Chapter 2: Methodology

This chapter summarizes the methodology used to conduct the feasibility and alternatives analysis for the Rosecrans Corridor Mobility Study. The study analyzed the effects of potential changes within the public right-of-way that would affect pedestrian, bicycle, transit and vehicular circulation within the four identified study areas.

For traffic flow, an operational analysis was conducted to determine existing (2009) and horizon year (year 2030) levels of service and traffic flows for the improvements proposed. The operational analysis involved measuring and evaluating the ability of cars, trucks, and emergency vehicles to access, serve and travel along the corridor. Transit performance including spacing between stops, delay at stops and ridership were elements of the mobility study as well.

Improving access and circulation for bicycles and pedestrians was a key objective of this study. Improvements to existing facilities, completion of missing segments of sidewalks and bicycle lanes and identification of improved connections between pedestrians and transit were goals of the mobility analysis.

2.1 OPERATIONAL ANALYSIS REQUIREMENTS

The operational analysis requirements of the Rosecrans Corridor Mobility Study were as follows:

- Establish and report measures of effectiveness (MOEs) that assess conditions for pedestrians, bicycles, transit, cars/trucks, and parking
- Generate micro-simulations to accurately quantify and illustrate operations
- Conduct traffic analysis consistent with City of San Diego Traffic Impact Study Guidelines
- Assess impacts to, and accommodate, emergency vehicles in the recommended alternative.

2.2 MEASURES OF EFFECTIVENESS

In order to understand the effects of potential changes along the Rosecrans Corridor, measures of effectiveness (MOEs) were developed based on community input to comprehensively assess future conditions for each mode under each study alternative. Traffic analysis and simulation software programs such as Synchro and VISSIM were used to determine some of the measures.

Measures of effectiveness can be quantitative or qualitative. Qualitative MOEs describe a benefit or disbenefit along the corridor that is difficult to quantify. Pedestrian features such as street lighting and landscaping are improvements that would be typically classified as qualitative MOEs. Quantitative MOEs can be measured and are reported in measurements such as seconds of delay and minutes of travel time. The following sections summarize the MOEs established for each mode for this study.

Pedestrians

The Rosecrans Corridor Mobility Study focused on identifying was to improve walkability in the study area. Walkability is a measure of the overall walking conditions in the area. Factors that affect walkability include land use mix, residential density, street connectivity, orientation and placement of homes and buildings, retail floor area ratio, access to mass transit, presence and quality of sidewalks, presence of curb ramps, presence of a buffer between walkways and moving vehicles (planter strips, on-street parking or bike lanes), safe and convenient pedestrian crossings, nearby local destinations, street furniture, street lighting, traffic flow, and air quality.

The walkability of the corridor was evaluated based on the criteria listed below. Based on the findings, recommendations to improve the walkable nature of the corridor were proposed.

- ***Crosswalk Locations:*** Spacing of safe, convenient, and accessible street crossings along the corridor.
- ***Crosswalk Visibility:*** Clearly marked and identifiable crosswalks for pedestrians and drivers.
- ***Pedestrian Exposure at Crosswalks:*** Distance/number of lanes for pedestrians to cross the street. (May indicate the need for center median refuge areas).
- ***Vehicle Speeds at Pedestrian Crossings***
- ***Conflicts between Pedestrians***
- ***Presence and Quality of Sidewalks:*** Adequate width, presence of four zones (edge zone, furnishings zone, throughway zone and frontage zone), accessible by persons with disabilities.
- ***Walkability:*** Quality of the walking environment considers presence of buffer from moving vehicles, street trees, street lighting, street furniture, and public art.
- ***Access to Transit:*** Spacing between transit stops, quality of the pedestrian waiting areas at stops and quality of pedestrian connections to transit stops.

Bicycles

Bicycle circulation was evaluated based on several different criteria, which included:

- ***Capacity:*** Ability to safely provide separate or shared facility for bicycle use on Fourth, Fifth and Sixth Avenues.
- ***Crossings:*** Safe and convenient east-west bicycle crossings of the principal north-south corridor streets to improve bicycle connectivity in study area.

- ***Linkage to Bicycle Master Plan:*** Evaluates potential alternative routes in the study area and whether direct linkage to the City's Bicycle Master Plan and/or Community Plan bicycle routes is provided to and within the study corridor.
- ***Vehicle Speeds***
- ***Access to Transit:*** Quality of bicycle connections to transit service, presence of bicycle storage facilities at transit stops and ability to transport bicycles on transit vehicles.

Transit

The alternatives analysis evaluated the potential for improving access to transit within the study area. This included improvements to pedestrian and bicycle access near the Old Town Transit Center. Additionally, a reduction of total transit stops and relocation of specific stops are considered in this study that would affect transit operations along the corridor.

