LINSCOTT LAW & GREENSPAN
ENGINEERS

ENGINEERS & PLANNERS ▪ TRAFFIC, TRANSPORTATION, PARKING

1580 Corporate Drive, Suite 122 ▪ Costa Mesa, California 92626
Phone: 714 641-1587 ▪ Fax: 714 641-0139

5400.3.2

APR 1 ^ 1997

April 8, 1997

Mr. Michael C. Battaglia
COMSTOCK, CROSSER & ASSOCIATES
DEVELOPMENT COMPANY, INC.
321 12th Street, Suite 200
Manhattan Beach, California 90266

SUBJECT: REALIGNED RESIDENTIAL PROJECT ENTRIES ON 228TH STREET FOR TENTATIVE TRACT MAP NO. 52281

Dear Mr. Battaglia:

This letter has been prepared in response to your request for a safety evaluation of the Tentative Tract Map No. 52281 residential project entries on 228th Street. You stated that the City of Carson requested that the two proposed project entries be relocated, for safety purposes, to align directly with the existing streets on the north side of 228th Street.

228th Street is a 40-foot wide, two-lane residential collector road with centerline striping and parking on both sides. The posted speed limit is 30 miles per hour and the adjacent land uses are primarily residential with few driveways located on 228th Street. This reduces the amount of conflicting vehicle movements between intersecting streets. Based on our evaluation of the revised site plan, it is our finding that the project entries on 228th Street have been adequately relocated to eliminate the potential safety concerns presented in the prior site plan.

The easterly entry has been relocated to be aligned directly with Rashdall Avenue. This is a safety improvement because it creates standard intersection movements which eliminates conflicting left-turn movements from 228th Street. In our opinion, the westerly entry need not be relocated. This project entry is centrally located between Delford and Frigate Avenues which are spaced 250 feet apart. The separation between Delford and Frigate Avenues and the new project entry, along with the fact that 228th Street is a two lane residential collector (ie. low speeds) with no striped turn lanes, means no conflicting left turn movements at Delford Avenue, Frigate Avenue and the westerly project entry.

Philip M. Linscott, P.E. (Ret.)
Jack M. Greenspan, P.E.
William A. Law, P.E. (Ret.)
Paul W. Wilkinson, P.E.
John P. Keating, P.E.
David S. Shender, P.E.

Pasadena - 818 796-2322 ▪ San Diego - 619 299-3090 ▪ Las Vegas - 702 451-1920 ▪ An LG2WB Company

We appreciate the opportunity to provide this evaluation for you. Should you need any further assistance, or have any questions regarding this evaluation, please call me or Richard Barretto.

Very truly yours,
LINSCOTT, LAW & GREENSPAN, ENGINEERS

Keil D. Maberry, P.E.
Transportation Engineer III

cc: Richard Barretto / LLG

A:\tm52281

LINSCOTT
LAW &
GREENSPAN
ENGINEERS

TRAFFIC IMPACT ANALYSIS REPORT
CARSON TERMINAL SITE
RESIDENTIAL PROJECT
Carson, California

Prepared For:

COMSTOCK CROSSER & ASSOCIATES
321 - 12th Street
Manhattan Beach, California 90266

Prepared By:

LINSCOTT, LAW & GREENSPAN, ENGINEERS
1580 Corporate Drive, Suite 122
Costa Mesa, CA 92626
Phone: (714) 641-1587
FAX: (714) 641-0139

2-961843-1

October 28, 1996

Prepared By:
Richard E. Barretto
Transportation Engineer III

Under the Supervision of:
Jack M. Greenspan, P.E.
Principal

REGISTERED PROFESSIONAL ENGINEER
JACK M. GREENSPAN
No. 0142
Exp. 3/31/00
TRAFFIC
STATE OF CALIFORNIA

LINSCOTT LAW & GREENSPAN
ENGINEERS

TABLE OF CONTENTS

LINSCOTT LAW & GREENSPAN
ENGINEERS

ENGINEERS & PLANNERS ▪ TRAFFIC, TRANSPORTATION, PARKING

1580 Corporate Drive, Suite 122 ▪ Costa Mesa, California 92626
Phone: 714 641-1587 ▪ Fax: 714 641-0139

October 28, 1996

Mr. Robert Comstock
COMSTOCK CROSSER & ASSOCIATES
321 12th Street
Manhattan Beach, California 90266

Subject: **TRAFFIC IMPACT ANALYSIS REPORT**
CARSON TERMINAL SITE RESIDENTIAL PROJECT
Carson, California

Dear Mr. Comstock:

Linscott, Law & Greenspan, Engineers (LLG) is pleased to submit this Traffic Impact Analysis Report for the Carson Terminal Site single family residential development, located west of Main Street and south of 228th Street in the City of Carson, California.

Our study investigates the potential traffic impacts as well as circulation needs associated with the development of the proposed residential housing tract development within the project study area. Per City requirements, the analysis evaluates the relative traffic impacts of the project at six study intersections upon buildout of the site (2001) and two years afterwards (2003), and presents specific recommendations as to local area circulation improvements. Briefly, based on the results of our analysis, the project will have a significant impact on the operating conditions at only one of the six study intersections. An Executive Summary sets forth a summary of findings and conclusions on the following pages.

We appreciate the opportunity to prepare this investigation. Should you have any questions regarding this analysis, please call us at (714) 641-1587.

Very truly yours,
LINSCOTT, LAW & GREENSPAN, ENGINEERS

Richard E. Barretto
Transportation Engineer III

Jack M. Greenspan, P.E.
Principal

1843COV.LTR
Philip M. Linscott, P.E. (Ret.)
Jack M. Greenspan, P.E.
William A. Law, P.E. (Ret.)
Paul W. Wilkinson, P.E.
John P. Keating, P.E.
David S. Shender, P.E.

LINSCOTT LAW & GREENSPAN
ENGINEERS

LIST OF TABLES

LINSCOTT LAW & GREENSPAN
ENGINEERS

EXECUTIVE SUMMARY
TRAFFIC IMPACT ANALYSIS REPORT
CARSON TERMINAL SITE RESIDENTIAL PROJECT
Carson, California

INTRODUCTION

This report addresses the potential traffic impacts and circulation needs associated with the Carson Terminal Site (CTS) Residential Project. The potential traffic impacts of the proposed project have been evaluated in a year 2001 and 2003 by analyzing future Levels of Service (LOS) during the AM and PM peak hours at six key intersections.

Further, this report identifies recommended intersection improvements that may be required to accommodate future traffic volumes and restore/maintain an acceptable Level of Service, and/or mitigate the impact of CTS project traffic. This report is intended to satisfy the traffic impact requirements of the City of Carson and be consistent with the 1995 Congestion Management Program (CMP) for Los Angeles County.

PROJECT DESCRIPTION AND TRAFFIC CHARACTERISTICS

- The project site is at the Carson Terminal Site in the City of Carson. The project site is a rectangular-shaped 20.6-acre parcel of land located south of 228th Street and west of Main Street. The project consists of 166 single family residential homes.

- At buildout, the CTS project is expected to generate 1,660 daily trips, with 133 trips produced in the AM peak hour (27 inbound, 106 outbound) and 166 trips produced in the PM peak hour (116 inbound, 50 outbound).

EXISTING TRAFFIC CONDITIONS

- Based on existing traffic volumes and existing intersection geometries, each of the six key signalized intersections currently operate at Level of Service D or better during the AM and PM peak commute hour.

FUTURE TRAFFIC CONDITIONS

- Currently, there are no known planned and/or approved, related projects in the vicinity of the Cottages Specific Plan. Hence, horizon year background traffic growth estimates have been calculated using the growth factors recommended for use by the City of Carson. Per City criteria, traffic growth has been calculated at 3% per year. This growth factor is assumed to account for "small projects" and/or undeveloped land inside the study area and regional traffic growth.

Intersection Capacity Analysis

- A review of future 2001 traffic conditions indicates that ambient traffic growth will deteriorate the AM PM peak hour Level of Service at four locations. However, only the Figueroa/223rd intersection is expected to operate at an adverse service level when compared to the City of Carson LOS criteria. The remaining key intersections are forecast to operate at Level of Service D or better during the peak hours.

- An analysis of future 2003 traffic conditions indicates that ambient traffic growth will deteriorate the AM and/or PM peak hour Level of Service at five locations. The intersections of Figueroa/223rd and Figueroa/Sepulveda are expected to operate at unacceptable LOS E and will require improvements to alleviate the traffic conditions. The remaining three affected intersections are expected to operate at acceptable LOS D or better during the peak hours.

- Traffic associated with the CTS project will have a significant impact at only one of the six key intersections when compared to the City impact criteria. The Figueroa/Sepulveda is forecast to operate at LOS E during the PM peak hour. The project is expected to add 1.4% to the ICU value at this impacted intersection.

Freeway Segment (Mainline) CMP Analysis

- The Carson Terminal Site project is expected to generate a maximum of 29 peak hour trips on any of the freeway segments in the study area. Therefore, since AM and PM peak hour project generated trips on the key freeway segments in the project study area are below the threshold of 150 trips required for the freeway segment analysis, a Freeway Segment (Mainline) CMP Analysis was not conducted.

LINSCOTT LAW & GREENSPAN
ENGINEERS

LIST OF EXHIBITS

LINSCOTT LAW & GREENSPAN

ENGINEERS

EXECUTIVE SUMMARY

LINSCOTT LAW & GREENSPAN
ENGINEERS

AREA TRAFFIC IMPROVEMENT MEASURES

- Based on this analysis, areawide traffic improvements are required at the intersections of Figueroa/223rd and Figueroa/Sepulveda to alleviate unacceptable traffic conditions caused by ambient traffic growth. The improvements, which would restore acceptable traffic conditions, consist of the following:

    1. Figueroa Street @ 223rd Street: Restripe eastbound approach of 223rd Street to provide dual left-turn lanes and two through lanes.

    2. Figueroa Street @ Sepulveda Boulevard: Restripe the westbound approach on Sepulveda Boulevard to provide one left-turn lane, two through lanes, and a separate right-turn lane.

Parking restrictions on 223rd Street and Sepulveda Boulevard will most likely be required to implement these improvements.

PROJECT-SPECIFIC IMPROVEMENTS

- The proposed project is projected to have significant traffic impact at only the Figueroa Street and Sepulveda Boulevard intersection.

- The CTS residential development project may be required to contribute to the improvement costs of the Figueroa/Sepulveda intersection on fair share basis.

- In addition to the above mitigation measures the following improvements are recommended in conjunction with the development of the Carson Terminal Site residential project:

    1. For the gated project access roadways intersecting 228th Street, provide two inbound lanes and one outbound lane. Install a "STOP" sign to control exiting project traffic.

    2. Develop an internal signing and striping plan that will provide clear signage for future residential development.

    3. Validate final plans, including landscaping plans, for adequate sight distance on 228th Street.

LINSCOTT
LAW &
GREENSPAN
ENGINEERS

TRAFFIC IMPACT ANALYSIS REPORT

LINSCOTT LAW & GREENSPAN
ENGINEERS

TRAFFIC IMPACT ANALYSIS
CARSON TERMINAL SITE RESIDENTIAL PROJECT
Carson, California

INTRODUCTION

This Traffic Impact Analysis Report addresses the potential traffic impacts and circulation needs associated with the development of a single family residential housing tract located south of 228th Street and west of Main Street in the City of Carson.

The traffic analysis focuses on evaluating the potential traffic impacts of the proposed project on the streets and intersections in the vicinity of the site. This traffic report is intended to satisfy the traffic impact requirements of the City of Carson and be consistent with the 1995 Congestion Management Program (CMP) for Los Angeles County.

