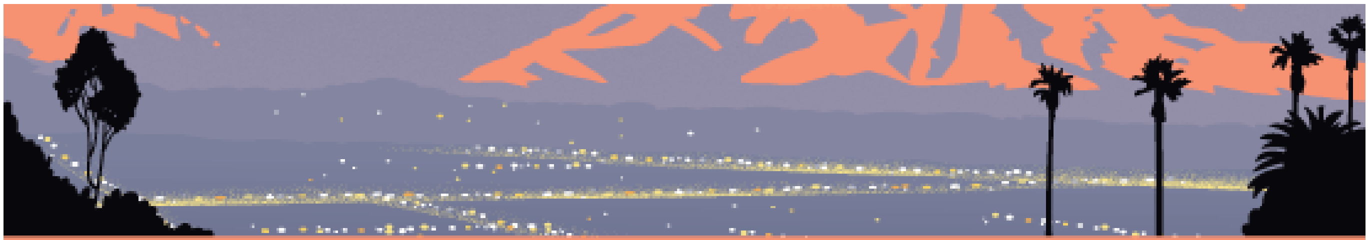

SR-710 Study

Alternatives Analysis Report

Appendix G

Model Methodology Report

Metro

Alternatives Analysis Phase

SR 710 EIR/EIS
Model Methodology Report

Prepared for

Metro

Los Angeles County
Metropolitan Transportation Authority

September 6, 2012

CH2MHILL®

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Suite 2100
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Contents

Acronyms and Abbreviations

%RMSE	Percent Root Mean Squared Error
ADT	Average Daily Traffic
CTPP	Census Transportation Planning Package
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GVW	Gross Vehicle Weight
HBW	Home-Based Work
HDT	Heavy Duty Truck
HH	Heavy-Heavy
I	Interstate
LACMTA	Los Angeles County Metropolitan Transportation Authority
LH	Light-Heavy
MH	Medium-Heavy
MPOs	Metropolitan Planning Organizations
MTOs	Metropolitan Transportation Organizations
NCHRP	National Cooperative Highway Research Program
PA/ED	Project Approval/Environmental Document
PeMS	Performance Measurement System
PortsTAM	Ports Transportation Analysis Model
RMSE	Root Mean Squared Error
RTP	Regional Transportation Plan
SCAG	Southern California Association of Governments
SR	State Route
TAZ	Traffic Analysis Zone
TMIP	Travel Model Improvement Program
VMT	Vehicle Miles Traveled

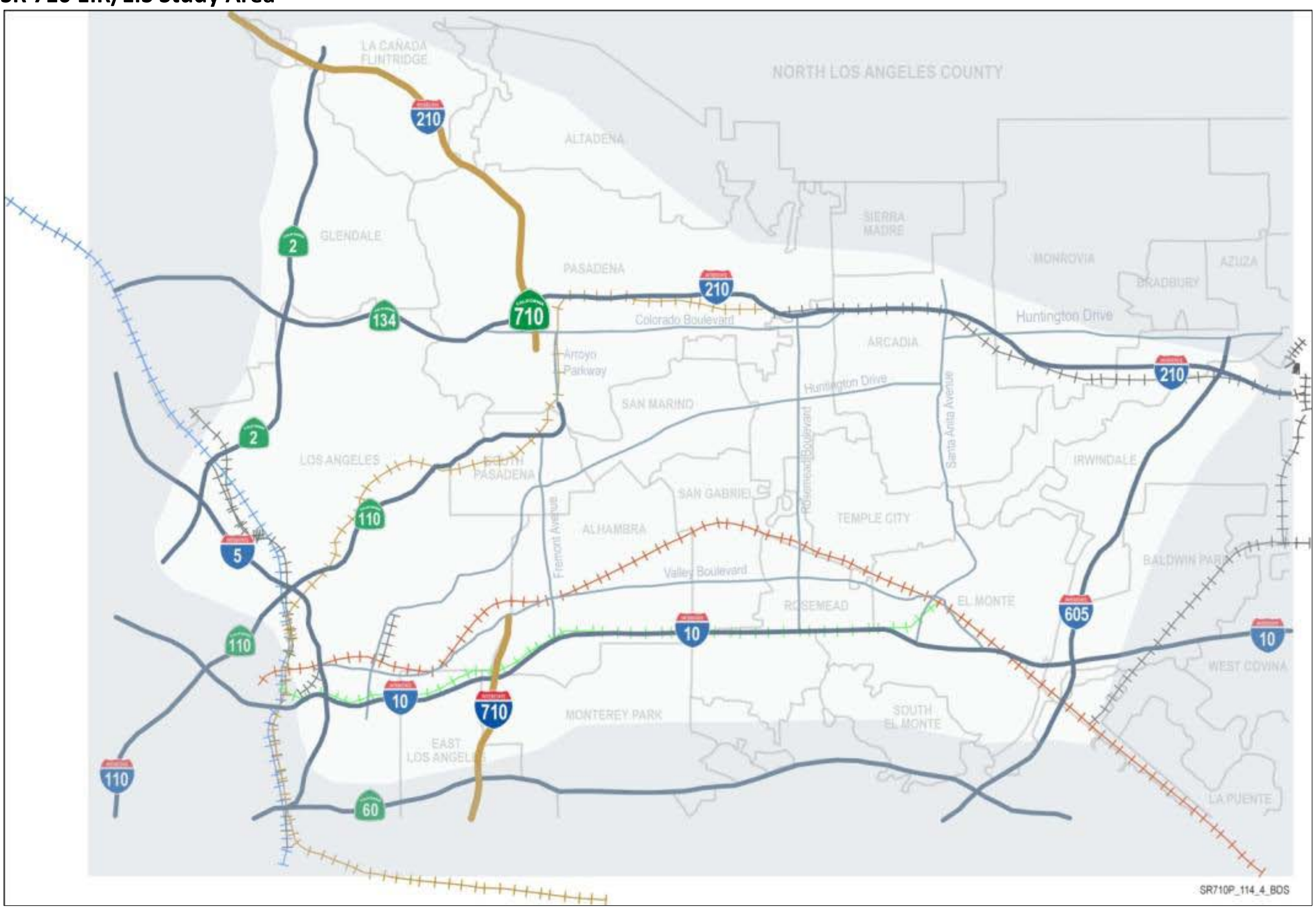
SECTION 1

Introduction

The State Route (SR) 710 corridor and study area are located in and near some of the most densely developed parts of southern California. The north-south demand for the transportation facilities causes congestion on the freeways and arterials, which in turn affects the mobility and safety of all modes. An important element of the SR 710 Environmental Impact Report/Environmental Impact Statement (EIR/EIS) is to analyze the benefits of transportation improvement projects in the area.

The study area is bordered by SR 2, Interstate (I)-5, I-10, I-210, and I-605. Figure 1 is an illustration of the general study area for this project. Because a multimodal transportation system is being evaluated, the project influence zone is expected to be much wider than the study area.

FIGURE 1
SR 710 EIR/EIS Study Area



The modeling efforts described in this report focus on Part 1 (Alternatives Analysis) of the study process. In Parts 2 and 3, the Project Report (PR) and EIR/EIS will be completed, and additional model development and forecasting will be conducted.

In Part 1, a range of transportation improvement projects are being identified, defined, and screened according to feasibility and effectiveness. An important element of the screening process involves understanding the likely impacts of each alternative on travel demand and congestion. Demand and congestion estimates are generated with a series of travel demand models that represent the interrelationships between existing and future population, employment, transportation supply, and travel demand. Together, these models are used to assess the frequency of trip making, origins and destinations of travel, choice of mode, and choice of route. This information will guide the evaluation of alternatives to understand how different projects affect mobility and contribute to or alleviate traffic congestion and transit operations.

This report describes the overall modeling methodology, the process for validating the travel models, and briefly documents the results of the validation of the modeling process developed to support the Part 1 Alternatives Analysis. Additional detail regarding the Part 1 model methodology and validation elements for highway, transit, and trucks can be found in the attachments to this document. After the completion of Part 1, a more detailed travel modeling approach will be developed to support the environmental analysis activities in Parts 2 and 3.

SECTION 2
Task 6 Documentation Approach

Task 6 (Travel Demand Forecasting) is focused on transportation system analysis, and it includes several deliverables. This memorandum is the deliverable for Task 6.5 ("Model Methodology Report"). Table 1 is a summary of the deliverables for Task 6, which shows how this report fits within the overall structure.

TABLE 1
Task 6 Deliverables

Report Title	Task	Original Scope of Work Deliverable(s)	Description	Appendices
Existing Conditions System Performance Report	6.2	Baseline Conditions Report	Field data and model results for existing conditions	Field traffic and transit data, plus model output
Forecast Results and Future System Performance Report	6.3	System Performance Report	Application of the model for 2035 conditions – No Build and alternatives	Detailed modeling results
Model Methodology Report	6.5	Model Methodology Report and Forecast Results Report	Approach for modeling, and setup/validation of the models	Forecasting methodology document (December) and detailed validation reports for each mode
Model Results Report	6.7	SR 710 Gap Model Results Report	Executive summary of the other reports	Other memos not included in other Task 6 reports

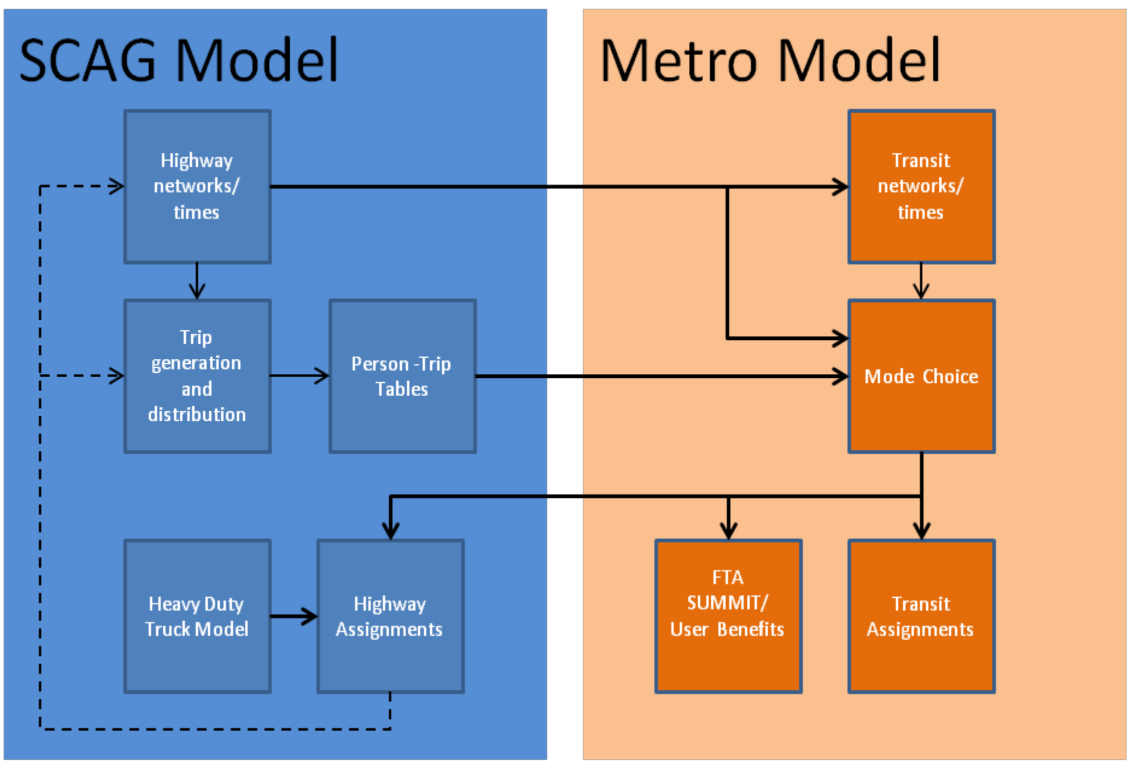
SECTION 3

Travel Demand Modeling Approach

Part 1 (Alternatives Analysis) of the SR 710 EIR/EIS will evaluate project impacts using a travel demand modeling (forecasting) process that combines the Southern California Association of Governments (SCAG) 2008 Regional Transportation Plan (RTP) travel forecasting model and the Metro Measure R transit forecasting model. This blended modeling approach is designed to take advantage of the strengths of each tool (highway and transit forecasts) and to maintain the schedule requirements determined by Metro and Caltrans. This solution was identified in December 2011 by a working group comprised of technical experts from Caltrans, Metro, SCAG, and the consulting team. After Part 1 is complete, a revised, more detailed modeling approach will be developed which will take advantage of potential model improvements associated with the 2012 SCAG RTP model which is scheduled for release in the near future.

The agreed-upon application approach consists of a blended process utilizing the SCAG 2008 RTP model for highway forecasting and the Measure R Metro model for transit forecasting. Figure 2 is an overview of the modeling approach applied for Part 1.

FIGURE 2
Overview of Part 1 Modeling Approach



The SCAG and Metro models are run using existing SCAG and Metro modeling procedures to generate estimates of highway and transit utilization. The SCAG model feedback process is represented by the dotted lines in Figure 2 and consists of a series of steps to update highway network times and trip generation and distribution based on assigned highway volumes.

Because of potentially long (up to five days) model runs due to distribution feedback in the SCAG model, the full SCAG model is run only for alternative "trunks" representing very different network assumptions, such as the No Build or similar highway alternatives that can be reasonably grouped together. Relatively minor differences in the alternative specifications will use the same trip distribution as the trunk levels. The details of the modeling approach are described in Attachment 1: *SR 710 EIR/EIS Travel Forecasting Alternatives Analysis Framework*.

As shown in Figure 2, the SCAG and Metro models have linkages at three places:

- SCAG highway networks and times provide the basis for transit network building and estimated highway travel time estimates are used by the mode choice model to estimate automobile mode shares.
- Two sets of SCAG model trip tables are used, representing No Build and a "Major Highway Improvements" alternative. The non-work SCAG trip tables for each alternative are used with the Metro model to account for the trip distribution effects of a "major highway improvement." Because work trips are census-based in the Metro model, distribution doesn't change for home-based work trips.
- For each model run or alternative, the post-mode choice incremental (defined as the difference between No Build and the given alternative) auto trip tables from the Metro model are applied to the SCAG post-mode choice auto trip tables prior to highway assignment. The purpose of this linkage is to remove new transit riders from the highway trip tables, which reduces total vehicles on the highway network to reflect auto travelers now using transit.

Before applying the blended modeling approach, each key model component was validated against observed transportation supply and travel demand characteristics to establish the degree to which existing conditions are accurately represented. This validation was conducted separately for general traffic flow (from the SCAG Model), transit ridership (from the Metro model), and truck traffic flow (from the SCAG model). The validation approach and results are presented in the sections that follow.

3.1 Highway Model Validation

The SCAG RTP 2008 model was calibrated and validated to regional measures consistent with accepted practices for metropolitan planning organizations (MPOs) and regional model application[1]. The metrics used to validate the regional model include total field count to model comparisons of average daily traffic (ADT) and peak hour traffic crossing corridor screenlines. Separate comparisons were made for each facility type. The highway validation measures focus on the peak periods and overall daily observed versus model volumes in the study area. New cutlines were developed to compare the model performance to recent count information. The location of the SCAG screenlines and the SR 710 EIR/EIS model cutlines are shown in Figure 3.

During the course of the validation process, several opportunities were identified to improve the explanatory power of the model. The resulting model remediation elements were implemented to address shortcomings in model results, while maintaining the overall integrity of the regional model. The model remediation elements included adjustments to the time-of-day factors and changes to specific highway network elements to more accurately reflect existing conditions in the corridor. These adjustments were made to reflect existing corridor-specific conditions in a manner appropriate for both existing and future year networks and are more than just changes in the base model to improve validation statistics.

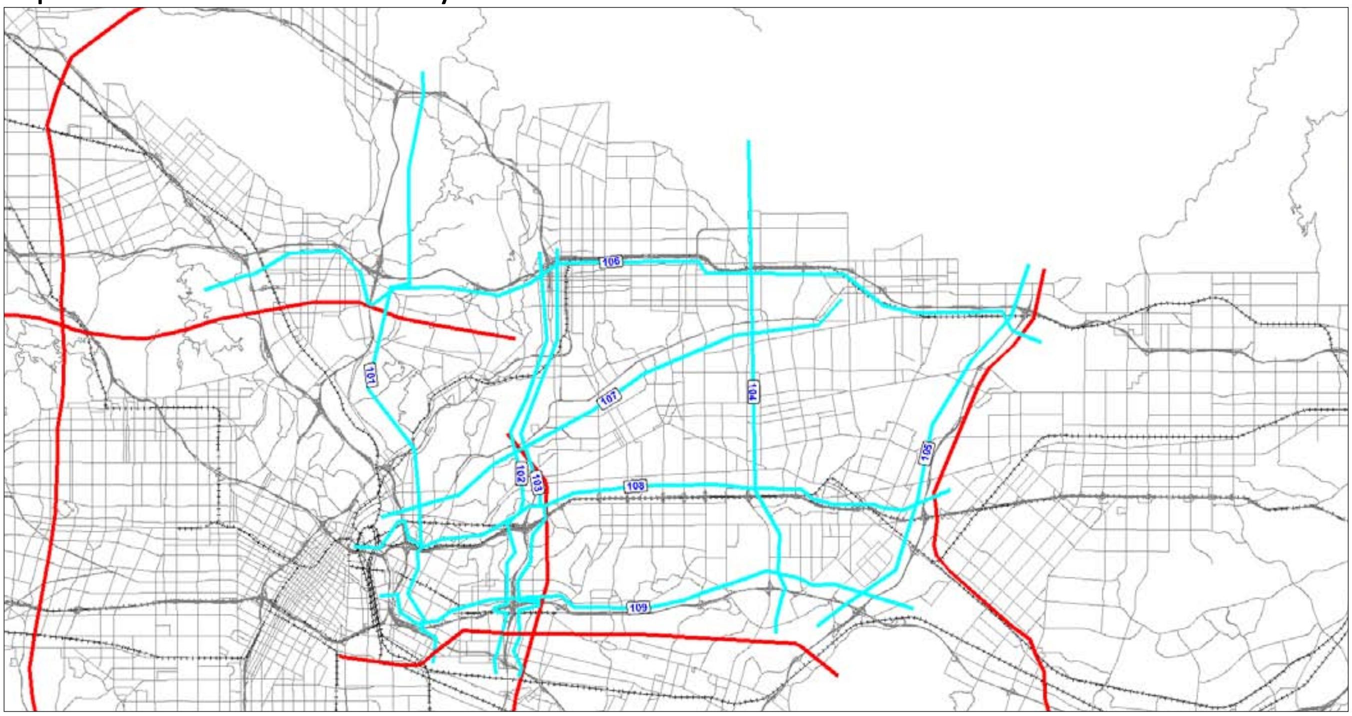
The first adjustment concerns the time-of-day distribution of corridor travel. The initial analysis of the SCAG regional model indicated that it performed well in matching daily traffic volumes on corridor facilities. However, the SCAG model significantly overestimated the amount of traffic occurring in the peak due to the use of regional time-of-day factors rather that distributions calibrated specifically for the corridor. The modeling process developed for the SR 710 EIR/EIS uses time of day factors developed specifically for this corridor to better align with traffic counts in the study area.

The other major remediation effort involved reviewing highway network components in the corridor to confirm that coded information (e.g., number of lanes and facility types) match observed characteristics. Some of these

[1] Detailed SCAG Regional Model Documentation can be found on the Southern California Association of Governments website at http://www.scag.ca.gov/modeling/

changes (e.g., number of lanes) are designed to reflect quantitative and objective highway characteristics. Other changes (e.g., operational and functional class) are designed to better represent the role of the link in the regional transportation system and improve modeled estimates of traffic volumes.

FIGURE 3
Map of Screenlines and Cutlines in Study Area



Model validation guidelines published by Caltrans and the Federal Highway Administration (FHWA) were used as guidance for the acceptance of the model to support alternative screening analysis. The model validation metrics exceed most of the Caltrans and FHWA validation guidelines. For other validation criteria, the model results are close to the guidelines.

Key validation statistics are shown in Tables 2 and 3.

TABLE 2
Count to Model Volume Comparison, and RMSE in Study Area

SR 710 EIR/EIS Count - Volume Comparison for Blended Model

	AM Period	PM Period	ADT
Caltrans and FHWA Criteria:			
Freeways (Target: +/- 7%)	4%	5%	6%
Major Arterials (Target: +/- 10%)	15%	-3%	-2%
Minor Arterials (Target: +/- 15%)	12%	-9%	-9%

*Note: Caltrans Criteria is from the Caltrans Travel Forecasting Guidelines, November 1992.

*Note: FHWA Criteria was obtained from the Model Validation and Reasonableness Checking Manual

SR 710 EIR/EIS Count - Volume Comparison for Blended Model

	AM Period	PM Period	ADT
Target RMSE (<40 for Periods, <30 Daily):			
%RMSE =	35	31	29

TABLE 3
Comparison of Counted and Modeled Daily Vehicle Trips Crossing SR 710 Corridor Cutlines

Cutline Name	Number	Cutline Direction	Number of Counts	Total Sum of Counts	Total Modeled Volumes at Locations with Counts	Model/ Count Ratio	Caltrans Pass/Fail Criteria	FHWA Pass/Fail Criteria
Daily								
East of SR 2 & I-5 : I-5 & US 101 to I-210 in La Canada Flintridge	101	EB/WB	28	1,137,264	1,219,214	1.07	PASS	PASS
West of SR 710 : US 101 to SR 134	102	EB/WB	25	728,286	773,562	1.06	PASS	PASS
East of SR 710 : US 101 to I-210	103	EB/WB	46	1,431,587	1,581,816	1.10	FAIL	PASS
East of Rosemead : SR 60 to I-210	104	EB/WB	20	456,543	442,443	0.97	PASS	PASS
West of I-605 : SR 60 to I-210	105	EB/WB	13	855,479	868,354	1.02	PASS	PASS
South of SR 134 and I-210 : I-5 to I-605	106	NB/SB	51	1,127,598	1,070,268	0.95	PASS	PASS
South of Huntington Drive : SR 2 to Santa Anita Avenue	107	NB/SB	24	404,883	475,080	1.17	FAIL	PASS
North of I-10 : Union Station to I-605	108	NB/SB	35	860,380	892,836	1.04	PASS	PASS
North of SR 60 : US 101 to I-605	109	NB/SB	32	962,912	1,074,488	1.12	FAIL	PASS
Combined Cutline Totals for Daily			**274**	**7,964,932**	**8,398,061**	**1.05**		

The FHWA *Travel Model Validation and Reasonableness Checking Manual* notes that resources and schedule are also critical elements in the validation process. Based on this guidance, the updated SR 710 EIR/EIS travel model is appropriately validated for screening in the Alternatives Analysis phase of the SR 710 EIR/EIS. The detail of the highway model validation results can be found in Attachment 2: *SR 710 EIR/EIS SCAG Highway Model Validation Technical Memorandum*.

3.2 Transit Model Validation

The Los Angeles County Metropolitan Transportation Authority Transportation Analysis Model (LACMTA or Metro model) has been reviewed by the Federal Transit Administration (FTA) for use in regional planning, and is consistent with the SCAG 2008 RTP socioeconomic and transportation network within Los Angeles County. The FTA review included a comprehensive validation of the model's ability to represent transit demand at the regional level.

As part of this project, the Metro model was further validated within the study area to ensure that the model matches corridor-specific transit travel patterns. This review included an assessment of linked trip origins and destinations, boardings by transit submode and route, and transit running times.

As shown in Table 4, the Metro model closely matches both the transit linked trip origins and destinations in the study area. The total modeled number of transit trips generated in the corridor and the distribution of trip ends closely match observed travel patterns. This suggests that the model has a robust understanding of the geographic areas where strong transit markets are present.

TABLE 4
Comparison of Year 2001 Survey and Modeled 2006 Average Weekday Transit Linked Trips by Production and Attraction District

Year 2001 Survey

Total								
		1	2	3	4	5	6	
	From\To	SR 710 Study Area	Other L.A. County	Orange County	Ventura County	San Bernardino County	Riverside County	Total
1	**SR 710 Study Area**	39,806	53,288	772	0	306	36	**94,207**
2	**Other L.A. County**	43,126	653,797	13,732	118	682	305	**711,760**
3	**Orange County**	752	13,612	144,345	11	68	209	**158,997**
4	**Ventura County**	138	1,214	24	39	2	0	**1,417**
5	**San Bernardino County**	1,431	7,261	622	4	168	5	**9,490**
6	**Riverside County**	162	2,660	2,758	0	12	30	**5,623**
	Total	**85,414**	**731,832**	**162,253**	**172**	**1,238**	**585**	**981,494**

Year 2006 Model

Total

		1	2	3	4	5	6	
	From\To	SR 710 Study Area	Other L.A. County	Orange County	Ventura County	San Bernardino County	Riverside County	Total
1	SR 710 Study Area	37,797	59,403	794	71	650	61	98,776
2	Other L.A. County	44,825	795,306	16,687	860	4,721	255	862,654
3	Orange County	1,065	22,762	125,776	31	110	282	150,026
4	Ventura County	158	2,327	48	6,878	12	0	9,423
5	San Bernardino County	1,875	10,910	701	8	29,193	696	43,383
6	Riverside County	156	1,309	2,320	0	774	10,582	15,141
	Total	85,876	892,017	146,326	7,849	35,459	11,876	1,179,402

Table 5 is a comparison of observed and modeled daily transit ridership by service type in the corridor. Overall modeled boardings match observed boardings to within 7 percent. The assignment of trips to individual service types generally follows actual ridership patterns. The model, however, overstates trips on Foothill Transit local routes by a large percentage but, to some extent, this is balanced by an under-assignment of trips to Foothill Transit services on the El Monte Busway.

TABLE 5

Comparison of Observed and Modeled 2006 Average Weekday Boardings

	Observed			2006 Model			Difference			% Difference		
Operator	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**
Metrolink	-	-	13,003	12,870	1,258	14,128	-	-	1,125	-	-	**9%**
Metro Rail	11,577	5,201	16,778	13,808	7,498	21,306	2,231	2,297	4,528	**19%**	**44%**	**27%**
Metro Bus	120,914	71,013	191,928	147,196	57,170	204,366	26,282	-13,843	12,438	**22%**	**-19%**	**6%**
Foothill (Local)	11,445	6,548	17,993	14,547	19,291	33,838	3,102	12,743	15,845	**27%**	**195%**	**88%**
El Monte Busway (Metro + Foothill)	66,016	8,845	74,861	58,493	11,404	69,897	-7,523	2,559	-4,964	**-11%**	**29%**	**-7%**
El Monte Trolleys	-	-	2,171	21	103	124	-	-	-2,047	-	-	**-94%**
Pasadena ARTS	-	-	5,298	656	846	1,502	-	-	-3,796	-	-	**-72%**
Total Selected Routes in Study Area			322,032			345,161			23,129			**7%**

Table 6 is a comparison of observed and modeled daily transit running times for selected routes by service type in the corridor. Modeled transit run times match scheduled run times (in most cases) to within 30 percent. This level of accuracy is typical for regional demand forecasting models.