Traffic

The Highway Capacity Manual (HCM) methodology is the most widely accepted and familiar tool for analyzing intersection operations in the San Diego region. It is also required by the City of San Diego in traffic studies. As such, intersection delay using the HCM methodology was reported for both existing conditions and future changes to the intersection and roadway geometry as part of the alternatives analysis. VISSIM, a traffic micro-simulation program, was used to report additional MOEs for the Base and 2005 Concept scenarios as well as for all alternative concept plan scenarios because it provided a more accurate and useful tool to evaluate the alternatives. The traffic MOEs evaluated in the study area are as follows:

- ***Intersections Delay (HCM Methodology):*** Average vehicle delay for all approaches of an intersection, reported in seconds per vehicle.
- ***Roadway Segment Daily Volume-to-Capacity (V/C) Ratios (City Average Daily Traffic (ADT) Thresholds):*** Reports a Level of Service (LOS) based on daily traffic volumes and associated planning-level capacity thresholds.
- ***Passenger Vehicle Travel Time (VISSIM):*** Average time it takes to travel from one end of the corridor to the other, reported in minutes per vehicle. Additional information on the VISSIM traffic simulation software program is provided in Section 3.2
- ***Corridor Delay (VISSIM):*** Cumulative delay along each corridor during the peak hour measured in hours. Additional information on the VISSIM traffic simulation software program is provided in Section 3.2.

Parking

Changes to the roadway configuration, pop-outs and transit improvements in the alternatives may affect parking supply and traffic flow. The measures of effectiveness for evaluating parking are as follows:

- ***Number and Change in Number of Parking Spaces:*** Number of spaces and net increase or decrease in parking spaces by block and corridor.
- ***Effects of Increase/Decrease in Parking:*** The effect of increase/decrease in parking by location.
- ***Interaction of Parking Maneuvers and Traffic Flow:*** Evaluation of safety and delay time to complete parking maneuvers for parallel, head-in diagonal and back-in diagonal parking which corresponds to delays imposed on traffic flow.

2.3 VISSIM – WHAT IS IT?

The VISSIM analysis software is a microscopic model capable of simulating multi-modal traffic flows, including cars, trucks, buses, heavy rail, light rail, bicycles, and pedestrians. The simulation capabilities of VISSIM are unlike typical HCM methods of analysis in that VISSIM tracks the individual vehicle interactions in the study corridor that affect overall operating conditions. VISSIM quantifies overall and individual intersection delays more realistically, as well as other measures of effectiveness, such as travel time and intersection delay. VISSIM also measures the effects of transit signal priority measures at individual intersections.

VISSIM was selected as an analytical tool because it is sensitive to the conditions that affect transit and traffic operations along the corridor, and allows passenger vehicle and transit travel characteristics to be quantified separately. The VISSIM traffic model generates travel time and delay based on multiple model runs that simulate a range of potential traffic operations scenarios.

2.4 CITY OF SAN DIEGO TRAFFIC IMPACT STUDY REQUIREMENTS

The Rosecrans Corridor Mobility Study was not a typical traffic impact study. Rather than analyzing the effects of a proposed development project or change in land use, the study analyzed the effects of potential changes in roadway configuration in order to determine the alternative that would best meet the project goals. The study still followed the City's Traffic Impact Study Guidelines to help evaluate the alternatives and to provide the required traffic analysis for the environmental study to follow.

Study Scenarios

The following scenarios were analyzed to determine the impacts of the proposed changes in roadway capacity along the corridor:

- Existing Conditions
- Horizon Year 2030 Conditions with Existing Roadway/ Intersection Configuration
- Horizon Year 2030 with Recommended Improvements

Peak hour conditions within the a.m. peak period (7:00 to 9:00 a.m.) and p.m. peak period (4:00 to 6:00 P.M.) were evaluated for each study scenario. The following sections discuss the detailed operational analysis methodology.

Intersection Analysis Methodology

According to City standards, intersections are typically analyzed using the Highway Capacity Manual (HCM) methodology. Several software packages, such as Traffix, Synchro, and HCS, are available to evaluate traffic signals with the HCM methodology.

The HCM methodology peak hour intersection analysis calculates the average delay per vehicle for all approaches of an intersection in the case of signalized and all-way stop intersections and for the stop-controlled approach only in the case of a minor street stop-controlled intersection. A letter designation ranging from A through F is then associated to the intersection operations based on a set of delay ranges. Levels of service (LOS) A, B, and C are generally considered acceptable, LOS D is considered marginal, and LOS E and F are considered unacceptable. Table 2-1 presents the delay range for LOS A through F at signalized and unsignalized intersections.

