Appendix B-1. Traffic Study of General Plan Update

INTRODUCTION

A set of travel demand forecasts and accompanying traffic demand methodology report was developed in 1991 by Comsis for the City of Davis for the analysis of the City's General Plan. As part of the General Plan Update, kdANDERSON Transportation Engineers has recalibrated the City of Davis' existing travel demand model to 1998 conditions.

This recalibrated model was utilized to project future traffic conditions. The future traffic forecasts focus on four land use alternatives. These land use alternatives ranged from the existing General Plan's land use with current approved projects incorporated into the land use data, to a reduced version of the existing General Plan's land use, to specific development proposals such as the Oeste and PG&E sites.

In addition, the Traffic Analysis & Travel Demand Forecasting Model report that was originally prepared by Comsis in 1991 was updated utilizing current data. The following report is the update of this traffic demand modeling report pertaining only to the calibration issues.

METHODOLOGY AND MODEL RECALIBRATION

INTRODUCTION

Any travel forecasting process or "model" consists of the following three components:

- A set of mathematical rules by which data is manipulated, normally coded into a set of computer programs
- A set of assumptions
- A set of input data

This analysis considers the efficiency of the first two elements of the Davis process. The third component of input data is used in its provided form. The review of land use forecasts and highway networks that are assumed to be representative of future conditions is beyond the scope of this analysis.

The City of Davis, California travel demand forecasting process consists of a conventional three-step "disaggregate" model set not unlike those used throughout the United States in cities of this size. A disaggregate model, such as this one, builds up the travel on individual facilities from estimates of the travel between traffic analysis zones or "TAZ's". The process starts with an estimate of the number of vehicle trips which will be made from or to each of the traffic zones, based upon the amount and kind of land use in the zone.

This is referred to as "trip generation". The second step estimates where each of these trips will go (i.e., the percentage distribution of trips from each of these zones to every other zone). This is referred to as "trip distribution". Finally, the model determines the path, or paths, which trips from each zone will take across the highway network to get to their destinations. This is referred to as "trip assignment".

The model is applied through the MINUTP microcomputer-based software. This is a travel demand forecasting package which accommodates each of the individual models developed for Davis. The MINUTP software has a number of user-selected options available for each of the steps in the modelling process. It also accommodates special applications which may be user programmed and introduced into the model chain.

ROADWAY NETWORK

Existing

The City of Davis's existing roadway network was developed into a computer simulated network for travel demand forecasting applications as was indicative of 1987 conditions. A future base network had also been developed as part of the original General Plan which accounted for future roadways that were anticipated at that time. Due to the tremendous amount of roadway construction between 1987 and 1998, the circulation system that existed in 1998 more closely resembled the future conditions network than that of the 1987 roadway configuration. Therefore, the future roadway network was selected to modify to decrease the amount of work required to obtain a "1998 existing circulation system network." The changes that were made to the future network to become the 1998 circulation system are summarized in this section.

- **Revise number of lanes to match existing laneage.** The future network had a number of four lane roadways, which were two lane facilities in 1998. Therefore, these existing two lane roadways were recoded correctly to match the existing street system.

- **Extend the circulation network to the east.** The freeway and parallel frontage roads were extended to the east past the Webster ramps. The Webster hook ramps were also incorporated into the 1998 base network and terminal times adjusted.

- **Expand model network to encompass UCD.** The model's network roadway was extended to the west past SR 113 and to the south past I-80 to encompass these portions of the UCD Campus. As part of these efforts, the Hutchins Drive interchange with SR 113 and the Old Davis Road interchange with I-80 were incorporated into the network and terminal times adjusted. The TAZ's zonal structure within the UCD Campus itself was modified to be consistent with the UCD Long Range Planning Study's model network.

- **Reconfigure the zonal structure in the vicinity of Cowell Boulevard and Pole Line Road.** The existing model allowed development in this area to access the adjacent street system across physical barriers where no access currently exists. Therefore, the centroid network loadings were relocated to more accurately replicate travel patterns in this area.

- **Relocate Sutter Davis Hospital.** The Sutter Davis Hospital was relocated to its existing location which is north of Covell Boulevard and west of John Jones Road.

- **Relocate Shasta Drive.** Shasta Drive's connection was relocated from aligning with John Jones Road to aligned with the entrance of the existing hospital, as currently exists.

With the roadway segments (links) and land use activities (zones/centroids) coded into a network that represents the connectivity, access, and travel patterns for all movements in Davis, the resulting 1998 base year network consisted of the following components: 279 zones, of which 45 are unused for future infill and zone splitting, approximately 850 nodes, and approximately 2,100 links representing the roadway segments. Each link identified in the network is coded with attributes needed for modeling including: distance, speed, capacity, number of lanes, and count (if available). Centroid connectors were coded to represent the zonal access and egress for land use activity in the study area.

Link speeds and capacities for the Davis model were developed in a one-dimensional categorization. The speed on each link determines the time that will be needed to traverse a link in path building and the capacity will affect path diversion as congestion increases during assignment. The existing one-dimensional link classification was used as developed previously is shown in Table 1.

TABLE 1
SPEED AND CAPACITY CLASSIFICATION

FACILITY TYPE	CLASS	HARD-CODED SPEED (mph)	LOOK-UP CAPACITY (per hr.)
Freeways	1	55	2,000
Freeway Ramps	2	20	1,800
Major Arterial	3	25-40	900
Minor Arterial	4	25-35	700
Collectors/Local	5	25-30	500
Centroids	9	20	10,000[1]

[1] Centroids are coded to avoid capacity constraint

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Speeds as shown are identified by the model on a link-by-link basis. Depending upon the facility type, link speeds varied depending upon their location in the network, as they should if they were also stratified by area type. This is most evident in the major arterial speeds which on the periphery would operate at 40 mph and only at 25 mph in the central business district core.

Future

A future network was needed to accommodate the four land use alternative analyses. The future roadway network modified the 1998 base network. These modifications consisted of roadway widenings, ramp modifications, new roadway additions, and additional centroid loadings to accommodate future developments.

LAND USE

The 1998 evaluation of the Davis traffic Model incorporated the land uses that existed in the 1998 base year. City staff undertook the effort to inventory all of the land use that existed at that time. In addition, City staff also summarized future land uses under all four of the future study alternatives. UCD provided both current 1997 conditions as well as their future 2000-2005 projections for the campus. No additional TSM reduction in traffic was taken as was previously done in the old General Plan. Comparison of intersection and daily traffic volumes revealed that TSM measures to reduce single auto occupancy trips during the p.m. peak commute hours already exist. Therefore, an additional 10% TSM reduction probably could not be achieved by the year 2010.