TABLE 6

Comparison of Observed and Modeled Average Weekday Run Times (Minutes) for Selected Routes

		2012 Observed		2006 Model		Difference		% Difference	
Operator	Route	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Metrolink	703	90	90	79	79	-11	-11	-13%	-13%

		2012 Observed		2006 Model		Difference		% Difference	
Operator	Route	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Metro Rail - Gold Line	804	29	29	36	36	7	7	23%	23%

		2009 Observed		2006 Model		Difference		% Difference	
Operator	Route	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Metro Bus	38	41	41	37	42	-4	1	-10%	2%
Metro Bus	45	67	75	64	68	-3	-7	-5%	-9%
Metro Bus	70	77	81	69	79	-8	-1	-11%	-2%
Metro Bus	76	79	82	81	76	2	-6	3%	-7%
Metro Bus	78	73	80	70	83	-3	4	-4%	5%
Metro Bus	81	90	100	86	88	-4	-12	-4%	-12%
Metro Bus	90	90	95	112	113	21	18	23%	19%
Metro Bus	94	89	93	111	116	21	23	24%	24%
Metro Bus	176	37	55	55	60	18	5	49%	10%
Metro Bus	180	85	97	77	68	-8	-28	-10%	-29%
Metro Bus	251	64	75	57	55	-7	-20	-11%	-27%
Metro Bus	260	102	112	90	96	-12	-16	-12%	-15%
Metro Bus	264	50	58	45	55	-5	-3	-11%	-6%
Metro Bus	267	64	65	63	73	-2	8	-2%	12%
Metro Bus	268	57	79	61	72	4	-7	7%	-9%
Metro Rapid	751	44	45	51	52	8	7	17%	15%
Metro Rapid	780	92	104	74	78	-17	-26	-19%	-25%

		2012 Observed		2006 Model		Difference		% Difference	
Operator	Route	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Foothill (Local)	178	84	95	106	81	22	-14	26%	-15%
Foothill (Local)	187	135	141	163	111	28	-30	21%	-21%
Foothill (Local)	269	21	21	21	19	0	-2	0%	-10%
Foothill (Local)	272	43	41	54	41	11	0	26%	0%
Foothill (Local)	482	75	72	78	81	3	9	3%	13%
Foothill (Local)	486	64	62	45	55	-19	-7	-30%	-11%
Foothill (Local)	488	77	78	80	67	3	-11	4%	-14%
Foothill (Local)	492	88	80	115	83	27	3	31%	4%
Foothill (Local)	690	80	-	78	-	-2	-	-3%	-

Similar to highway validation, transit validation guidance does not specify rigid standards that a model must pass for it to be validated. Instead, the FTA seeks a modeling process that understands the market for transit and generates useful information about the likely magnitude of ridership on a new facility. The LACMTA model has an strong understanding of the geographic distribution of transit travel and a good understanding of transit supply and route-level ridership that is sufficient to support Alternatives Analysis Screening. More detail of the transit model validation results can be found in Attachment 3: *SR 710 EIR/EIS Metro Transit Model Validation Technical Memorandum*.

3.3 Truck Model Validation

As part of the SR 710 EIR/EIS model development, the Heavy Duty Truck (HDT) component of the model was reviewed and a model validation effort focusing in the study area was performed. The validation process is primarily a comparison between model-generated traffic volumes and observed traffic volumes. Since neither Caltrans nor FHWA have specific guidelines or thresholds of acceptability for the heavy duty truck models, the statistical methodologies identified by the Caltrans *Travel Forecasting Guidelines* (November 1992) and *Travel Model Improvement Program (TMIP) Model Validation and Reasonableness Checking Manual* (September 2010) for general traffic are used to compare the forecast/model truck volumes with the truck counts.

Validation of the HDT model validation reveals this element of the SCAG 2008 RTP model does not generally replicate existing conditions. Under these circumstances, it is necessary to develop additional methods to ensure that forecast traffic volumes more closely match base-year traffic counts and patterns. The common methodology is to post-process the model traffic volumes. This technique is regularly applied in various studies.

The post-processing method is integrated within the model so the entire system takes full advantage of what the HDT model does well, while recognizing the need to use base-year traffic count data that is directly comparable with base-year traffic forecasts. For the purpose of this study, the post-processing methodology will be based on accepted industry standards including but not limited to the National Cooperative Highway Research Program (NCHRP) Report 255, *Highway Traffic Data for Urbanized Area Project Planning and Design*. Additional field truck data will be collected to support that effort.

The detail of the truck model validation results can be found in Attachment 4: *SR 710 EIR/EIS SCAG Truck Model Validation Technical Memorandum.*

SECTION 4

Conclusions

The blended model approach for highway and transit has been validated in the SR 710 subarea to the level of detail and accuracy necessary to support analysis activities associated with Part 1 alternatives screening.

Attached to this report are four memoranda that provide supplementary information describing the decision to employ the blended model approach and additional detail on each element of the model validation effort. The following documents are provided:

Attachment 1

SR 710 EIR/EIS Travel Forecasting Alternatives Analysis Framework. A memorandum dated December 20, 2011 outlining the proposed blended approach including a discussion of available modeling resources, recommendations from the December 6, 2011 technical meeting on modeling, and an outline of the approach to develop the Part 1 model.

Attachment 2

SR 710 EIR/EIS SCAG Highway Model Validation Technical Memorandum. A memorandum dated May 3, 2012 providing an overview of the highway validation process and results.

Attachment 3

SR 710 EIR/EIS Metro Transit Model Validation Technical Memorandum. A memorandum dated May 3, 2012 providing an overview of the transit validation process and results.

Attachment 4

SR 710 EIR/EIS SCAG Truck Model Validation Technical Memorandum. A memorandum dated April 26, 2012 providing an overview of the truck model validation process and results.

Attachment 1
SR 710 EIR/EIS Travel Forecasting Alternatives Analysis Framework

SR 710 EIR/EIS Travel Forecasting Alternatives Analysis Framework

PREPARED FOR: Yoga Chandran, Loren Bloomberg

COPY TO: Mahmoud Ahmadi (AFSHA), Jennifer Emerson, Ed Granzow, Steve Greene (AECOM), John Lobb (RSG), William Woodford (RSG)

PREPARED BY: Pat Coleman (AECOM), Stephen Weller

DATE: December 20, 2011

PROJECT NUMBER: 428908

Summary

The State Route 710 (SR 710) Environmental Impact Report/Environmental Impact Statement (EIR/EIS) consultant team, in consultation with the agency partners (Metro, Southern California Association of Governments (SCAG), and Caltrans) has determined that the best approach for travel forecasting for the alternatives analysis (Part 1) step is to use the existing adopted modeling tools currently available for the Los Angeles region. The existing adopted modeling tools are the SCAG 2008 Regional Transportation Plan (RTP) model and the Metro model used for Measure R forecasting.

This recommendation is based on extensive discussions, research, and the experience of the consultant and agency team members. The study team acknowledges that there are limitations to the SCAG 2008 RTP model. The team discussed these model limitations with the agency partners and team member, Resource Systems Group, who are acting as "semi-independent" forecasting reviewers. The discussions focused on the advantages and disadvantages of using the adopted models as they are versus attempting to make significant modifications in the modeling process or using draft updated data sets from the draft SCAG 2012 RTP model. The conclusion was that the application of the SCAG 2008 RTP and Metro models was the only viable technical approach to meet the schedule requirements set out by Metro and Caltrans.

Project Overview

The study area is bordered by SR-2, I-5, I-10, I-210, and I-605. A multi-modal transportation system will be evaluated, so the project influence zone is expected to be much wider than the study area discussed above. The consultant team will conduct alternatives analyses, preliminary engineering and environmental studies. The basic structure includes an alternatives analysis in Part 1, and the Project Approval/Environmental Document (PA/ED) in Parts 2 and 3. Part 1 will be completed by mid-2012, with Parts 2 and 3 to follow. The efforts in Part 1 will be focused on travel forecasting to provide the technical basis for the purpose and need and alternatives evaluation.

Potential Modeling Resources

SCAG is responsible for maintaining the travel forecasting model for the Southern California region. The model, most recently developed using the TransCAD platform, is regularly updated. The most recent update was completed as part of the 2008 RTP. Other agencies and consultants use the SCAG model. For example, Metro has developed a transit-focused version of the 2008 RTP model that they use to evaluate transit projects and programs.

SCAG is in the process of updating their travel forecasting model to support the 2012 RTP. The draft SCAG 2012 RTP model will include more a detailed representation of the transportation network and will be validated using more recent data. That modeling effort is well along, but will not be completed until 2012, until the 2012 RTP is officially released. The model release is currently scheduled for April 2012.

For the SR 710 alternatives analysis, the first question was to determine which version of the SCAG model to use. The study team engaged a group of agency partners to help guide the strategy. A focused technical meeting was held on December 6, 2011, and included the following attendees:

Tony Van Haagen, Caltrans
Robert Farley, MTA
Bill Woodford, RSG
Pat Coleman, AECOM
Steve Weller, CH2M HILL
Chaushie Chu, MTA
Loren Bloomberg, CH2M HILL
John Lobb, RSG
Steve Greene, AECOM
Mike Ainsworth, SCAG (Phone)
Jennifer Emerson, CH2M HILL
Yoga Chandran, CH2M HILL
Mahmoud Ahmadi, AFSHA

The consensus of the group was that waiting for the adopted SCAG 2012 RTP model and data sets is not a viable option, given the aggressive alternatives screening schedule set forth by Metro.

The study team and agency partners also discussed the possibility of using the SCAG 2008 RTP model with draft 2012 RTP inputs (socioeconomic data and networks) as well as the Metro model with 2040 demographics. Draft socio-economic data for the years 2010, 2020, and 2035 for the SCAG 2012 RTP are provided via SCAG's website. Highway and transit network data for the SCAG 2012 RTP are also anticipated to be publicly available soon. Upon the official release of the RTP the draft data will be updated with the final version of the RTP datasets.

While this option was seriously considered, it was decided not to pursue this approach. Due to multiple changes in the SCAG 2012 RTP model process, utilization of the draft data from 2012 RTP in the SCAG 2008 RTP model process would be an invalidated approach. Using 2012 model inputs could lead to unforeseen issues that could cause inaccurate forecasting and contribute to schedule risks. The study team is also concerned that the delay in waiting for the finalization and release of the SCAG 2012 RTP model and datasets could extend beyond the projected April 2012 release date. Therefore, the study team has concluded that the best approach to developing the travel forecast for Part 1 is to use the currently-adopted modeling tools (the SCAG 2008 RTP and Metro models).

Application Approach

With the decision to use the SCAG 2008 RTP and Metro models, the next step was to develop the application approach. The currently-adopted SCAG and Metro models, while utilizing similar inputs and processes, have differences in the forecasting approach and some model inputs. The Metro model uses trip tables derived from the Census Transportation Planning Package (CTPP) to measure home-based work transit travel. For forecasting purposes, these trips are grown using a Fratar (growth factoring) method to develop future year transit trip tables. SCAG model trip tables are used as the base trip tables for the other trip purposes.

A blended approach utilizing the SCAG 2008 RTP model for highway forecasting and the Measure R Metro model for transit forecasting is proposed for the Part 1 Level 2 screening to support the alternatives analysis. Because of potentially long (up to 5 days) model runs due to distribution feedback in the SCAG model, the full SCAG model will be run completely for alternative "trunks" representing very different network assumptions, such as the No-Build or similar highway alternatives that can be reasonably grouped together. Relatively minor differences in the alternative specifications will use the same trip distribution as the trunk levels.

The SCAG and Metro models, while applied individually, will have trip table linkages proposed at two places:

- Two sets of SCAG model trip tables, representing the No-Build and "Major Highway Improvements," are anticipated. The non-work trip tables for each from the SCAG model will be utilized with the Metro model to account for the trip distribution effects of a "major highway improvement." Because work trips are CTPP based in the Metro model, distribution doesn't change for home-based work trips.
- For each model run or alternative, the post-mode choice incremental (defined as the difference between No-Build and the given alternative) auto trip tables from the Metro model will be applied to the SCAG post-mode choice auto trip tables prior to highway assignment. The purpose here is to remove new transit riders from the highway trip tables, which will reduce total vehicles on the highway network to reflect auto travelers now using transit. This step should be relatively straightforward as the auto classes

(drive alone, Shared Ride 2 persons (SR 2), SR 3+) and highway assignment time periods are the same between the two models. Also the traffic analysis zone (TAZ) equivalency between the two models is basically “one to one” in Los Angeles County, where the majority of the transit riders for the build alternatives are expected.

Validation

The model inputs will be checked to ensure compatibility with the adopted transportation plans and that the model networks include the Measure R planned projects. The base year models will also be validated to existing and available data sources. This validation has been done recently for the Metro model for Measure R forecasting, but refined validation in the study area will be conducted to ensure that the model behaves appropriately for forecasting the transit markets for all alternatives. The SCAG model has been validated for the purposes of regional modeling, which may not provide enough detail for the SR 710 alternatives analysis screening process. The SCAG model is currently validated to daily screenline crossings, which shows that the model reflects the regional travel patterns.

To validate the model for the SR 710 alternatives analysis screening, the SCAG model (in and around the project study area) will be examined in more detail. Utilizing cut lines defined for the corridor, the model results will be compared to AM, PM, mid-day and evening period counts by direction. These count locations will be summarized by screenline and cut lines but also displayed individually to show the model’s ability to differentiate between different classes of facilities at different times of day.

Additionally, the impact of reflecting the Metro model transit results in the SCAG model needs to be validated. Although there is a mid-day time period for analysis, it is a generic mid-day representation, which when combined with the evening period, generates estimates of off-peak travel. There is no detailed mid-day peak analysis, and the model does not support weekend, special event, or holiday travel estimates. Therefore, the focus will be on peak period validation and application.

Speed validation is also critical to understand the applicability of the model. Speed data are typically available through Caltrans’ Performance Measurement System (PeMS) online data, although the applicability of spot speed data to link speed data in travel models is often questioned. Travel time runs or data available through third party vendors may provide better speed comparison points. More resources will be focused on this validation exercise for Parts 2 and 3, but validation will be conducted as data are available in Part 1.

Summary and Conclusion

In summary, the study team will apply the best available models: the SCAG 2008 RTP model and the Metro model used for Measure R forecasting. These will be the basis for the Part 1 Alternative Analysis screening step. The two models will be blended to ensure that the highway and transit characteristics from each model are reflected. These models have been validated for regional forecasting applications. For the SR 710 alternative screening process, the models will be validated to available data in and around the study area.

Attachment 2
SR 710 EIR/EIS SCAG Highway Model Validation Technical Memorandum

Metro CH2MHILL. Caltrans

SR 710 EIR/EIS: SCAG Highway Model Validation Technical Memorandum

PREPARED FOR:	TAC Members
	Michelle Smith/Metro
COPY TO:	Caltrans
PREPARED BY:	CH2M HILL Team
DATE:	May 3, 2012
PROJECT NUMBER:	428908

Introduction

The model approach for the SR 710 EIR/EIS consists of a blended model comprised of the 2008 Regional Transportation Plan (RTP) travel forecasting model developed and maintained by the Southern California Association of Governments (SCAG) and the Metro transit model used for Measure R forecasting. Both models have similar inputs and processes but have different forecasting approaches and select model inputs. The biggest differences in the models are that the Metro model utilizes trip tables derived from the Census Transportation Planning Package (2000 CTPP) for Home-Based Work (HBW) transit travel and has a different mode choice model. The blended modeling approach will allow the Metro model to forecast transit trips in the SR 710 corridor while retaining the strength of the SCAG model for highway trips.

The blended model approach leads to a two step validation process. The first step validates the highway and transit models independently. The second step combines the models following the blended approach to ensure that steps used to improve validation of one model did not adversely affect the other.

In the first step, the highway model was adjusted through a series of remediation steps to improve its representation of travel by time-of-day and to improve the representation of transportation supply on specific corridor highway links. Because the impact of blending the models did not adversely affect the individual validations, additional Step 2 remediation efforts were not required.

This memorandum focuses on the highway validation portion of the blended model.

Model Validation Process

The SCAG RTP 2008 model was calibrated and validated using measures consistent with accepted practices for Metropolitan Transportation Organizations (MPOs) and regional model application. The metrics used to validate the model include total count to model comparisons of Average Daily Traffic (ADT) and peak period traffic crossing corridor screenlines, corresponding Root Mean Squared Error (RMSE) of the count to model differences, aggregate count to model volumes by facility type, and a scatter plot of observed volumes versus model volumes. For this process, the intent is to refine the validation within the study area to have more confidence in the model's ability to adequately screen potential scenarios.

The validation measures used for the SR 710 EIR/EIS focus on the peak periods and overall daily observed versus model volumes in the study area. A series of model adjustments was implemented to better represent the time-of-day distribution of travel in the corridor and the supply characteristics of corridor highway links. Each of these remediation elements is designed to maintain the overall integrity of the regional model. The most critical element of the validation remediation elements is that they are consistent with reality and are forecastable, not just changes in the base model to improve validation statistics.

This document focuses on the model parameter and network modifications made to improve the validation of the base SCAG model. The remainder of this section displays the model performance against observed data.

Model Remediation Elements

The model parameters and networks were adjusted to better align the study area traffic volumes with available peak and daily counts. Analysis of the SCAG model showed that the existing model performed well for daily validation, but it over-estimated the amount of traffic occurring in the peak. The regional model uses time-of-day factors by trip purpose to allocate daily trips to the four time periods in the SCAG model. The four time periods defined in the SCAG model are: AM peak (6:00-9:00 AM – 3 hours), Midday (9:00 AM-3:00 PM – 6 hours), PM Peak (3:00-7:00 PM – 4 hours), and Night (7:00 PM-6:00 AM – 11 hours).

The original regional model time of day factors are estimated based on travel survey information and, like most regional models, these factors are held constant once developed. The regional model time-of-day factors are generic, as one set of factors covers the entire modeling area. Because a specific study area (e.g., the SR 710 study area) will have trips that are distributed differently from the region as a whole, the time-of -day factors were adjusted to better align with traffic counts in the study area. The base and adjusted time-of-day factors for Part 1 of SR 710 EIR/EIS are displayed in Table 1.

The transportation network was inspected to ensure that the model was accurately reflecting the existing network. In many cases this can be deterministic, such as changing the number of lanes. It can also be qualitative in terms of describing the facility in terms of operational and functional classification. In select locations the speed of the facility was altered to help better match the overall flow on the links. It is critical that these changes not be severe or arbitrary, as that type of change may provide reasonable calibration to counts, but will be totally ineffective in forecasting future travel activity. The list of modifications to the transportation network can be found in Appendix A.

Validation Results

This section describes the comparison of the model performance to observed traffic data collected from various sources. Initially, the highway components of the standard SCAG model framework were validated. The validation approach was repeated a second time using the SCAG Model with inputs from the Metro model (i.e., the "blended" model). The following tables display the results from the blended model validation.

Table 2 shows the number of count locations in the study area and the overall difference between the count location observed data and model results by facility type, as well as the Percent Root Mean Squared Error (%RMSE) of the observed data to the model results. Caltrans and FHWA provide guidance on the levels of errors that should be accepted in these validation metrics. Current FHWA guidelines do not specify a particular percent error by functional class, but instead display example validation standards from multiple states. Under both current Caltrans[2] and older FHWA[3] guidelines, the guidance in overall deviation in traffic counts is:

- +/-7% for Freeways and HOV facilities
- +/-10% for Major Arterials
- +/-15% for Minor Arterials

Guidelines set for RMSE in the Caltrans and FHWA documents are rather general and varied based on the midpoint of the link volume group. As with all model validation metrics, these are guidelines or thresholds, not standards that must be met or once they are met indicates "an acceptable model." Based on this information, the study team set a %RMSE goal to be below 30% on a daily basis and 40% for the peak periods.

As shown in Table 2, both total counts and estimates of %RMSE generated by the blended version SR 710 Highway Model (i.e., the SCAG 2008 RTP model with time of day and link adjustments), fall within Caltrans and FHWA guidance for model validation.

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[2] Caltrans Travel Forecasting Guidelines, Prepared by JHK & Associates, November 1992. Page 65.

[3] TMIP (FHWA) Travel Model Validation and Reasonableness Checking Manual, Second Edition, Prepared by Cambridge Systematics, September 2010. Table 9.2, Page 9-19

TABLE 1
Base SCAG and SR 710 EIR/EIS Time-of-Day Factors

	Base Normalized TOD Factors					Adjusted Normalized TOF Factors			
	AM Peak	Midday	PM Peak	Evening		AM Peak	Midday	PM Peak	Evening
Trip Purpose	6:00 - 9:00 AM	9:00 AM - 3:00 PM	3:00 - 7:00 PM	7:00 PM- 6:00 AM		6:00 - 9:00 AM	9:00 AM - 3:00 PM	3:00 - 7:00 PM	7:00 PM- 6:00 AM
Home Based Work Direct (Departure)	44.37	27.17	3.33	25.14		37.59	31.01	2.69	28.71
Home Based Work Direct (Return)	1.42	18.47	50.95	29.16		1.20	22.33	41.21	35.26
Home Based College/ University (Departure)	46.74	33.43	17.82	2.02		39.60	43.37	14.41	2.62
Home Based College/University (Return)	1.25	32.58	32.58	33.60		1.06	35.74	26.35	36.86
Home Based School (Departure)	81.57	10.33	1.16	6.94		69.12	17.91	0.94	12.03
Home Based School (Return)	0.00	70.92	26.13	2.95		0.00	75.72	21.13	3.15
Home Based Shop (Departure)	15.47	44.18	29.44	10.90		13.11	50.60	23.81	12.48
Home Based Shop (Return)	2.32	29.44	51.14	17.10		1.96	35.85	41.36	20.83
Home Based Other (Departure)	24.14	35.13	30.07	10.66		20.45	42.37	24.32	12.86
Home Based Other (Return)	2.89	23.77	42.83	30.51		2.45	27.55	34.64	35.36
Work Based Other (Departure)	3.85	44.18	45.88	6.09		3.26	52.41	37.11	7.23
Work Based Other (Return)	42.49	41.93	8.11	7.47		36.00	48.76	6.56	8.69
Other Based Other (Departure)	11.52	40.36	38.48	9.64		9.76	47.72	31.12	11.40
Other Based Other (Return)	11.52	40.36	38.48	9.64		9.76	47.72	31.12	11.40
Home Based Serving Passengers (Departure)	35.44	37.33	16.36	10.87		30.03	43.94	13.23	12.80
Home Based Serving Passengers (Return)	14.60	30.85	33.46	21.10		12.37	35.97	27.06	24.61
Home Based Work Strategic HBI (Departure)	43.92	41.18	3.58	11.33		37.21	46.98	2.89	12.92
Home Based Work Strategic HBI (Return)	0.19	10.96	51.09	37.76		0.16	13.17	41.32	45.35
Home Based Work Strategic IBW (Departure)	42.31	43.02	4.33	10.33		35.85	48.90	3.50	11.74
Home Based Work Strategic IBW (Return)	1.13	37.73	51.06	10.08		0.96	45.57	41.30	12.18
Light Heavy Truck (Departure)	8.60	23.10	10.75	7.55		9.11	23.82	10.87	6.21
Light Heavy Truck (Return)	8.60	23.10	10.75	7.55		9.11	23.82	10.87	6.21
Medium Heavy Truck (Departure)	7.15	19.55	13.15	10.15		6.06	21.92	10.64	11.38
Medium Heavy Truck (Return)	7.15	19.55	13.15	10.15		6.06	21.92	10.64	11.38
Heavy Heavy Truck (Departure)	5.80	14.55	9.70	19.95		2.95	17.67	4.71	24.67
Heavy Heavy Truck (Return)	5.80	14.55	9.70	19.95		2.95	17.67	4.71	24.67

TABLE 2
Number of Counts, Count to Blended SR 710 Model Volume Comparison, and RMSE in Study Area

SR 710 EIR/EIS Count - Volume Comparison for Blended Model

Number of Counts	AM Period	PM Period	ADT
Freeways & HOV	95	95	64
Major Arterials	315	315	319
Minor Arterials	268	268	272
Total Number of Counts	678	678	655

SR 710 EIR/EIS Count - Volume Comparison for Blended SR 710 Model

	AM Period	PM Period	ADT
Caltrans and FHWA Criteria:			
Freeways (Target: +/- 7%)	4%	5%	6%
Major Arterials (Target: +/- 10%)	15%	-3%	-2%
Minor Arterials (Target: +/- 15%)	12%	-9%	-9%

*Note: Caltrans Criteria is from the Caltrans Travel Forecasting Guidelines, November 1992.

*Note: FHWA Criteria was obtained from the Model Validation and Reasonableness Checking Manual

SR 710 EIR/EIS Count - Volume Comparison for Blended SR 710 Model

	AM Period	PM Period	ADT
Target RMSE (<40 for Periods, <30 Daily):			
%RMSE =	35	31	29

The next test compared counted and modeled link traffic volumes for all locations where a count is present. Figure 1 is a scatter plot of the observed count data to the model volumes for the AM period. This chart shows that the model generally over-predicts counted volumes by about three percent. The AM period scatter plot shows a reasonable relationship between counts and modeled volumes. Figure 2 shows a similar plot for the PM peak period and Figure 3 shows the same plot for the daily loadings.

The Caltrans California Travel Forecasting Guidelines recommend setting the criterion that over 75% of the links that have counts are within the Caltrans standard deviation of modeled volumes (ibid. page 65). Both Caltrans (ibid. page 65) and FHWA (ibid. page 9-10) recommend a correlation coefficient of 0.88 between the observed data and the model results, although the FHWA Model Validation and Reasonableness Checking Manual suggests that this standard has little meaning for the validity of the model. Table 3 displays the correlation coefficient (R) for the AM peak, PM Peak, and daily results, and the percent of links within the Caltrans recommended deviation. By each of these measures, the Blended model meets or exceeds Caltrans and FHWA guidance for model validation.