The project site has been visited and an inventory of adjacent area roadways and intersections made. Existing traffic information has been compiles and supplemented with manual peak period turning movement counts conducted at three locations in support of detailed intersection capacity analyses. Prior traffic studies have been reviewed and information concerning cumulative projects (planned/and/or approved) in the vicinity of the project have been researched. Based on our research, there are no planned and/or approved related projects in the immediate vicinity of the project site or within the study area.

Per City guidelines, this traffic report analyzes existing and future peak hour traffic conditions upon buildout the project (2001) and two years afterwards (2003) at the six key area intersections listed below, which provide both regional and local access to the site area:

1) Main Street @ 223rd Street
2) Main Street @ 228th Street
3) Main Street @ Sepulveda Boulevard
4) Figueroa Street @ 223rd Street
5) Figueroa Street @ 228th Street
6) Figueroa Street @ Sepulveda Boulevard

The key intersections analyzed in this study were selected for evaluation based on the City of Carson guidelines for traffic impact studies. The Volume-Capacity (V/C) characteristics and Level of Service (LOS) investigations for the AM and PM peak hour at these six key locations were used to evaluate the potential traffic-related impacts associated with anticipated area growth and the proposed Main/228th residential project. Further, this report identifies recommended intersection improvements that may be required to accommodate future traffic volumes and restore/maintain an acceptable Level of Service, and/or mitigate the impact of project traffic.

LINSCOTT LAW & GREENSPAN
ENGINEERS

PROJECT DESCRIPTION AND LOCATION

The project site is at the Carson Terminal Site (CTS) located in the City of Carson. The project site, which was previously used by Fletcher Oil as a storage facility, is a rectangular-shaped 20.6-acre parcel of land located south of 228th Street, and west of Main Street. Existing homes/apartments border the project site to the south and west. A church is located directly north of the site, north of 228th Street. **Exhibit 1** presents a Vicinity Map, which illustrates the general location of the project and depicts the surrounding street system. Existing development in the vicinity of the proposed residential project consists of a mixture of uses, including industrial, residential and commercial uses. Currently, there are eleven abandoned oil storage tanks on the project site.

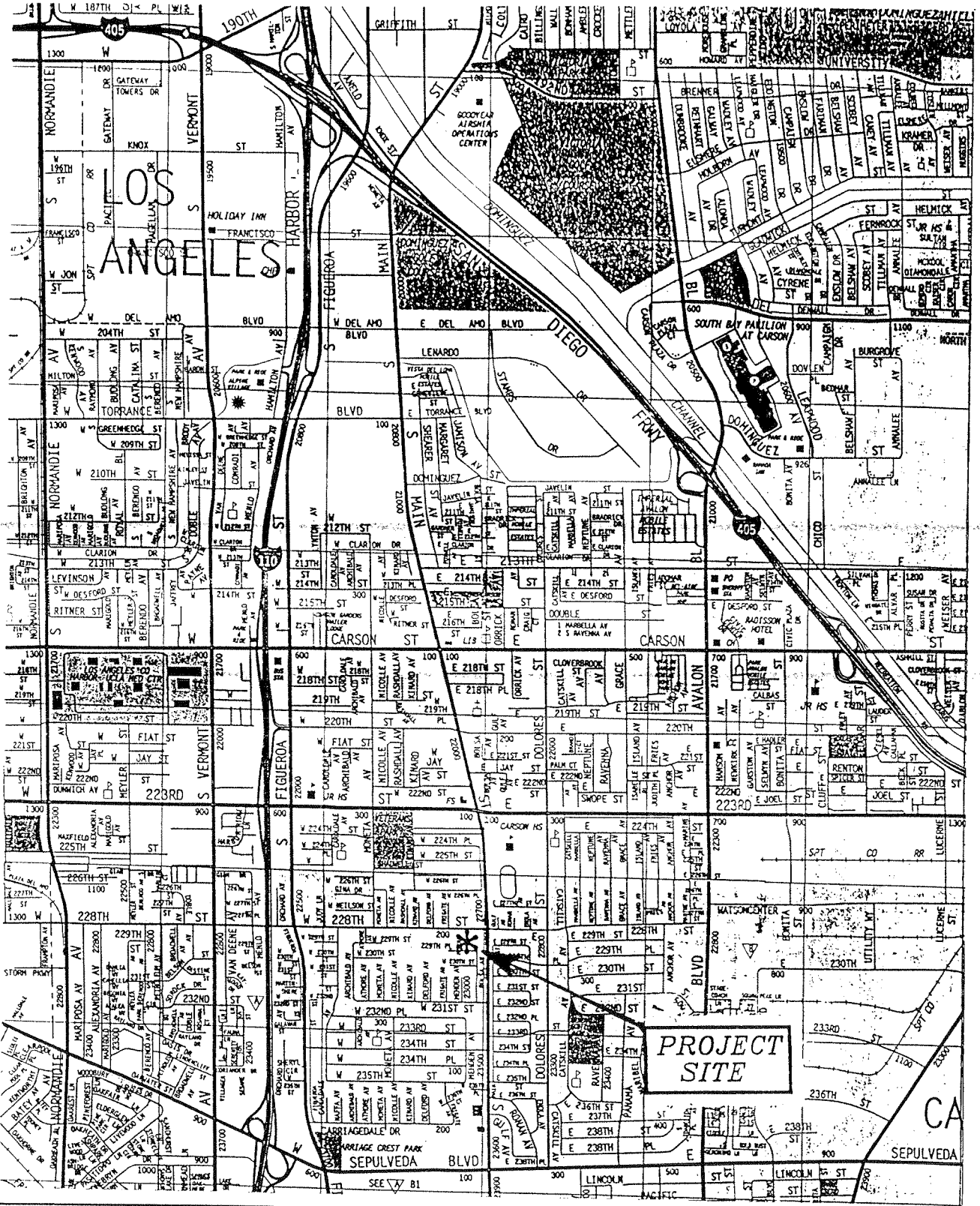
Exhibit 2 presents the conceptual site plan for the project as prepared by the Keith Companies. Review of the site plan indicates that the proposed CTS residential project consists of 166 single family residential homes, which are to be constructed in four phases. The first phase of development (anticipated to be completed by 1998) consists of 42 single family homes. The second phase consists of another 42 single family homes (completion by 1999). The third and fourth phases are expected to be completed by the end of 2000 and 2001, and consists of 41 single family homes each.

Primary access to the proposed residential project will be provided by two, gate-access controlled driveways along 228th Street. Both access points are proposed as full access driveways, allowing all movements into and out of the site.

EXISTING STREET NETWORK

Regional access to the project site is provided by the Harbor (I-110), San Diego (I-405) and Long Beach (I-710) Freeways. The 8-lane Harbor Freeway is located directly west of the project site and intersects the San Diego Freeway approximately 2½ miles north of the project site. Primary project access from the Harbor Freeway is provided via an interchange at Sepulveda Boulevard. Other Harbor Freeway interchanges are provided at 223rd Street (southbound) and 220th Street (northbound). San Diego Freeway interchange facilities are provided at Main Street, Avalon Boulevard, Carson Street, and Wilmington Boulevard. Access from the Long Beach Freeway, which is located approximately 5½ miles east of the project site, is provided via an interchange at Sepulveda Boulevard-Willow Street.

The principal local network of streets serving the Carson Terminal Site residential project are Main Street, Sepulveda Boulevard, Figueroa Street, 223rd Street, and 228th Street. The following discussion provides a brief synopsis of these key area streets. These descriptions are based on an inventory of existing roadway conditions.



MAP SOURCE: THOMAS BROS.

N

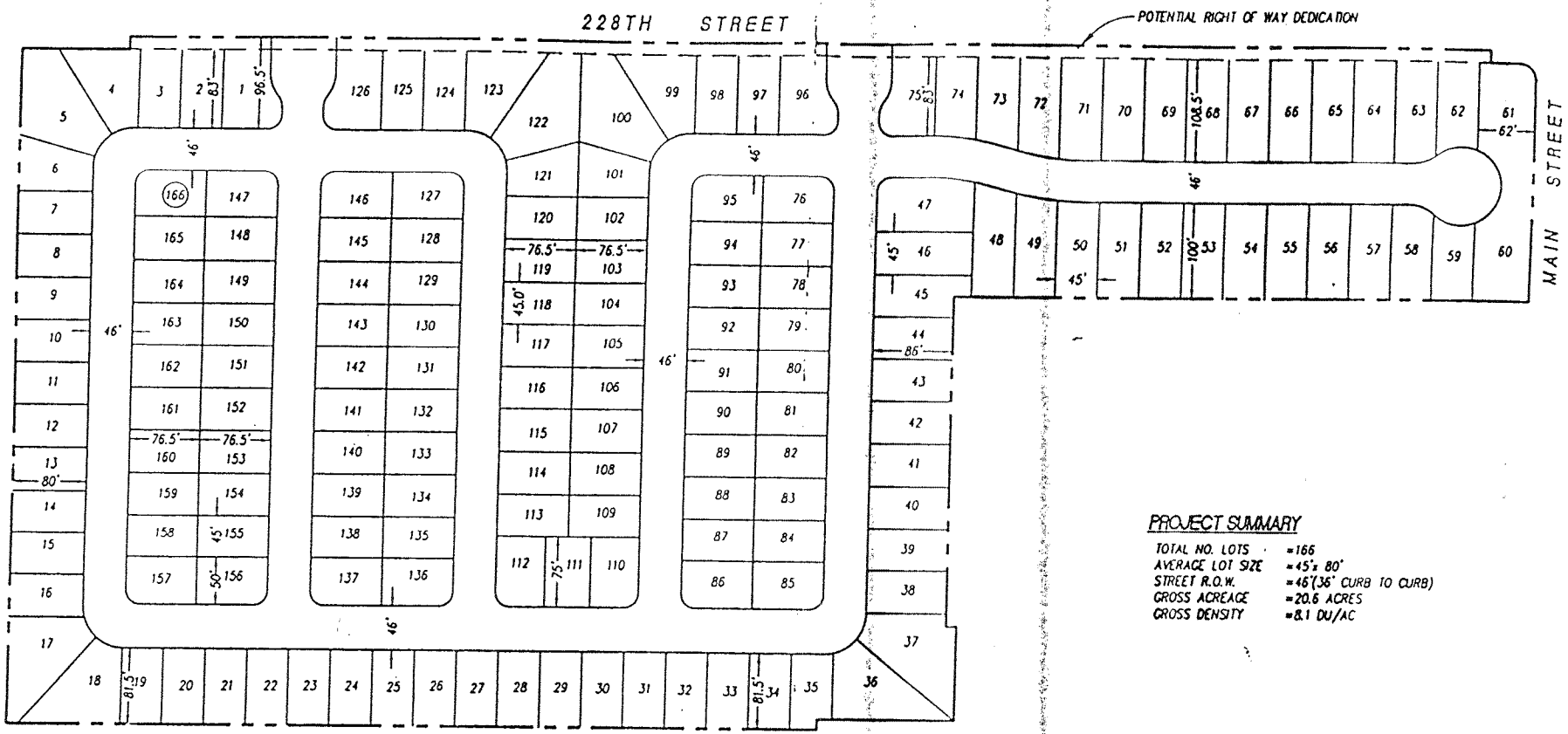
NO SCALE

1

LINSCOTT LAW & GREENSPAN ENGINEERS

VICINTY MAP

CARSON TERMINAL SITE



SOURCE: KEITH COMPANIES

NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

2

PROPOSED SITE PLAN
CARSON TERMINAL SITE

Main Street is an existing north-south arterial which borders the project site on the west. According to the City of Carson Circulation Element, Main Street is classified as a major highway (100-foot right-of-way). Main Street is a fully improved four-lane roadway with landscaped medians. Curb parking is allowed along all sections of this roadway in the project study area. The posted speed limit on Main is 40 miles per hour (mph). Traffic signals control the study intersections on Main at 223rd, 228th, and Sepulveda. Daily traffic on Main Street, adjacent to the site, totals approximately 14,800 vehicles per day (vpd).