Table 2 presents a comparison of the land use data. As shown, a total of 22,856 residences currently exist in the planning area, with that number increasing by 15-21% by 2010 depending on the alternative selected. Retail uses are anticipated to grow at a faster rate, with an 86-107% increase over existing conditions by 2010. The 192 acres of non-retail uses (excluding parks) are anticipated to increase by 76%, while the office square footage is planned to increase by 63-96% depending on the land use alternative. The number of elementary and high school students enrolled at Davis schools is planned to increase by about 28%. At the UC Davis campus, a 27% increase in staff is anticipated while the enrollment is anticipated to increase by about 16%. The UC Davis staff and employment projections are for 2005-2006 as the UC Board of Regents has not made projections past this date.

The 2010 old General Plan land use data set results at a total of 612,190 daily trips. Comparisons of daily trips by land use alternative are presented in Table 3. As shown, in comparison to the General Plan (i.e., Alternative 2), the reduced plan would generate about 96% of the daily trips resulting from Alternative 2. Alternatives 4 and 5 would generate 104% and 105%, respectively.

TABLE 2
COMPARISON OF LAND USE DATA

LAND USE TYPE	1998 LAND USE	2010 LAND USE			
		ALT. 2	ALT. 3	ALT. 4	ALT. 5
Residential (DU's)					
Single Family	11,609	14,317	13,230	13,909	14,302
Duplex/condo	1,890	1,950	1,998	1,998	2,068
Apartments	8,815	10,813	10,813	10,664	10,807
Mobile Homes	542	542	542	542	542
Total Residential	22,856	27,622	26,329	27,113	27,719
Nonresidential					
Retail (1,000 sf)					
CBD	655	990	990	990	990
Neighborhood center	832	1,216	1,157	1,195	1,179
Community center	194	597	532	715	715
Auto sales	72	593	593	738	658
Total Retail	1,753	3,396	3,272	3,638	3,542
Light industrial (acres)	13	23	23	23	23
Heavy industrial (acres)	175	210	210	210	210
BP/R&D (acres)	4	105	105	178	182
Office (1,000 sf)	1,479	2,567	2,411	2,892	2,879
Parks (acres)	205	271	271	271	271
Schools (students)					
Elementary	8,260	10,626	10,626	10,626	10,626
High	1,631	2,000	2,000	2,000	2,000
Total schools	9,891	12,626	12,626	12,626	12,626
UC Davis (2005-2006)[1]					
Employee/Staff	9,655	12,280	12,280	12,280	12,280
Off-campus Students	19,200	22,020	22,020	22,020	22,020
Resident Students	3,260	4,011	4,011	4,011	4,011

[1] A 150-room hold also was included in the residential totals.

TABLE 3
COMPARISON OF TOTAL DAILY TRIP ENDS

	1998 LAND USE	2010 LAND USE			
		ALT. 2 (General Plan)	ALT. 3 (Reduced)	ALT. 4 (Oeste)	ALT. 5 (PG&E)
Total Number of Trips Generated	418,059	612,190	587,782	639,315	640,090
Percentage of Existing General Plan Alt. 2	68%	100%	96%	104%	105%

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TRIP GENERATION

Trip Generation Rates

Residential Rates

In the absence of a locally conducted personal travel survey - the Institute of Transportation Engineers' Trip Generation, Sixth Edition publication is the most commonly recognized source of trip generation rates. Rates suggested by this source were reviewed, and compared with the trip rates that were used in the 1987 model. The results are shown in Table 4.

The Comsis report had indicated that the NCHRP 187 Report also was another recognized source of trip generations rates. Since that time, the NCHRP 187 report has been updated to NCHRP 365. This document utilized ITE's Fifth Edition of the Trip Generation manual which was superseded by the Sixth Edition in 1997. However, as a basis for comparison, these published rates are also presented in Table 4.

As shown, the old General Plan model had utilized a single family trip generation rate of 10.5 daily trips per single family residence. This rate was based on the early results of the 1990 NPTS[1] which had suggested that vehicle trip rates had been growing at a rate of about 1.3 percent per year thereby representing a 12 percent increase from the date the NCHRP 187 was published to 1987. This would have made the residential rates significantly higher than had been used previously. These higher rates had been used in the prior modeling process and the justification of those rates were confirmed with the matching of model projections to cordon counts in residential neighborhoods.

These original model rates were run with the updated 1998 land use base. The results indicated that these rates led to higher daily projections than actually existed on the city streets. Therefore, these rates were lowered to more accurately depict existing 1998 conditions.

Non-Residential, Non-Retail Rates

The seven categories of non-residential, non-retail land uses constitute only a relatively small percentage of all trip ends. There appears to be little justification for any major adjustments to these rates as used in the prior model based upon the suggested values of the ITE publicized trip rates. Consequently, these rates were retained without significant change.

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[1] 1990 Nationwide Personal Transportation Survey, Early Results, USDOT, Federal Highway Administration, August 1991

TABLE 4
COMPARISON OF TRIP GENERATION RATES BY LAND USE TYPES

a) Residential Land Use (Daily trips per Unit)

	Single Family	Duplex/ Condo	Apartment	Mobile Home
Model (old)	10.5	9.8	8.5	7.0
ITE (6th Edition)	9.57	5.9	6.6	4.8
NCHRP Report 365[1]	9.55	5.86	6.47	4.81
Currently Used	**9.5**	**9**	**8**	**7.0**

b) Non-Residential, Non-Retail Land Use (Daily trips per Unit)

	Light Industrial (Acres)	Heavy Industrial (Acres)	BP/R&D (Acres)	Offices (1000 gsf)	Parks (Acres)	Elementary Schools (Students)	High Schools (Students)
Model (old)	60	16	152.0	17	6.0	0.81	1.4
ITE (6th Edition)	51.8	6.75	149.79	11.01-36.13	0.65-2.28	1.02	1.79
NCHRP Report 365[1]	51.8	6.75	159.75	11.42-34.17	0.5-2.99	1.09	1.38
Currently Used	**60.0**	**16.0**	**152.0**	**17.0**	**6.0**	**0.81**	**1.4**

c) Retail Land Use (Daily trips per Unit)

	CBD	Neighborhood Center	Community Center	Auto Sales
Model (old)	40.0	105.0	70.0	45.0
ITE (6th Edition)		99	68.17	37.50
NCHRP Report 365[1]		105	70.67	47.91
Currently Used	**40.0**	**95**	**65**	**45.0**

d) UCD Land Use (Daily Trips Per Unit)

	UCD Employees	Off-Campus Students	Resident Students
Long Range Planning Study	3.896	0.441	2.068
Currently Used	3.896	0.441	2.068

[1] NCHRP Report 365 utilizes ITE trip Generation rates from the 5th Edition

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Retail Rates

The trip generation characteristics of retail land uses vary widely by type of retail use. For this reason the current version of the model uses retained the four types of retail land use.