TABLE 3
Correlation Coefficient and percent of links within Caltrans recommended Standard Deviation for AM Peak, PM Peak, and Daily

SR 710 EIR/EIS Count - Volume Comparison for Blended Model

Criteria:	AM Period	PM Period	ADT
Correlation Coefficient (Target >=0.88)	0.98	0.97	0.98

SR 710 EIR/EIS Count - Volume Comparison for Blended Model

Criteria:	AM Period	PM Period	ADT
% of Links within Caltrans Standard Deviations (Target >=0.75)	80%	90%	75%

FIGURE 1
AM Peak Period Scatter Plot

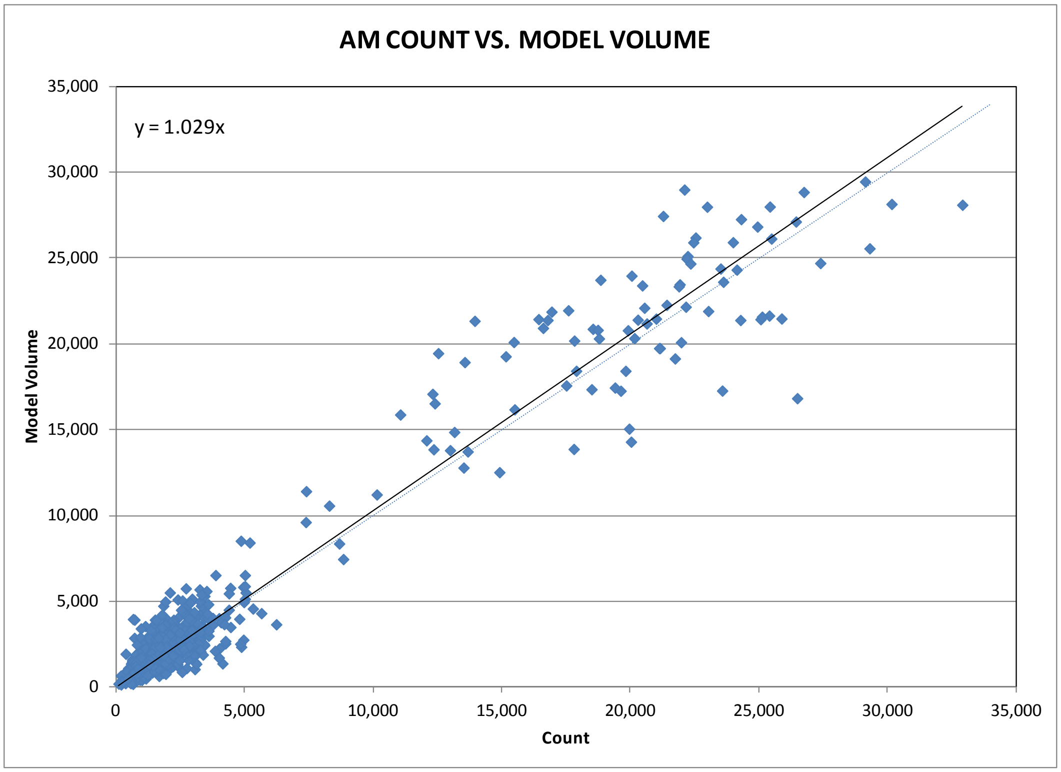


FIGURE 2
PM Peak Period Scatter Plot

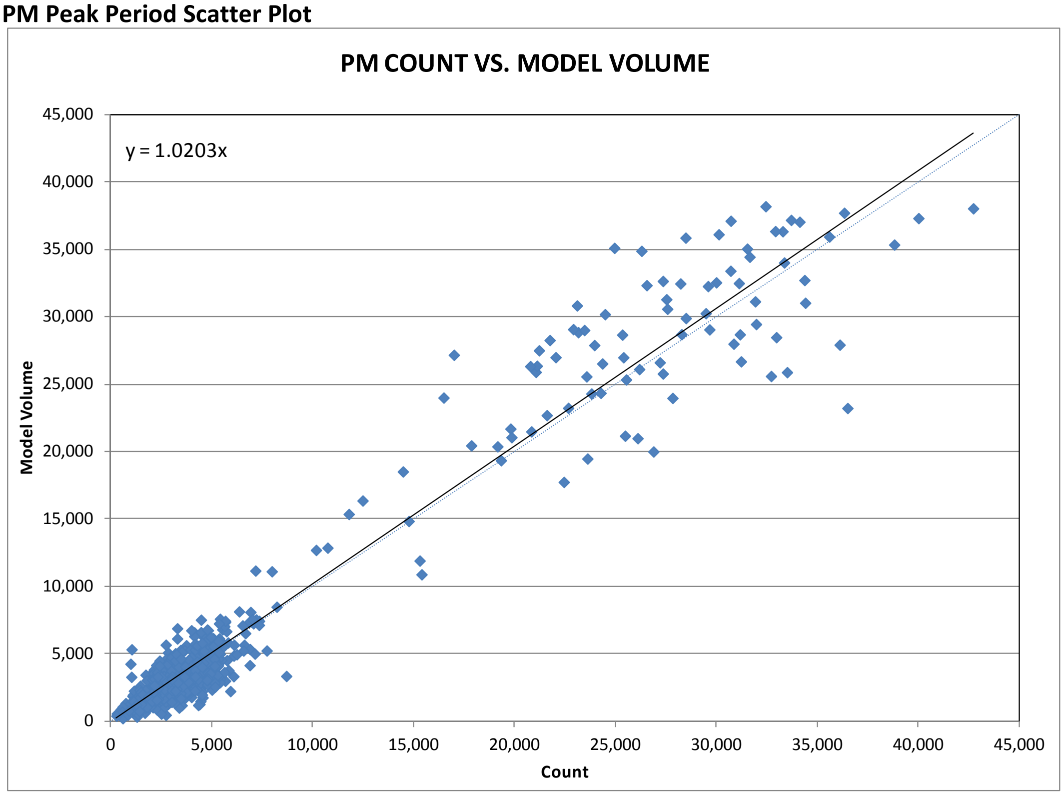
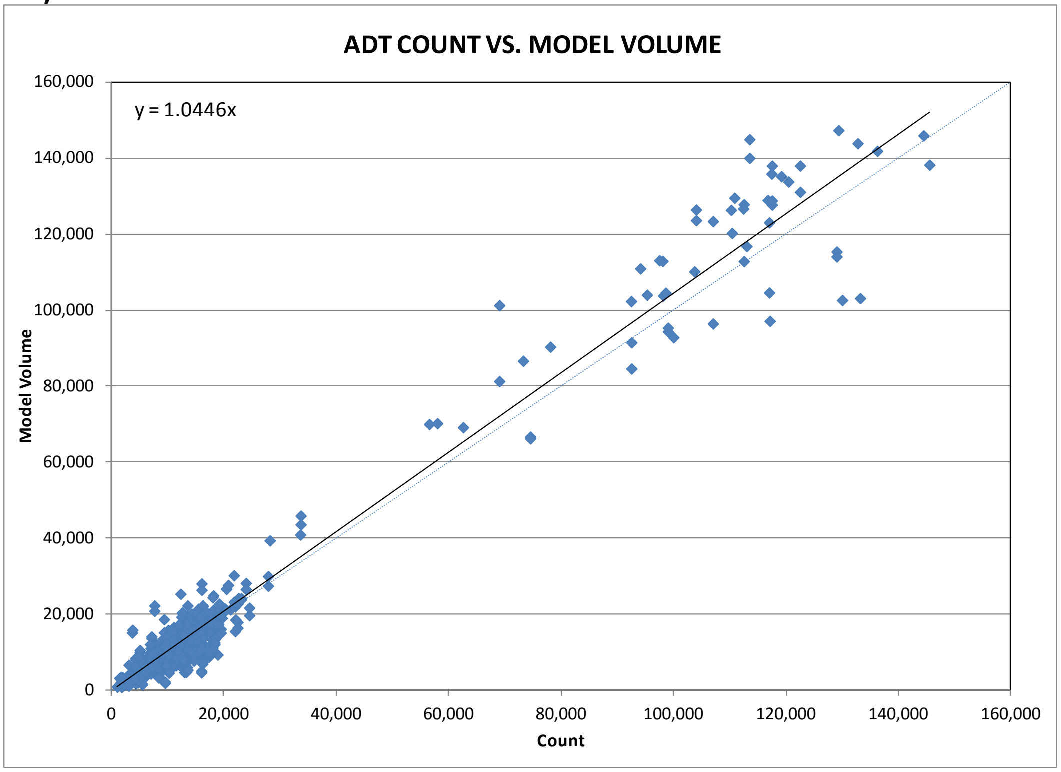


FIGURE 3
Daily Scatter Plot



While the aggregate statistics are well-validated, additional analysis is needed to assess the model performance at specific geographic locations. The SCAG model has 23 existing screenlines, but only three are in the SR 710 EIR/EIS study area. Cutlines were developed based on existing count locations to allow for more detailed comparisons within and around the study area. Figure 4 displays the cutlines developed for the study area.

Both FHWA (ibid., Figure 9.9, page 9-21) and Caltrans (ibid. Figure 3-9, Page 67) have developed criteria for acceptance of screenline volumes in terms of maximum desirable percent deviation in total screenline volumes. The curves used to determine the maximum desirable deviation are shown in Figure 5 and Figure 6.

FIGURE 4
Study Area Cutline Map

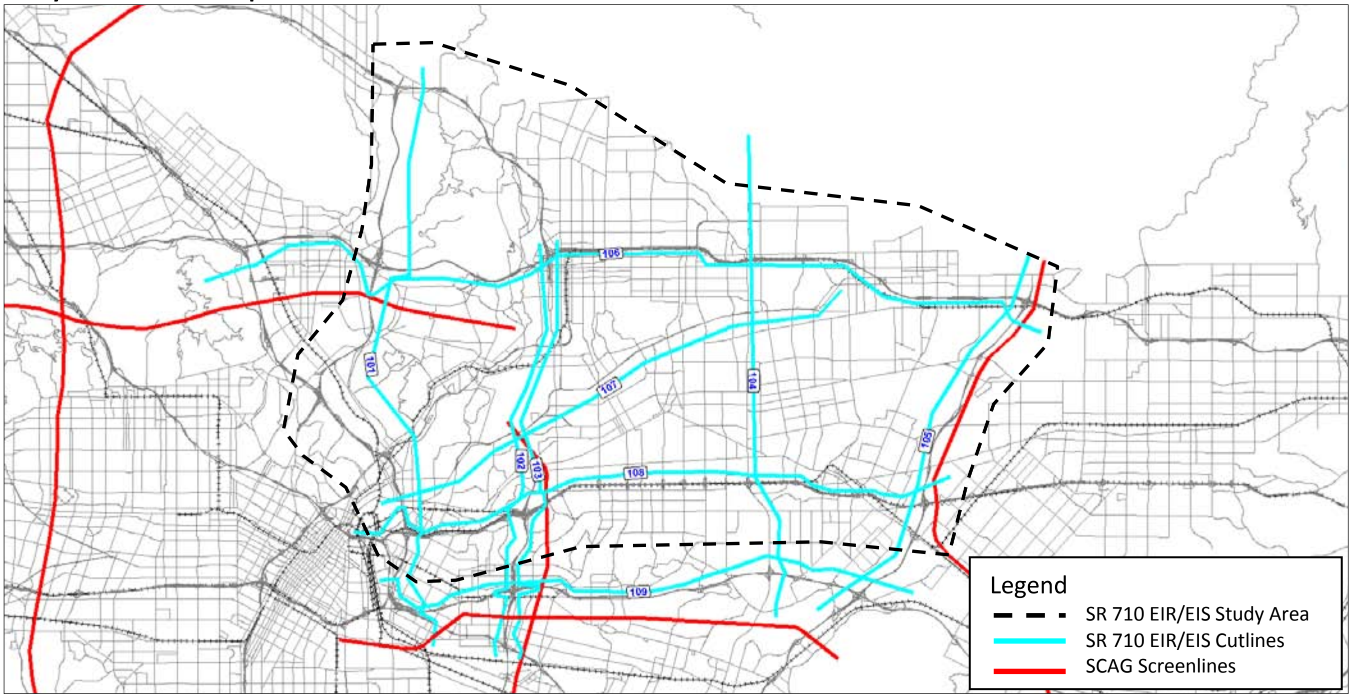


FIGURE 5
Maximum Desired Deviation for Screenlines (from FHWA)

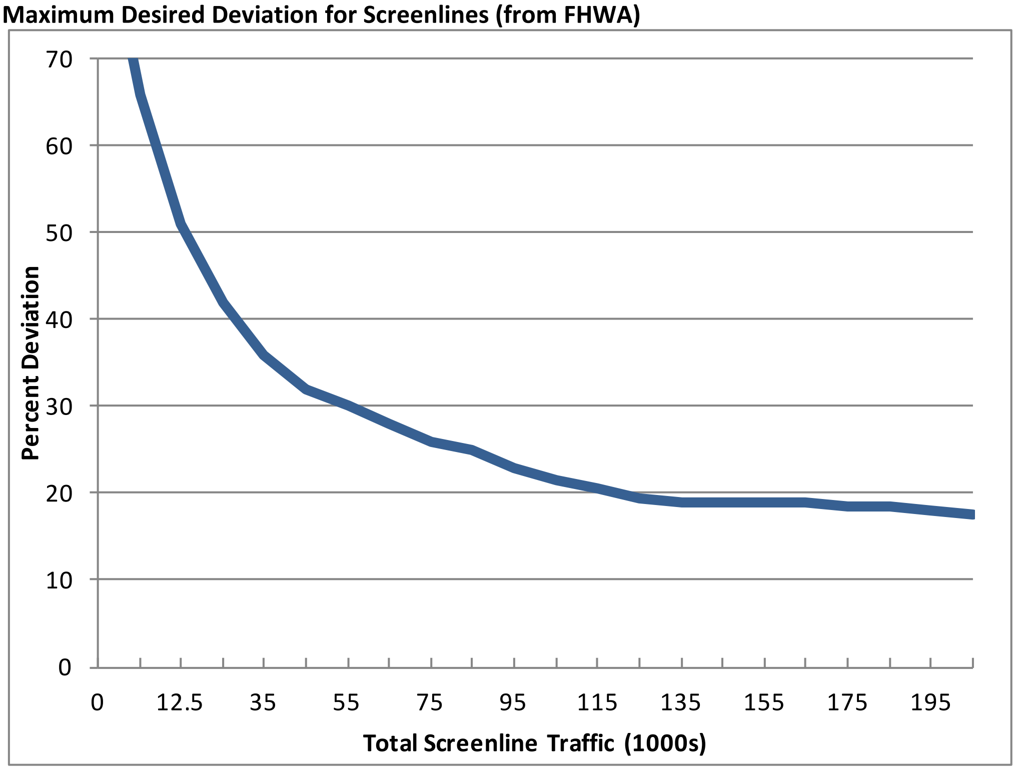
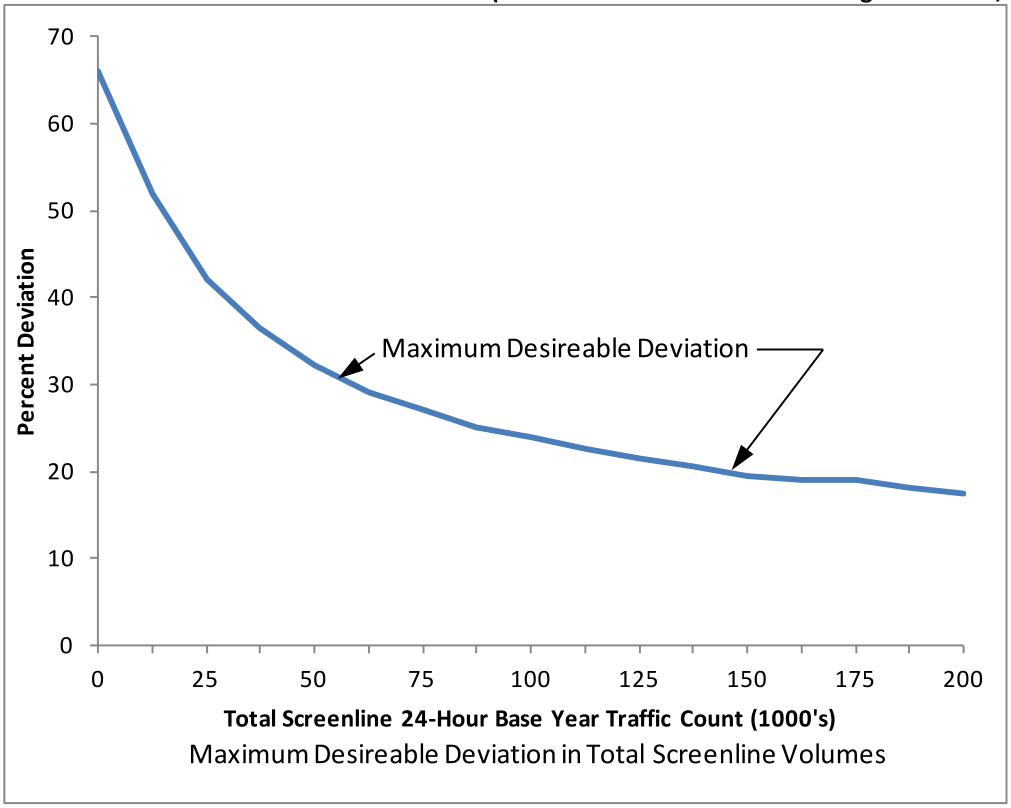


FIGURE 6
Maximum Desired Deviation for Screenlines (from California Travel Forecasting Guidelines, 1992)



Not every link on every cutline has observed volumes, so only links with both observed and modeled volumes are summed. Table 4 shows total observed and modeled volumes for each cutline and whether it passes the Caltrans and FHWA criteria for screenlines for the AM peak, PM peak, and daily periods. Tables 5 through 7 further disaggregate the cutline totals to facility type totals for the AM peak period, PM peak period, and daily totals respectively. Appendix B provides more detailed information for each cutline including link level volumes and counts and charts showing the link by link volume to count information.

Conclusions

The TMIP Model Validation and Reasonableness Checking Manual provides guidance and checks for each step of the modeling process but generally stop short of specifying pass fail criteria for model performance. The document states that:

> *The definition of an acceptable threshold should be a local decision and needs to balance the resources and time available for model development with the decisions that will be supported by the travel forecast obtained using the model.*
>
> *The term "threshold" rather than "standard" will generally be used throughout this manual. The term standard connotes a formal definition of acceptance: "The standard has been met, therefore the model is valid." While it is important to match base year observations for validation, simple matching of traffic counts, for instance, is not sufficient to establish the validity of a travel model. Quality model validation must test all steps of the travel model and also should test model sensitivity. If standards are set for models by agencies or model reviewers, it is beneficial that they not convey a formal definition of acceptance but, rather to help set boundaries or levels of confidence regarding the use of travel forecasts for studies.*[4]

[4] Cambridge Systematics, Inc., *Travel Model Validation and Reasonableness Checking Manual- Second Edition*, 2010

The blended SCAG and Metro model has been validated against available data sources and is acceptable to be applied for screening in the Alternatives Analysis phase of the SR 710 EIR/EIS.

TABLE 4
Cutline Summary

Cutline Name	Number	Cutline Direction	Number of Counts	Total Sum of Counts	Total Modeled Volumes at Locations with Counts	Model/ Count Ratio	Caltrans Pass/Fail Criteria	FHWA Pass/Fail Criteria
AM Peak Period								
East of SR 2 & I-5 : I-5 & US 101 to I-210 in La Canada Flintridge	101	EB/WB	35	169,187	195,503	1.16	PASS	PASS
West of SR 710 : US 101 to SR 134	102	EB/WB	34	129,474	153,781	1.19	PASS	PASS
East of SR 710 : US 101 to I-210	103	EB/WB	50	220,673	249,455	1.13	PASS	PASS
East of Rosemead : SR 60 to I-210	104	EB/WB	24	74,969	87,294	1.16	PASS	PASS
West of I-605 : SR 60 to I-210	105	EB/WB	12	34,001	38,292	1.13	PASS	PASS
South of SR 134 and I-210 : I-5 to I-605	106	NB/SB	65	162,481	177,515	1.09	PASS	PASS
South of Huntington Drive : SR 2 to Santa Anita Avenue	107	NB/SB	29	67,143	85,737	1.28	PASS	PASS
North of I-10 : Union Station to I-605	108	NB/SB	41	135,003	166,888	1.24	FAIL	FAIL
North of SR 60 : US 101 to I-605	109	NB/SB	38	135,710	154,074	1.14	PASS	PASS
Combined Cutline Totals for AM Peak Period			**328**	**1,128,641**	**1,308,539**	**1.16**		
PM Peak Period								
East of SR 2 & I-5 : I-5 & US 101 to I-210 in La Canada Flintridge	101	EB/WB	35	231,436	260,937	1.13	PASS	PASS
West of SR 710 : US 101 to SR 134	102	EB/WB	34	201,436	211,961	1.05	PASS	PASS
East of SR 710 : US 101 to I-210	103	EB/WB	50	317,090	348,778	1.10	PASS	PASS
East of Rosemead : SR 60 to I-210	104	EB/WB	24	127,547	122,902	0.96	PASS	PASS
West of I-605 : SR 60 to I-210	105	EB/WB	12	47,417	53,127	1.12	PASS	PASS
South of SR 134 and I-210 : I-5 to I-605	106	NB/SB	65	290,671	260,742	0.90	PASS	PASS
South of Huntington Drive : SR 2 to Santa Anita Avenue	107	NB/SB	29	103,817	116,252	1.12	PASS	PASS
North of I-10 : Union Station to I-605	108	NB/SB	41	209,871	228,317	1.09	PASS	PASS
North of SR 60 : US 101 to I-605	109	NB/SB	38	198,116	212,274	1.07	PASS	PASS
Combined Cutline Totals for PM Peak Period			**328**	**1,727,401**	**1,815,290**	**1.05**		

TABLE 4
Cutline Summary (Continued)

Cutline Name	Number	Cutline Direction	Number of Counts	Total Sum of Counts	Total Modeled Volumes at Locations with Counts	Model/ Count Ratio	Caltrans Pass/Fail Criteria	FHWA Pass/Fail Criteria
Daily								
East of SR 2 & I-5 : I-5 & US 101 to I-210 in La Canada Flintridge	101	EB/WB	28	1,137,264	1,219,214	1.07	PASS	PASS
West of SR 710 : US 101 to SR 134	102	EB/WB	25	728,286	773,562	1.06	PASS	PASS
East of SR 710 : US 101 to I-210	103	EB/WB	46	1,431,587	1,581,816	1.10	FAIL	PASS
East of Rosemead : SR 60 to I-210	104	EB/WB	20	456,543	442,443	0.97	PASS	PASS
West of I-605 : SR 60 to I-210	105	EB/WB	13	855,479	868,354	1.02	PASS	PASS
South of SR 134 and I-210 : I-5 to I-605	106	NB/SB	51	1,127,598	1,070,268	0.95	PASS	PASS
South of Huntington Drive : SR 2 to Santa Anita Avenue	107	NB/SB	24	404,883	475,080	1.17	FAIL	PASS
North of I-10 : Union Station to I-605	108	NB/SB	35	860,380	892,836	1.04	PASS	PASS
North of SR 60 : US 101 to I-605	109	NB/SB	32	962,912	1,074,488	1.12	FAIL	PASS
Combined Cutline Totals for Daily			**274**	**7,964,932**	**8,398,061**	**1.05**		

TABLE 5
AM Peak Period Cutline Detail by Facility Type

Cutline Name	Number	Cutline Direction	Number of Counts	Total Sum of Counts	Total Modeled Volumes at Locations with Counts	Model/ Volume Ratio	Caltrans Pass/Fail Criteria	FHWA Pass/Fail Criteria
East of SR 2 & I-5 : I-5 & US 101 to I-210 in La Canada Flintridge	101	EB/WB	35	169,187	195,503	1.16	PASS	PASS
Freeways and HOV Facilities			7	123,989	141,296	1.14		
Principal Arterials			14	25,574	28,552	1.12		
Minor Arterials			14	19,624	25,655	1.31		
West of SR 710 : US 101 to SR 134	102	EB/WB	34	129,474	153,781	1.19	PASS	PASS
Freeways and HOV Facilities			6	82,330	105,247	1.28		
Principal Arterials			14	30,954	32,138	1.04		
Minor Arterials			14	16,190	16,396	1.01		
East of SR 710 : US 101 to I-210	103	EB/WB	50	220,673	249,455	1.13	PASS	PASS
Freeways and HOV Facilities			10	154,535	173,335	1.12		
Principal Arterials			18	38,884	46,379	1.19		
Minor Arterials			20	26,791	28,408	1.06		
East of Rosemead : SR 60 to I-210	104	EB/WB	24	74,969	87,294	1.16	PASS	PASS
Freeways and HOV Facilities			2	38,883	50,381	1.30		
Principal Arterials			10	18,545	18,850	1.02		
Minor Arterials			12	17,541	18,063	1.03		
West of I-605 : SR 60 to I-210	105	EB/WB	12	34,001	38,292	1.13	PASS	PASS
Freeways and HOV Facilities			0	-	-	N/A		
Principal Arterials			10	27,932	31,198	1.12		
Minor Arterials			2	6,069	7,094	1.17		

TABLE 5
AM Peak Period Cutline Detail by Facility Type (Continued)

Cutline Name	Number	Cutline Direction	Number of Counts	Total Sum of Counts	Total Modeled Volumes at Locations with Counts	Model/ Volume Ratio	Caltrans Pass/Fail Criteria	FHWA Pass/Fail Criteria
South of SR 134 and I-210 : I-5 to I-605	106	NB/SB	65	162,481	177,515	1.09	PASS	PASS
Freeways and HOV Facilities			3	55,889	61,935	1.11		
Principal Arterials			30	53,518	58,622	1.10		
Minor Arterials			32	53,074	56,958	1.07		
South of Huntington Drive : SR 2 to Santa Anita Avenue	107	NB/SB	29	67,143	85,737	1.28	PASS	PASS
Freeways and HOV Facilities			1	20,048	23,973	1.20		
Principal Arterials			14	29,918	40,229	1.34		
Minor Arterials			14	17,177	21,535	1.25		
North of I-10 : Union Station to I-605	108	NB/SB	41	135,003	166,888	1.24	FAIL	FAIL
Freeways and HOV Facilities			5	61,783	65,598	1.06		
Principal Arterials			22	53,769	76,995	1.43		
Minor Arterials			12	18,635	23,393	1.26		
North of SR 60 : US 101 to I-605	109	NB/SB	38	135,710	154,074	1.14	PASS	PASS
Freeways and HOV Facilities			6	80,837	82,691	1.02		
Principal Arterials			14	32,725	45,214	1.38		
Minor Arterials			16	21,642	25,810	1.19		
Combined Cutline Totals			**328**	**1,128,641**	**1,308,539**	**1.16**		
Freeways and HOV Facilities			40	618,294	704,456	1.14		
Principal Arterials			146	311,819	378,177	1.21		
Minor Arterials			136	196,743	223,312	1.14		

** All Counts are for 2008
Totals may not sum due to other facility types not listed

TABLE 6
PM Peak Period Cutline Detail by Facility Type

Cutline Name	Number	Cutline Direction	Number of Counts	Total Sum of Counts	Total Modeled Volumes at Locations with Counts	Model/ Volume Ratio	Caltrans Pass/Fail Criteria	FHWA Pass/Fail Criteria
East of SR 2 & I-5 : I-5 & US 101 to I-210 in La Canada Flintridge	101	EB/WB	35	231,436	260,937	1.13	PASS	PASS
Freeways and HOV Facilities			7	163,572	183,421	1.12		
Principal Arterials			14	36,882	39,495	1.07		
Minor Arterials			14	30,982	38,021	1.23		
West of SR 710 : US 101 to SR 134	102	EB/WB	34	201,436	211,961	1.05	PASS	PASS
Freeways and HOV Facilities			6	119,349	142,626	1.20		
Principal Arterials			14	52,248	43,344	0.83		
Minor Arterials			14	29,839	25,991	0.87		
East of SR 710 : US 101 to I-210	103	EB/WB	50	317,090	348,778	1.10	PASS	PASS
Freeways and HOV Facilities			10	205,649	239,351	1.16		
Principal Arterials			18	62,659	64,928	1.04		
Minor Arterials			20	47,742	42,778	0.90		
East of Rosemead : SR 60 to I-210	104	EB/WB	24	127,547	122,902	0.96	PASS	PASS
Freeways and HOV Facilities			2	57,245	69,453	1.21		
Principal Arterials			10	37,324	27,655	0.74		
Minor Arterials			12	32,978	25,794	0.78		
West of I-605 : SR 60 to I-210	105	EB/WB	12	47,417	53,127	1.12	PASS	PASS
Freeways and HOV Facilities			0	-	-	N/A		
Principal Arterials			10	39,307	43,806	1.11		
Minor Arterials			2	8,110	9,321	1.15		

TABLE 6
PM Peak Period Cutline Detail by Facility Type (continued)

Cutline Name	Number	Cutline Direction	Number of Counts	Total Sum of Counts	Total Modeled Volumes at Locations with Counts	Model/ Volume Ratio	Caltrans Pass/Fail Criteria	FHWA Pass/Fail Criteria
South of SR 134 and I-210 : I-5 to I-605	106	NB/SB	65	290,671	260,742	0.90	PASS	PASS
Freeways and HOV Facilities			3	85,187	89,587	1.05		
Principal Arterials			30	98,628	85,224	0.86		
Minor Arterials			32	106,856	85,931	0.80		
South of Huntington Drive : SR 2 to Santa Anita Avenue	107	NB/SB	29	103,817	116,252	1.12	PASS	PASS
Freeways and HOV Facilities			1	24,476	30,187	1.23		
Principal Arterials			14	48,215	54,829	1.14		
Minor Arterials			14	31,126	31,236	1.00		
North of I-10 : Union Station to I-605	108	NB/SB	41	209,871	228,317	1.09	PASS	PASS
Freeways and HOV Facilities			5	79,872	85,506	1.07		
Principal Arterials			22	94,747	108,526	1.15		
Minor Arterials			12	34,077	33,066	0.97		
North of SR 60 : US 101 to I-605	109	NB/SB	38	198,116	212,274	1.07	PASS	PASS
Freeways and HOV Facilities			6	105,315	109,394	1.04		
Principal Arterials			14	54,694	65,629	1.20		
Minor Arterials			16	37,110	36,360	0.98		
Combined Cutline Totals			**328**	**1,727,401**	**1,815,290**	**1.05**		
Freeways and HOV Facilities			40	840,665	949,525	1.13		
Principal Arterials			146	524,704	533,436	1.02		
Minor Arterials			136	358,820	328,498	0.92		
Major Collector			6	3,212	3,831	1.19		