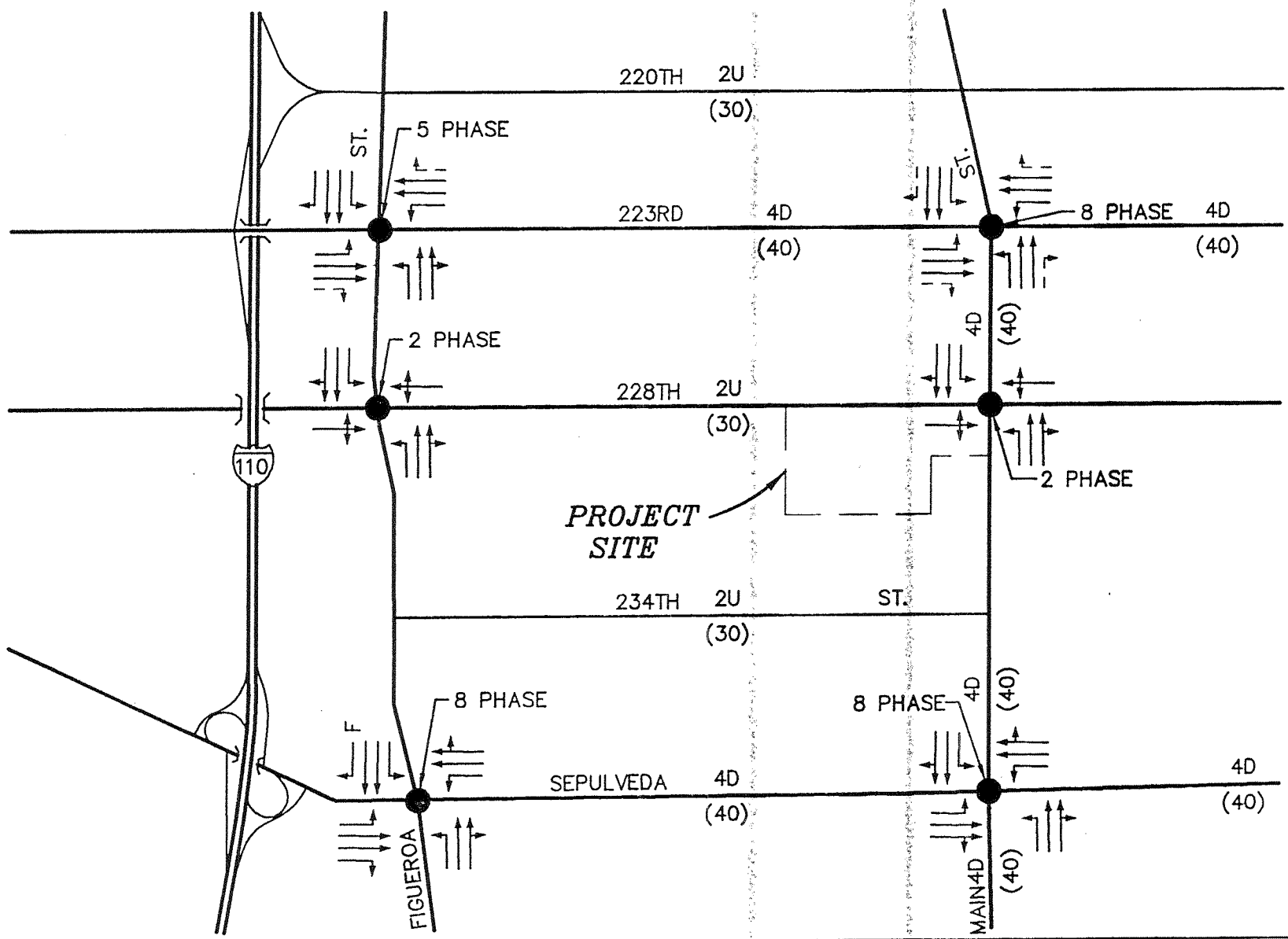
Sepulveda Boulevard is an east-west primary arterial highway located south of the project site. This roadway is constructed as a four-lane divided roadway over most of its length in the project study area. Parking is permitted along most sections of this roadway. The posted speed limit is 40 mph. Sepulveda provides full access to the I-110 Freeway via a partial cloverleaf interchange. Traffic signals control the intersections with Figueroa and Main. Sepulveda Boulevard is estimated to carry daily traffic volumes on the order of 19,000 vpd to 20,000 vpd.

Figueroa Street is north-south, four-lane divided arterial, which parallels the I-110 Freeway west of the project site. The posted speed limit is 40 mph. Curb parking is allowed along all sections of this roadway in the project study area. Traffic signals control the study intersections with 223rd, 228th and Sepulveda Boulevard. Daily traffic volumes range from approximately 10,000 vpd to 13,000 vpd.

223rd Street is an east-west, four-lane arterial located north of the project site. Parking is permitted along most sections of this roadway. The posted speed limit is 40 mph. Traffic signals control the study intersections with Figueroa and Main. Daily traffic volumes range from approximately 15,900 vpd to 18,100 vpd.

228th Street is a two-lane undivided street which borders the site to the north. 228th is estimated to carry daily traffic volumes on the order of 6,500 to 7,500 vpd within the study area. Traffic signals control the study intersections with Figueroa and Main. Parking is permitted on all sections of this local residential street. The posted speed limit is 30 mph.

Exhibit 3 presents an inventory of the existing roadway conditions for the arterials and intersections evaluated in this report. The number of travel lanes and intersection controls for the key area intersections are identified.



N NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

KEY

F = FREE RIGHT TURN
= APPROACH LANE ASSIGNMENT
= TRAFFIC SIGNAL
= STOP SIGN
= FUNCTIONS AS SEPARATE TURN LANE
2U = NUMBER OF TRAVEL LANES
(XX) = SPEED LIMIT
D = DIVIDED, U = UNDIVIDED

3

EXISTING 1996 ROADWAY CONDITIONS AND INTERSECTION CONTROLS

CARSON TERMINAL SITE

LINSCOTT LAW & GREENSPAN
ENGINEERS

EXISTING AREA TRAFFIC VOLUMES

Existing AM and PM peak hour traffic volumes for the six key intersections evaluated in this report were obtained from manual morning and evening peak hour turning movement counts conducted by H.K Traffic Data in August and September 1994. The 1994 traffic data were supplemented with counts completed by Accutek in October 1996. The measured 1994 volumes were increased by three percent per year (6%) to reflect 1996 existing conditions.

The six key intersections were designated for evaluation based on City of Carson guidelines for traffic impact studies and discussions with Mr. Richard Garland, City Traffic Engineer. **Exhibit 4** presents the existing AM and PM peak hour traffic volumes for the study intersections. **Appendix A** contains the detailed manual count sheets.

EXISTING INTERSECTION CONDITIONS

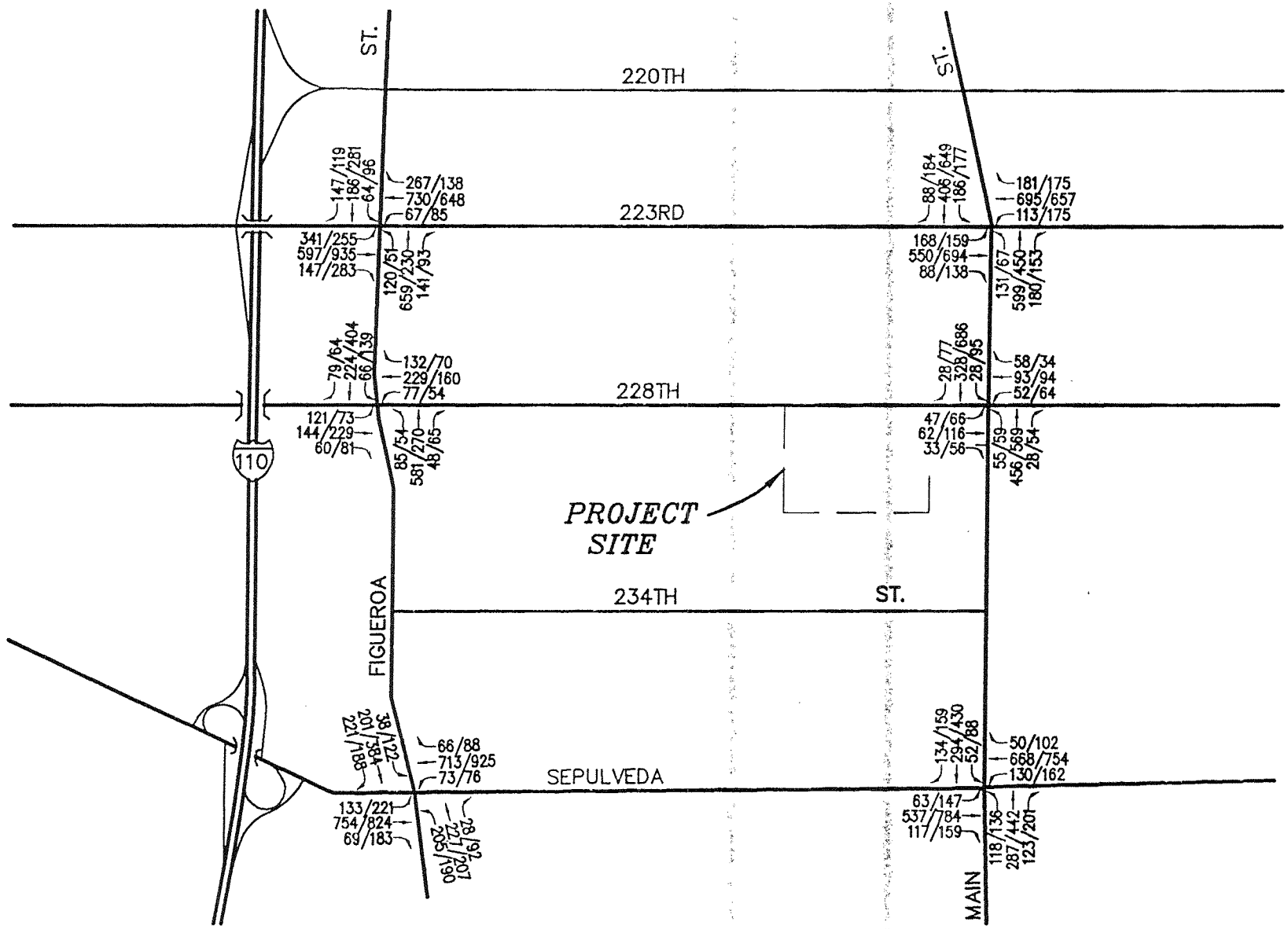
ICU Method of Analysis

In conformance with the City of Carson and LA County CMP requirements, existing AM and PM peak hour operating conditions for six key signalized intersections were evaluated using the Intersection Capacity Utilization (ICU) method. The ICU technique is intended for signalized intersection analysis and estimates the volume to capacity (V/C) relationship for an intersection based on the individual V/C ratios for key conflicting traffic movements. The ICU numerical value represents the percent signal (green) time, and thus capacity, required by existing and/or future traffic. It should be noted that the ICU methodology assumes uniform traffic distribution per intersection approach lane and optimal signal timing.

The ICU value translates to a Level of Service (LOS) estimate, which is a relative measure of the intersection performance. Per the City of Carson criteria, the six qualitative categories of Level of Service have been defined along with the corresponding ICU value range, as shown in **Table 1**.