- Central Business District (CBD)
- Neighborhood Shopping Center
- Community Shopping Center
- Auto Sales

The CBD area, which is the original downtown of Davis, is expected to generate fewer vehicle trips than the shopping centers. Trip rates vary by size and type of shopping centers. In general, the larger the shopping center, the lower the trip rate per 1,000 square feet. This is usually explained by the fact that an individual can make several stops during a single trip at a larger shopping center given the larger variety of choice. Perhaps more important, the smaller centers tend to have a larger percentage of food and convenience stores, which draw customers more frequently than clothing or variety stores.

This version of the Davis model kept auto sales as a separate category. This was important to modelling traffic in Davis because of the concentration of auto sales in the east section of South Davis and the fact that auto dealers are characterized by a large floor area for showrooms but relatively few customers during weekdays. As shown in Table 4, the trip rates for auto sales are much lower than those of shopping centers.

The 1998 land use data was also run utilizing the trip rates in the old General Plan model. Utilizing the old rates resulted in model projections which overstated the existing traffic volumes. In addition, an imbalance between residential and non-residential uses ensued. Therefore, the retail rates were lowered. These rates are presented in Table 4.

University of California-Davis Rates

The trip generation characteristics of UCD were taken directly from the rates utilized in the University of California's Long Range study. These trip generation rates are also presented in Table 4. However, no comparison to the 1987 model is presented as the 1987 model assigned a specified number of trips and did not utilize trip generation rates based on students nor faculty.

Trip Productions and Attractions by Purpose

The second step in the trip generation process is the distribution of the trip ends generated by trip productions and trip attractions by trip purpose. The percentages of productions and attractions by purpose have been reviewed, as shown in Table 5. Percentages are reviewed for three trip purposes: home-based-work (HBW), home-based-other (HBO), and non-home-based (NHB).

For the land use categories, the percentages currently being used in this report are close to those used in the 1987 calibrated model. The previous study compared the rates being used among other studies which have been retained in this document to show the variation in trip generation rates.

The current percentages for the Davis model shown in Table 5 were based initially upon the 1987 models percentages and then adjusted after a series of test runs of the model to better balance the total productions and attractions.

Internal-External and External-Internal Trips

The next step in the trip generation process is to estimate the percentage of trip productions which will have a destination of the Davis area, Internal-External or "I-X" trips and the percentage of trip attractions which will have an origin outside of the Davis area, External-Internal trips or "X-I" trips.

The percentages of Internal-External and External-Internal trips were originally those utilized in the 1987 model. These I-X and X-I trips in turn yielded ramp volumes that were too low and Davis roadway volumes that were too high. In addition, the NBW, HBO and NHB productions and attractions were out of balance. Therefore, the I-X and X-I were increased.

These percentages were in turn validated by running the model and comparing the output results with traffic counts. Table 6 shows these currently used percentages of I-X and X-I trips for each purpose. Table 7A presents the 1987 trip generation by purpose, while Table 12B presents the computed total productions and attractions of trips for each purpose for the 1998 land use base. These percentages yielded a better balance of total productions and attractions of internal trips for each trip purpose.

Tables 8A-8D show 2010 trip generation results as developed for the alternatives.

Future Year Model

For future year runs it is important not to arbitrarily change any of the model parameters. Consequently, the model was applied with the same trip rates, and with the same distribution of trips by purpose.

TABLE 5
TRIP PRODUCTIONS AND ATTRACTIONS AS PERCENTAGES OF TOTAL TRIP ENDS
A COMPARISON AMONG VARIOUS STUDIES

a) Residential Land Use

	Existing Model	SACOG	Charlt.[1]	N.H.[2]	Current
Production					
HBW	16.0	15.0-26.0	14.0	14.0	**18.0**
HBO	62.0	57.0-65.0	45.0	52.0	**62.0**
NHB	7.0	1.0-7.0	35.0	19.0	**5.0**
Attraction					
HBW	0.0	0.0	0.0	0.0	**0.0**
HBO	8.0	9.0-14.0	3.0	10.0	**8.0**
NHB	7.0	1.0-7.0	3.0	5.0	**5.0**

b) Retail Land Use

	Existing Model	SACOG	NCHRP 187	ADOT[3]	Charlot.[1]	N.H.[2]	Current
Production							
HBW	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
HBO	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
NHB	13.0	25.0	13.0	25.0	11.0	7.0	**13.0**
Attraction							
HBW	8.0	8.0	11.0	3.0	8.0	12.0	**12.0**
HBO	66.0	42.0	64.0	47.0	70.0	73.0	**62.0**
NHB	13.0	25.0	13.0	25.0	11.0	7.0	**13.0**

c) Non-Retail Land Use

	Existing Model	SACOG	NCHRP 187	ADOT[3]	Charlot.[1]	N.H.[2]	Current
Production							
HBW	0	0	0	0	0	0	**0**
HBO	0	0	0	0	0	0	**0**
NHB	31	14	35	22	14	27	**30**
Attraction							
HBW	23	33	24	22	30	36	**25**
HBO	15	39	7	34	43	10	**15**
NHB	31	14	35	22	14	27	**30**

1 Comsis Corporation, Charlottesville Route 29 Corridor Study, Virginia
2 Comsis Corporation, Concord-Spaulding Corridor Study, New Hampshire
3 Comsis Corporation and JHK Assoc., Trip Attraction Rates Study, for the Arizona DOT, 1987

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TABLE 6
INTERNAL-EXTERNAL AND EXTERNAL-INTERNAL TRIPS AS PERCENTAGES OF PRODUCTIONS AND ATTRACTIONS

	Residential				Non-Residential		UC Davis			
	1987 Model		1998 Model					1998 Model		
	South	Others	South	Others	1987 Model	1998 Model	1987 Model	UCD Resident Students	UCD Commuter Students	UCD Employees
Internal-External										
HBW	45.0	32.0	48.0	37.0	0.0	0.0	0.0	0.5	0.0	0.0
HBO	18.0	8.0	23.0	17.0	0.0	0.0	0.0	15.0	0.0	0.0
NHB	12.0	5.0	15.0	13.0	3.0	9.0	3.0	0.0	15.0	12.0
External-Internal										
HBW	0.0	0.0	0.0	0.0	30.0	30.0	35.0	0.0	0.0	35.0
HBO	12.0	5.0	15.0	13.0	3.0	13.0	4.0	15.0	15.0	25.0
NHB	12.0	5.0	15.0	13.0	3.0	9.0	3.0	0.0	15.0	12.0

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TABLE 7A
1987 TRIP GENERATION BY PURPOSE

Purpose	Computed		Final	
	Productions	Attractions	Productions	Attractions
HBW	18,924	18,588	18,924	18,924
HBO	99,955	97,966	99,955	99,955
NHB	38,308	38,308	38,308	38,308
I-X	21,041	---	21,041	21,041
X-I	---	13,881	13,881	13,881
Total	**178,228**	**165,903**	**192,109**	**192,109**

