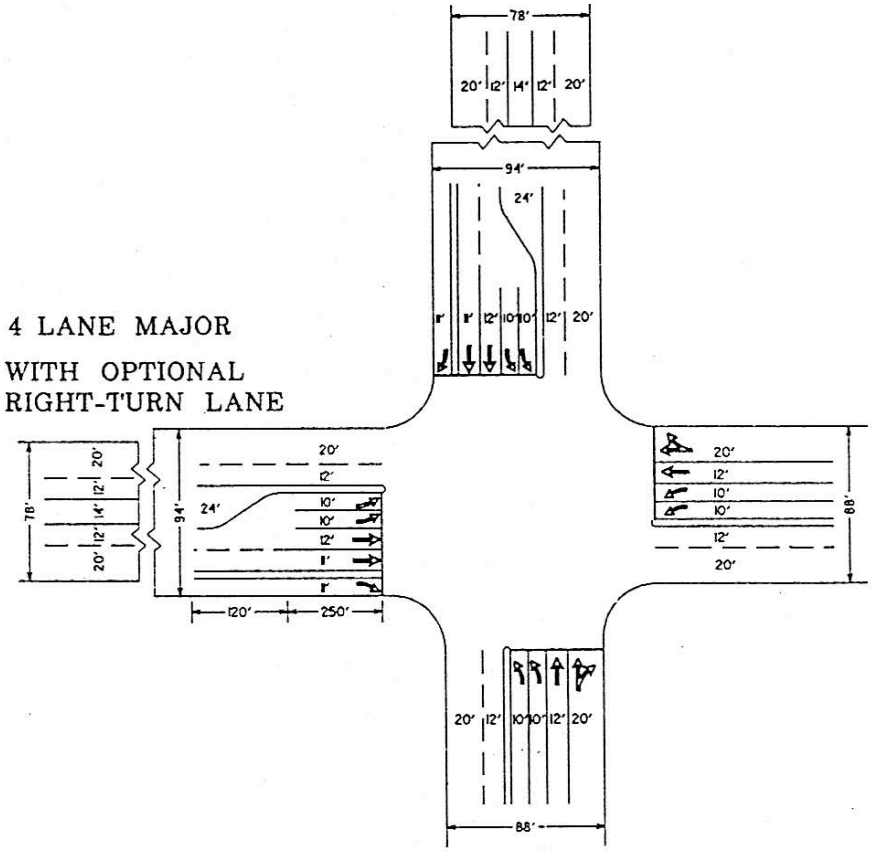


4 LANE COLLECTOR

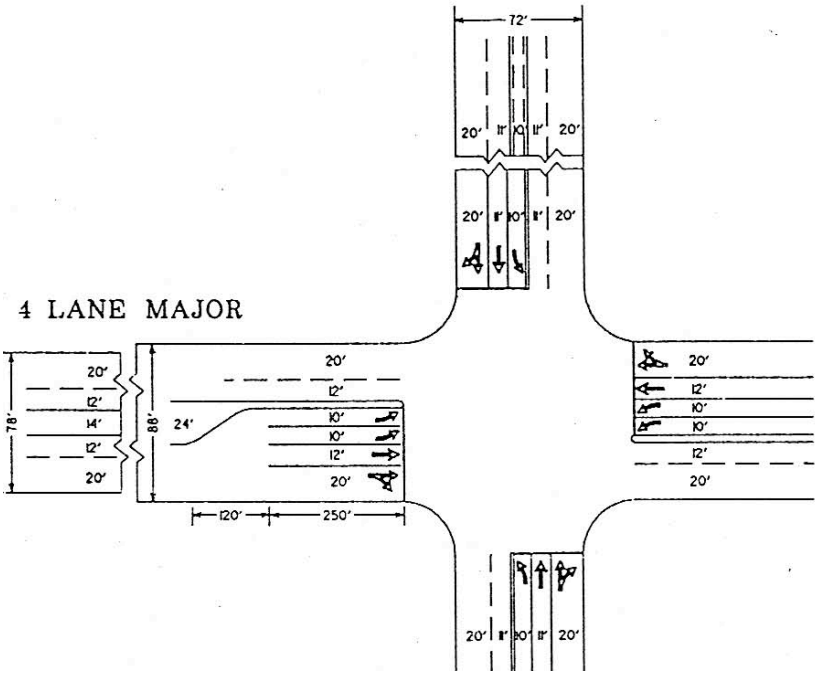


WITH OPTIONAL
WIDENING FOR DUAL
LEFT TURN LANES

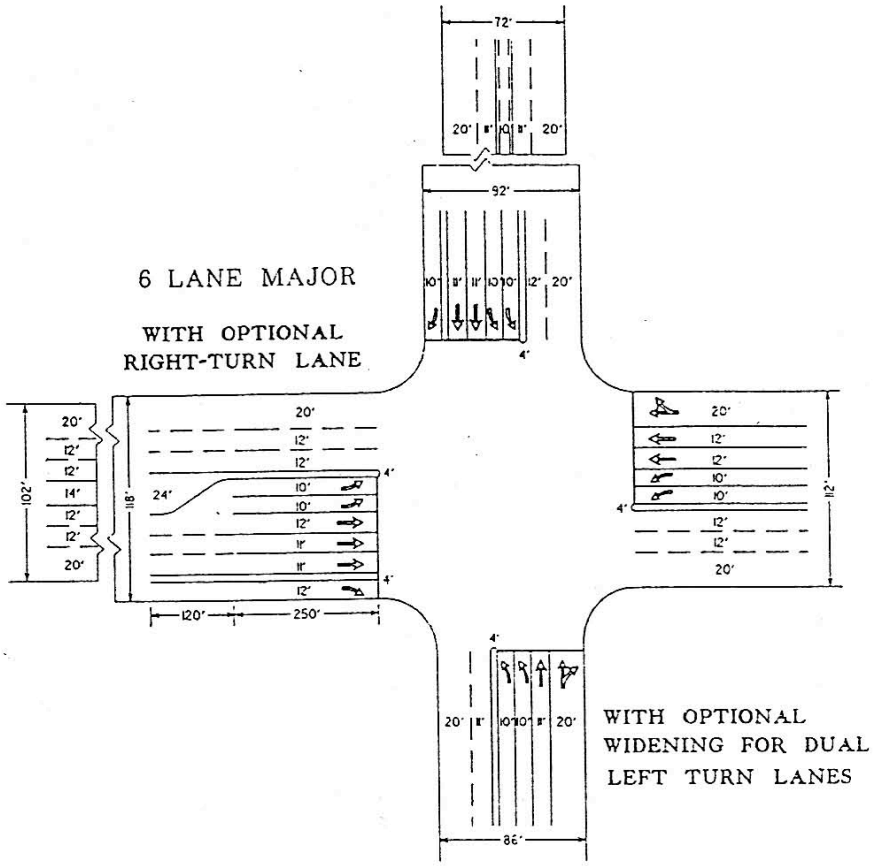
4 LANE MAJOR



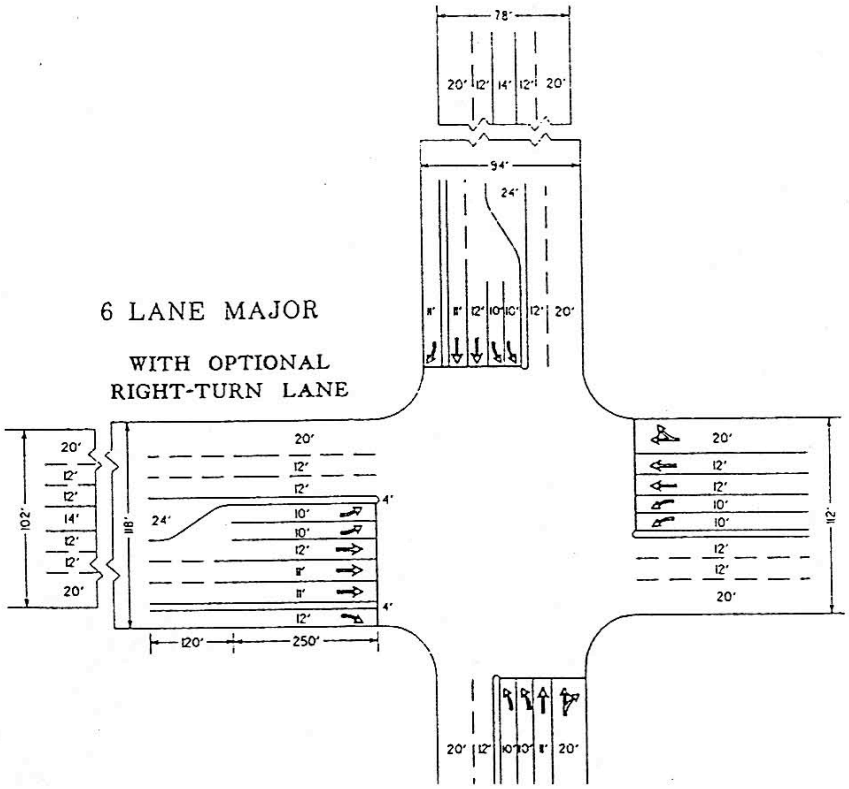