The ICU value is the sum of the critical volume to capacity ratios at an intersection; it is not intended to be indicative of the LOS of each of the individual turning movements. The City has established the following guidelines of acceptable service levels for intersection operations:

- Local/Residential Street Intersections: LOS C (ICU = 0.70 - 0.79)
- Other Surface Street Intersections: LOS D (ICU = 0.80 - 0.89)
- Freeway Ramp Intersections: LOS E (ICU = 0.90 - 0.94)



KEY
XX/YY = AM/PM PEAK HOUR TRAFFIC VOLUMES

N NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

4

EXISTING 1996 PEAK HOUR TRAFFIC VOLUMES
CARSON TERMINAL SITE

8

LINSCOTT LAW & GREENSPAN
ENGINEERS

TABLE 1

LEVEL OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS[1]

Carson Terminal Site Residential Project

Level of Service (LOS)	Intersection Capacity Utilization Value (V/C)	Level of Service Description
A	0.00 - 0.59	Free Flow
B	0.60 - 0.69	Rural Design
C	0.70 - 0.79	Urban Design
D	0.80 - 0.89	Maximum Urban Design
E	0.90 - 1.00	Capacity
F	≥ 1.01	Forced Flow

[1] See Appendix B for detailed explanation of ICU method and LOS Concept

Existing Level of Service Results

Table 2 summarizes the existing peak hour service level calculations for the six study intersections based on existing traffic volumes and current street geometry. Review of Table 2 shows that based on the ICU method of analysis and the City's LOS criteria, all six key signalized intersections currently operate at acceptable Levels of Service during the AM and PM peak commute hour.

Only the study intersection of Figueroa at 223rd operates at LOS D during the AM and/or PM peak hour. The five remaining study intersections currently operate at LOS C or better during the AM and/or PM peak hour.

TRAFFIC FORECASTING METHODOLOGY

In order to estimate the traffic impact characteristics of the proposed CTS residential project, a multi-step process has been utilized. The first step is traffic generation, which estimates the total arriving and departing traffic on a peak hour and daily basis. The traffic generation potential is forecast by applying the appropriate vehicle trip generation equations or rates to the project development tabulation.

The second step of the forecasting process is traffic distribution which identifies the origins and destinations of inbound and outbound project traffic. These origins and destinations are typically based on demographics and existing/expected future travel patterns in the study area.

The third step is traffic assignment, which involves the allocation of project traffic to study area streets and intersections. Traffic assignment is typically based on minimization of travel time which may or may not involve the shortest route, depending on prevailing operating conditions and travel speeds. Traffic distribution patterns are indicated by general percentage orientation, while traffic assignment allocates specific volume forecasts to individual roadway links and intersection turning movements throughout the study area.

With the forecasting process complete and project traffic assignments developed, the impact of the project is isolated by comparing operational (LOS) conditions at selected key intersections using expected future traffic volumes with and without forecast project traffic. The need for site-specific and/or cumulative local area traffic improvements can then be evaluated

LINSCOTT LAW & GREENSPAN
ENGINEERS

TABLE 2

1996 EXISTING PEAK HOUR LEVELS OF SERVICE[2]
Carson Terminal Site Residential Project

KEY INTERSECTION	TIME PERIOD	CONTROL TYPE	ICU (V/C)	LOS
Main Street @ 223rd Street	AM	8∅ Traffic	0.702	C
	PM	Signal	0.656	B
Main Street @ 228th Street	AM	2∅ Traffic	0.387	A
	PM	Signal	0.510	A
Main Street @ Sepulveda Boulevard	AM	8∅ Traffic	0.573	A
	PM	Signal	0.736	C
Figueroa Street @ 223rd Street	AM	5∅ Traffic	0.802	D
	PM	Signal	0.605	B
Figueroa Street @ 228th Street	AM	2∅ Traffic	0.600	B
	PM	Signal	0.525	A
Figueroa Street @ Sepulveda Boulevard	AM	8∅ Traffic	0.599	A
	PM	Signal	0.768	C

ICU	LOS	CRITERIA
< 0.70	B	OK for all I/S
> 0.70 - 0.79	C	OK for all I/S
> 0.79 - 0.85	D+	OK for LA County Arterials
> 0.85 - 0.89	D	OK for Carson Arterials
> 0.89 - 0.94	E+	OK for Carson I/C Ramps
> 0.94 - < 1.00	E	NO GOOD for all Carson I/S
≥ 1.00	F	NO GOOD for all I/S

[2] Appendix B contains ICU/LOS sheets for key study intersections.

Project Traffic Generation

Traffic generation is expressed in vehicle trip ends, defined as one-way vehicular movements, either entering or exiting the generating land use. Generation factors and equations used in the traffic forecasting procedure are found in the 1995 Congestion Management Program for Los Angeles County, dated November 1995, published by the Metropolitan Transportation Agency (MTA) and San Diego Traffic Generators, dated July 1995, published by SANDAG as well as the City of Carson Guidelines for Traffic Impact Studies.

Table 3 summarizes the trip generation rates used in forecasting the impact of the CTS residential project, and presents the forecast peak hour and daily project traffic volumes for a "typical" weekday. As shown, the proposed project is expected, at buildout of the site, to generate 1,660 daily trips, with 134 trips produced in the AM peak hour (28 inbound, 106 outbound) and 166 trips produced in the PM peak hour (116 inbound, 50 outbound).

Phase I (1998) and Phase II (1999) are each expected to generate 420 daily trips with an AM peak hour of 34 trips and a PM peak hour of 42 trips. Phases III (2000) and IV (2001) will each add an additional 410 daily trips, 33 AM peak hour and 41 PM peak hour trips.

Project Traffic Distribution and Assignment

The general directional traffic distribution pattern for the project has been furnished by the City of Carson. **Table 4** presents the general directional distribution pattern based on the model provided by the Traffic Engineer.

The specific traffic distribution and assignment patterns for the proposed residential project is presented in **Exhibit 5**. Project traffic volumes in and out of the site have been distributed and assigned to the adjacent street system based upon the following considerations: 1) the traffic model distribution patterns shown in Table 4, 2) the site's proximity to major traffic carriers (e.g., I-110, I-405, I-710 Freeways); 3) expected localized traffic flow patterns based on adjacent street channelization and presence of traffic signals; and 4) ingress/egress availability at site driveways on 228th Street.

Exhibit 6 displays the added project traffic volumes for the CTS residential project at adjacent intersections and site driveways during the AM peak hour and PM peak hour. **Exhibit 7** presents the added daily project traffic assignments on the key roadways in the study area.

LINSCOTT LAW & GREENSPAN
ENGINEERS

TABLE 3

PROJECT TRAFFIC GENERATION FORECAST[3]
Carson Terminal Site Residential Project

DESCRIPTION	DAILY	AM PEAK HOUR			PM PEAK HOUR		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Generation Factors:							
Single Family Residential (TE/DU)	10.00	0.16	0.64	0.80	0.70	0.30	1.00
Generation Forecast:							
Carson Terminal Site Project (166 DU)	1,660	27	106	133	116	50	166
Trips Per Phase							
Phase I - 1998 (42 DU)	420	7	27	34	29	13	42
Phase II - 1999 (42 DU)	420	7	27	34	29	13	42
Phase III - 2000 (41 DU)	410	7	26	33	29	12	41
Phase IV - 2001 (41 DU)	410	7	26	33	29	12	41

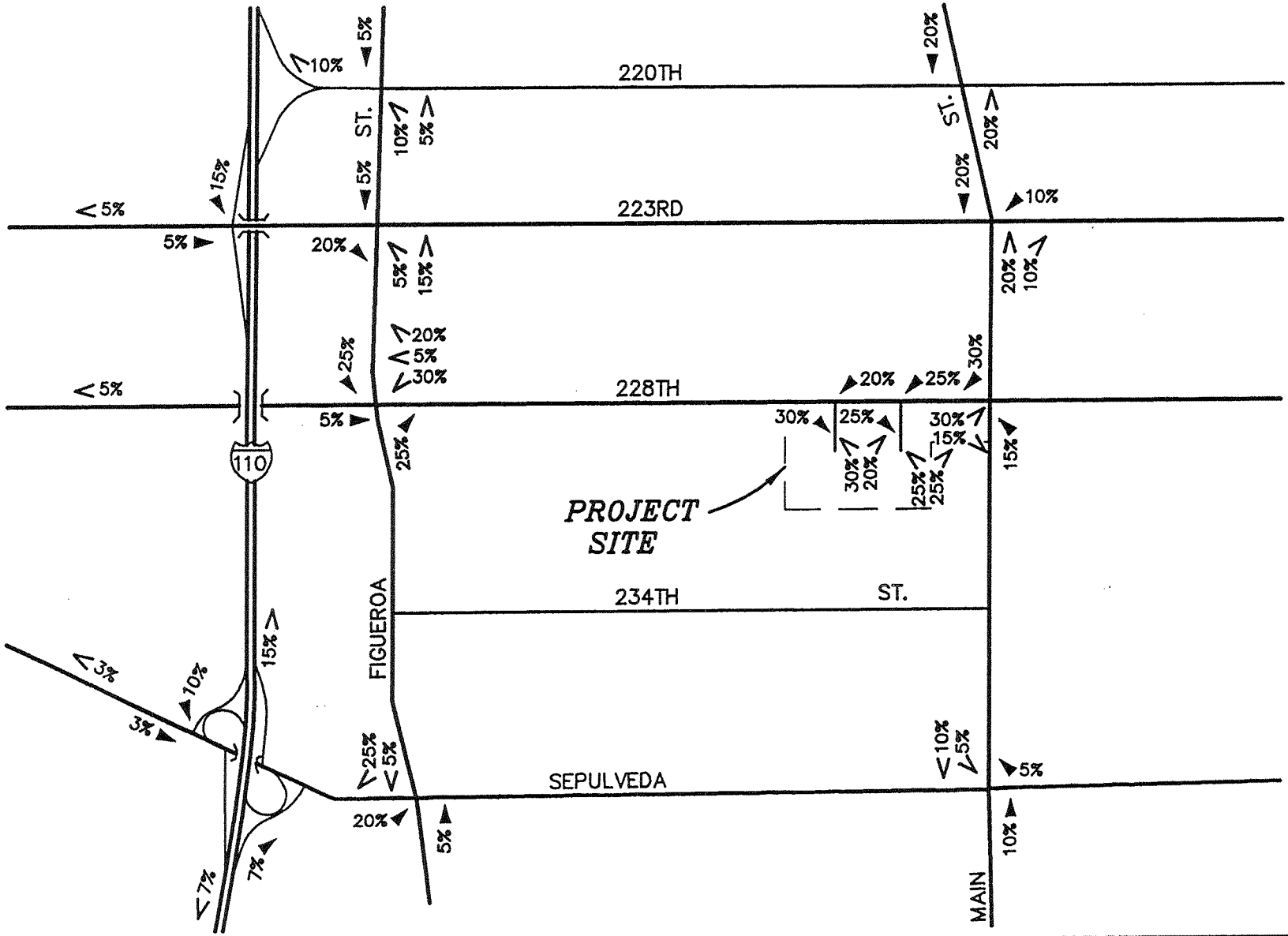
[3] Source: 1995 Congestion Management Program for Los Angeles County, dated November 1995, published by MTA and San Diego Traffic Generators, dated July 1995, published by SANDAG, per City of Carson Guidelines for Traffic Impact Study.

TABLE 4

DIRECTIONAL DISTRIBUTION PATTERN[4]
Carson Terminal Site Residential Project

DISTRIBUTION PERCENTAGE	ORIENTATION
20%	To the north and west via Harbor and San Diego Freeways and Artesia Boulevard.
20%	To the north and east via Long Beach and Artesia Freeways.
20%	To the south and east via the San Diego and Long Beach Freeways and Pacific Coast Highway.
7%	To the south and west via the Harbor Freeway and Pacific Coast Highway.
5%	To the north via arterial streets.
13%	To the west via arterial streets.
5%	To the south via arterial streets.
5%	To the east via arterial streets.
5%	Internal to Carson via local streets.