TABLE 7B
1998 TRIP GENERATION BY PURPOSE

Purpose	Computed		Final	
	Productions	Attractions	Productions	Attractions
HBW	22,725	22,888	22,725	22,725
HBO	106,565	106,088	106,565	106,565
NHB	41,611	41,611	41,611	41,611
I-X	42,244	---	42,244	42,244
X-I	---	33,260	33,260	33,260
Total	**213,145**	**203,847**	**246,405**	**246,405**

TABLE 8A
2010 TRIP GENERATION BY PURPOSE
ALTERNATIVE 2 (OLD GENERAL PLAN)

Purpose	Computed		Final	
	Productions	Attractions	Productions	Attractions
HBW	31,383	32,202	31,383	31,383
HBO	145,825	147,145	145,825	145,825
NHB	68,681	68,681	68,681	68,681
I-X	30,893	---	30,893	30,893
X-I	---	86,023	86,023	86,023
Total	**276,782**	**334,051**	**362,805**	**362,805**

TABLE 8B
2010 TRIP GENERATION BY PURPOSE
ALTERNATIVE 3 (REDUCED)

Purpose	Computed		Final	
	Productions	Attractions	Productions	Attractions
HBW	29,879	31,189	29,879	29,879
HBO	138,946	141,689	138,946	138,946
NHB	66,115	66,115	66,115	66,115
I-X	29,512	---	49,225	49,225
X-I	---	82,979	82,979	82,979
Total	**264,452**	**321,972**	**347,431**	**347,431**

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TABLE 8C
2010 TRIP GENERATION BY PURPOSE
ALTERNATIVE 4 (OESTE)

Purpose	Computed		Final	
	Productions	Attractions	Productions	Attractions
HBW	35,077	34,813	35,077	35,077
HBO	143,152	146,353	143,152	143,152
NHB	74,192	74,192	74,192	74,192
I-X	27,094	---	27,094	27,094
X-I	---	103,087	103,087	103,087
Total	**279,515**	**358,445**	**382,602**	**382,602**

TABLE 8D
2010 TRIP GENERATION BY PURPOSE
ALTERNATIVE 5 (PG&E)

Purpose	Computed		Final	
	Productions	Attractions	Productions	Attractions
HBW	35,871	35,010	35,871	35,871
HBO	146,328	145,748	145,748	145,748
NHB	74,347	74,347	74,347	74,347
I-X	27,156	---	27,156	27,156
X-I	---	99,927	99,927	99,927
Total	**283,702**	**355,032**	**383,629**	**383,629**

Changes occurred in the I-X assumptions. As with the previous model, the higher percentage of I-X trips of South Davis as compared to the rest of Davis was expected to come into line with the rest of the City by 2010 as development infills between what is currently South Davis and the balance of the City.

The X-I percentage was adjusted to balance the expected non-residential land use projected by City staff. The resultant percentages of external to internal trips are as listed in Table 9. In 2010 these percentages suggest that about 30 percent of all commercial land uses will be supported by individuals living outside of Davis as compared to about 13 percent today. Similarly, there is an increase in the percentage of Home Based Other trips to U.C. Davis based upon the growth of that facility.

Because of the added land use in Alternatives 4 and 5, total trip productions and attractions increased for the study area. When determining the percentage I-X trips from the model, the growth in productions results in an increase in total I-X trips. This increase cannot be shown in X-I trips since the controlling end is outside of the study area and has to be increased manually. For this reason, X-I trips were increased from 30% to 35%. Similarly, the Home Base Work I-X was decreased to 20% under Alternatives 4 and 5.

TRIP DISTRIBUTION

The distribution model used for Davis is the standard gravity model, which uses the vehicle trips to and from each zone, produced by trip generation, the zone-to-zone minimum time paths from the highway network, and friction factors indicating the willingness to travel a certain distance. Friction factors are not developed as part of the model chain and must be calibrated from survey data or borrowed from a comparable city with similar travel characteristics.

The gravity model estimates the number of vehicle trips between each pair of zones for each of the three internal trip purposes. Internal-external and external-internal trips constitute the fourth and fifth purposes of the model. Through trips, or trip with both ends outside of the Davis area, are directly inserted into the model from manual calculation. K-factors are introduced into the model to compensate for problems encountered in trying to calibrate trip making from South Davis (District 10), south of I-80 in the future development area. Trips from South Davis interact more frequently with other districts in Davis than is normally observed. Imposing a K-factor will keep more trips local than currently provided by the model which cannot account for this anomaly. From District 10 to all other internal districts the K-factor was adjusted from 0.60 to 0.50. K-factors with values less than 1.00 will result in more trips staying local to District 10.

TABLE 9
INTERNAL-EXTERNAL AND EXTERNAL-INTERNAL TRIPS
2010 MODEL COMPARED TO CURRENT 1998 MODEL

	Residential			Non-Residential		U.C. Davis					
	1998		2010 All Areas	1998	2010	1998			2005		
	South	Other				Employees	Resident Students	Commute Students	Employees	Resident Students	Commute Students
Internal-External											
Home Based Work	48.0	37.0	30.0[1]	0.0	0.0	0.0	10.0	0.0	0.0	5.0	0.0
Home Based Other	23.0	17.0	7.0	0.0	0.0	0.0	15.0[1]	0.0	0.0	15.0	0.0
Non Home Based	15.0	13.0	5.0	9.0	9.0	12.0	0.0	15.0	12.0	0.0	15.0
External-Internal											
Home Based Work	0.0	0.0	0.0	30.0	45.0	35.0	0.0	0.0	40.0	0.0	0.0
Home Based Other	15.0	13.0	5.0	13.0	30.0[2]	25.0	15.0	20.0	30.0	15.0	20.0
Non Home Based	15.0	13.0	5.0	9.0	9.0	12.0	0.0	15.0	12.0	0.0	15.0

1 For Alternatives 4 and 5, this was decreased to 20%, as discussed in the text
2 For Alternatives 4 and 5, this was increased to 35%, as discussed in the text

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Mathematically the gravity model is stated as follows:

$$T_{ij} = P_i \frac{(A_j)(F_{ij})(K_{ij})}{\sum_{j=1}^{z} (A_j)(F_{ij})(K_{ij})}$$

where:

T_{ij} = the number of trips produced by zone i and attracted to zone j

P_i = the total number of trips produced by zone i

A_j = the total number of trips attracted to zone j

F_{ij} = the minimum zone-to-zone highway travel time, including terminal times

K_{ij} = the zone-to-zone adjustment factor to allow for the incorporation of the effect on travel patterns not otherwise accounted for in the gravity model

z = the total number of zones in the system

For all three of the internal purposes, the gravity model iterates to ensure that the estimated number of trips attracted to each zone equals the projected number of trips attracted from the trip attraction model. Satisfaction of this constraint is guaranteed for trip productions, since the gravity model simply allocates the total number of productions to attractions in other zones. There is no guarantee, however, that the sum of all trips allocated to a zone will equal the expected number of attractions. Each iteration of the distribution model therefore artificially increases the attractiveness of zones in which the trips are less than the number of trip attractions, and decreases the attractiveness of zones in which trips are overstated. The gravity model runs with three iterations providing reasonable closure between final attractions and the expected attractions.