** All Counts are for 2008
Totals may not sum due to other facility types not listed

TABLE 7
Daily Cutline Detail by Facility Type

Cutline Name	Number	Cutline Direction	Number of Counts	Total Sum of Counts	Total Modeled Volumes at Locations with Counts	Model/ Volume Ratio	Caltrans Pass/Fail Criteria	FHWA Pass/Fail Criteria
East of SR 2 & I-5 : I-5 & US 101 to I-210 in La Canada Flintridge	101	EB/WB	28	1,137,264	1,219,214	1.07	PASS	PASS
Freeways and HOV Facilities			9	901,574	962,577	1.07		
Principal Arterials			9	130,448	141,348	1.08		
Minor Arterials			10	105,242	115,289	1.10		
West of SR 710 : US 101 to SR 134	102	EB/WB	25	728,286	773,562	1.06	PASS	PASS
Freeways and HOV Facilities			6	471,603	544,624	1.15		
Principal Arterials			8	162,646	148,172	0.91		
Minor Arterials			11	94,037	80,766	0.86		
East of SR 710 : US 101 to I-210	103	EB/WB	46	1,431,587	1,581,816	1.10	FAIL	PASS
Freeways and HOV Facilities			12	1,066,326	1,200,811	1.13		
Principal Arterials			16	206,923	230,117	1.11		
Minor Arterials			17	155,584	145,327	0.93		
East of Rosemead : SR 60 to I-210	104	EB/WB	20	456,543	442,443	0.97	PASS	PASS
Freeways and HOV Facilities			2	234,158	264,846	1.13		
Principal Arterials			8	115,943	91,805	0.79		
Minor Arterials			10	106,442	85,792	0.81		
West of I-605 : SR 60 to I-210	105	EB/WB	13	855,479	868,354	1.02	PASS	PASS
Freeways and HOV Facilities			6	691,000	686,212	0.99		
Principal Arterials			6	135,967	145,531	1.07		
Minor Arterials			1	28,512	36,611	1.28		

TABLE 7
Daily Cutline Detail by Facility Type (continued)

Cutline Name	Number	Cutline Direction	Number of Counts	Total Sum of Counts	Total Modeled Volumes at Locations with Counts	Model/ Volume Ratio	Caltrans Pass/Fail Criteria	FHWA Pass/Fail Criteria
South of SR 134 and I-210 : I-5 to I-605	106	NB/SB	51	1,127,598	1,070,268	0.95	PASS	PASS
Freeways and HOV Facilities			5	433,040	454,014	1.05		
Principal Arterials			23	334,019	305,930	0.92		
Minor Arterials			23	360,539	310,324	0.86		
South of Huntington Drive : SR 2 to Santa Anita Avenue	107	NB/SB	24	404,883	475,080	1.17	FAIL	PASS
Freeways and HOV Facilities			1	110,826	129,559	1.17		
Principal Arterials			12	181,707	239,657	1.32		
Minor Arterials			11	112,350	105,864	0.94		
North of I-10 : Union Station to I-605	108	NB/SB	35	860,380	892,836	1.04	PASS	PASS
Freeways and HOV Facilities			5	339,826	343,451	1.01		
Principal Arterials			17	378,043	409,879	1.08		
Minor Arterials			12	138,371	135,281	0.98		
North of SR 60 : US 101 to I-605	109	NB/SB	32	962,912	1,074,488	1.12	FAIL	PASS
Freeways and HOV Facilities			9	644,355	732,466	1.14		
Principal Arterials			10	195,291	221,716	1.14		
Minor Arterials			12	119,748	117,798	0.98		
Combined Cutline Totals			**274**	**7,964,932**	**8,398,061**	**1.05**		
Freeways and HOV Facilities			55	4,892,708	5,318,560	1.09		
Principal Arterials			109	1,840,987	1,934,155	1.05		
Minor Arterials			107	1,220,825	1,133,052	0.93		

** All Counts are for 2008
Totals may not sum due to other facility types not listed

APPENDIX A: List of Network Modifications made in Validation Process

TABLE 2A-1
Projects Added to the Model from 2008 RTP that Were Not Coded Correctly

Project ID	Description	Issue	Resolution
16931	SR 90 from Mindanao Way to Culver Blvd	Incorrectly coded	Revised to existing conditions
LA98STIP4	US 101 from Los Angeles St to Center Street	Incorrectly coded	Revised to existing conditions
20120K	I 405/ 101 Connector Gap	Incorrectly coded	Revised to existing conditions
LA0D390	I-110 and SR 47 / John Gibson Blvd Interchange)	Incorrectly coded	Reconfigured interchange
LA960142	Linero Cyn Rd	Incorrect number of lanes	Revised to 3 land SB and 2 lanes NB

TABLE 2A-2
List of TAZs with Centroid Connectors Revised in the Network

1607	1692	1983	2038	2086	2112	2147	2186	2222
1614	1704	1986	2039	2089	2116	2159	2187	2223
1620	1709	1991	2040	2090	2117	2160	2188	2234
1624	1710	1998	2041	2092	2118	2161	2189	2237
1625	1716	1999	2042	2093	2121	2162	2193	2239
1626	1729	2000	2043	2095	2124	2167	2194	2253
1634	1871	2005	2045	2096	2127	2173	2195	2255
1636	1958	2011	2073	2098	2133	2174	2203	2262
1639	1972	2019	2074	2102	2134	2175	2204	2282
1645	1977	2024	2078	2103	2135	2176	2206	2284
1650	1980	2029	2079	2107	2136	2179	2213	2299
1663	1981	2035	2083	2109	2137	2181	2214	
1686	1982	2036	2085	2111	2140	2182	2218	

TABLE 2A-3
Street and Highway Links Revised in the Network

Atlantic between I-10 and Huntington	Speed=40 mph (per posted)
Alameda Street S. of I-10 to 55th Street	FType=50
Alameda East Street to Slauson	Lanes=1, Speed=25 mph, FClass=50
Alameda Street	Connection at 37th street removed.
Alameda west Street	Speed=30 mph
Arrow Hwy between Live Oak and Live Oak	Speed=40 mph
Atlantic, Helman to end of ramps	FClass=41, Speed=35 mph (posted at 40 mph)
Atlantic, ramps to valley	FClass=42, Speed=35 mph (posted at 40)
Atlantic between Valley and I-10	SB lanes=3, FClass=42
California Michillinda to Rosemead	FType=51, Lanes=2
Cogswell Rd Valley Blvd to Peck	Speed=35 mph (per posted), FClass=60
Concord Ave between Mission and Fremont	FClass 60,Speed=25 mph (per posted)
Downey Rd between Union Pacific and SR60	Speed=35 mph, FClass=52
Eagle Rock Blvd between Verdugo and Verdugo	Speed=35 mph, FClass=41
Eagle Rock Blvd between Verdugo and York,	Speed=35 mph
Eagle Rock between Verdugo and Colorado	Speed=35 mph
Eastern Ave between Floral and City Terrace	Speed=35 mph
Ellenwood Dr between York and Colorado,	FClass=50, Lanes=1, Speed=25 (per posted)
Euclid	Speed=20 mph (posted speed=25), FClass=50, Trucks restricted (per posted)
Fair Oaks between Mission and Union	FType=52, Speed=40 mph (posted speed=35)
Fair Oaks between Huntington and W State	Speed=30 mph
Fair Oaks Ave between Huntington Drive and Monterey Road	Speed=35 mph (per posted)
Fair Oaks Ave s between Monterey and Mission (Posted)	Speed=30 mph (per posted),Lanes=1
Figueroa between I-5 and Avenue 50	Speed=45 mph, FClass=42
Foothill between SR2 and Angeles Crest Hwy	Speed=35 mph (posted at 30), FClass=42
Fremont	Speed=40 mph (posted at 35).
Fremont	Lanes=1, FType=52
Glendale Lexington to Adams	FClass=52
Glendale Ave between Lexington and Freeway	Lanes=3 (NB)
Glendale Freeway from Glendale Blvd to I-5	Speed=50 mph

TABLE 2A-3
Street and Highway Links Revised in the Network (Continued)

Glendale Blvd from Glendale Fwy to I-110	Speed=30 mph
Grande Visa between Washington and Lorena	Speed=25 mph
Griffin from Broadway to Avenue 28	FClass=52
Griffin Mission to Broadway	Speed=30 mph (per posted), FType=52
Hill Ave from California to Orange Grove	Speed=35 mph
Huntington Drive between California and I210	Speed=45mph
I-10 between I5 and I710	Speed=60 mph (per posted)
I-110 Whittier to I-5	Speed=40 mph
I-5 NB @ Triggs	Lanes=4
I-5 NB	Speed=40 mph
I-5 NB & SB from Lorena to Calzona	Speed=55 mph
I-5 NB & SB from US110 to I710	Speed=60 mph
Indiana St between Union Pacific and 1st	Speed=25 mph (posted at 30), Lanes=1
Live Oak between Arrow Hwy and Arrow Hwy	Speed-45 mph
Longden between El Monte and Live Oak	Speed=30 mph
Los Angeles Street I-605 to Azusa Canyon Road	Speed=40 mph (per posted) , FType=42
Lower Azusa Road Durfee to Freeway	Speed=45 mph (per posted), FClass=40 & 42
Marengo St between Freeway and Soto St	Speed=35 mph (per posted), FType=52
Marshall St Extended, Rio Hondo Added	FType=50
Monterey Pass Road between Floral and Fremont	Speed=40 mph
Monterey Road between Fair Oaks and Huntington Drive	Speed=30 mph (per posted), FType=60
Monterey Road SR110-Fair Oaks	Speed=25
N Mission between Main and Soto	Speed=40 mph
N Mission between Marengo and Main	Speed=40 (posted sat 35), FClass=42
North Lake Ave between California Blvd and I-210	FType=40
North Lake Ave between California Blvd and I-210	Speed=35 mph (per posted)
North Lake Ave between I-210 and Colorado Blvd	Lanes=3
North Lake Ave between Colorado and California	Lanes=2
North Lake Ave between I-210 and Mendocino Ave	FType 40 (and 42), Lanes=2
Rosemead from SR10 to Las Tunas	Speed-35 mph

TABLE 2A-3
Street and Highway Links Revised in the Network (Continued)

Rosemead between freeway and Sierra Madre	Speeds 35 mph (posted at 40), FType=41&42
Santa Anita Ave between I10 and Valley	Speed=30 mph (posted at 35)
Santa Anita Ave Brockway to valley Mall	FType=41
Santa Anita Tyler to I-10	Speed=30 mph(Posted at 35)
SR 110 between I5 and Orange Grove	Speed=50 mph
SR 110 SB @ Fair Oaks to Orange Grove	Lanes=2
SR 110 between Fair Oaks and Orange Grove	Speed=50 mph
SR 110 between Arroyo and Fair Oaks	Speed=45 mph
SR 134 at zoo drive, and HOV connections west.	Updated the interchange
SR 60 @ I705	Lanes=4
Stewart Road- added Ramona to Live Oak	Speed=40 mph, FType=50
Triggs St between S Mariana Ave and Freeway	Speed=30 mph
Valley Blvd between Peck and Valley Mall	FType=42
Valley Blvd @ Valley Mall	FType=41
Valley Blvd between Mall and Santa Anita	FType=42
Valley Blvd Peck to Santa Anita	Speed=30 mph (posted at 35mph)
Walnut Grove between Ramps @ I-10 (network mistake)	Dir=0
Washington Blvd between 23rd Street and Downey Road	Speed=30 mph
Whittier Blvd between Downey Road and Atlantic Blvd	Posted Speed=35 (posted at 30), FType=42