[4] Source: City of Carson.



N NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

KEY

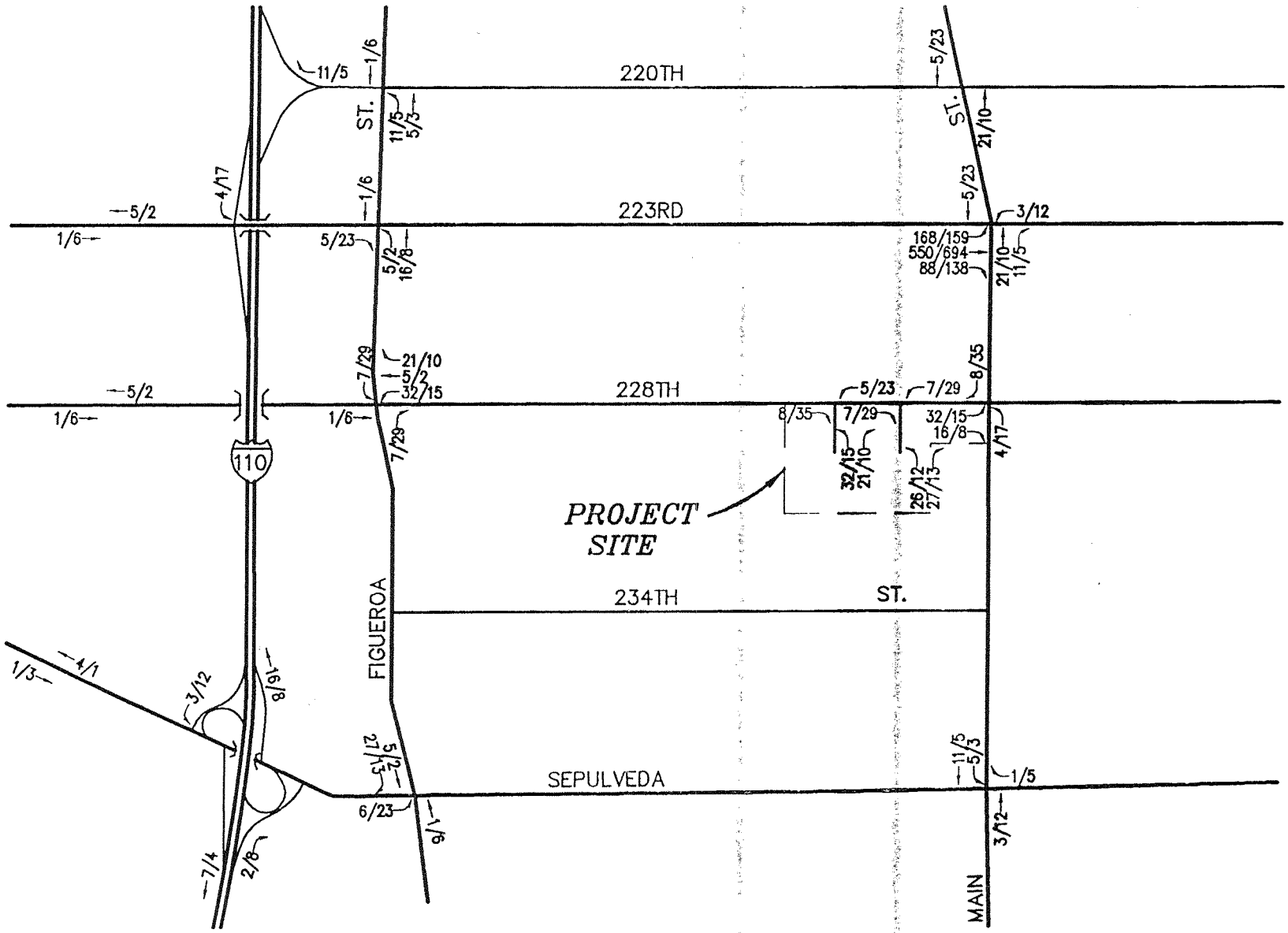
< XX% = OUTBOUND PERCENTAGE

◀ XX% = INBOUND PERCENTAGE

5

PROJECT TRAFFIC DISTRIBUTION PATTERN

CARSON TERMINAL SITE



KEY

XX/YY = AM/PM PEAK HOUR PROJECT TRAFFIC VOLUMES

N

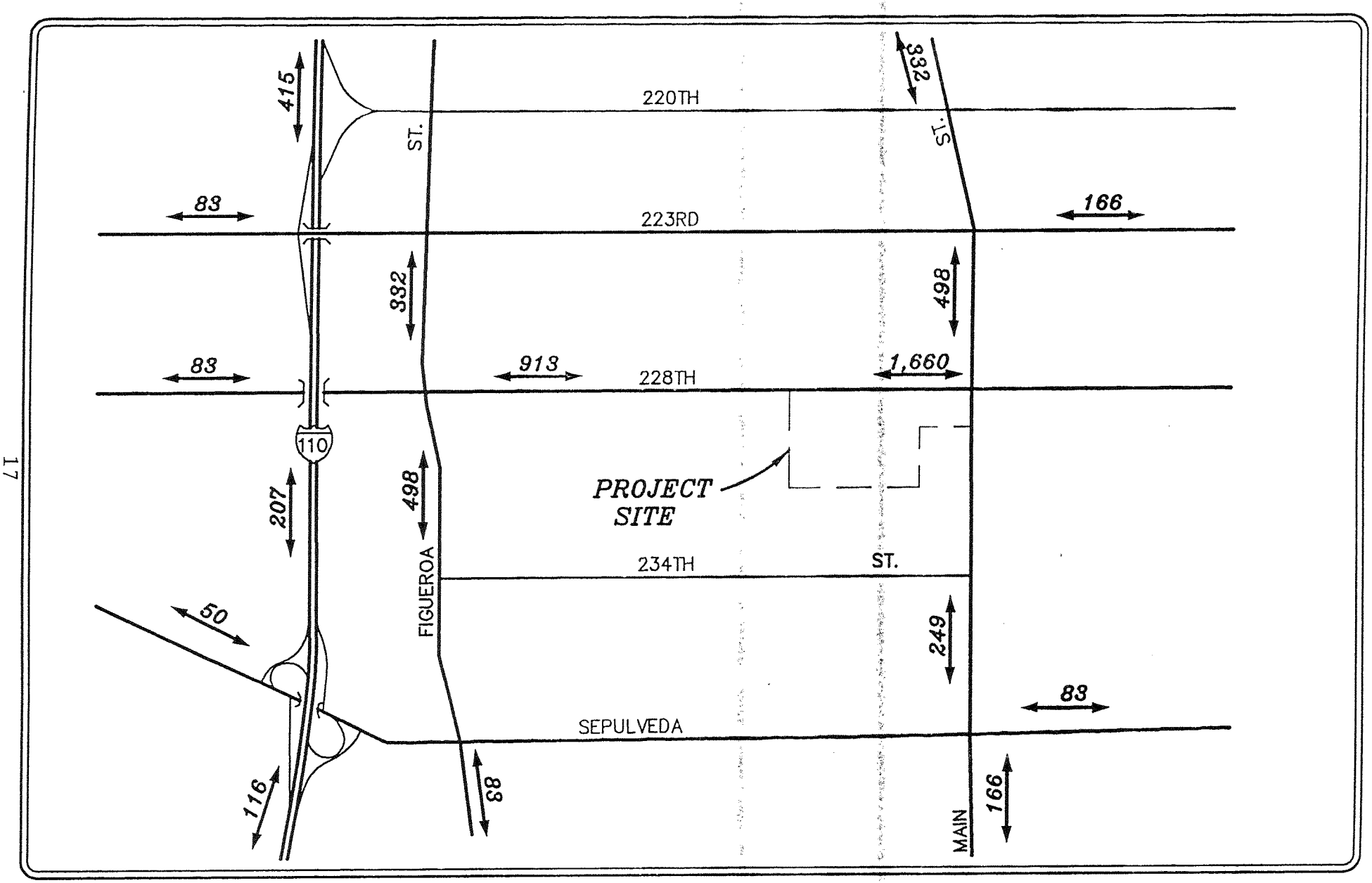
NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

6

PEAK HOUR PROJECT TRAFFIC VOLUMES

CARSON TERMINAL SITE



N NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

KEY

X,XXX = DAILY VOLUME

7

AVERAGE DAILY PROJECT TRAFFIC VOLUMES

CARSON TERMINAL SITE

BACKGROUND TRAFFIC CONDITIONS

Pre-Project Conditions

Currently, there are no known planned and/or approved, related projects in the vicinity of the CTS residential project. Hence, horizon year background traffic growth estimates have been calculated using only the growth factors recommended for use by the City of Carson.

The ambient traffic growth factor is intended to include unknown and future related projects in the study area, as well as regular growth in traffic volumes due to development of projects located outside the study area. Per City criteria, traffic growth has been calculated at three percent (3%) per year. Applied to existing 1996 traffic volumes results in a 15 percent and 21 percent growth in existing volumes at the six key intersections to horizon years 2001 and 2003, respectively. By comparison, the 1995 Congestion Management Program for Los Angeles County concludes that the South Bay communities can expect a cumulative growth in traffic volumes of 5.3 percent from 1995 to 2005. Thus, the ambient growth rate required for use in the City's traffic study guidelines would appear to overstate the actual growth that the CMP expects to occur on the Carson City streets.

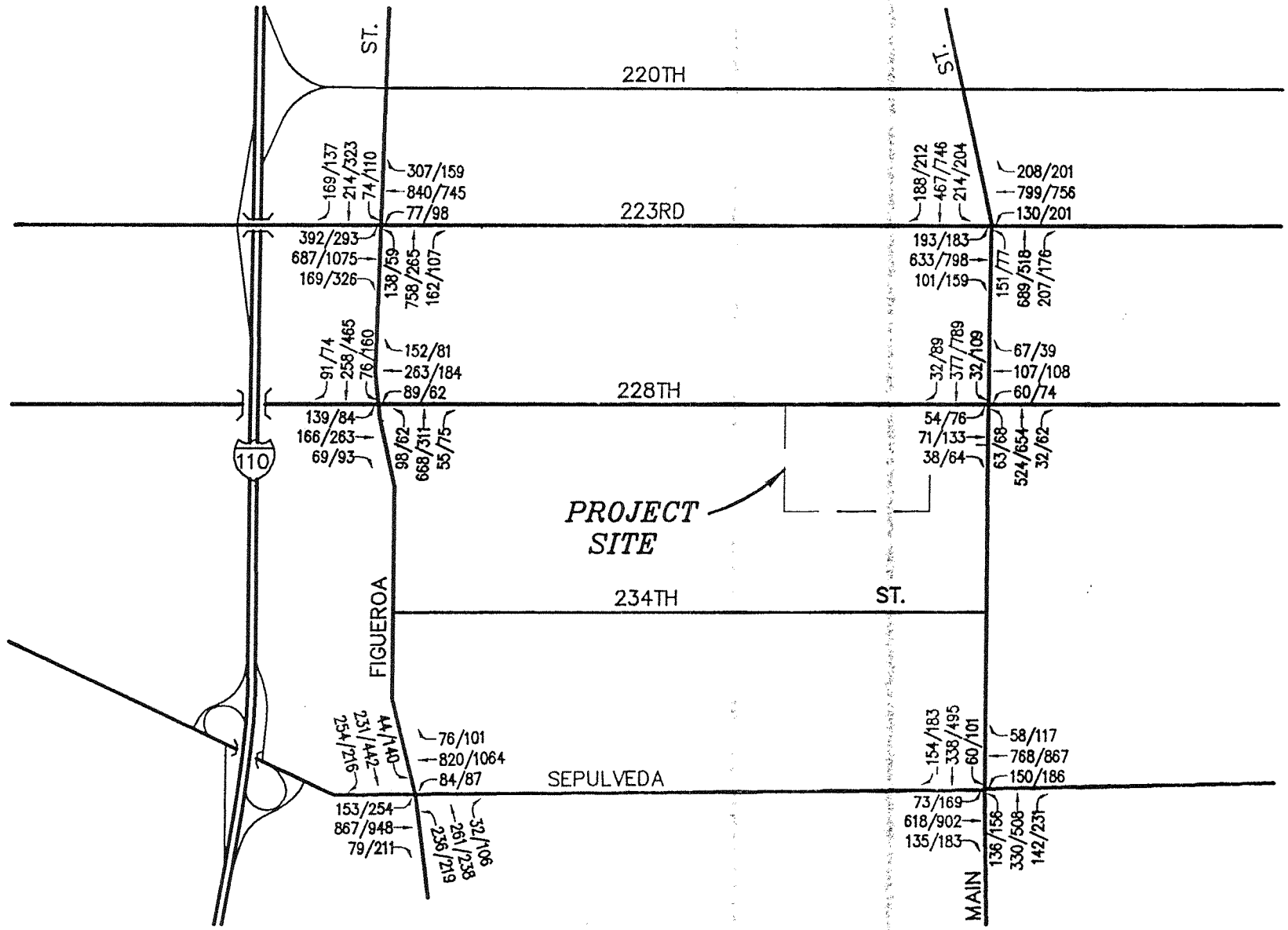
Exhibits 8 and **9** present future AM/PM peak hour background traffic volumes at the six existing key intersections in the Year 2001 and 2003, respectively.