Average trip lengths by purpose for the 1998 model are shown in Table 10.

TABLE 10
1998 AVERAGE TRIP LENGTHS

Home-Based Work	8.91	Internal-External	19.21
Home-Based Other	7.52	External-Internal	21.43
Non-Home-Based	8.47	Davis Overall Average	11.69

ASSIGNMENT

Traffic Assignment

The final application in the modeling process is the loading of the vehicle trip table onto the simulated highway network. Reviewing the flow and distribution of simulated trips and comparing these results to existing ground counts in the City of Davis provides the validation test for the accuracy of the model. Validation of the Davis model was performed for virtually all facilities in the network, given the extensive number of counts available. In a network the size of Davis, validation is difficult due to the limited number of links in the network. A common rule for developing a network is to code the links at one level below the level at which validation will be made. This will insure "spreading" of the trips over the network. The fewer network links, the more trips that would have used other routes, are now forced to use only the available routes which tend to become overloaded. Validation of the Davis model is performed for virtually all facilities in the network.

The Davis model uses a four iteration equilibrium assignment technique. This technique was previously used for Davis and is carried forward in this study. Ground counts are coded for most major links in the highway network. Reviewing the results, a number of different issues surface which warrant further discussion. Some of these issues are beyond the limits of the validation process and are identified for certain areas in the network so that they are not overlooked during the future alternatives analysis. Some professional judgement and manual adjustment will be needed to use these assigned volumes.

Smoothing Technique

When developing base and future year travel forecasts there is a need to adjust the volumes that are output from the travel model, to account for probable assignment error. Of course, if the base year assigned volume was identical to the base year count, this would not be necessary. Unfortunately, this is rarely the case. A technique is provided by the Transportation Research Board[2]. This outlines a procedure for calculating an adjustment due to assignment deviation.

The procedure is based on the fact that future year assignment forecasts are frequently based on the relationship between the base year assignments and the base year counts. The discrepancy between a base year count and a base year assignment is likely to be of the same magnitude in the future year. Given this assumption, the future year assignment can

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2 National Cooperative Highway Research Program Report 255 - Highway Traffic Data for Urbanized Area Project Planning and Design, p.50.

be modified by comparison to the relative ratios and differences between the base year assignment and count. The ratio and differences methods are equally valid for producing directional or nondirection adjusted volumes.

To apply the "smoothing" procedures, the following data is required:

- Future year assignment link volume
- Base year assignment link volume
- Base year link count

The first two data items are generated by the computer assignment and the third is measured from existing field count programs. The two methods can be applied separately or in combination.

Ratio Method

Each link volume in the future year assignment is factored by the ratio of the base year actual traffic count to the base year assignment.

$$V_{ri} = F_i * (B_{ci} / B_{ai})$$

where:

V_{ri} = ratio adjusted future year volume for link i;
F_i = future year forecasted volume for link i;
B_{ci} = base year traffic count for link i; and
B_{ai} = base year assigned volume for link i.

Difference Method

Each link volume in the future year assignment is adjusted by the difference of the base year actual traffic count to the base year assignment.

$$V_{di} = F_i + (B_{ci} - B_{ai})$$

where:

V_{di} = difference adjusted future year volume for link i;
F_i = future year forecasted volume for link i;
B_{ci} = base year traffic count for link i; and
B_{ai} = base year assigned volume for link i.

Both the ratio and the difference methods must be carefully applied to avoid extreme values. If the ratio method is applied, a significant difference between the base year count and the base year assignment can produce an unrealistic factor that may show the adjusted future year volume to be extremely high or low. This is especially true of low volume links that can typically be over-assigned by two or three times their actual count or not assigned at all. Similarly, in the difference method, if the discrepancies in the base year are significant, the future year volume can be incorrect and negative values can occur.

Combined Method

The averaging method tends to reduce the extremes experienced by the individual methods, but careful review should still be conducted to ensure reasonable results. This can most easily be checked by looking at the before and after effect of the technique on the future year volume. Significant differences between the two typically indicates a problem with the procedure.

$$V_{fi} = (V_{ri} + V_{di}) / 2$$

where:

V_{fi} = final averaged future year volume for link i;
V_{ri} = ratio adjusted future year volume for link i; and
V_{di} = difference adjusted future year volume for link i.

The "combined method" was used for this project.

Adjustments

Some manual adjustment was made on selected links where it was felt that the adjusted volumes may not accurately reflect future year conditions. Some professional judgement is always required in the interpretation of raw computer output as the real world is never quite as simple as the assumptions that can be built into the model chain. Manual adjustments were made only for potentially impacted streets, those streets which would be subject to widenings under the City's criteria. In making these adjustments the criteria which were employed were the following:

- Is the street segment impacted under either the adjusted or raw forecasts?
- What is the size of the smoothing factor (S factor)?
- Was the volume on the street in the base year very small?
- Was there a very large growth on the segment?

- What is the magnitude of adjacent S factors?

- Is there a significant change in travel patterns between the base and future year impacting the segment?

There were only a very few locations where manual adjustments were applied. These in each case represented locations where the point of loading of a centroid connector created a false impression of the real volume on the link or locations where it was felt that the count volume upon which an adjustment factor was based was questionable.

MODEL VALIDATION

A key step in the preparation of travel demand models is the process of validating the models against known base year travel patterns. The validation process for the Davis travel demand forecasting models was complicated by the lack of a current origin-destination survey that could be used to verify the trip rates, the distribution of trips by trip purpose, the percentages of internal to external and external to internal trips and the distribution of trips by trip length. This made it impossible to validate each of the model steps independently as they were developed. Instead the final test of whether the models adequately reflect the base year travel patterns was a "bottom line" comparison at the end of the model chain of forecasted travel on street segments for which the City had actual daily count data.

It is impossible for any model to precisely replicate human choice patterns, which is essentially what the travel demand models attempt to accomplish. There simply are too many variables that are involved, and different individuals react differently to these variables. All that can be done is to develop a model set which achieves a "reasonable" comparison or validation of trip forecasts with travel counts. What constitutes "reasonableness" is always an issue. In reviewing link volumes in Table 12, it should be noted that acceptable levels of validation are determined by facility type and associated link volume. Guidelines such as those provided by the U.S. Department of Transportation[3] give a rule-of-thumb for acceptable values in highway validation. Table V-4 of that document outlines the levels of accuracy shown in Table 11. The acceptable level of accuracy is also presented in NCHRP Report 365. This document sites FHWA's manual Calibration and Adjustments of System Planning Models (1990) which suggests limits by functional classification: freeways - less than 7 percent; principal arterials - less than 10 percent; minor arterials - less than 15 percent; and, collectors - less than 25 percent.