FIGURE 2B-1

AM Peak Period Model Results to Traffic Counts at Cutline 101

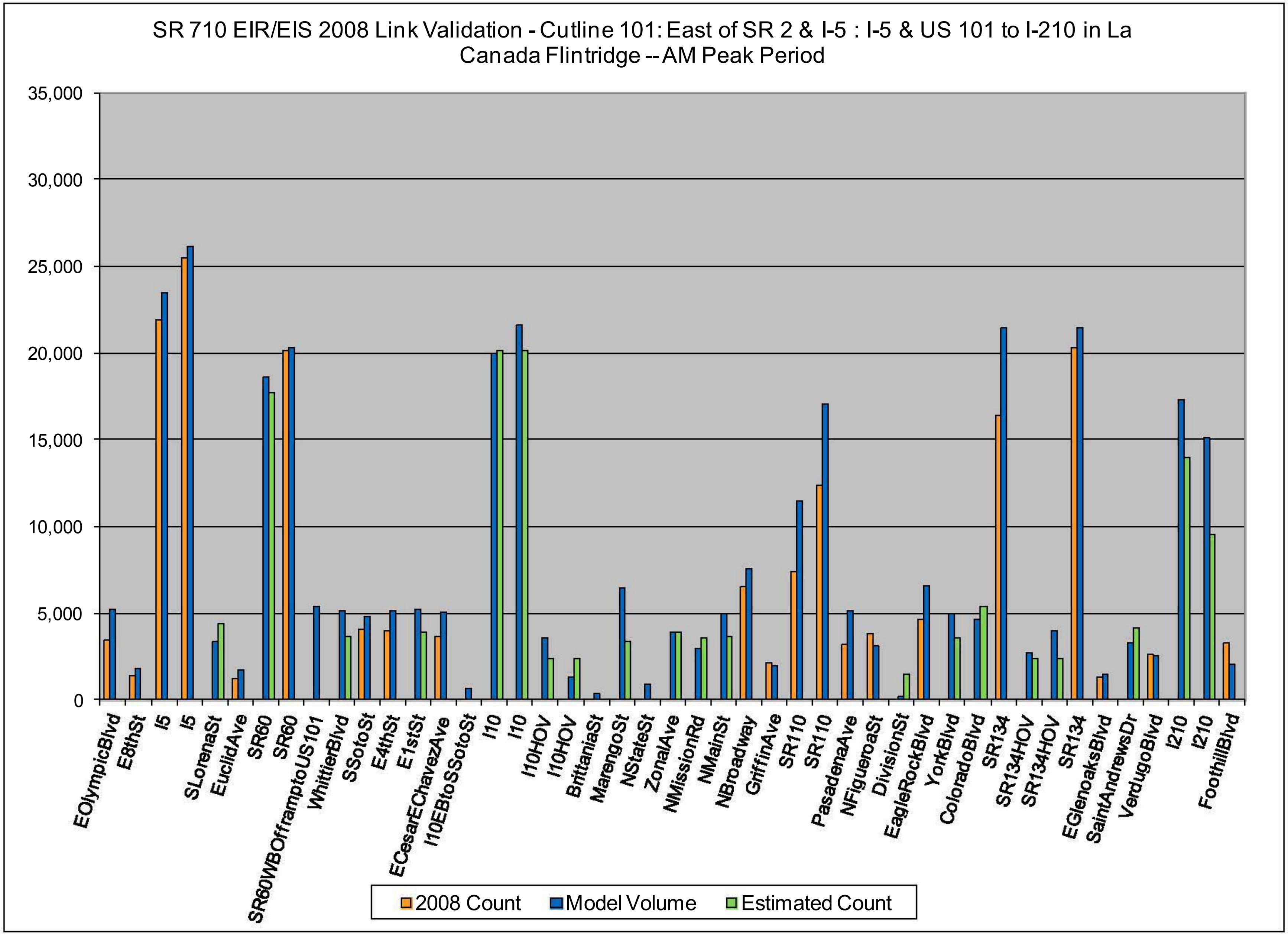


FIGURE 2B-2

AM Peak Period Model Results to Traffic Counts at Cutline 102

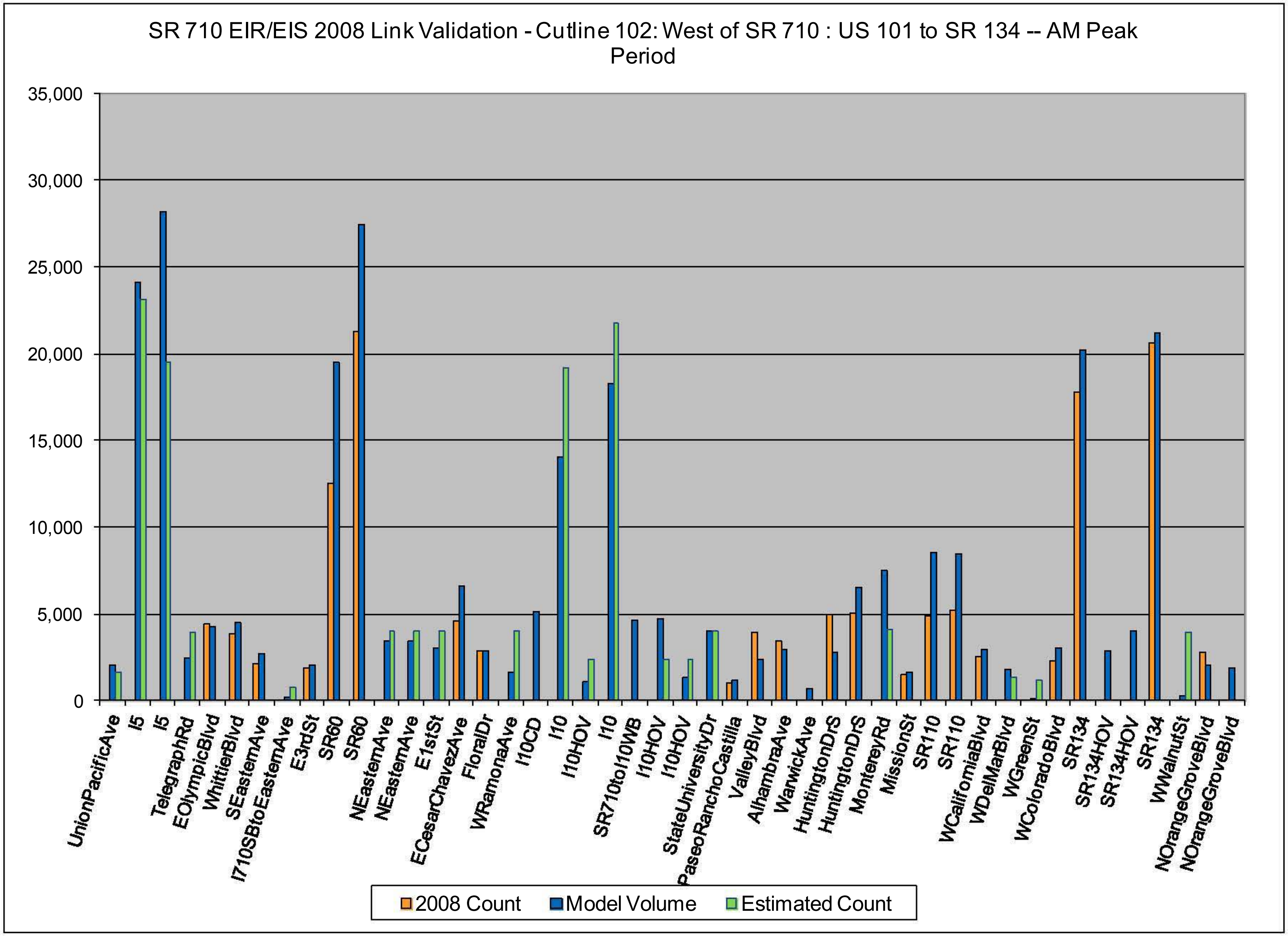


FIGURE 2B-3

AM Peak Period Model Results to Traffic Counts at Cutline 103

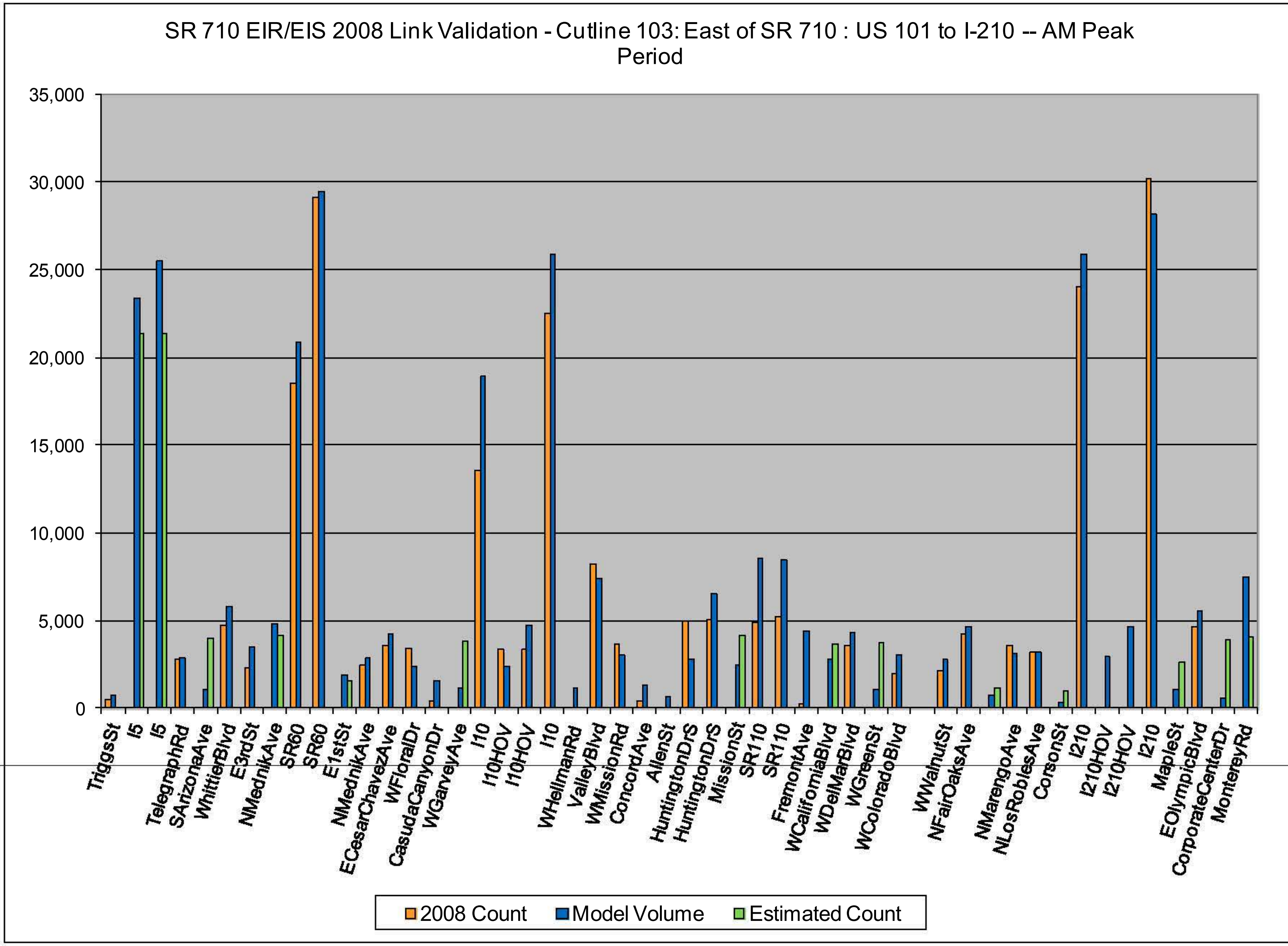


FIGURE 2B-4
AM Peak Period Model Results to Traffic Counts at Cutline 104

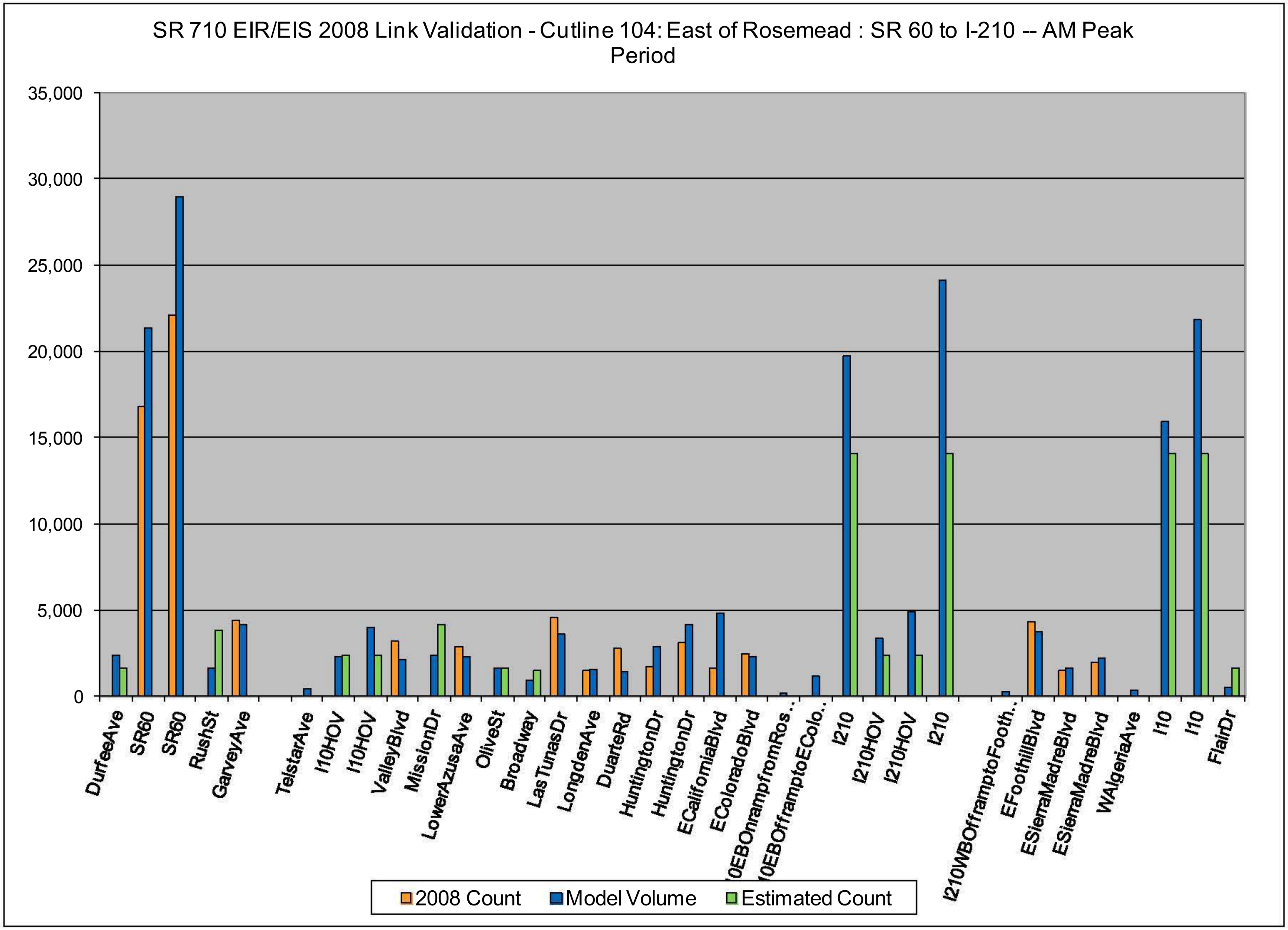


FIGURE 2B-5
AM Peak Period Model Results to Traffic Counts at Cutline 105

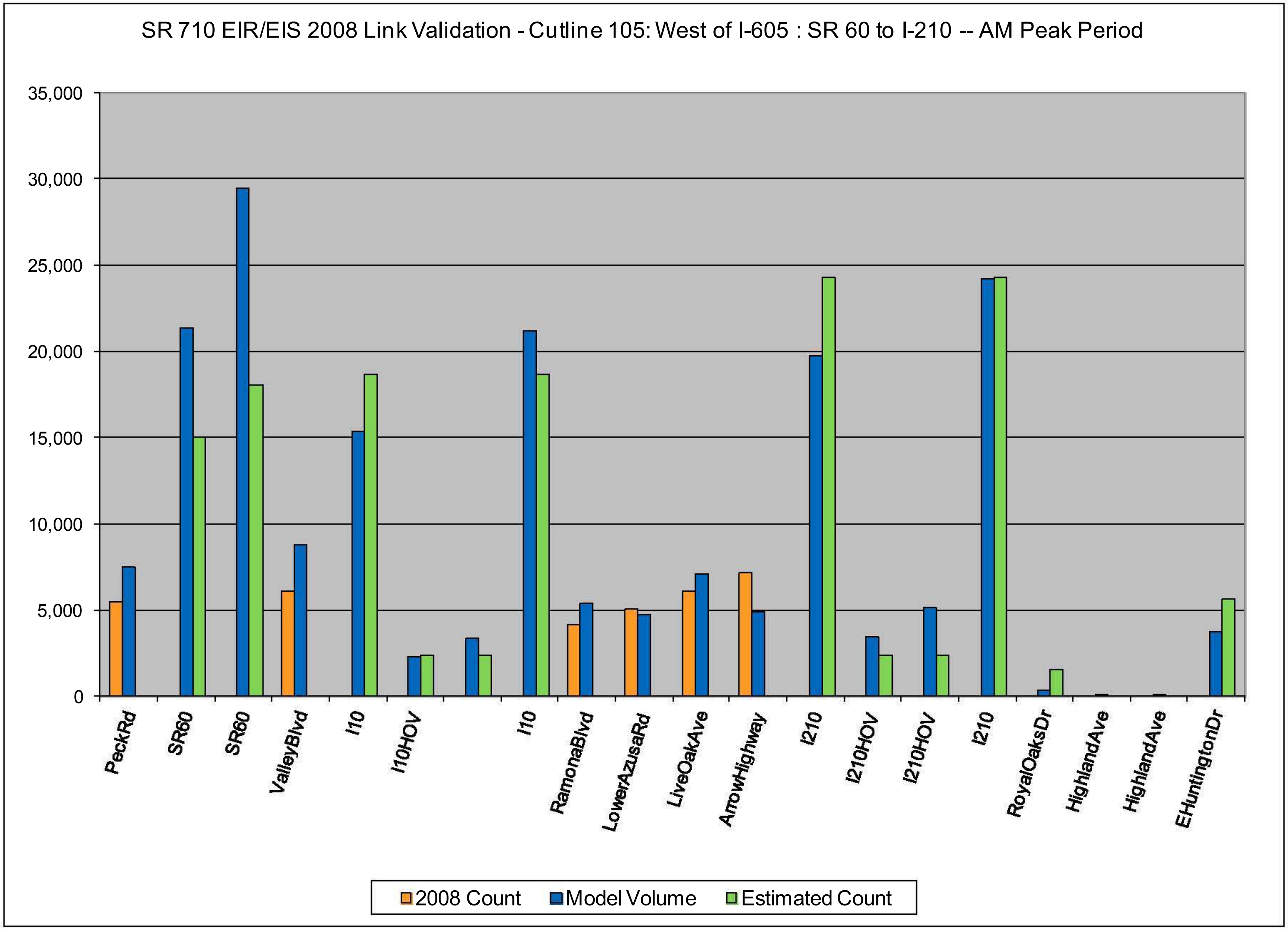


FIGURE 2B-6
AM Peak Period Model Results to Traffic Counts at Cutline 106

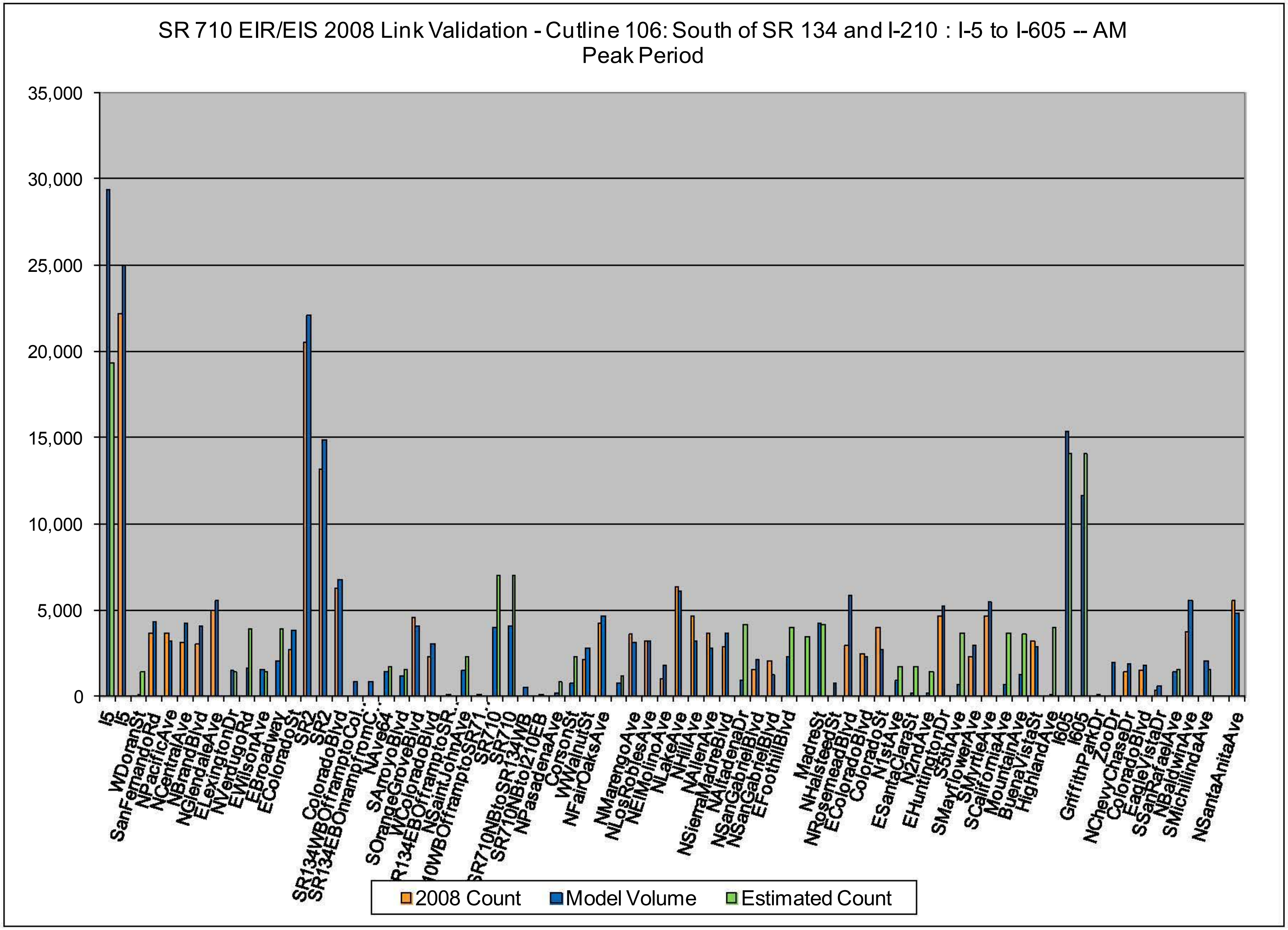


FIGURE 2B-7
AM Peak Period Model Results to Traffic Counts at Cutline 107

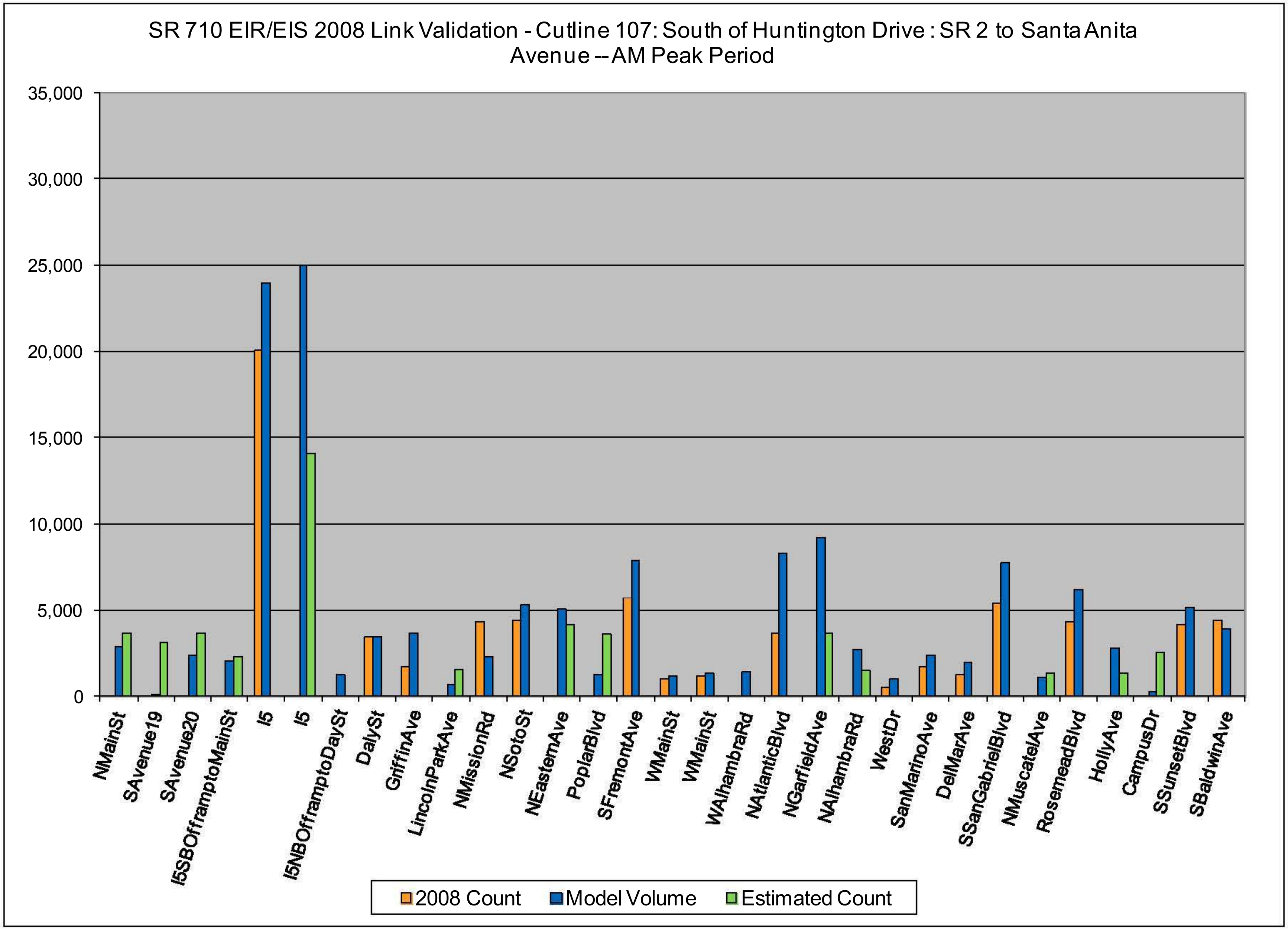


FIGURE 2B-8

AM Peak Period Model Results to Traffic Counts at Cutline 108

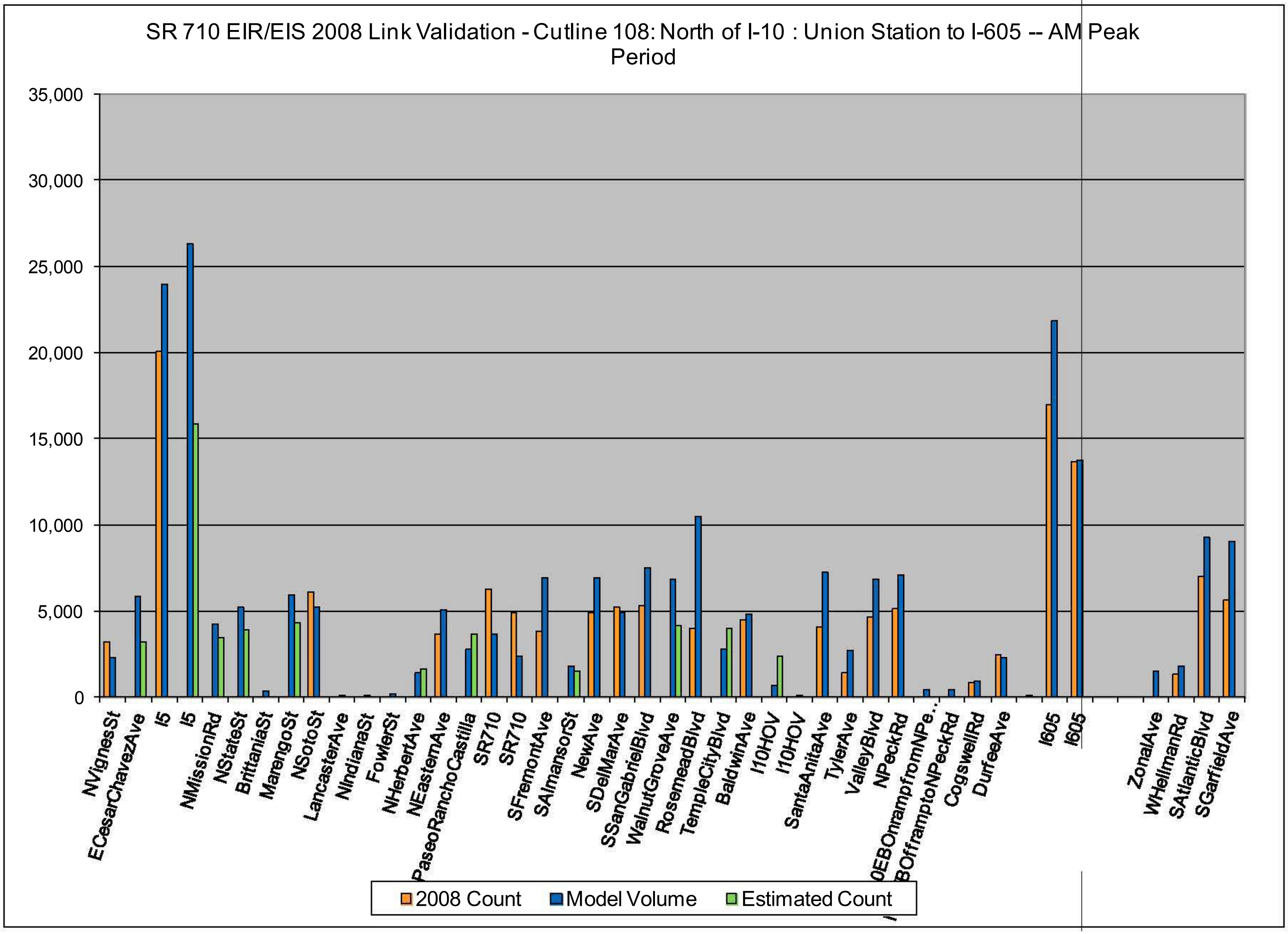


FIGURE 2B-9
AM Peak Period Model Results to Traffic Counts at Cutline 109