Exhibits 10 and **11** illustrate forecast AM/PM peak hour traffic volumes with the inclusion of the Carson Terminal Site project buildout (2001) and two years afterwards (2003). Per City criteria, 2001 project traffic conditions assume 90% occupancy. Year 2003 project traffic conditions assumes 100% occupancy.

TRAFFIC IMPACT ANALYSIS METHODOLOGY

Impact Criteria and Thresholds

The relative impact of the added project traffic volumes generated by the proposed residential project during the AM and PM peak hours was evaluated based on analysis of future operating conditions at the six key area intersections, without, then with, the proposed project. The previously-discussed capacity analysis procedures were utilized to investigate the future volume-to-capacity relationships and service level characteristics at each study intersection. The significance of the potential impacts of the project at each key intersection was then evaluated using traffic impact criteria of the City of Carson and the County of Los Angeles CMP guidelines.



19

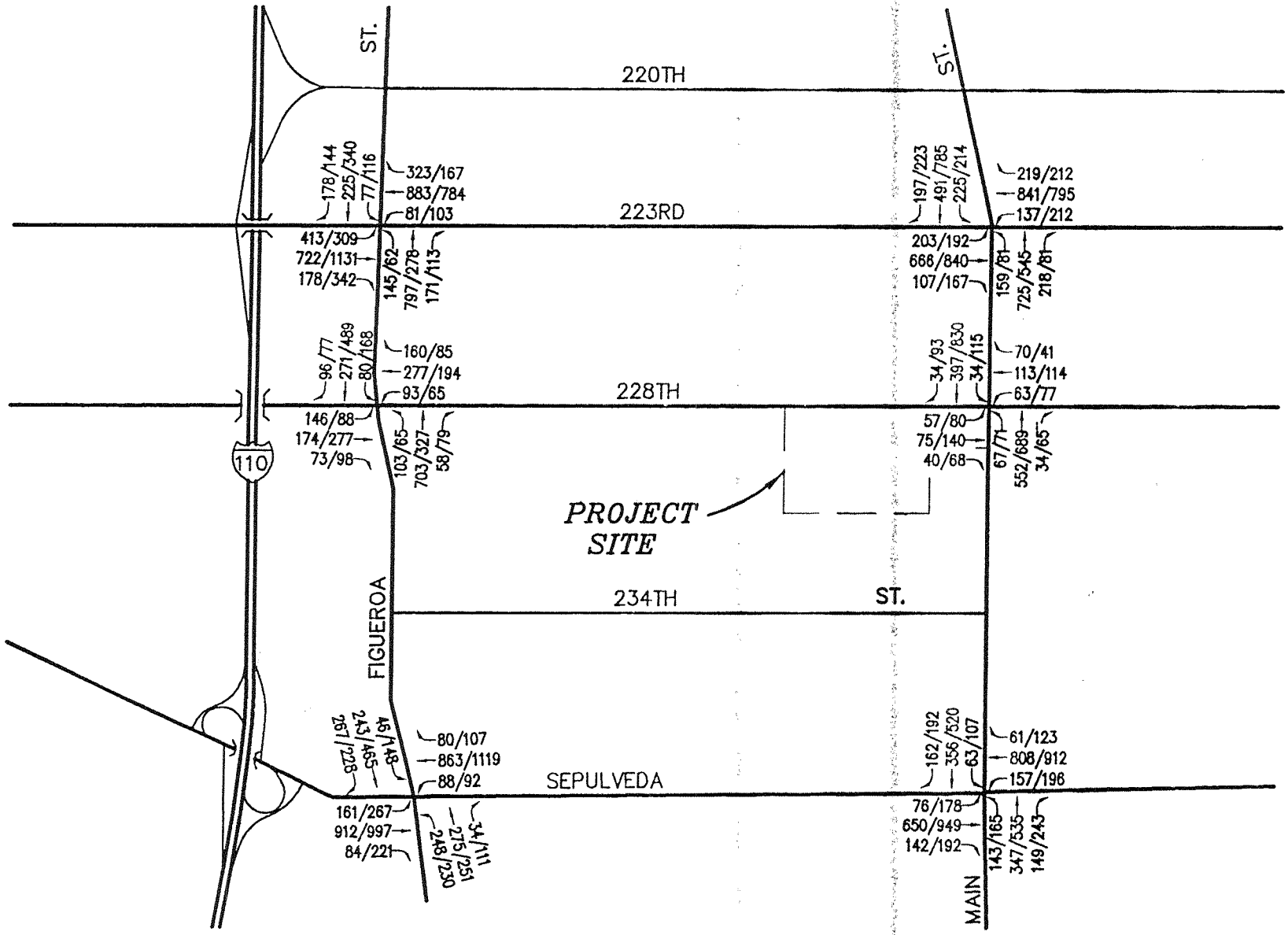
KEY
XX/YY = AM/PM PEAK HOUR TRAFFIC VOLUMES

N NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

8

FUTURE 2001 BACKGROUND PEAK HOUR TRAFFIC VOLUMES
CARSON TERMINAL SITE



KEY
XX/YY = AM/PM PEAK HOUR TRAFFIC VOLUMES

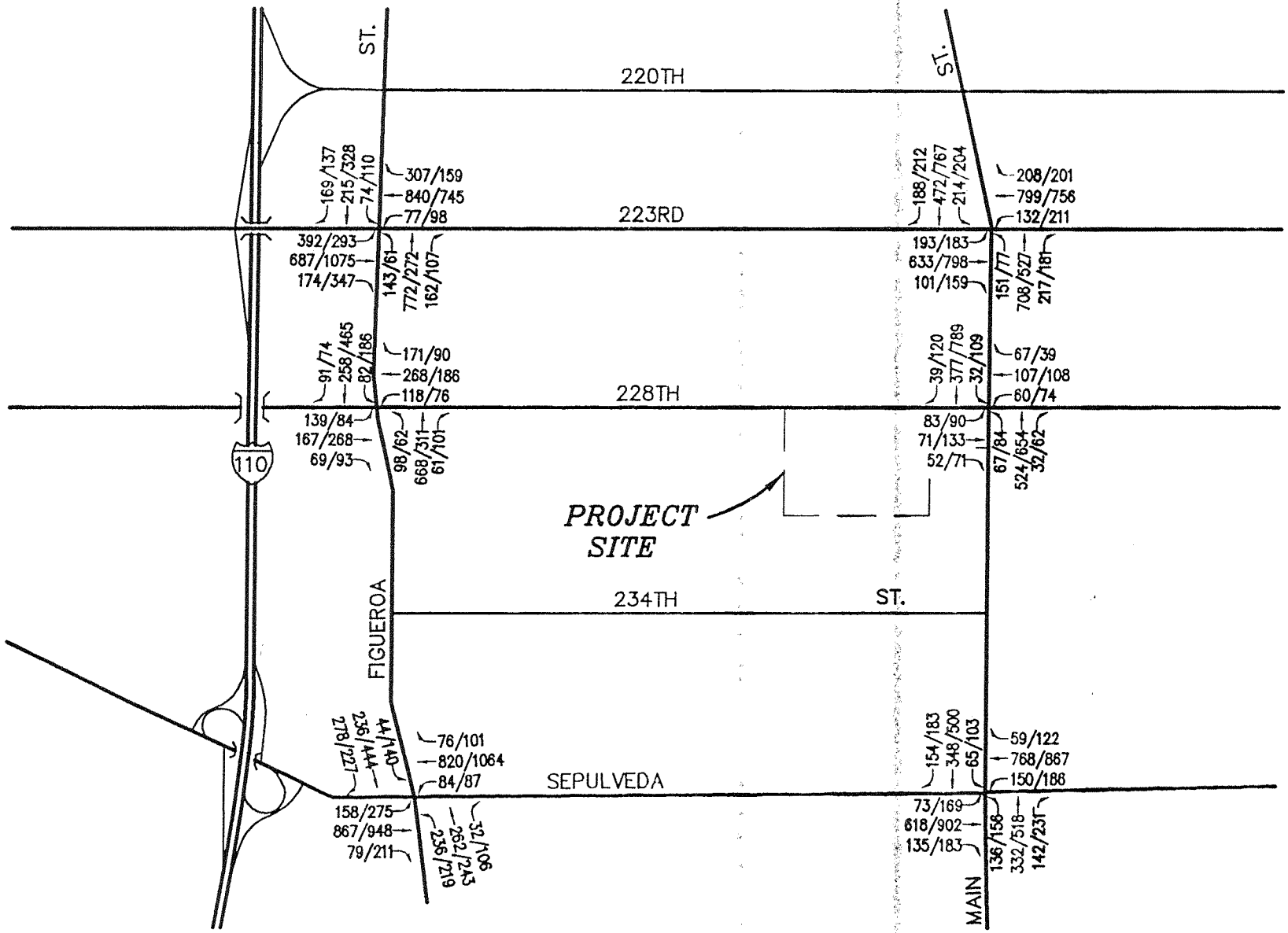
N NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