Table 2-1.
Intersection LOS & Delay Ranges

LOS	Average Delay (sec)	
	Signalized Intersection	Unsignalized Intersection
A	0.0 – 10.0	0.0 – 10.0
B	>10.0 – 20.0	>10.0 – 15.0
C	>20.0 – 35.0	>15.0 – 25.0
D	>35.0 – 55.0	>25.0 – 35.0
E	>55.0 – 80.0	>35.0 – 50.0
F	>80.0	>50.0

Source: 2000 Highway Capacity Manual.

Roadway Segment Methodology

Roadway segment operations are generally evaluated by comparing existing and forecast average daily traffic levels to planning-level daily capacity thresholds. Daily capacity thresholds vary based on the street classification which is determined by functionality, roadway width, and the number of travel lanes.

Table 2-2 presents the various street classifications and associated planning-level daily traffic thresholds for LOS A through LOS E as published in the City of San Diego Traffic Impact Study Manual (TISM). The TISM indicates that the volumes and the average daily levels of service listed in Table 2-2 are only intended as a general planning guideline. The table does not take into consideration other factors that affect actual roadway capacity, such as lane widths, presence of a raised median, presence of driveways, number and spacing of cross streets, traffic controls, presence of parallel or angled parking and grade.

Table 2-2.
Roadway Classifications, LOS, and ADT Thresholds

Street Classifications (# Lanes)	Levels of Service				
	A	B	C	D	E
Expressway (6)	30,000	42,000	60,000	70,000	80,000
Prime Arterial (6)	25,000	35,000	50,000	55,000	60,000
Major Arterial (6)	20,000	28,000	40,000	45,000	50,000
Major Arterial (4)	15,000	21,000	30,000	35,000	40,000
Secondary Arterial/Collector (4)	10,000	14,000	20,000	25,000	30,000
Collector, no center lane (4); continuous left-turn lane (2)	5,000	7,000	10,000	13,000	15,000
Collector, no fronting (2)	4,000	5,500	7,500	9,000	10,000
Collector, Commercial-industrial fronting (2)	2,500	3,500	5,000	6,500	8,000
Collector, multi-family (2)	2,500	3,500	5,000	6,500	8,000
Sub-Collector, single-family (2)	-	-	2,200	-	-

Source: City of San Diego Traffic Impact Study Manual
*The daily roadway segment capacities summarized in Table 3-2 for one-way Streets were developed with City of San Diego staff.

Thresholds of Significance

The City has established thresholds of significance to determine when a project's impact is significant and mitigation measures are to be identified. The thresholds are based upon the current and future operating conditions at an intersection or along a roadway segment. Table 2-3 summarizes the City's adopted thresholds of significance.

Table 2-3.
City of San Diego Thresholds of Significance Criteria

Level of Service with Project *	Allowable Change Due To Project Impact **					
	Freeways		Road Segment		Int.	Ramp Meter
	V/C	Speed (mph)	V/C	Speed (mph)	Delay (sec.)	Delay (min.)
LOS E (or ramp meter delays above 15 min.)	0.010	1.0	0.020	1.0	2.0	2.0
LOS F (or ramp meter delays above 15 min.)	0.050	1.0	0.010	0.5	1.0	1.0

* All LOS measurements are based upon Highway Capacity Manual procedures for peak-hour conditions. However, V/C ratios for roadway segments are estimated on an ADT/24-hour traffic volume basis (using Table 2 of the City's Traffic Impact Study Manual. The acceptable LOS for freeways, roadways, and intersections is generally "D" ("C" for undeveloped locations). For metered freeway ramps, LOS does not apply. However, ramp meter delays above 15 minutes are considered excessive.

** If a proposed project's traffic causes the values shown in the table to be exceeded, the impacts are determined to be significant. The project applicant shall then identify feasible improvements (within the Traffic Impact Study) that will restore/and maintain the traffic facility at an acceptable LOS. If the LOS with the proposed project becomes unacceptable (see above * note), or if the project adds a significant amount of peak-hour trips to cause any traffic queues to exceed on- or off-ramp storage capacities, the project applicant shall be responsible for mitigating the project's direct significant and/or cumulatively considerable traffic impacts.

KEY: Delay = Average control delay per vehicle measured in seconds for intersections, or minutes for ramp meters
LOS = Level of Service
Speed = Speed measured in miles per hour
V/C = Volume to Capacity ratio

2.5 SUMMARY

Establishing a clear set of measures of effectiveness at the onset of the project allowed the Project Team to objectively evaluate alternatives for the corridor. In this chapter, city criteria as well as project MOEs were established which were used and referenced throughout this document.

After a thorough review of the MOEs reported for each of the alternatives, the alternative with the most favorable overall balance of travel time and delay among the various modes and users along the corridor will be identified as the Recommended Concept Plan. The Recommended Concept Plan will be reviewed to ensure that the plan met the initial goals and community concerns identified for the project.

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