4 LANE COLLECTOR



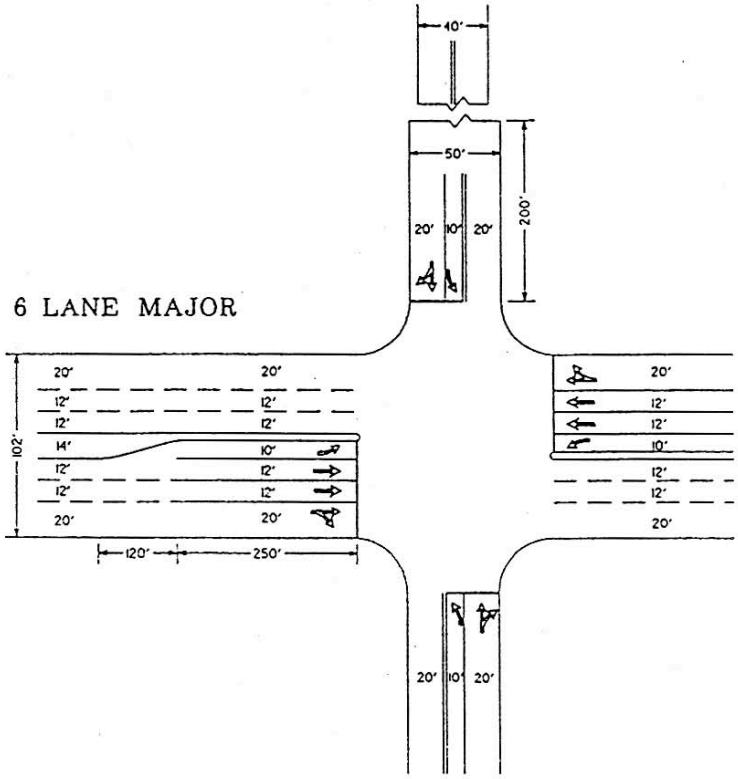
4 LANE COLLECTOR



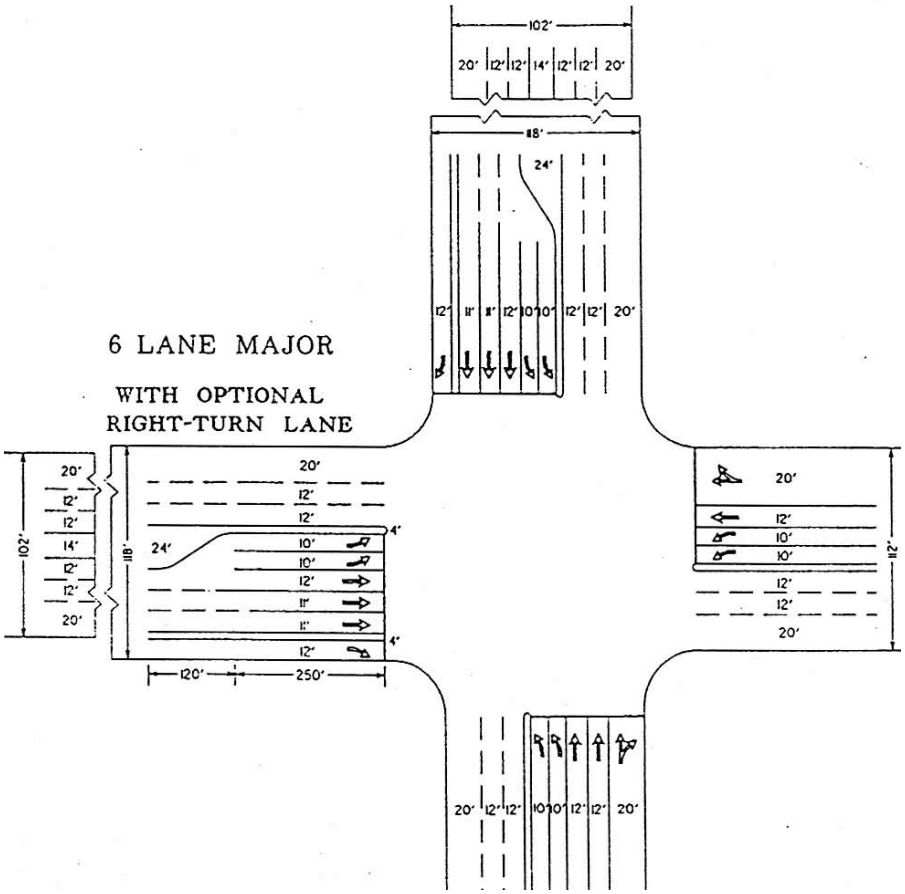
4 LANE MAJOR



2 LANE COLLECTOR



6 LANE MAJOR



6 LANE MAJOR

WITH OPTIONAL
RIGHT-TURN LANE

City Staff Members who participated in the 1993 effort:

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Tijana Stojsic Hamilton (Barton-Aschman Associates, Inc.)
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Ronald Sieke (P&D Technologies, Inc.)