FUTURE 2003 BACKGROUND PEAK HOUR TRAFFIC VOLUMES
CARSON TERMINAL SITE

9

20



KEY
XX/YY = AM/PM PEAK HOUR TRAFFIC VOLUMES

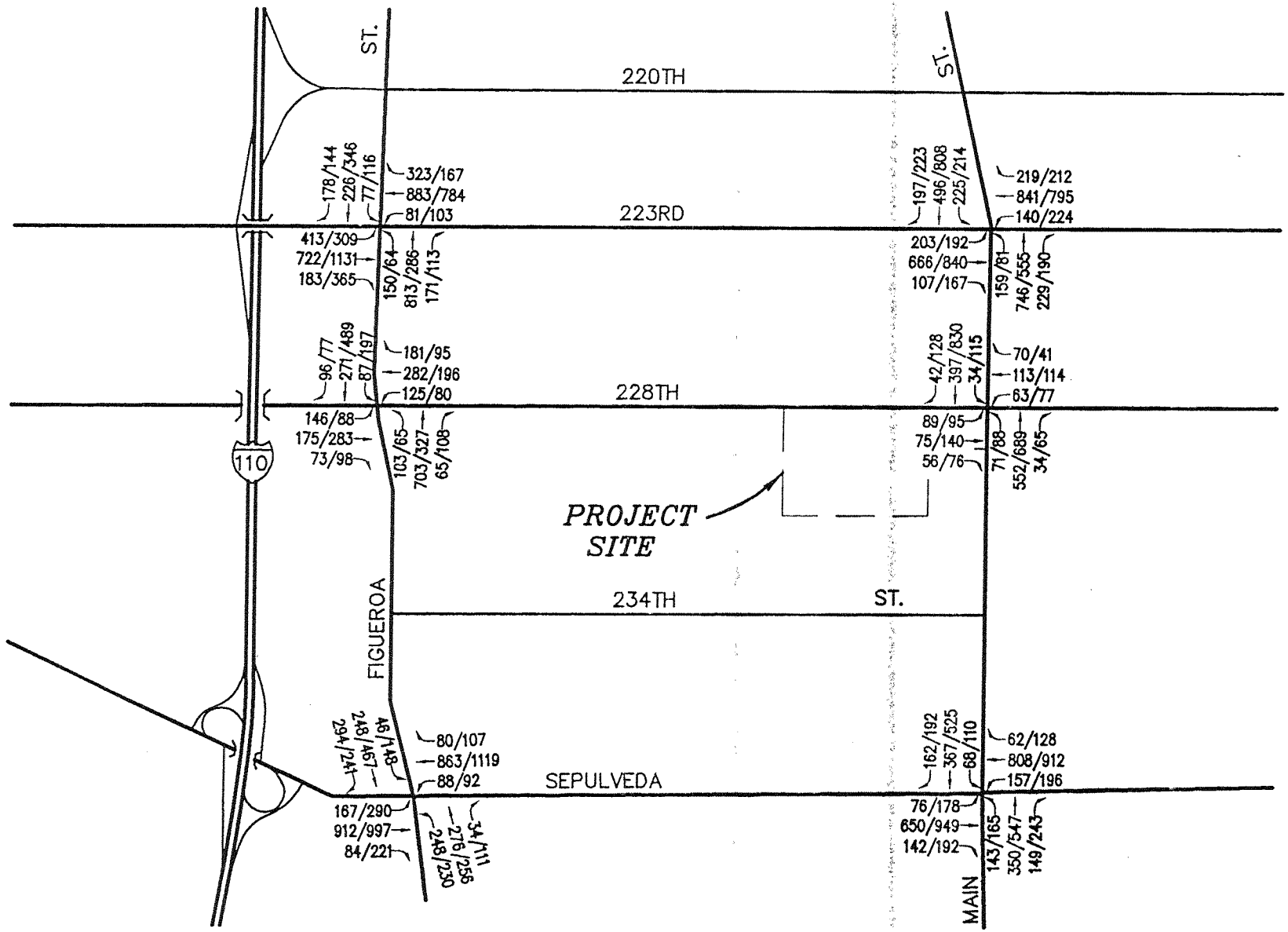
N NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

10

FUTURE 2001 BACKGROUND PEAK HOUR TRAFFIC VOLUMES WITH PROJECT TRAFFIC

CARSON TERMINAL SITE



KEY

XX/YY = AM/PM PEAK HOUR TRAFFIC VOLUMES

N NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

11

FUTURE 2003 BACKGROUND PEAK HOUR TRAFFIC VOLUMES WITH PROJECT TRAFFIC

CARSON TERMINAL SITE

As mentioned previously, LOS E (ICU = 0.90 - 0.94) is the minimum acceptable service level that should be maintained during the peak hours at City street/freeway ramps intersections. The City considers LOS C (ICU = 0.70 - 0.79) to be the minimum acceptable for local/residential street intersections and LOS D (ICU = 0.80 - 0.89) for all other signalized intersections.

The City of Carson traffic impact criteria identifies a significant project impact when the project increases traffic demand at a study intersection by 1% of capacity (ICU ≥ 0.010), causing or worsening an unacceptable LOS per City criteria.

Traffic Impact Analysis Scenarios

The following scenarios are those for which LOS calculations have been performed:

1) 1996: Existing Traffic Conditions

2001 Horizon Year

2) 2001: Future Background (Existing plus Growth to 2001 at 3% per year)
3) 2001: Future Background with CTS Project Traffic (90% occupancy)
4) Condition (3) with Mitigation, if necessary

2003 Horizon Year

5) 2003: Future Background (Existing plus Growth to 2003 at 3% per year)
6) 2003: Future Background with CTS Project Traffic (100% occupancy)
7) Condition (6) with Mitigation, if necessary

PEAK HOUR INTERSECTIONS CAPACITY ANALYSIS

2001 Horizon Year

Table 5 summarizes the peak hour Level of Service results at the six study intersections for the 2001 horizon year. The first column (1) of ICU/LOS values in Table 5 presents a summary of existing AM/PM peak hour traffic conditions (which were also presented in Table 2). The second column (2) lists existing plus ambient growth traffic conditions (to the Year 2001) based on existing intersection geometry, but without any CTS project traffic.

LINSCOTT LAW & GREENSPAN
ENGINEERS

TABLE 5

2001 PEAK HOUR INTERSECTION CAPACITY ANALYSIS
ICU/LOS SUMMARY
Carson Terminal Site Residential Project

Key Intersections	Time	(1) 1996 Existing Traffic Conditions		(2) Year 2001 Background Traffic		(3) Year 2001 CTS Project Traffic		(4) Project Impact/ Significance	
		ICU	LOS	ICU	LOS	ICU	LOS	ICU Inc.	Y/N
Main Street @	AM	.702	C	.793	C	.798	C	.005	N
223rd Street	PM	.656	B	.741	C	.750	C	.009	N
Main Street @	AM	.387	A	.430	A	.430	A	.000	N
228th Street	PM	.540	A	.572	A	.604	B	.032	N
Main Street @	AM	.573	A	.645	B	.648	B	.003	N
Sepulveda Blvd	PM	.736	C	.832	D	.834	D	.002	N
Figueroa St. @	AM	.802	D	.909	E	.913	E	.004	N
223rd Street	PM	.605	B	.680	B	.682	B	.002	N
Figueroa St. @	AM	.600	B	.676	B	.713	C	.037	N
228th Street	PM	.525	A	.589	A	.615	B	.026	N
Figueroa St. @	AM	.599	A	.676	B	.680	B	.004	N
Sepulveda Blvd.	PM	.768	C	.869	D	.883	D	.014	N

ICU	LOS	CRITERIA
< 0.70	B	OK for all I/S
> 0.70 - 0.79	C	OK for all I/S
> 0.79 - 0.85	D+	OK for LA County Arterials
> 0.85 - 0.89	D	OK for Carson Arterials
> 0.89 - 0.94	E+	OK for Carson I/C Ramps
> 0.94 - < 1.00	E	NO GOOD for all Carson I/S
≥ 1.00	F	NO GOOD for all I/S

The third column (3) presents future forecast traffic conditions with the addition of project traffic. Per City criteria, project traffic conditions assume 90% occupancy of the site. The fourth column (4) shows the increase in ICU value due to the added peak hour project trips and indicates whether the traffic associated with the residential project will have a significant impact based on City of Carson criteria.

1996 Existing Conditions

As previously presented in Table 2, review of this table indicates that existing peak hour operating conditions are within satisfactory ranges based on the City's LOS standards. Each of the six key intersections currently operate at LOS D or better during the AM and PM peak hours.

2001 Future Background Traffic Conditions

An analysis of future (2001) background traffic conditions indicates that ambient traffic growth will deteriorate the AM peak hour Level of Service at one location. Figueroa Street @ 223rd Street is expected to operate at LOS E (ICU value = 0.909) during the AM peak hour and LOS B during the PM peak hour.

The Levels of Service at the Main/223rd, Main/Sepulveda, and Figueroa/Sepulveda are expected to deteriorate one service level, but are still forecast to operate at an acceptable LOS during the AM and PM peak hours based on City LOS Criteria. The addition of ambient growth traffic is not expected to result in any changes to the existing service levels at the Main/228th and Figueroa/228th intersections.

Carson Terminal Site Residential Project Traffic (90% Occupancy)

Review of Columns 3 and 4 of Table 5 shows that traffic associated with the proposed single family development will not have a significant impact at any of the six study intersections when compared to the City of Carson impact and LOS criteria. The proposed project is not expected to adversely change the service level to an unacceptable condition at any intersection. The addition of project traffic is expected to result in a maximum project-related ICU increase of 0.032 and 0.037 at the intersection of Main/228th (LOS B) and Figueroa/228th (LOS C), respectively, with either a 0.014 or less ICU increase at all other intersections.

At the intersection of Figueroa and 223rd, CTS project traffic will increase the ICU value by 0.004 in the AM peak hour, which is already projected to operate at LOS E in Year 2001 background conditions. This is not a significant impact. As mentioned earlier, a "significant" adverse project traffic impact occurs when the project increases traffic demand at the study intersection by 1% of capacity (ICU $\geq$ 0.010), causing or worsening LOS E or F conditions.

2003 Horizon Year

Table 6 presents a summary of the Year 2003 ICU calculations and corresponding LOS values. The structure of this table is similar to the 2001 Horizon Year capacity analysis presented in Table 5. However, project traffic conditions assume 100% occupancy of the site. Further, the fifth column (5) of Table 6 indicates the forecast operating conditions with intersection improvements (mitigation), if required, recommended to achieve an acceptable Level of Service.

2003 Future Background Traffic Conditions

As shown in column 2 of Table 6, under future year 2003 conditions without any project traffic, two of the six analyzed intersections are projected to operate at an unsatisfactory service level (LOS E or F). Figueroa at 223rd and Figueroa at Sepulveda are forecast to operate at LOS E during the morning and evening peak commute hour, respectively. The addition of ambient growth traffic is not expected to result in any significant changes to the existing service levels at the remaining four key intersections.

The Carson Terminal Site Residential Project Traffic (100% Occupancy)

Review of Columns 3 and 4 of Table 6 shows that traffic associated with the proposed residential project will have a significant impact at only one of the six key intersections in the Year 2003 when compared to the City impact criteria. This intersection, Figueroa at Sepulveda, is projected to operate at unacceptable LOS E during the PM peak hour. The project is expected to add 1.4% (0.014) to the ICU value at this impacted intersection.

As described earlier, a significant project impact occurs when the project increases traffic demand at a study intersection by 1% of capacity (ICU $\geq$ 0.010), causing or worsening an unacceptable LOS per City criteria.

Freeway Segment (Mainline) CMP Analysis

The Congestion Management Program (CMP) is a state mandated program providing a framework for addressing state-wide congestion concerns. In Los Angeles County, the CMP is administered by the Los Angeles Metropolitan Transportation Authority (LACMTA). The CMP includes a Land Use Analysis Program that sets the warrants and procedure for the transportation impact analysis (TIA) of new development, the generated trips of which have a potential for significantly impacting the adopted CMP highway and arterial network. The objective of the mainline freeway analysis is to identify the potential project traffic impacts on the CMP network within the immediate vicinity of this project.

Based on the project traffic distribution pattern shown in Exhibit 5, the Carson Terminal Site project is expected to generate a maximum of 29 peak hour trips on any freeway segment. Therefore, since AM and PM peak hour project generated trips on the key freeway segments in the project study area were below the threshold of 150 trips required for the freeway segment analysis, a Freeway Segment (Mainline) CMP Analysis was not conducted.