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[3] UTPS Highway Network Development Guide, January, 1983.

TABLE 11
ACCEPTABLE PERCENT ERROR IN ASSIGNMENT RESULTS RELATED TO ADT

Facility Type	Number of Lanes	ADT Range (1000's)	% Error
Freeway	8	80-105	13
	6	55-80	18
	4	30-55	29
Arterial	8 Divided	37-47	13
	6 Divided	27-37	17
	4 Divided	16-27	25
	4 Undivided	9-18	34
	2 Undivided	2-8	56
	4 One-way	18-24	13
	3 One-way	13-18	17
	2 One-way	8-13	25

The following are some of the issues identified from the base year validation:

1) The speed differential between major and minor arterials tends to bias trip loading towards the major arterials. Some traffic movements that may normally filter southbound on Sycamore Lane or Oak Avenue from north of Covell Boulevard, to a destination in the CBD or points south, are routing along Covell Boulevard and southbound on F Street or Pole Line Road in the model.

2) A simulated volume on 5th Street is higher than the existing count, while traffic volumes on 14th, 8th and 2nd Streets are lower than existing counts. This overestimation exhibits the same problems as identified in item 1.

3) Overestimation of Chiles Road west of Mace Boulevard exhibits the same overestimation problems as given in item 1. Volumes east of that location on Chiles Road match favorably with ground counts. Localized production zones and attraction zones contribute to this problem and are noted for future assignment runs.

The ideal validation would result in assigned volumes that match existing counts within 10%. The network detail and trip assignment for the Davis model require validation efforts of 10% - 30% to be the realistic goal of the validation effort.

Virtually all of the link level travel forecasts fall within the generally accepted standards listed in Table 11 above, for links where counts are available, and where, therefore, such a comparison can be made. In most cases the forecasts validate much more closely than these standards. It can be concluded, therefore, that the model adequately replicates the base year travel forecasts and are a reliable instrument for forecasting future year travel on the land use alternatives to be studied.

A review of selected screenlines and cutlines will determine the accuracy of major traffic flows in the Davis model. Even if the compared volume to the existing count on any given road is not exact, the total distribution of trips by direction provides an acceptability check of the number of trips moving in that direction. Table 13 displays the screenline validation of ramp volumes. As shown, overall the model estimates traffic volumes within 1% of actual counts.

Table 14 shows the north-south screenlines that intersect street volumes moving east and west through the study area. A screenline to check the north-south movement of trips in the Davis model is shown in Table 15.

The east-west and north-south screenlines provide an acceptable level of validation and the difference observed may be a result of minor arterial and collector streets that were not included in the screenline.

A final validation check is to look at the trips entering and leaving the Davis CBD. This is accomplished by drawing a cordon around the downtown core and reviewing the available count locations and assigned volumes. A review of this cordon is shown in Table 16.

The screenline and cordon line validation for Davis produces acceptable results for use in developing future forecasts. The validation analysis does not give a complete view of all links in the network. When producing the future year assignment, a link-by-link review of results is used to ensure acceptable values for future volumes.

TABLE 12
COMPARISON OF 1998 MODEL VOLUMES AND ACTUAL COUNTS

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
North-South				
Anderson Road				
F St to Catalina Dr	2,400	1,850	-550	-23%
Catalina Dr to Covell Blvd	4,100	3,950	-150	-4%
Covell Blvd to Valdora Dr	10,300	10,800	500	5%
Valdora Dr to 8th St	10,500	9,600	-900	-9%
8th St to Russell Blvd	11,000	11,700	700	6%
B Street				
14th St to 8th St	3,600	4,200	600	17%
8th St to Russell Blvd	6,000	6,500	500	8%
Russell Blvd to 1st St	12,300	10,700	-1,600	-13%
California Avenue				
So. of Russell Blvd.	4,500	4,350	-150	-3%
Catalina Drive				
Grande Ave. to Covell Blvd.	1,700	1,700	0	0%
F Street				
Grande Ave to Covell Blvd	5,000	5,000	0	0%
Covell Blvd to 14 St	10,900	11,300	400	4%
14th St to 8th St	10,000	11,300	1,300	13%
8th St to 5th St	9,000	8,450	-550	-6%
5th St to 1st St	9,600	11,000	1,400	15%
Howard Way				
So. of Russell Blvd.	7,100	5,550	-1,600	-23%
J Street				
Covell Blvd to 8th St	3,850	3,800	-50	-1%
8th St to 3rd St	700	1,100	400	57%

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TABLE 12
COMPARISON OF 1998 MODEL VOLUMES AND ACTUAL COUNTS

	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
North-South				
Lake Boulevard				
No. of Covell Blvd	1,450	1,150	-300	-21%
Covell Blvd to Arlington Blvd	6,200	5,300	-900	-15%
Arlington Blvd to Russell	3,450	4,650	1,200	35%
Mace Boulevard				
Covell Blvd to 2nd St	14,400	13,200	-1,200	-8%
2nd St to Chiles Rd	17,300	17,100	-200	-1%
Chiles Rd to Cowell Blvd	12,200	13,500	1,300	11%
Cowell Blvd to Montgomery Rd	5,000	4,650	-350	-7%
Oak Avenue				
Covell Blvd to 14th St	5,350	2,850	-2,500	-47%
14th St to Eighth St	2,850	3,150	300	11%
Eighth St to Russell Blvd	2,000	1,600	-400	-20%
Pole Line Road				
No. of Covell Blvd	6,900	6,850	-50	0%
Covell Blvd to 8th St	9,200	7,850	-1,350	-15%
8th St to 5th St	10,200	10,300	100	0%
5th St to Cowell Blvd	12,000	13,100	1,100	9%
Richards Boulevard				
E St to East Olive Dr	24,000	25,100	1,100	5%
I-80 EB Ramps to I-80 WB Ramps	22,700	21,700	-1,000	-4%
I-80 WB Ramps to Research Park Dr	18,600	18,100	-500	-3%
State Route 113				
I-80 to Hutchison Dr	34,500	31,100	-3,400	-10%
Hutchison Dr to Russell Blvd	31,000	32,500	1,500	5%
Russell Blvd to Covell Blvd	26,500	27,600	1,100	4%
No. of Covell Blvd	19,900	16,500	-3,400	-17%