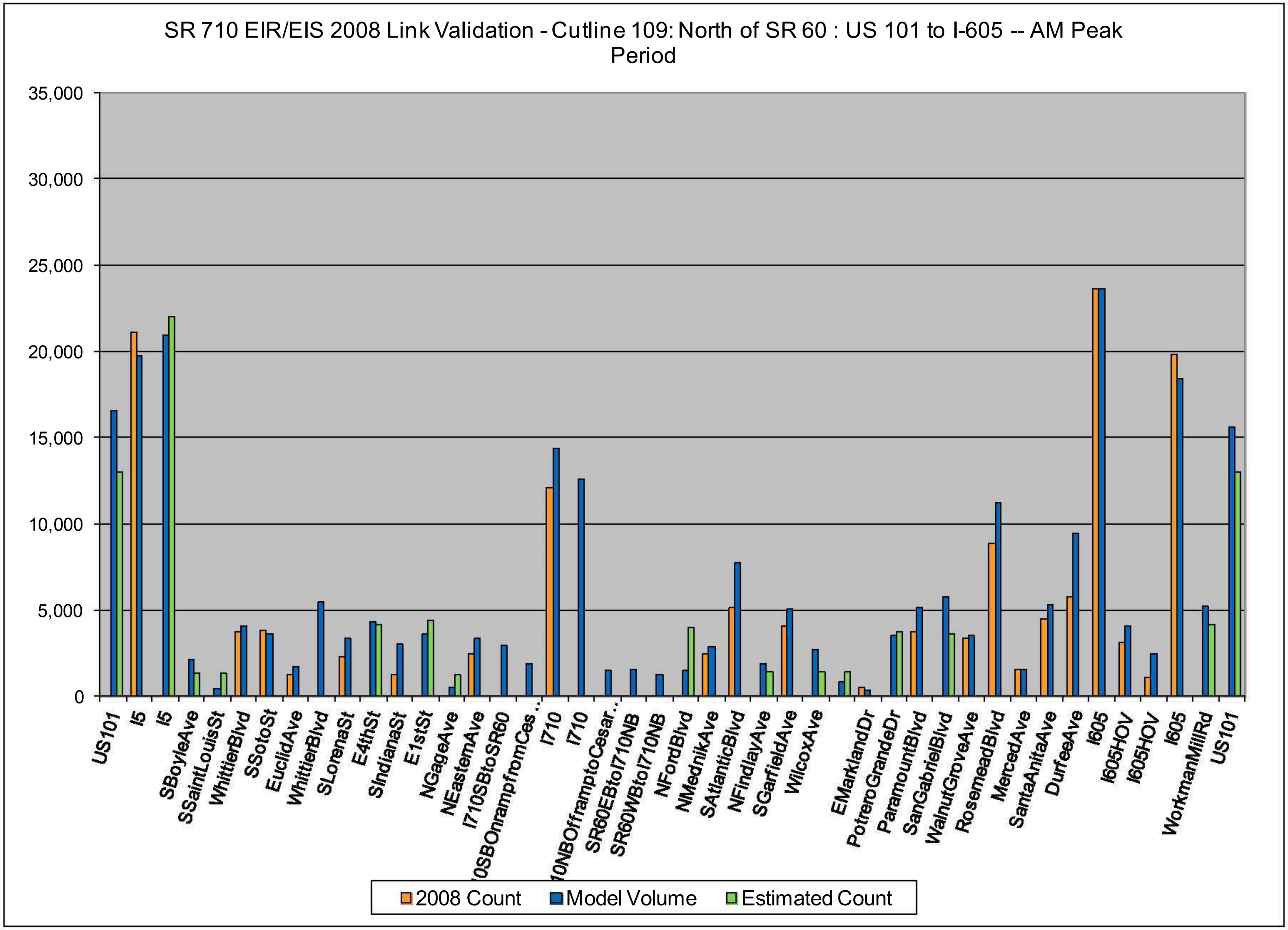


FIGURE 2B-10

PM Peak Period Model Results to Traffic Counts at Cutline 101

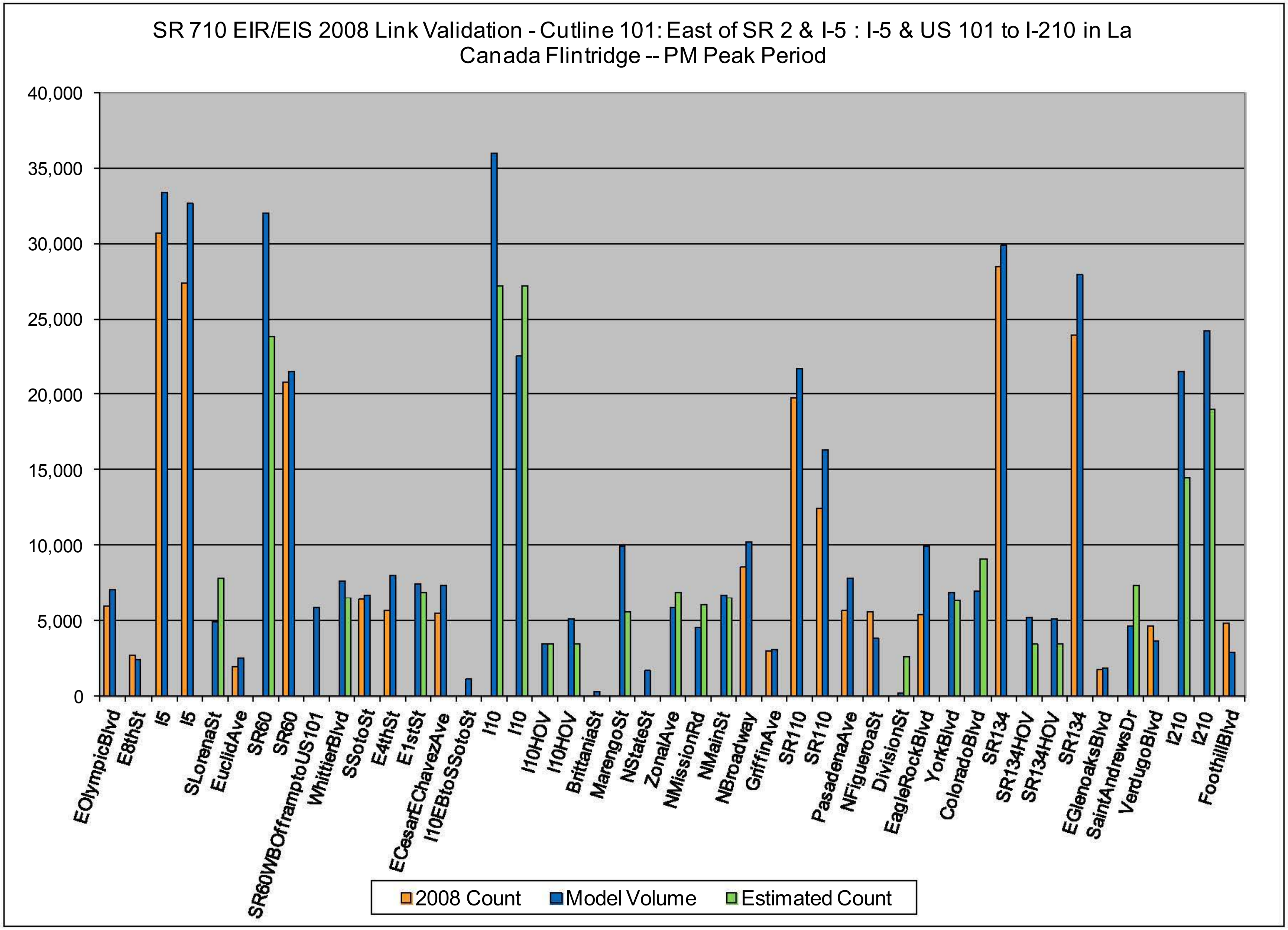


FIGURE 2B-11
PM Peak Period Model Results to Traffic Counts at Cutline 102

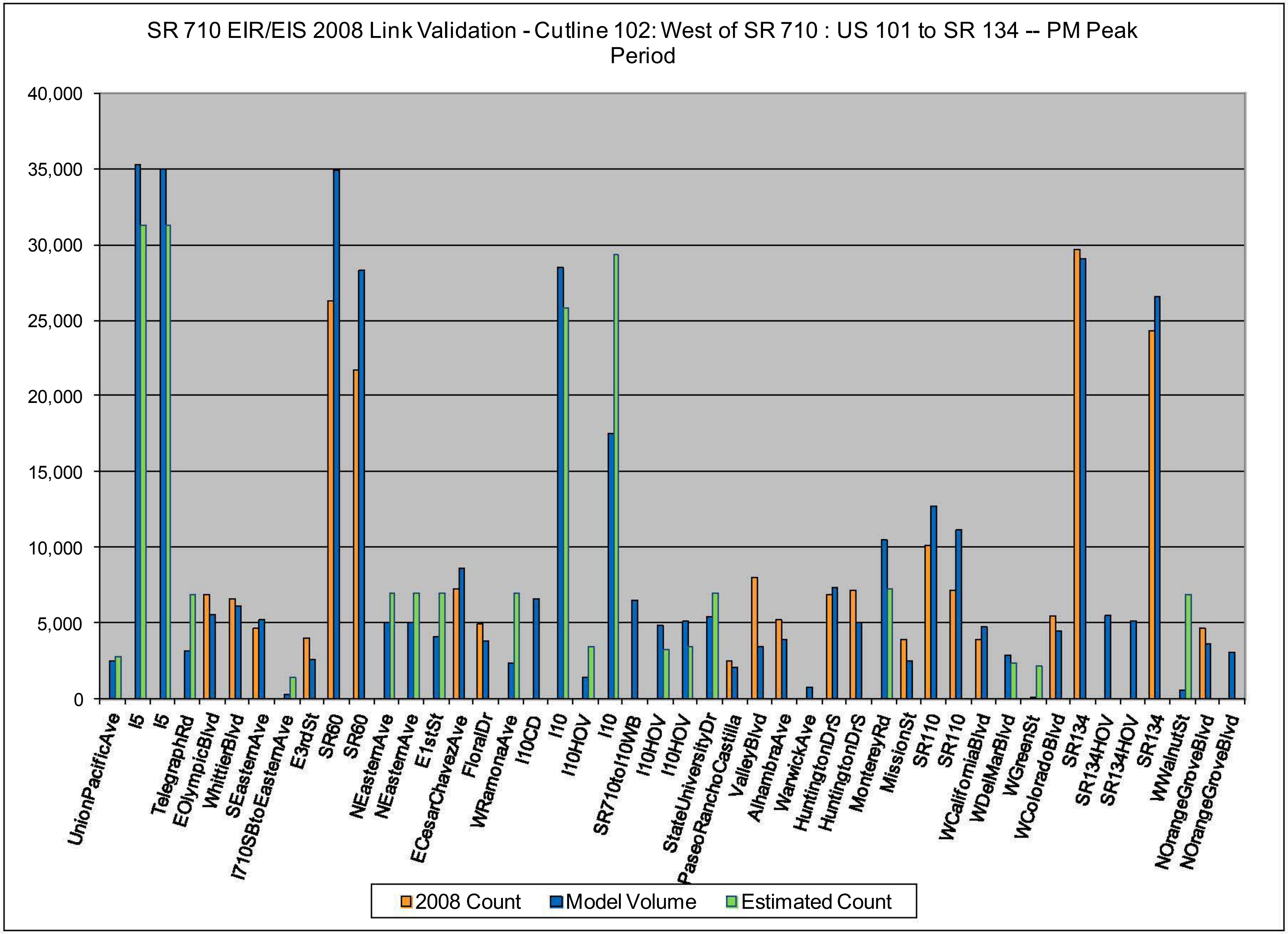


FIGURE 2B-12

PM Peak Period Model Results to Traffic Counts at Cutline 103

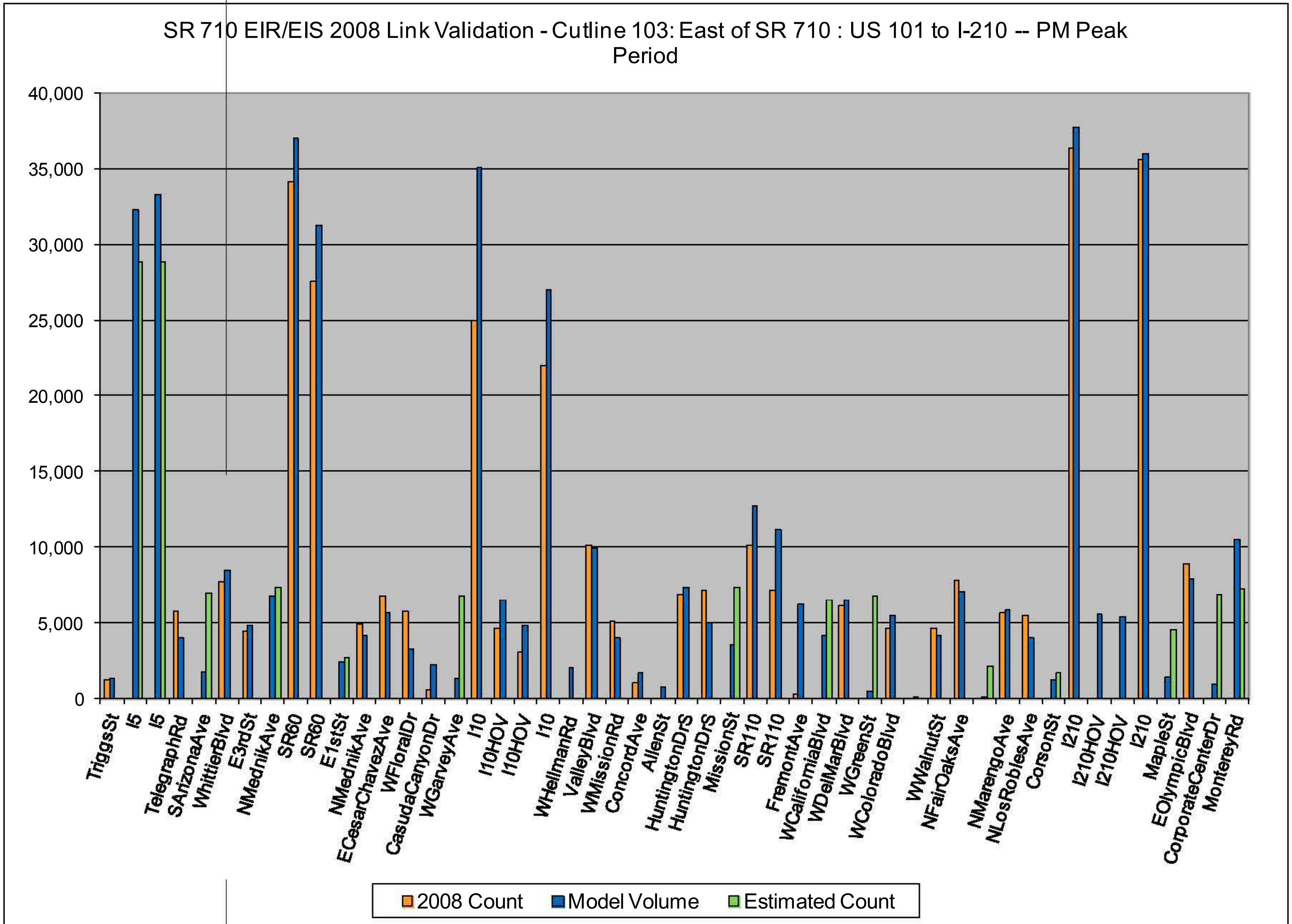


FIGURE 2B-13
PM Peak Period Model Results to Traffic Counts at Cutline 104

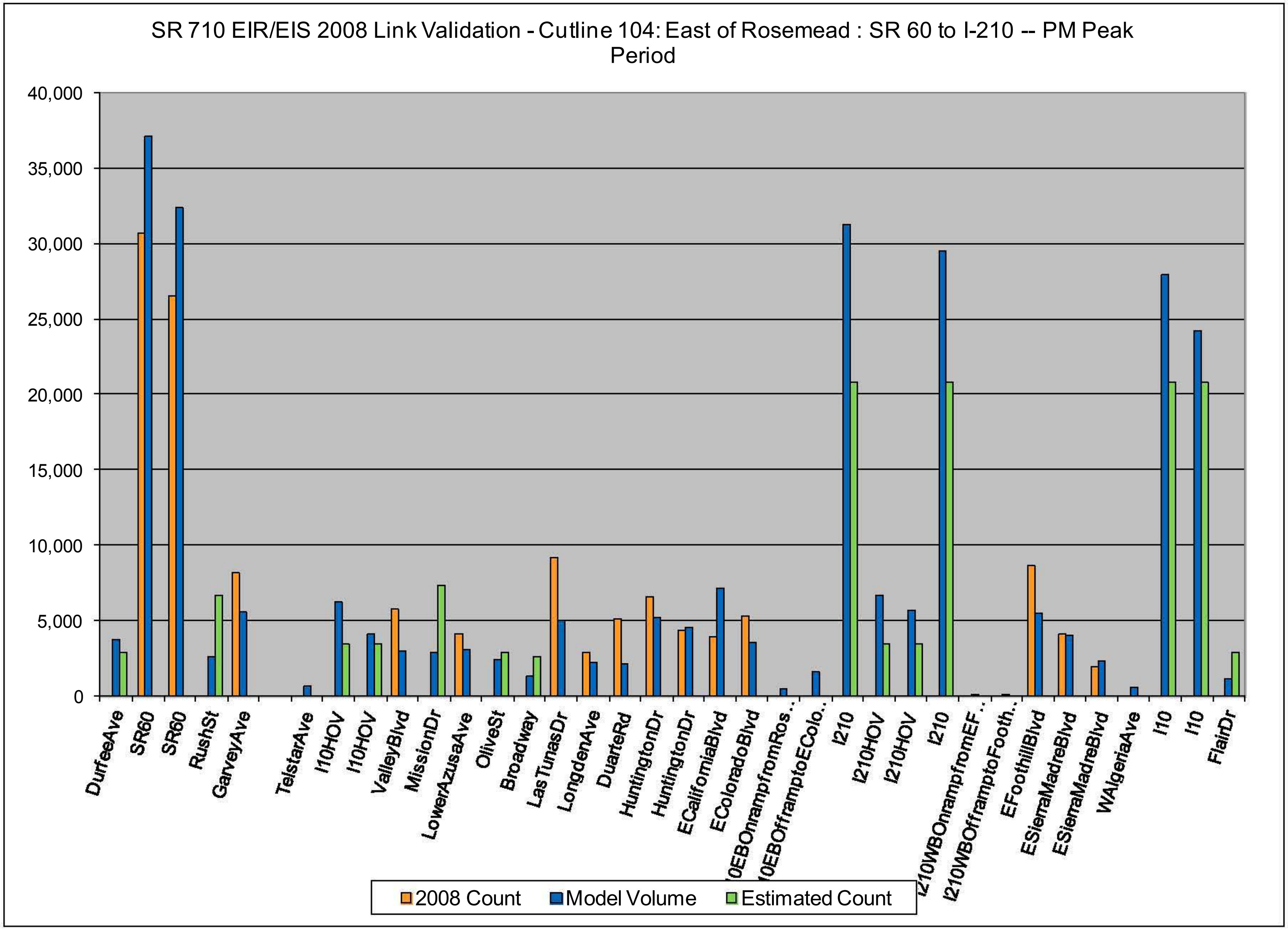


FIGURE 2B-14
PM Peak Period Model Results to Traffic Counts at Cutline 105

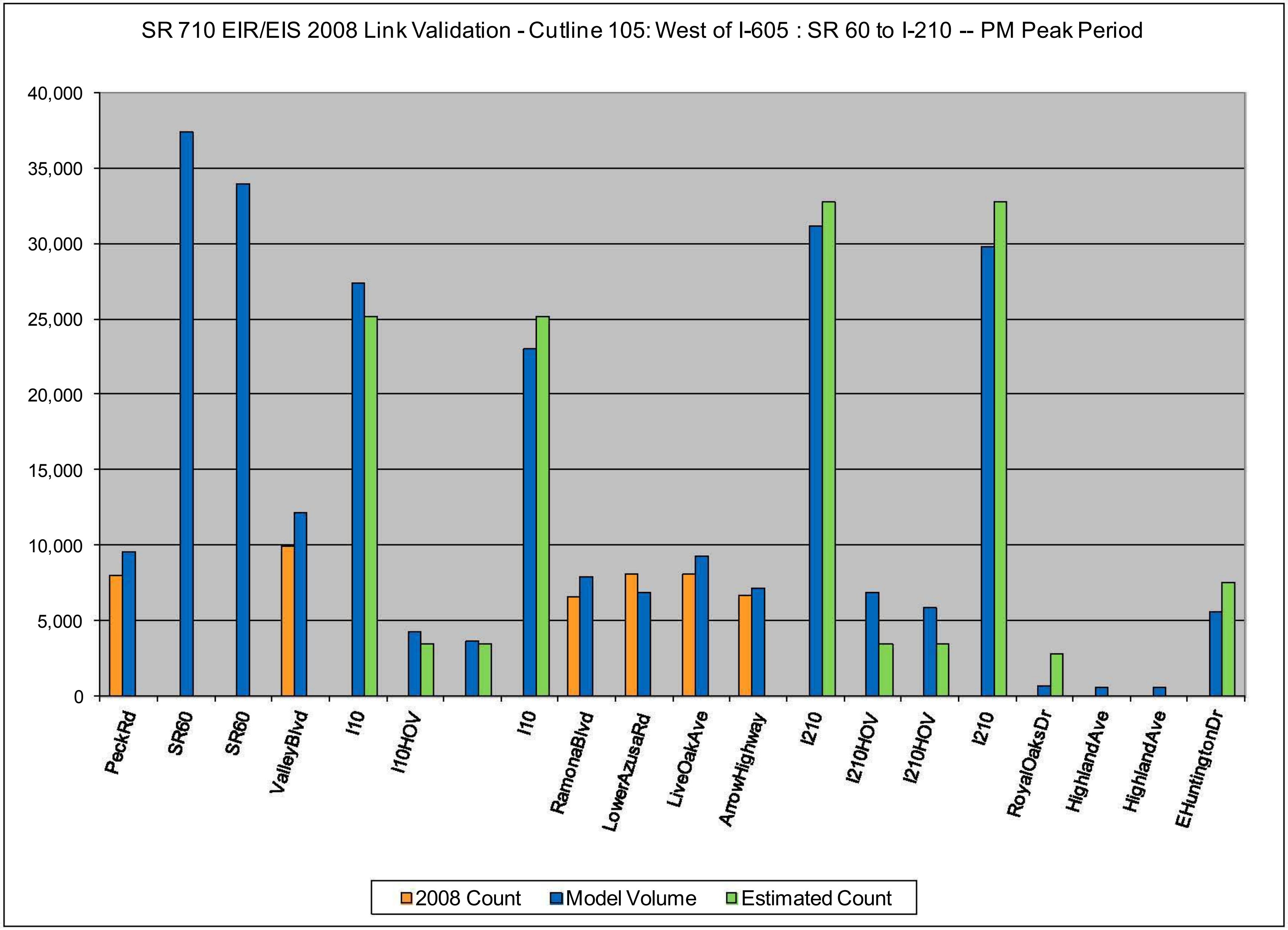


FIGURE 2B-15

PM Peak Period Model Results to Traffic Counts at Cutline 106

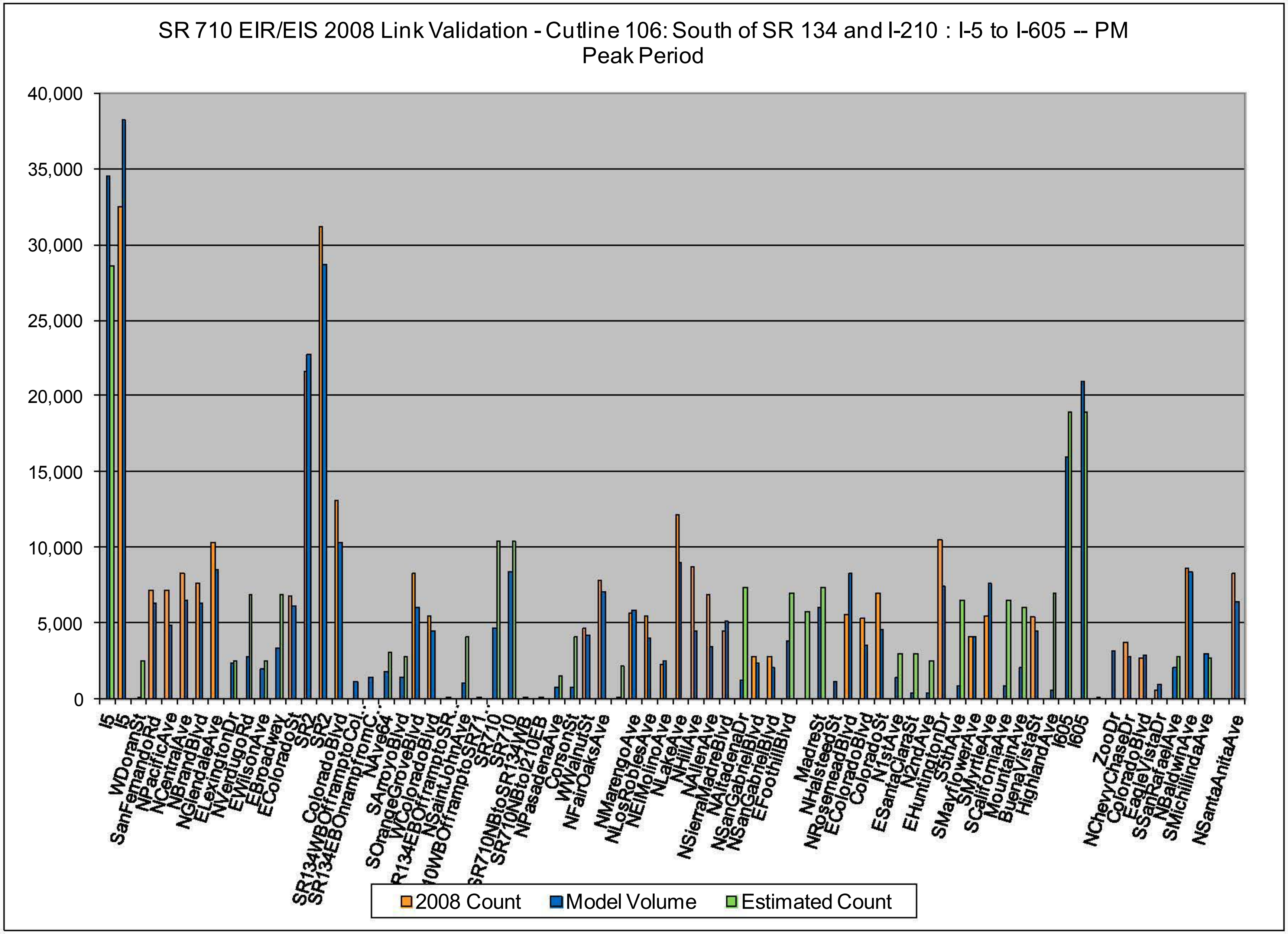


FIGURE 2B-16
PM Peak Period Model Results to Traffic Counts at Cutline 107

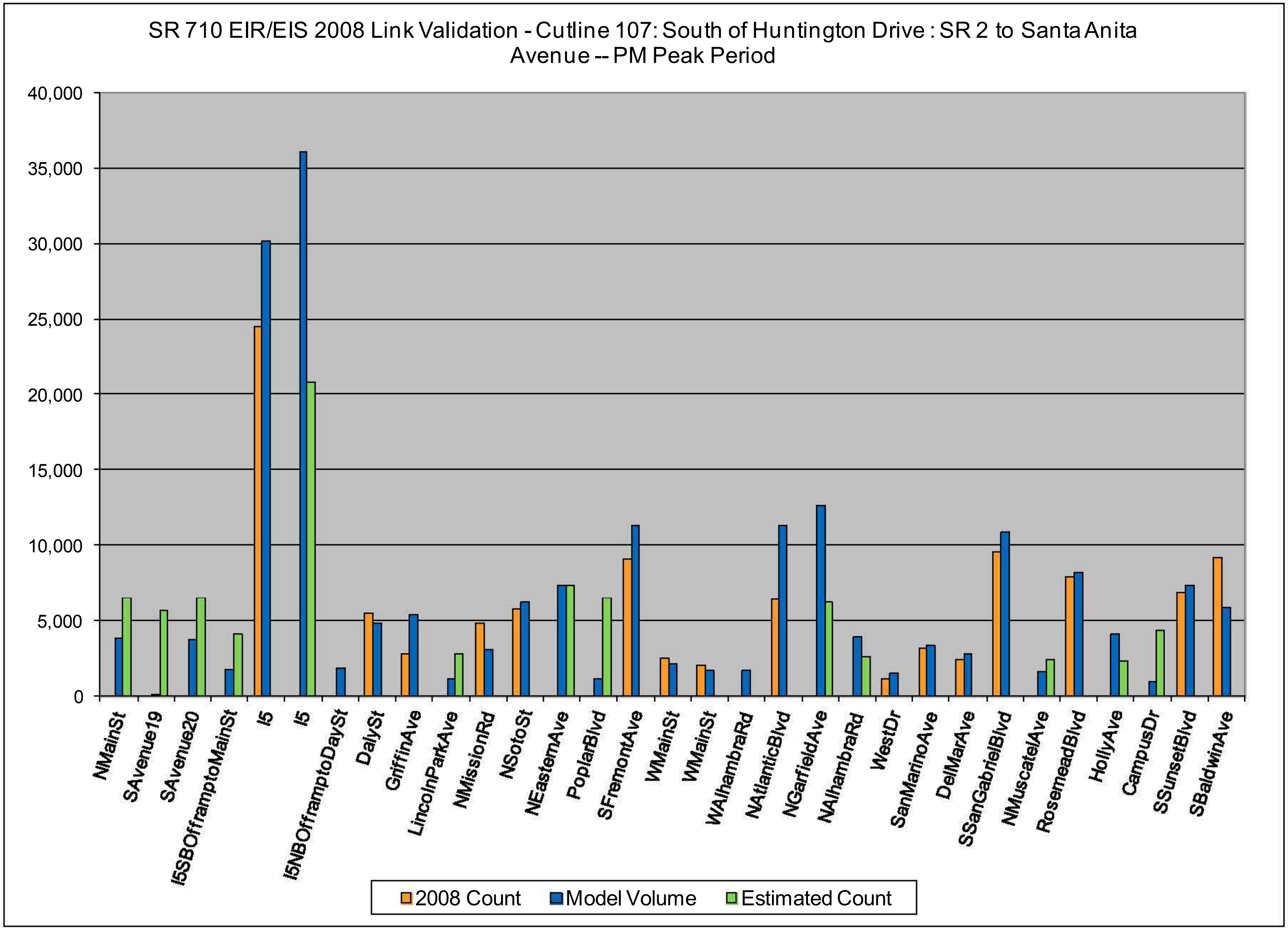


FIGURE 2B-17
PM Peak Period Model Results to Traffic Counts at Cutline 106

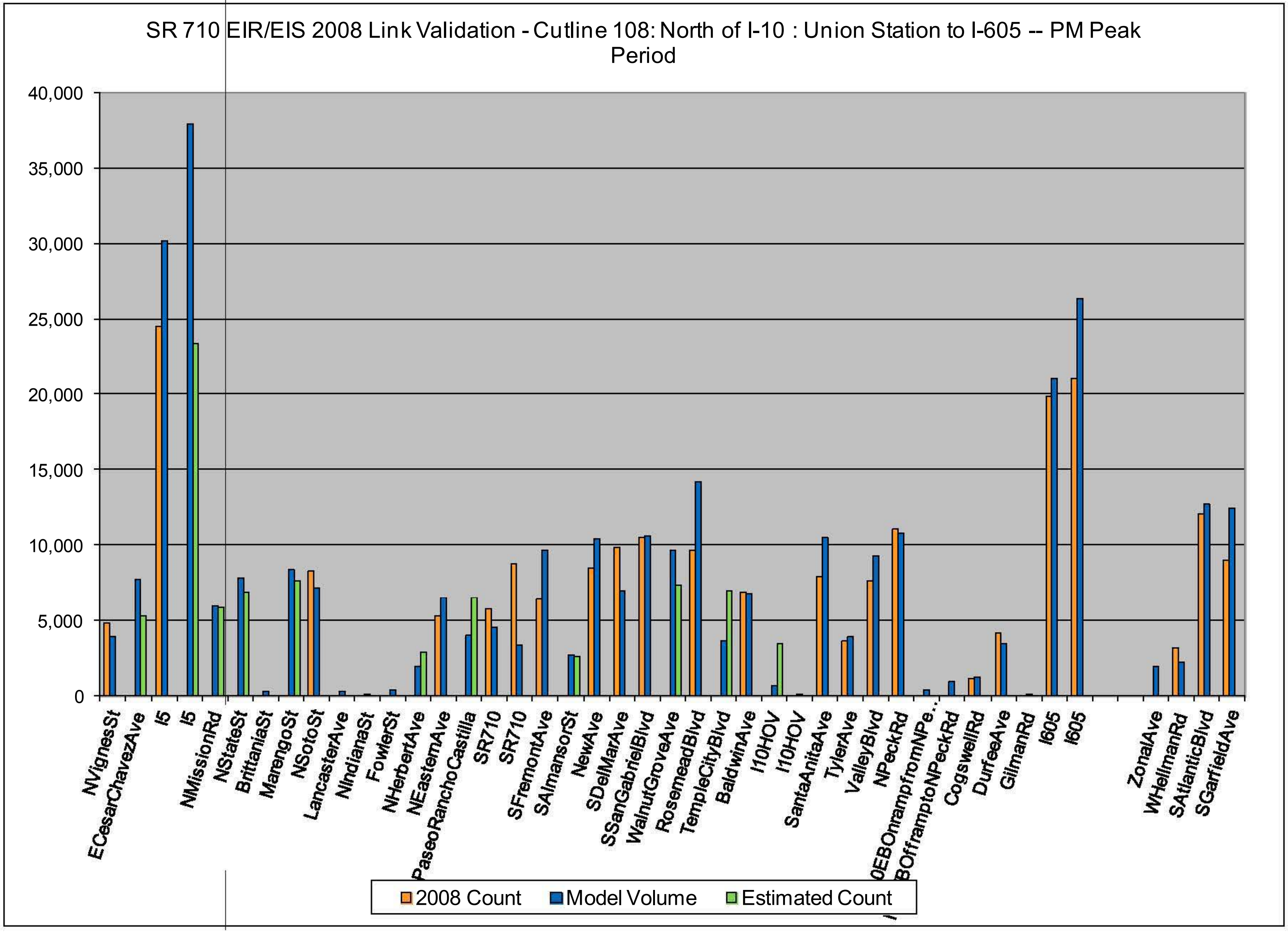


FIGURE 2B-18