LINSCOTT LAW & GREENSPAN
ENGINEERS

TABLE 6

2003 PEAK HOUR INTERSECTION CAPACITY ANALYSIS
ICU/LOS SUMMARY
Carson Terminal Site Residential Project

Key Intersections	Time	(1) 1996 Existing Traffic Conditions		(2) Year 2003 Background Traffic		(3) Year 2003 CTS Project Traffic		(4) Project Impact/ Significance		(5) Future Conditions W/ Improvements[5]	
		ICU	LOS	ICU	LOS	ICU	LOS	ICU Inc.	Y/N	ICU	LOS
Main Street @	AM	.702	C	.828	D	.834	D	.006	N	—	—
223rd Street	PM	.656	B	.774	C	.784	C	.010	N	—	—
Main Street @	**AM**	**.387**	**A**	**.447**	**A**	**.447**	**A**	**.000**	**N**	—	—
228th Street	PM	.540	A	.595	A	.631	B	.036	N	—	—
Main Street @	**AM**	**.573**	**A**	**.672**	**C**	**.676**	**C**	**.004**	**N**	—	—
Sepulveda Blvd	PM	.736	C	.871	D	.873	D	.002	N	—	—
Figueroa St. @	AM	.802	D	.951	E	.955	E	.004	N	0.840	D
223rd Street	PM	.605	B	.712	C	.714	B	.002	N	0.794	C
Figueroa St. @	AM	.600	B	.705	C	.748	C	.043	N	—	—
228th Street	PM	.525	A	.613	B	.644	B	.031	N	—	—
Figueroa St. @	AM	.599	A	.704	C	.709	C	.004	N	.686	B
Sepulveda Blvd.	PM	.768	C	.909	E	.923	E	.014	Y	.891	D

ICU	LOS	CRITERIA
< 0.70	B	OK for all I/S
> 0.70 - 0.79	C	OK for all I/S
> 0.79 - 0.85	D+	OK for LA County Arterials
> 0.85 - 0.89	D	OK for Carson Arterials
> 0.89 - 0.94	E+	OK for Carson I/C Ramps
> 0.94 - < 1.00	E	NO GOOD for all Carson I/S
≥ 1.00	F	NO GOOD for all I/S

[5] Improvements recommended are required specifically to mitigate the future non-project (ambient) traffic and/or project traffic.

LINSCOTT LAW & GREENSPAN
ENGINEERS

AREA TRAFFIC IMPROVEMENT MEASURES

For those intersections where future traffic volumes are expected to result in poor operating conditions, this report recommends improvements which change the intersection geometry to increase capacity. These capacity improvements involve roadway restriping to reconfigure (add lanes) to specific approaches of a key intersection. The identified improvements are expected to: 1) mitigate the impact of existing and/or future non-project (ambient growth) traffic and/or 2) improve Levels of Service to an acceptable range.

Year 2001 Improvements

As shown in Table 5, in Year 2001 one of the six key intersections is projected to operate at unacceptable LOS E during the AM and/or PM peak hour (without or with the addition of the CTS project traffic). Ambient traffic growth is expected to deteriorate the service level at the Figueroa/223rd intersection.

Year 2003 Improvements

As illustrated in Table 6, ambient traffic growth will deteriorate Level of Service at the intersections of Figueroa/223rd and Figueroa/Sepulveda to unacceptable LOS E during the AM and/or PM peak hour.

The intersections' service levels can be improved to acceptable levels by implementing the following improvements:

- Figueroa Street @ 223rd Street: Restripe the eastbound approach on 223rd Street to provide dual left-turn lanes and two through lanes. The existing "unstriped" right-turn lane will most likely be eliminated. Parking restrictions on the eastbound approach of 223rd will be required.

- Figueroa Street @ Sepulveda Boulevard: Restripe the westbound approach on Sepulveda Boulevard to provide an exclusive left-turn lane, two through lanes, and a separate right-turn lane. The right-turn lane addition can be achieved by restriping and without widening the existing roadway. Parking restrictions on the westbound approach of Sepulveda will be required.

All the other four key intersections are expected to operate at an acceptable LOS D or better without or with project traffic. Improvements recommended to specifically mitigate the traffic impact of the Carson Terminal Site residential development are discussed under Project-Specific Improvements.

LINSCOTT LAW & GREENSPAN
ENGINEERS

GATE ACCESS EVALUATION

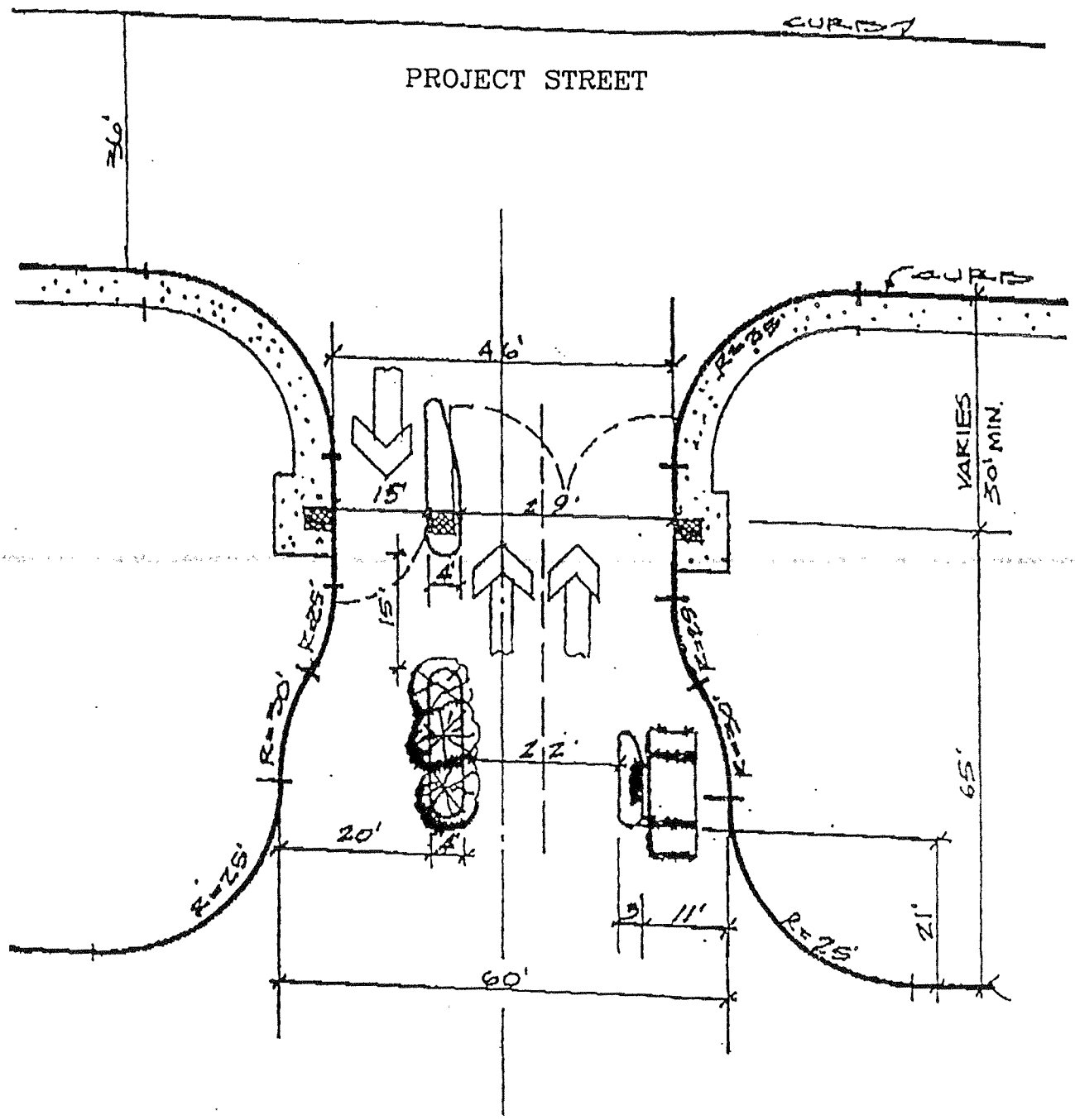
This section of this traffic study focuses on an evaluation of the design and configuration of the project's gated entry/exit, and the adequacy of storage to be provided for peak hour project traffic at the project's entrances on 228th Street. Review of the entry/exit design configuration prepared by the Keith Companies, illustrated in **Exhibit 12**, shows that two inbound lanes and one outbound lane are planned for the gated entry/exit roadways of the project, with gates located approximately 65 feet from the adjacent roadway (228th Street). Additional storage has also been provided for visitors to call and wait for a resident to open the gate. Further, a turn around area is provided in front of the gates, eliminating the possibility of "backing onto" 228th.

Our review of the current site plan reveals the proposed configuration of the project's gated entry/exit roadway will provide efficient access for project traffic. The project's driveway layout permits both visitors and residents to enter and exit the site without backing up onto 228th Street and impacting traffic flow. Further, the driveway dimensions, which measure 60 feet across at 228th and 46 feet as you enter the project, ensure that vehicles waiting at the call box do not obstruct the entry of resident vehicles. Two main entry lanes, measuring 11 feet each, and a separate visitor call box lane, measuring 11 feet in width, is provided within the 60 foot dimension.

An evaluation of the amount of reservoir (stacking) space provided in front of the gate versus the AM and/or PM peak hour indicates that adequate storage is provided for vehicles entering the site. Research has shown that random arrivals of traffic stream tend to follow the Poisson mathematical distribution. This distribution provides a means that, if the average arrival rate is known, the probability of exceeding a given volume in a unit of time may be calculated. Using this methodology the surges in traffic volumes can be calculated to properly design the reservoir or stacking space required in front of the controlled access gate.

As presented earlier, the proposed Carson Terminal Site residential project (166 dwelling units) is expected to generate 1,660 daily trips, with 133 trips (27 inbound, 106 outbound) produced in the AM peak hour and 166 trips (116 inbound, 50 outbound) produced in the PM peak hour. During the PM peak hour, 58 inbound project trips are anticipated at each of the two entry/exits. A coded-card operated gate has a design capacity of 340 vehicles per hour per lane. A "remote access control" system, similar to the "remote garage-door" opener, is anticipated for the project and would have a significantly higher capacity.

It is expected that two car lengths of storage plus accommodations for one visitor will provide adequate storage reservoir space behind the project's gated entry based on a "worst-case" analysis, which assumes a card operated gate. However, the proposed entryway design provides storage for up to seven vehicles (three in each of the two inbound lanes, plus one in the visitor position). This design could accommodate twice the anticipated project traffic volume without exceeding the planned reservoir capacity even with a card operated gate. The proposed design will provide for efficient ingress and egress to the project and is not expected to adversely impact traffic on 228th Street.



SOURCE: KEITH COMPANIES

NO SCALE

LINSCOTT LAW & GREENSPAN ENGINEERS

12

ILLUSTRATIVE PROJECT ENTRY/GATEWAYS

CARSON TERMINAL SITE

PROJECT-SPECIFIC IMPROVEMENTS

Table 6 indicates that the proposed residential development, at full occupancy (2003), is projected to significantly impact one key intersection. The intersection impacted by project traffic is Figueroa Street at Sepulveda Boulevard, which is shown to operate at an unacceptable LOS before the addition of project traffic.

Improvements for the intersection of Figueroa/Sepulveda are described in the preceding page (Year 2003 Improvements). These improvements are expected to alleviate unacceptable PM peak hour traffic conditions (background LOS E, ICU = 0.923) to LOS D (ICU = 0.891) with project traffic included. Since the CTS project is expected to have a significant impact at this intersection, the project may be required to participate in the improvement costs on fair-share basis.

In addition to the above described improvements, the following measures are recommended in conjunction with the development of the Carson Terminal Site residential development project:

- For the gated project access roadways intersecting 228th, provide two inbound lanes and one outbound lane, as conceptually illustrated in Exhibit 12. Install "STOP" signs and appropriate pavement legends to control exiting traffic.

- Develop an internal signing and striping plan that will provide clear signage for future residential development.

- Validate final plans, including landscaping plans, for adequate sight distance on 228th Street.

1843TIA.DOC (October 28, 1996)