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TABLE 12
COMPARISON OF 1998 MODEL VOLUMES AND ACTUAL COUNTS

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
North-South				
State Route 113 at Co Rd 31				
SB on from Co Ro 31	7,190	6,750	-440	-6%
NB off to Co Ro 31	6,665	7,300	635	10%
NB on from Co Rd 31	2,665	1,450	-1,215	-46%
SB off to Co Rd 31	2,425	1,450	-975	-40%
State Route 113 at Hutchison				
NB off to Hutchison Dr	2,840	2,350	-490	-17%
SB on from EB Hutchison	2,600	1,950	-650	-25%
NB on from EB Hutchison	2,500	2,800	300	12%
SB off to Hutchison Dr	2,770	2,900	130	5%
State Route 113 at Russell Blvd				
NB off to Russell Blvd	4,510	5,400	890	20%
SB on from Russell Blvd	4,835	5,250	415	9%
NB on from Russell Blvd	2,105	2,850	745	35%
SB off to Russell Blvd	2,045	2,850	805	39%
Sycamore Lane				
No. of Covell Blvd	11,200	11,800	600	5%
Covell Blvd to Russell Blvd	6,100	5,600	-500	-8%

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TABLE 12
COMPARISON OF 1998 MODEL VOLUMES AND ACTUAL COUNTS

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
East-West				
1st Street				
A St to F St	14,700	13,300	-1,400	-10%
2nd Street				
3rd St to Pole Line Rd	3,400	2,550	-850	-25%
Pole Line Rd to Mace Blvd	3,200	2,400	-800	-25%
West of Mace Blvd	3,500	4,850	1,350	39%
5th Street				
B St to J St	12,700	13,800	1,100	9%
J St to Pole Line Rd	10,600	12,700	2,100	20%
East of Pole Line Rd	6,300	6,600	300	5%
8th Street				
Sycamore Ln to F St	6,250	4,900	-1,350	-21%
F St to J St	7,200	8,750	1,550	22%
J St to L St	5,900	4,700	-1,200	-20%
L St to Pole Line Rd	7,000	4,950	-2,050	-29%
East of Pole Line Rd	3,400	3,850	450	13%
14th Street				
Oak Ave to F St	3,600	2,200	-1,400	-39%
Arlington Boulevard				
Lake Blvd to Russell Blvd	5,300	4,450	-850	-16%
Chiles Road				
Cowell Blvd to Mace Blvd	4,100	7,300	3,200	78%
East of Mace Blvd	1,500	1,350	-150	-10%
County Road 31				
West of Lake Blvd	5,800	5,450	-350	-6%

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TABLE 12
COMPARISON OF 1998 MODEL VOLUMES AND ACTUAL COUNTS

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
East-West				
County Road 32A				
E. of Mace Blvd.	1,200	750	-450	-38%
Covell Boulevard				
Lake Blvd to Shasta Dr	11,200	11,500	300	3%
Shasta Dr to SR 113	20,200	20,600	400	2%
SR 113 to Sycamore Ln	21,000	22,100	1,100	5%
Sycamore Ln to Pole Line Rd (overxing)	20,700	21,200	500	2%
Pole Line Rd to Alhambra Dr	13,300	11,300	-2,000	-15%
Alhambra Dr to Alhambra Dr	8,100	10,000	1,900	23%
Cowell Boulevard				
Research Park Dr to Pole Line	10,100	11,100	1,000	10%
Pole Line Rd to Chiles Rd	5,700	8,400	2,700	47%
Chiles Rd to Mace Blvd	3,600	3,950	350	10%
East of Mace Blvd	1,300	850	-450	-35%
Hutchison Drive				
State Route 113 to La Rue Rd	9,000	9,200	200	2%
I-80				
East of Webster	120,000	121,500	1,500	1%
Webster to Mace	118,000	119,400	1,400	1%
Mace Blvd to Olive Dr	109,000	107,900	-1,100	-1%
Olive Dr to Richards Blvd	107,000	107,000	0	0%
Richards Blvd to SR 113	104,000	104,500	500	0%
West of SR 113	98,000	98,800	800	0%
I-80 at Mace Boulevard				
WB on from Co Rd 104/Mace	3,850	3,450	-400	-10%
EB off to Co Rd 104/Mace	4,400	4,050	-350	-8%
EB on from Co Rd 104/Mace	8,000	8,950	950	12%
WB off to Co Rd 104/Mace	8,750	10,000	1,250	14%

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TABLE 12
COMPARISON OF 1998 MODEL VOLUMES AND ACTUAL COUNTS

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
East-West				
I-80 at Olive				
WB off to Olive Dr	1,700	850	-850	-50%
I-80 at Richards				
WB on from Richards	6,750	5,600	-1,150	-17%
WB off to SB Richards	5,150	5,350	200	4%
EB off to Richards Blvd	(6,100)	4,200	-1,900	-31%
EB on from Richards	(7,400)	7,000	-400	-5%
I-80 at Webster				
EB off to Webster	110	0	-110	-100%
WB on from Webster	80	0	-80	-100%
EB on from Webster	1,315	1,550	235	18%
WB off to Webster	1,080	550	-530	-49%
Lillard Drive				
Pole Line Rd to Drummond	7,800	7,450	-350	-5%
East of Drummond Ave	1,800	1,550	-250	-13%
Old Davis Road				
West of A St	7,000	5,950	-1,050	-15%
Russell Boulevard				
West of Lake Blvd	2,600	2,900	300	12%
Lake Blvd to SR 113	18,700	21,900	3,200	17%
SR 113 to Anderson Rd	18,900	16,300	-2,600	-14%
Anderson Rd to Oak Ave	25,700	25,100	-600	-2%
Oak Ave to B St	27,000	26,100	-900	-3%

( ) = estimated

TABLE 13
SCREENLINE VALIDATION OF RAMP VOLUMES

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
Southbound Off				
Covell	2,425	1,450		
Russell	2,045	2,850		
Hutchins	2,770	2,900		
	7,240	7,200	-40	0%
Southbound On				
Covell	7,190	6,750		
Russell	4,835	5,250		
Hutchins	2,600	1,950		
	14,625	13,950	-675	-5%
Northbound Off				
Covell	6,665	7,300		
Russell	4,510	5,400		
Hutchins	2,840	2,350		
	14,015	15,050	1,035	7%
Northbound On				
Covell	2,665	1,450		
Russell	2,105	2,850		
Hutchins	2,500	2,800		
	7,270	7,100	-170	-2%
Westbound Off				
Old Davis	1,900	1,600		
Webster	1,080	550		
Mace	8,750	10,000		
Richards	5,150	5,350		
Olive	1,700	850		
	18,580	18,350	-230	-1%
Westbound On				
Old Davis	800	2,450		
Webster	80	0		
Mace	3,850	3,450		
Richards	6,750	5,600		
	11,480	11,500	20	0%
Eastbound On				
Old Davis	1,800	1,050		
Webster	1,315	1,550		
Mace	8,000	8,950		
Richards	7,400	7,000		
	18,515	18,550	35	0%