PM Peak Period Model Results to Traffic Counts at Cutline 109

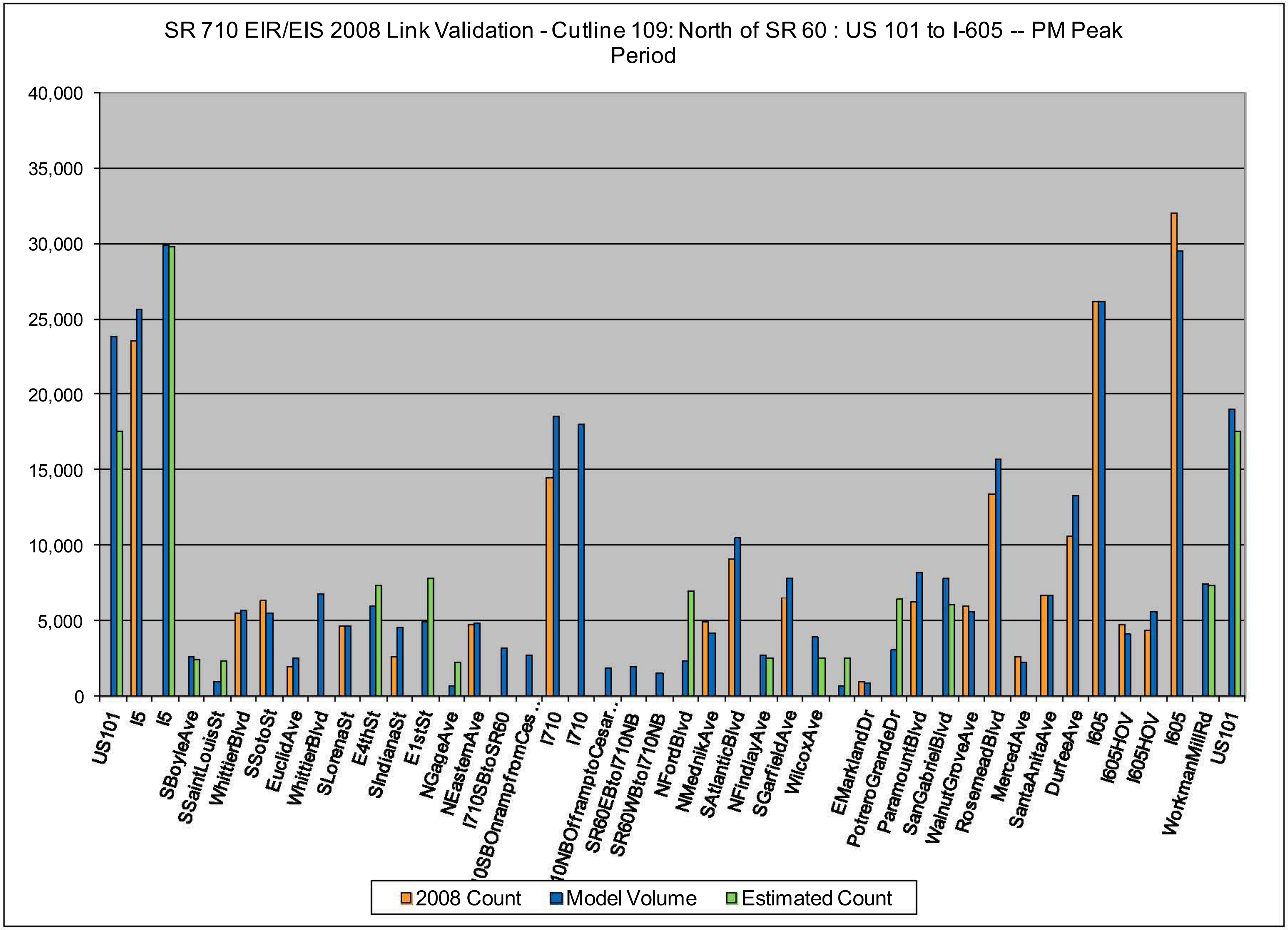


FIGURE 2B-19
Daily Model Results to Traffic Counts at Cutline 101

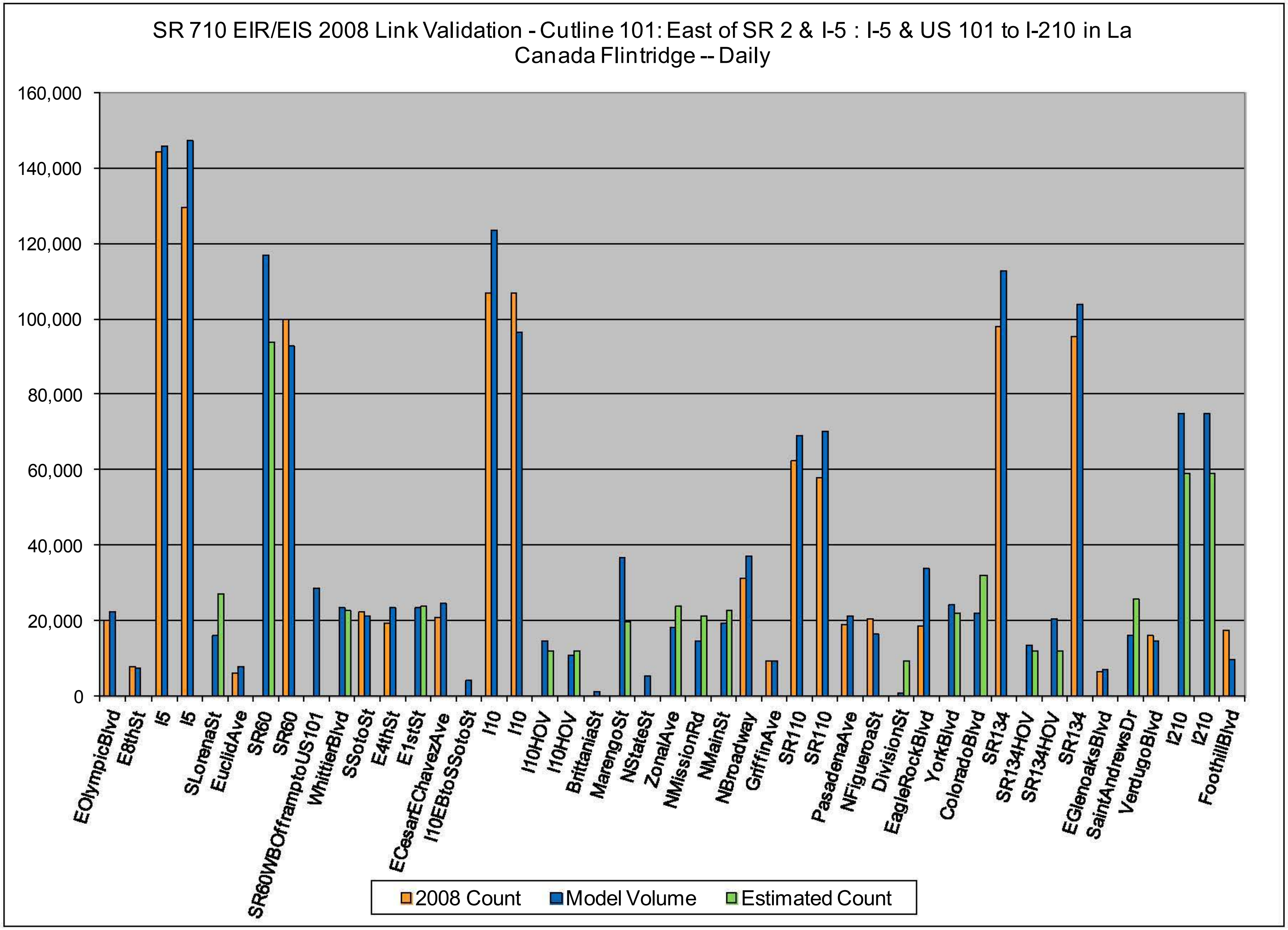


FIGURE 2B-20
Daily Model Results to Traffic Counts at Cutline 102

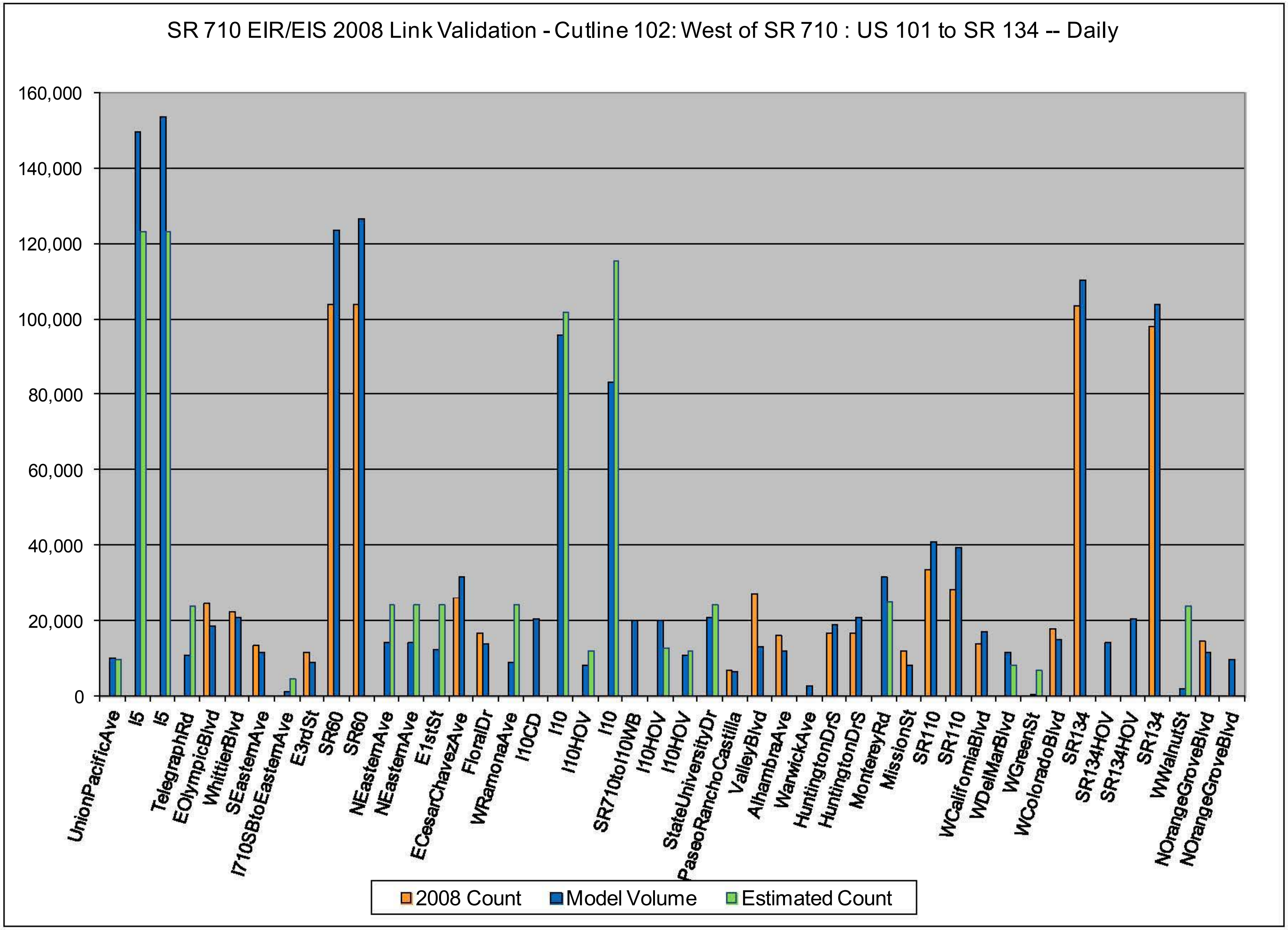


FIGURE 2B-21
Daily Model Results to Traffic Counts at Cutline 103

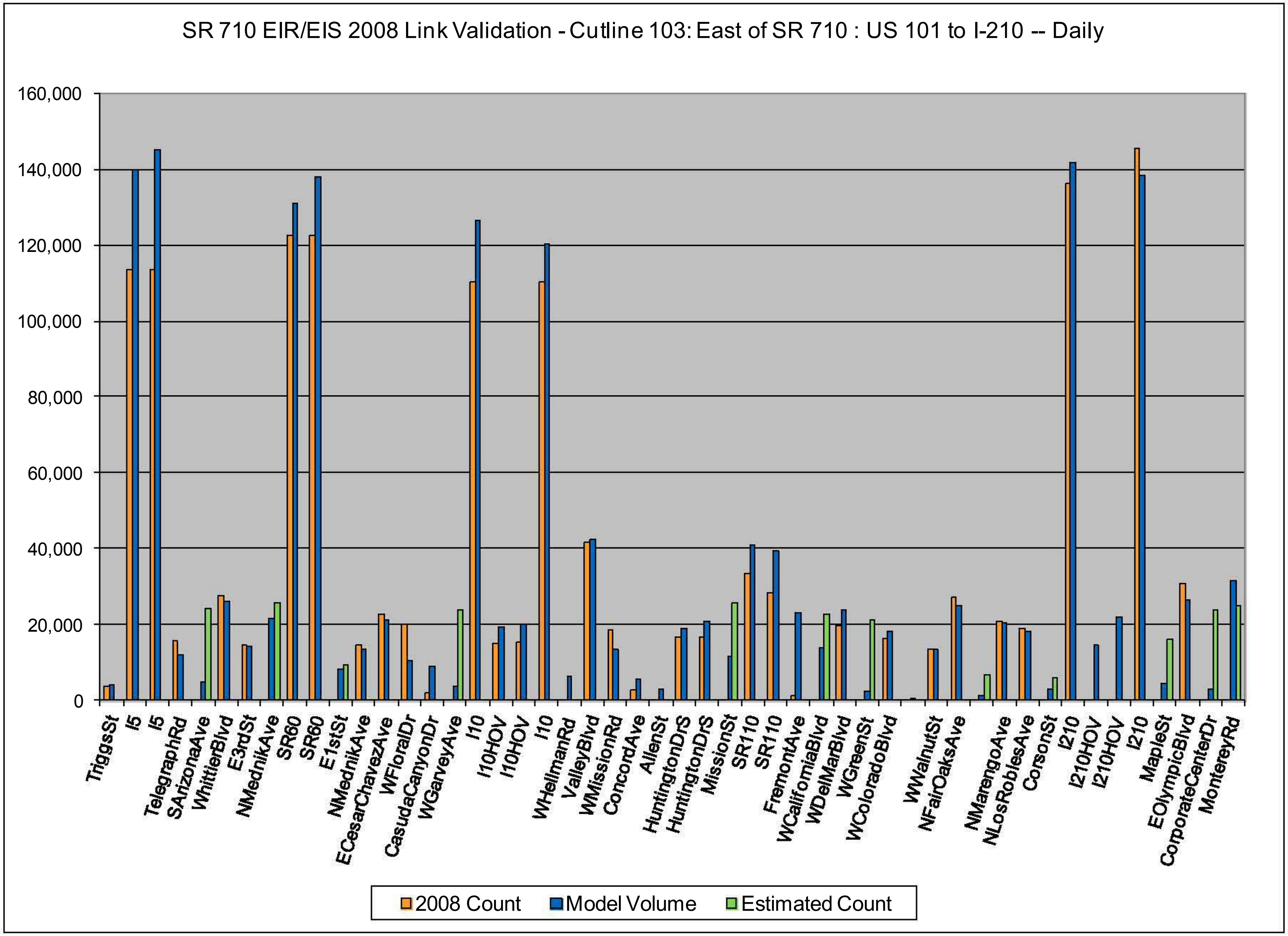


FIGURE 2B-22
Daily Model Results to Traffic Counts at Cutline 104

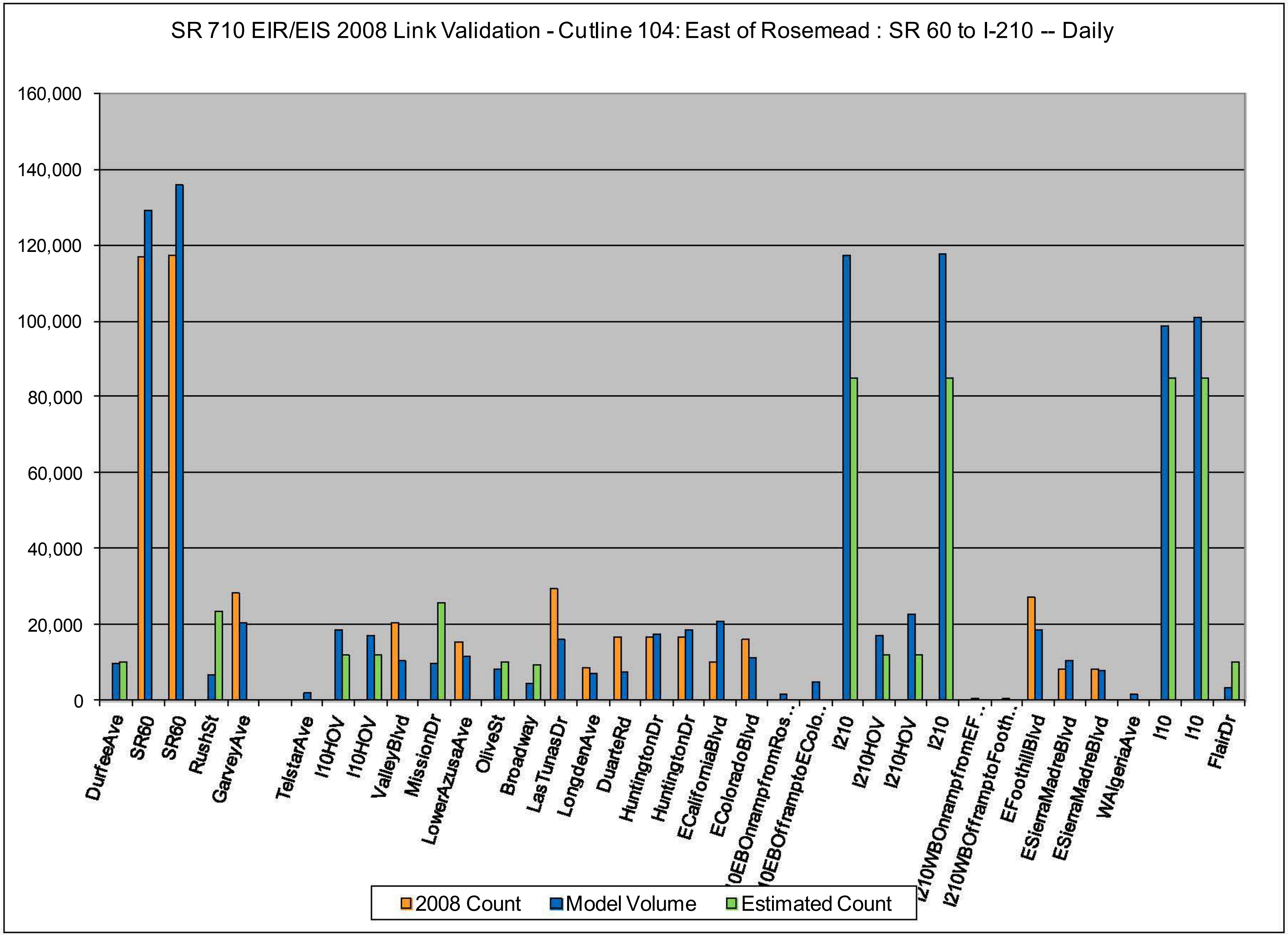


FIGURE 2B-23
Daily Model Results to Traffic Counts at Cutline 105

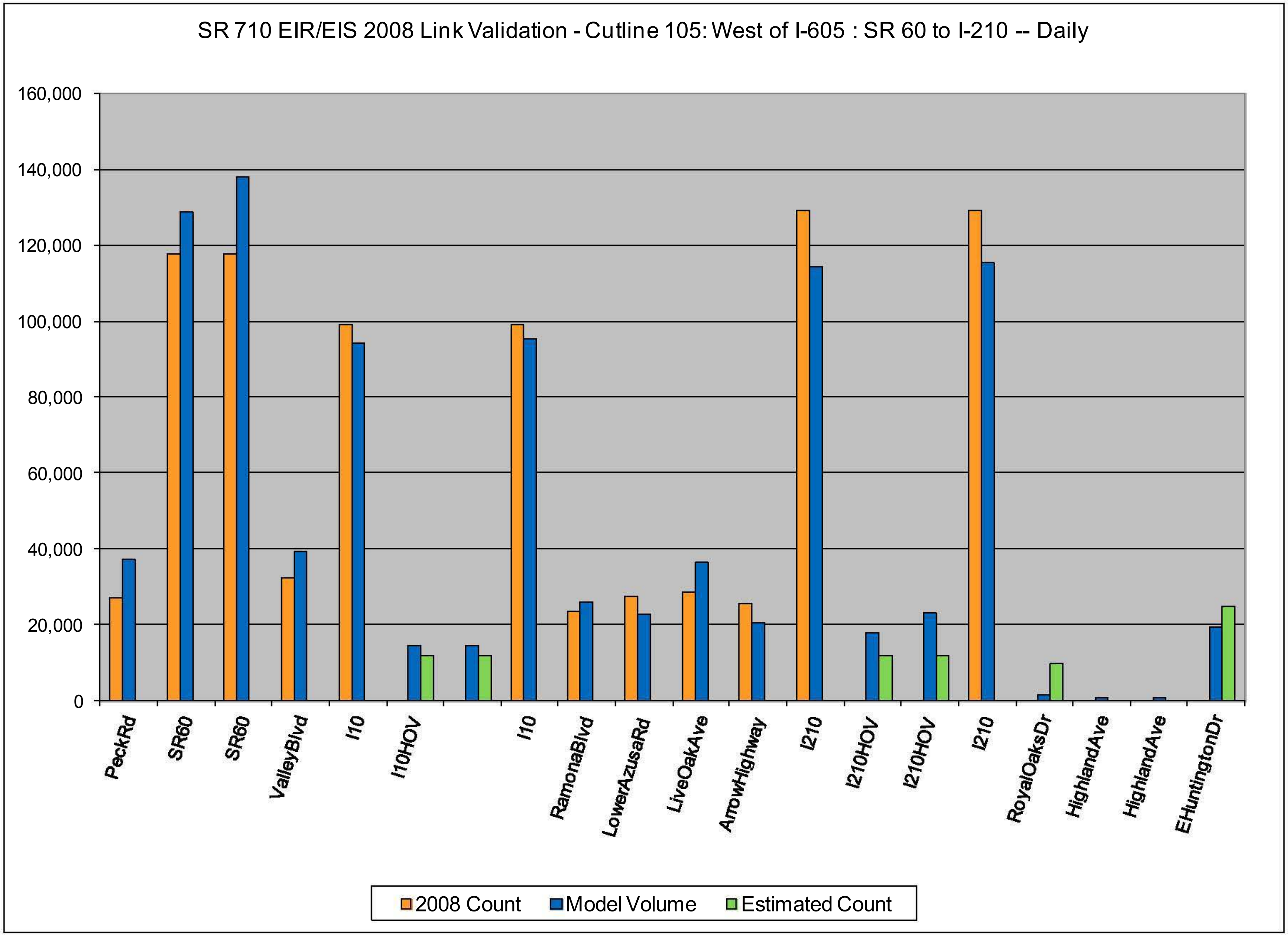


FIGURE 2B-24
Daily Model Results to Traffic Counts at Cutline 106

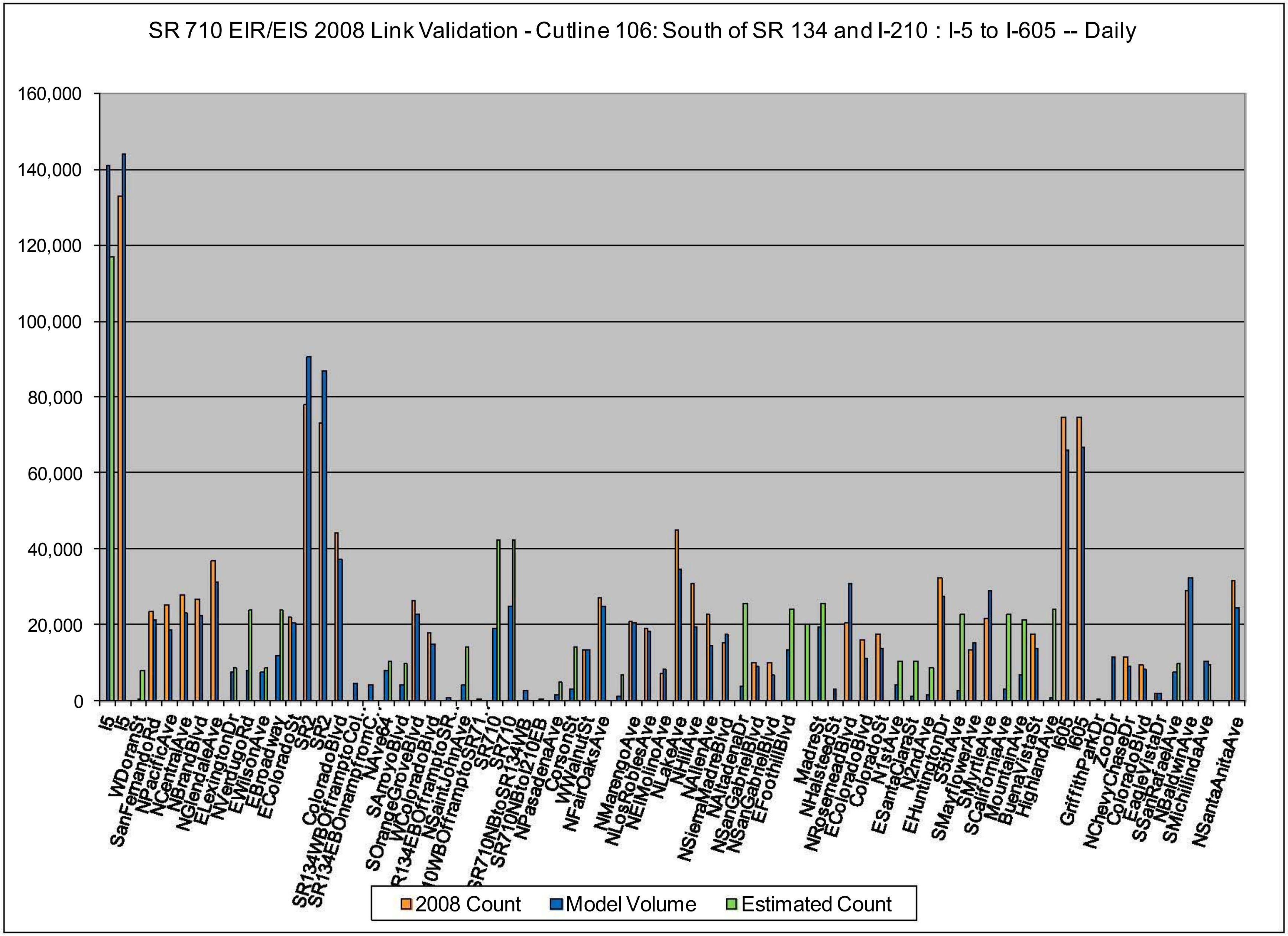


FIGURE 2B-25
Daily Model Results to Traffic Counts at Cutline 107

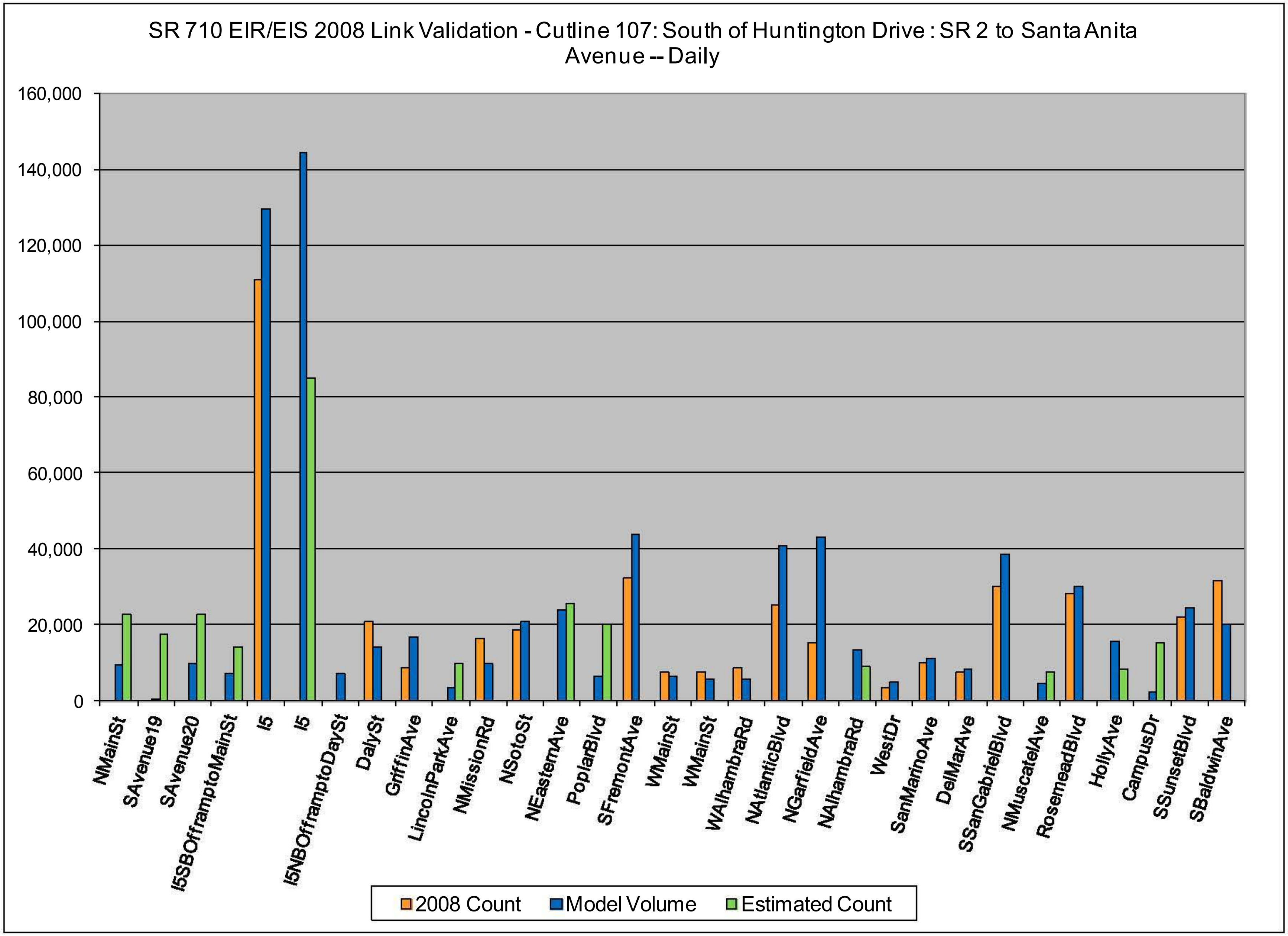


FIGURE 2B-26

Daily Model Results to Traffic Counts at Cutline 108

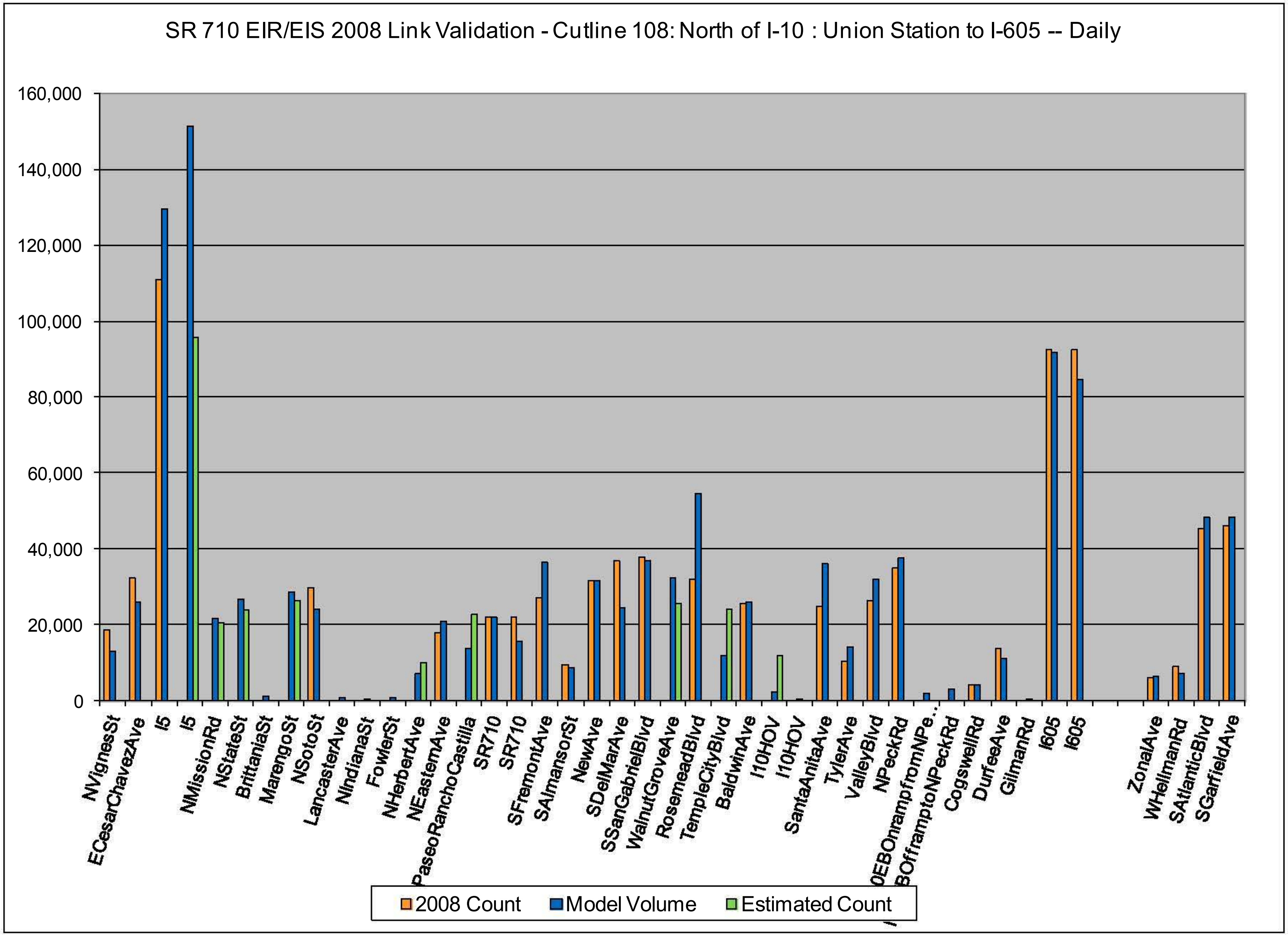
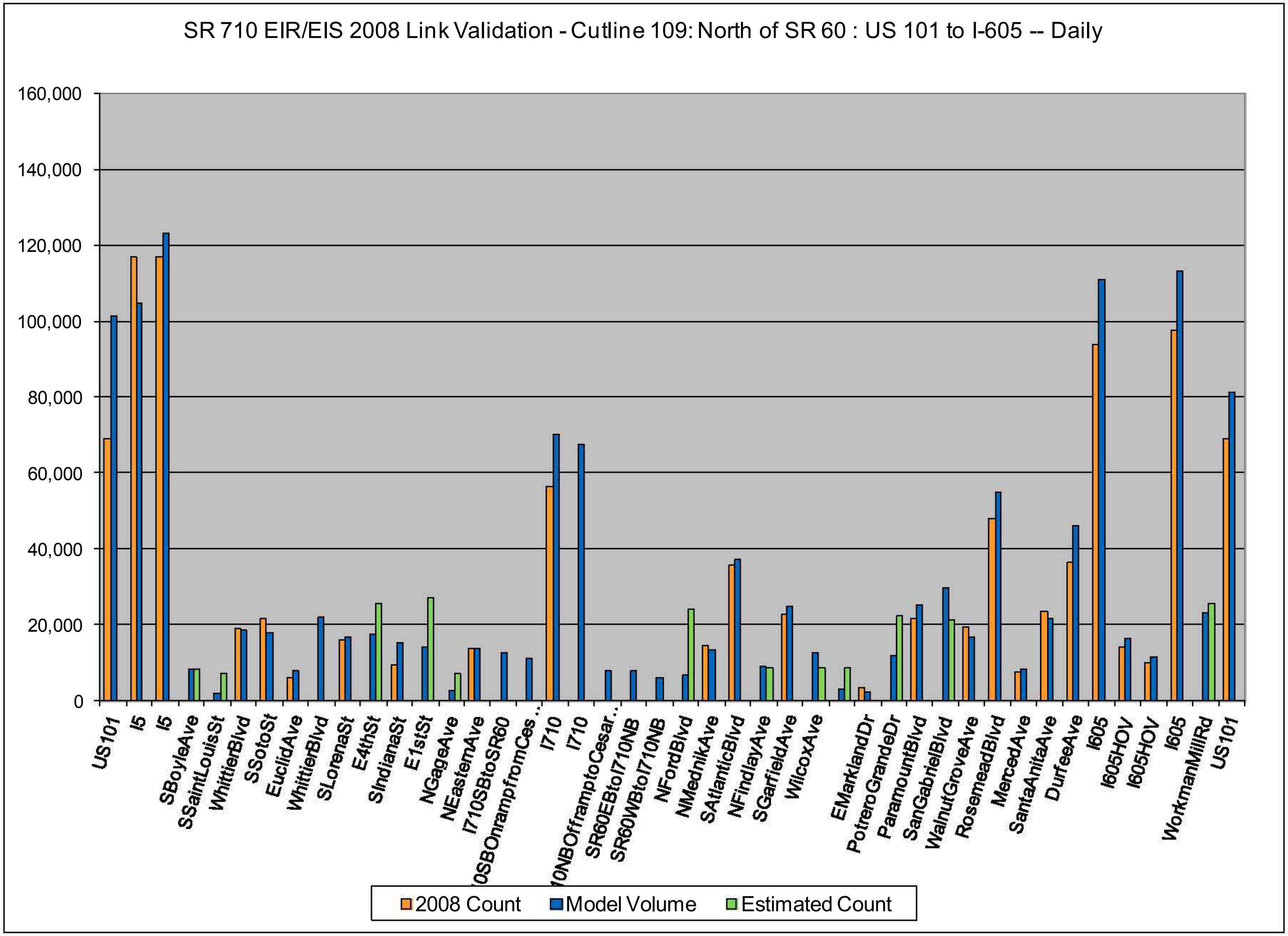