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TABLE 13
SCREENLINE VALIDATION OF RAMP VOLUMES

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
Eastbound Off				
Old Davis	990	2,000		
Webster	110	0		
Mace	4,400	4,050		
Richards	6,100	4,200		
	11,600	10,250	-1,350	-12%
All-Ramps				
NB-SB	43,150	43,300	150	0%
EB-WB	60,175	58,650	-1,525	-3%
Total	**103,325**	**101,950**	-1,375	-1%

TABLE 14
SCREENLINE VALIDATION OF NORTH-SOUTH TRAFFIC FLOW

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
North of Cowell				
Lake	1,450	1,150		
Sycamore	11,200	11,800		
Anderson	4,100	4,100		
F Street	7,300	9,150		
Pole Line	6,900	6,850		
SR 113	19,900	16,500		
Total without 113	**30,950**	**33,050**	2,100	7%
Total with 113	**50,850**	**49,550**	-1,300	-3%
South of Cowell				
Lake	6,200	5,300		
Anderson	10,300	10,800		
Oak	5,350	2,850		
F Street	10,900	11,300		
J Street	3,850	3,800		
L Street	3,900	5,000		
Pole Line	9,200	7,850		
5th Street	2,500	1,950		
Mace Blvd	14,400	13,200		
SR 113	26,500	27,600		
Total without 113	**66,600**	**62,050**	-4,550	-7%
Total with 113	**93,100**	**89,650**	-3,450	-4%
South of 14th/Drexel/Loyola				
Sycamore	3,900	2,100		
Anderson	10,500	9,650		
Oak	2,850	3,150		
B Street	3,600	4,200		
F Street	10,000	11,300		
Pole Line	9,200	7,850		
Cowell/Mace	14,400	13,200		
113	26,500	27,600		
Total without 113	**54,450**	**51,450**	-3,000	-6%
Total with 113	**80,950**	**79,050**	-1,900	-2%

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TABLE 14
SCREENLINE VALIDATION OF NORTH-SOUTH TRAFFIC FLOW

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
North of Russell/5th and South of 8th				
Lake	3,450	4,650		
Arlington	5,300	4,450		
Sycamore	3,400	1,750		
Anderson	11,000	11,700		
Oak	2,050	1,600		
B Street	6,000	6,500		
F Street	8,500	11,100		
Pole Line	10,200	10,300		
5th Street	2,800	2,550		
Mace Blvd	14,400	13,200		
SR 113	26,500	27,600		
Total without SR 113	**67,100**	**67,800**	**700**	**1%**
Total with SR 113	**93,600**	**95,400**	**1,800**	**2%**
At the RR Tracks North of I-80				
Richards	24,000	25,100		
Pole Line	12,000	13,100		
Mace Blvd	17,300	17,100		
Total	**53,300**	**55,300**	**2,000**	**4%**
South of I-80				
Richards	18,600	18,100		
Pole Line	12,000	13,100		
Cowell	6,300	6,800		
Drummund	1,300	1,450		
Mace Blvd	5,000	4,650		
Total	**43,200**	**44,100**	**900**	**2%**

TABLE 15
SCREENLINE VALIDATION OF EAST-WEST TRAFFIC FLOW

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
West of Lake				
County Rd 31	5,800	5,450		
Russell	2,600	2,900		
I-80	98,000	98,800		
Total without I-80	**8,400**	**8,350**	**-50**	**0%**
Total with I-80	**106,400**	**107,150**	**750**	**0%**
West of SR 113				
Covell	20,200	20,600		
Russell	18,700	21,900		
I-80	98,000	98,800		
Total without I-80	**38,900**	**42,500**	**3,600**	**9%**
Total with I-80	**136,900**	**141,300**	**4,400**	**3%**
East of SR 113				
Covell	21,000	22,100		
Russell	18,900	16,300		
Hutchins	9,000	9,200		
I-80 to 113	18,500	19,400		
Total without I-80	**48,900**	**47,600**	**-1,300**	**-3%**
Total with I-80	**67,400**	**67,000**	**-400**	**-0%**
West of Pole Line				
Covell	16,700	20,100		
8th	7,000	4,950		
5th	10,600	12,700		
2nd	3,400	2,550		
Cowell	10,100	11,100		
I-80	109,000	107,900		
Total without I-80	**47,800**	**51,400**	**3,600**	**8%**
Total with I-80	**156,800**	**159,300**	**2,500**	**2%**

TABLE 15
SCREENLINE VALIDATION OF EAST-WEST TRAFFIC FLOW

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
East of Pole Line				
Covell	13,300	11,300		
Loyola	3,700	2,100		
8th	3,400	3,850		
5th	6,300	6,600		
2nd	3,700	2,450		
Cowell	6,300	6,800		
Lillard	7,800	7,450		
I-80	109,000	107,900		
Total without I-80	**44,500**	**40,350**	**-4,150**	**-9%**
Total with I-80	**153,500**	**148,050**	**-5,450**	**-4%**
West of Drummund				
Covell	13,300	11,300		
Loyola	1,100	1,400		
5th	2,500	1,950		
2nd	3,500	4,650		
Cowell	5,700	8,400		
Lillard	3,050	3,050		
I-80	109,000	107,900		
Total without I-80	**29,150**	**30,750**	**1,600**	**5%**
Total with I-80	**138,150**	**138,650**	**500**	**0%**
East of Drummund				
Covell	13,300	11,300		
Loyola	1,100	1,400		
5th	2,500	1,950		
2nd	3,500	4,650		
Chiles	3,700	7,300		
Cowell	3,600	3,950		
Lillard	1,800	1,550		
I-80	109,000	107,900		
Total without I-80	**29,500**	**32,100**	**2,600**	**9%**
Total with I-80	**138,500**	**140,000**	**1,500**	**1%**

TABLE 15
SCREENLINE VALIDATION OF EAST-WEST TRAFFIC FLOW

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
East of Mace Blvd				
County Road 32A	1,200	750		
Chiles	1,500	1,350		
I-80	118,000	119,400		
Total without I-80	**2,700**	**2,100**	**-600**	**-22%**
Total with I-80	**120,700**	**121,500**	**800**	**0%**

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TABLE 16
SCREENLINE VALIDATION OF CENTRAL BUSINESS DISTRICT

LOCATION	1996-1999 TRAFFIC COUNT	1998 MODELED RESULTS	DEVIATION	% DEVIATION
B Street - N	3,600	4,200		
F Street - N	10,000	12,100		
J Street - N	3,850	3,550		
L Street - N	3,950	5,000		
8th Street - E	6,500	6,050		
5th Street - E	11,000	13,200		
2nd Street - E	3,400	2,550		
Richards Blvd - S	24,000	25,100		
Old Davis Rd - S	8,250	9,200		
5th Street - W	27,000	26,100		
8th Street - W	6,250	5,150		
Total	**107,800**	**112,200**	**4,400**	**4%**

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