FIGURE 2B-27
Daily Model Results to Traffic Counts at Cutline 109


SR 710 EIR/EIS 2008 Link Validation - Cutline 109: North of SR 60 : US 101 to I-605 -- Daily
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
US101
I5
I5
SBoyleAve
SSaintLouisSt
WhittierBlvd
SSotoSt
EuclidAve
WhittierBlvd
SLorenaSt
E4thSt
SIndianaSt
E1stSt
NGageAve
NEasternAve
I710SBtoSR60
WorkmanMillRd
US101
2008 Count
Model Volume
Estimated Count

Attachment 3
SR 710 EIR/EIS Metro Transit Model Validation Technical Memorandum

SR 710 EIR/EIS: Metro Transit Model Validation Technical Memorandum

PREPARED FOR:	TAC Members Michelle Smith/Metro
COPY TO:	Caltrans
PREPARED BY:	CH2M HILL Team
DATE:	May 3, 2012
PROJECT NUMBER:	428908

This memorandum describes the validation of the Los Angeles County Metropolitan Transportation Authority Transportation Analysis Model (LACMTA Model) for use in preparing transit ridership forecasts in the second screen of Part 1 (Alternatives Analysis) of the SR 710 EIR/EIS. A feedback test of the transit elements of the "Blended Model" process is also presented.

The LACMTA Model is used because it has already been reviewed by the Federal Transit Administration (FTA) for use in Section 5309 New Starts forecasts. It is consistent with SCAG socioeconomic and transportation network data with additional detail in Los Angeles County and is used in supporting FTA transit New Starts and Measure R projects in Los Angeles County. The current LACMTA model was reviewed by FTA staff in the summer of 2009, and the model structure, calibration, and validation were found to be acceptable. Please note, however, that FTA staff do not formally approve models, they only approve the resulting forecasts.

Validation Methodology

The LACMTA, or Metro, Model was validated to ensure that it replicates observed transit travel in the SR 710 EIR/EIS study area. The validation involved comparing modeled to observed person and transit linked trips, transit boardings, and travel times. The validation discussed in this memo focused on transit services in the SR 710 study area as shown in Figure 1.

For the travel demand model validation effort, the following data were available:

- 2001 Metro On-Board survey (includes line level daily boardings for bus and rail);
- 2001-2008 System Level Metro Boardings data (includes bus and rail);
- 2008 Metrolink line level daily passenger counts;
- Municipal Operator (Muni) counts; and
- Bus travel times from currently available timetables.

FIGURE 1
SR 710 Study Area

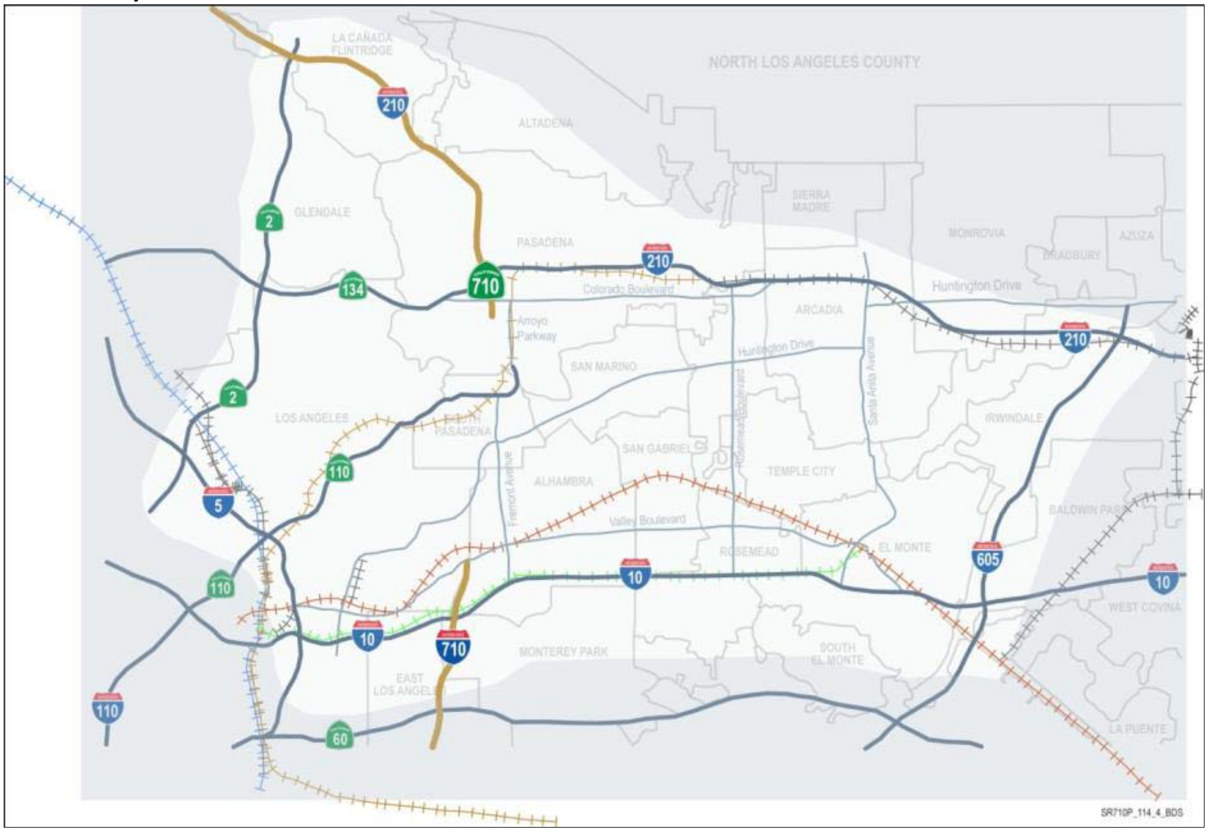
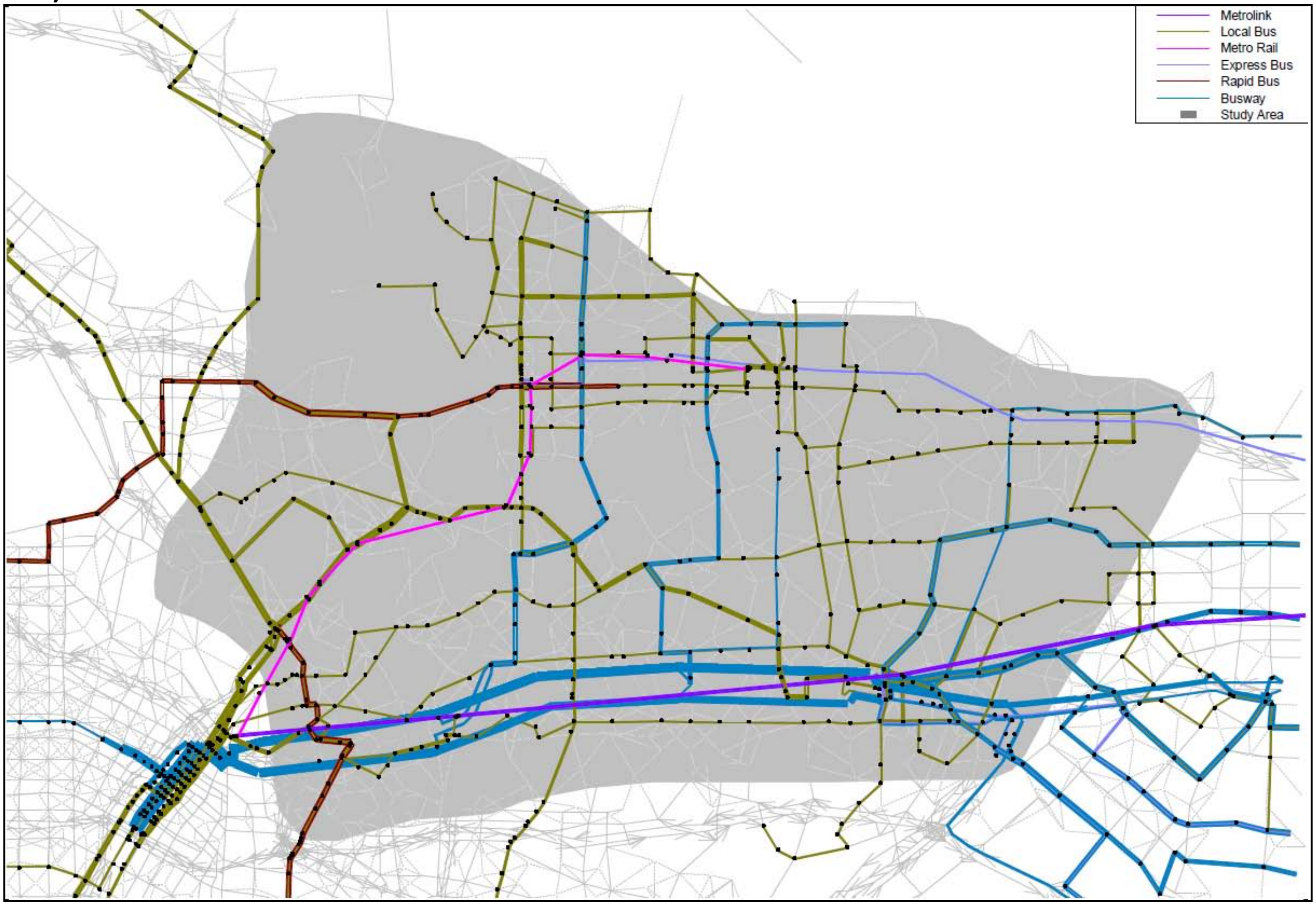


Table 1 and Figure 2 show selected transit routes in the study area. These routes selected for validation comparisons were based initially on those identified in each corridor of Metro's *State Route 710 Gap Closure Transit Profile Study* as well as additional routes indentified by the study team. While there are other routes in Metro's and municipal operator systems, those routes that did not exist in 2006 or had no available count data are not summarized in this document as part of the validation exercise. Timetables for bus services operating in the study area were obtained from operator websites. The timetables provide the expected travel times for services by route and time of day. 2006 Headways are reported because that is the calibration year for the Metro model. There are multiple routes on the El Monte busway.

TABLE 1
Study Area Routes Examined in Validation

			2006 Headway (minutes)	
Operator (Route Type)	**Route**	**Description**	**Peak**	**Off-Peak**
Metrolink	703	San Bernardino to Union Station	30	60
Metro Rail - Gold Line	804	Sierra Madre Villa to Union Station	20	25
Metro Bus (Local)	38	17th/Broadway to Washington/Fairfax Transit Hub via W. Jefferson Boulevard	7	15
Metro Bus (Local)	45	Lincoln Heights - Downtown Los Angeles - Rosewood via Broadway	15	25
Metro Bus (Local)	70	Downtown Los Angeles to El Monte via Garvey Avenue	6	12
Metro Bus (Local)	76	Downtown Los Angeles to El Monte via Valley Boulevard	10	15
Metro Bus (Local)	78	Downtown Los Angeles to Arcadia via Las Tunas Drive & Huntington Drive	14	24
Metro Bus (Local)	81	Eagle Rock to Downtown Los Angeles: Harbor Freeway Station via Figueroa	12	20
Metro Bus (Local)	90	Downtown Los Angeles to Sunland via Glendale Avenue/Foothill Boulevard	12	60
Metro Bus (Local)	94	Downtown Los Angeles to Sun Valley via San Fernando Road	12	30
Metro Bus (Local)	176	Highland Park to El Monte Station via Mission Street & Mission Drive	52	52
Metro Bus (Local)	180	Glendale to Pasadena via Los Feliz Boulevard & Colorado Boulevard	15	20
Metro Bus (Local)	251	Cypress Park to Lynwood via Soto Street	8	15
Metro Bus (Local)	260	Altadena to Artesia Blue Line Station via Fair Oaks Avenue & Atlantic Boulevard	15	60
Metro Bus (Local)	264	Altadena to Duarte	60	60
Metro Bus (Local)	267	Altadena to El Monte	30	32
Metro Bus (Local)	268	La Cañada Flintridge to El Monte via Baldwin Avenue & Washington Boulevard	36	60
Foothill (Local)	178	Puente Hills Mall to El Monte Station	30	30
Foothill (Local)	187	Montclair - Claremont - Glendora - Pasadena	20	20
Foothill (Local)	269	El Monte Station –to Montebello Town Center	30	30
Foothill (Local)	272	Duarte - Baldwin Park - West Covina	60	60
Foothill (Local)	482	Pomona - Rowland Heights - Puente Hills Mall	30	30
Foothill (Local)	486	Pomona - La Puente - El Monte Via Amar Road	25	15
Foothill (Local)	488	Glendora - West Covina - El Monte	60	60
Foothill (Local)	492	Montclair to Arcadia - El Monte via Arrow Highway	30	30
Foothill (Local)	690	Montclair to Pasadena via I-210 Freeway Corridor	30	-
El Monte Busway	-	Many Routes	-	-

FIGURE 2
Study Area Routes Examined in Validation



The trip tables were evaluated in three distinct areas: the study area, remaining Los Angeles County, and other counties. The data are used for a comparison of observed and modeled home-based work (HBW) transit trips as an initial check on the model's performance in the study area. Table 1 shows the number of daily HBW person trips compared to year 2000 US Census Transportation Planning Package (CTPP) Journey to Work data. These data have been scaled so that the region-wide model trip total is the same as the US Census control total. Table 2 shows a similar comparison for modeled work transit trips. These comparisons show reasonable agreement of modeled versus observed linked trips in the study area consistent with Metro's overall model calibration. Absolute differences are shown in lieu of percent differences in both tables to illustrate order of magnitude differences.

TABLE 1
2006 Daily Work Person Trip Comparison – Scaled CTPP 2000 vs. Modeled HBW Trips

CTPP 2000 (Scaled to Modeled2006 HBW Regional Daily Trips)

		1	2	3	4	5	6	
	From\To	SR 710 Study Area	Other L.A. County	Orange County	Ventura County	San Bernardino County	Riverside County	Total
1	SR 710 Study Area	312,942	393,930	17,238	2,259	7,124	1,961	**735,454**
2	Other L.A. County	310,675	4,179,838	224,992	45,905	54,534	12,066	**4,828,010**
3	Orange County	19,034	260,698	1,574,578	1,100	14,252	17,277	**1,886,940**
4	Ventura County	4,132	99,352	1,230	376,188	459	248	**481,610**
5	San Bernardino County	27,702	140,502	43,692	921	638,939	78,122	**929,877**
6	Riverside County	6,488	49,071	77,999	337	90,594	587,429	**811,918**
	Total	**680,973**	**5,123,392**	**1,939,730**	**426,710**	**805,901**	**697,103**	**9,673,809**

Modeled Year 2006 HBW Person Trips

		1	2	3	4	5	6	
	From\To	SR 710 Study Area	Other L.A. County	Orange County	Ventura County	San Bernardino County	Riverside County	Total
1	SR 710 Study Area	306,471	390,754	17,747	2,146	7,738	2,339	**727,194**
2	Other L.A. County	325,165	4,107,006	226,521	49,672	62,039	12,910	**4,783,313**
3	Orange County	18,197	239,368	1,516,563	1,182	13,276	16,004	**1,804,591**
4	Ventura County	3,959	91,006	1,300	370,713	586	278	**467,842**
5	San Bernardino County	29,664	143,310	44,257	827	666,831	84,346	**969,235**
6	Riverside County	7,055	50,649	82,425	279	104,311	676,918	**921,635**
	Total	**690,510**	**5,022,091**	**1,888,813**	**424,819**	**854,781**	**792,795**	**9,673,809**

Difference (Model-CTPP)

		1	2	3	4	5	6	
	From\To	SR 710 Study Area	Other L.A. County	Orange County	Ventura County	San Bernardino County	Riverside County	Total
1	SR 710 Study Area	-6,471	-3,176	509	-114	614	378	**-8,260**
2	Other L.A. County	14,489	-72,833	1,529	3,767	7,506	844	**-44,697**
3	Orange County	-838	-21,330	-58,015	82	-976	-1,273	**-82,350**
4	Ventura County	-174	-8,347	69	-5,474	126	31	**-13,768**
5	San Bernardino County	1,962	2,808	565	-94	27,892	6,225	**39,358**
6	Riverside County	567	1,578	4,426	-58	13,717	89,488	**109,717**
	Total	**9,537**	**-101,300**	**-50,918**	**-1,891**	**48,880**	**95,692**	**0**

TABLE 2
2006 Daily Transit Work Person Trip Comparison – Scaled CTPP 2000 Transit Trips vs. Modeled HBW Transit Trips

CTPP 2000 Transit Trips (Scaled to Modeled 2006 HBW Regional Daily Transit Trips).

		1	2	3	4	5	6	
	From\To	SR 710 Study Area	Other L.A. County	Orange County	Ventura County	San Bernardino County	Riverside County	Total
1	SR 710 Study Area	25,402	42,679	420	60	148	0	68,709
2	Other L.A. County	28,609	468,936	4,675	946	1,340	233	504,739
3	Orange County	658	8,399	74,292	25	67	81	83,522
4	Ventura County	104	2,637	97	5,113	0	0	7,951
5	San Bernardino County	1,868	8,540	617	0	16,573	577	28,174
6	Riverside County	372	2,603	2,303	0	656	12,291	18,224
	Total	57,013	533,794	82,403	6,144	18,783	13,182	711,320

Modeled Year 2006 HBW Transit Person Trips

		1	2	3	4	5	6	
	From\To	SR 710 Study Area	Other L.A. County	Orange County	Ventura County	San Bernardino County	Riverside County	Total
1	SR 710 Study Area	23,938	42,749	606	360	425	67	68,145
2	Other L.A. County	30,051	466,668	10,527	1,738	2,434	266	511,685
3	Orange County	744	12,487	74,247	65	71	163	87,778
4	Ventura County	184	2,378	14	3,663	5	0	6,245
5	San Bernardino County	1,686	9,066	1,304	26	14,440	379	26,901
6	Riverside County	230	1,877	2,586	2	282	5,590	10,567
	Total	56,833	535,224	89,286	5,854	17,657	6,465	711,320

Difference (Model-CTPP)

		1	2	3	4	5	6	
	From\To	SR 710 Study Area	Other L.A. County	Orange County	Ventura County	San Bernardino County	Riverside County	Total
1	SR 710 Study Area	-1,464	69	186	300	277	67	-565
2	Other L.A. County	1,442	-2,269	5,853	792	1,095	33	6,946
3	Orange County	86	4,088	-45	39	4	83	4,256
4	Ventura County	80	-259	-83	-1,450	5	0	-1,706
5	San Bernardino County	-182	526	688	26	-2,133	-198	-1,274
6	Riverside County	-142	-726	284	2	-374	-6,701	-7,658
	Total	-180	1,430	6,883	-290	-1,126	-6,717	0

Table 3 shows general agreement between modeled versus observed average weekday transit linked trips from Metro's 2001 On Board Survey in the SR 710 Study Area for each transit submode in the Metro model:

- Local Bus
- Express Bus
- Commuter Rail
- Urban Rail
- Transitway
- Rapid Bus

Table 5 is a summary of a comparison of modeled versus observed route boardings for the services identified in Table 1. This comparison showed modeled bus ridership was higher than observed for some routes and lower for others. Table 6 is an additional comparison of modeled versus observed run times. The running time for most routes is estimated to within 30 percent of scheduled running times. This level of precision is not uncommon in regional travel forecasting models and is sufficient to support alternative screening. Later analysis efforts should seek to refine estimates of transit running times to better match observed conditions.

TABLE 3

Year 2001 Observed versus 2006 Modeled Average Weekday Transit Linked Trips by Production and Attraction Area and Transit Sub-Mode

Total

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	39,806	53,288	772	0	306	36	94,207
2	Other L.A. County	43,126	653,797	13,732	118	682	305	711,760
3	Orange County	752	13,612	144,345	11	68	209	158,997
4	Ventura County	138	1,214	24	39	2	0	1,417
5	San Bernardino County	1,431	7,261	622	4	168	5	9,490
6	Riverside County	162	2,660	2,758	0	12	30	5,623
	Total	85,414	731,832	162,253	172	1,238	585	981,494

Total

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	37,797	59,403	794	71	650	61	98,776
2	Other L.A. County	44,825	795,306	16,687	860	4,721	255	862,654
3	Orange County	1,065	22,762	125,776	31	110	282	150,026
4	Ventura County	158	2,327	48	6,878	12	0	9,423
5	San Bernardino County	1,875	10,910	701	8	29,193	696	43,383
6	Riverside County	156	1,309	2,320	0	774	10,582	15,141
	Total	85,876	892,017	146,326	7,849	35,459	11,876	1,179,402

Transit

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	-2,008	6,115	22	71	344	26	4,569
2	Other L.A. County	1,699	141,509	2,955	742	4,039	-51	150,894
3	Orange County	313	9,150	-18,569	20	42	73	-8,971
4	Ventura County	20	1,113	24	6,839	10	0	8,006
5	San Bernardino County	444	3,649	79	4	29,025	691	33,893
6	Riverside County	-7	-1,351	-438	0	762	10,552	9,518
	Total	462	160,185	-15,927	7,677	34,221	11,291	197,908

Local Bus

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	32,010	33,279	257	0	0	0	65,545
2	Other L.A. County	26,592	420,695	5,528	39	14	9	452,878
3	Orange County	15	2,992	143,317	0	15	13	146,353
4	Ventura County	0	11	0	16	0	0	27
5	San Bernardino County	24	247	29	0	55	0	356
6	Riverside County	0	46	148	0	0	0	194
	Total	58,641	457,270	149,279	55	85	22	665,353

Local Bus

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	33,157	39,088	526	1	316	0	73,088
2	Other L.A. County	31,448	560,015	13,604	79	1,818	8	606,971
3	Orange County	481	12,426	119,784	0	6	0	132,697
4	Ventura County	2	124	0	6,221	0	0	6,347
5	San Bernardino County	265	1,931	1	0	27,649	502	30,348
6	Riverside County	1	27	0	0	686	10,278	10,991
	Total	65,354	613,612	133,915	6,301	30,474	10,788	860,443

Local Bus

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	1,148	5,810	269	1	316	0	7,543
2	Other L.A. County	4,855	139,320	8,076	40	1,803	-1	154,093
3	Orange County	466	9,433	-23,533	0	-9	-13	-13,656
4	Ventura County	2	114	0	6,205	0	0	6,321
5	San Bernardino County	240	1,684	-28	0	27,593	502	29,992
6	Riverside County	1	-19	-148	0	686	10,278	10,797
	Total	6,713	156,341	-15,365	6,246	30,389	10,765	195,090

Express Bus

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	894	1,212	26	0	0	0	2,132
2	Other L.A. County	1,188	33,277	264	0	0	0	34,730
3	Orange County	7	93	118	0	0	0	217
4	Ventura County	0	0	0	0	0	0	0
5	San Bernardino County	0	47	0	0	0	0	47
6	Riverside County	0	72	0	0	0	0	72
	Total	2,089	34,700	408	0	0	0	37,198

Express Bus

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	438	1,967	47	15	4	0	2,132
2	Other L.A. County	2,002	28,283	725	305	37	23	34,730
3	Orange County	47	1,229	4,403	0	4	192	217
4	Ventura County	20	700	8	550	0	0	0
5	San Bernardino County	50	179	20	0	306	105	47
6	Riverside County	0	2	241	0	0	87	72
	Total	2,557	32,358	5,444	871	352	408	37,198

Express Bus

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	-456	755	21	15	4	0	0
2	Other L.A. County	814	-4,994	461	305	37	23	0
3	Orange County	40	1,136	4,285	0	4	192	0
4	Ventura County	20	700	8	550	0	0	0
5	San Bernardino County	50	132	20	0	306	105	0
6	Riverside County	0	-70	241	0	0	87	0
	Total	468	-2,342	5,035	871	352	408	0

Commuter Rail

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	12	345	107	0	266	36	766
2	Other L.A. County	948	10,196	631	79	668	264	12,786
3	Orange County	328	3,983	431	11	53	196	5,001
4	Ventura County	102	963	24	10	2	0	1,100
5	San Bernardino County	1,371	5,727	592	4	113	5	7,811
6	Riverside County	162	2,054	2,610	0	12	30	4,868
	Total	2,924	23,266	4,396	103	1,113	531	32,332

Commuter Rail

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	272	1,447	29	6	50	57	1,861
2	Other L.A. County	1,211	10,304	193	55	309	150	12,221
3	Orange County	279	3,196	1,481	7	46	90	5,098
4	Ventura County	88	970	5	107	2	0	1,172
5	San Bernardino County	1,205	5,373	565	2	1,213	88	8,447
6	Riverside County	149	986	2,077	0	88	217	3,516
	Total	3,203	22,275	4,349	176	1,709	602	32,316

Commuter Rail

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	260	1,103	-79	6	-216	21	1,095
2	Other L.A. County	262	108	-438	-24	-358	-114	-565
3	Orange County	-49	-787	1,050	-4	-7	-106	97
4	Ventura County	-14	8	-19	98	0	0	72
5	San Bernardino County	-166	-354	-28	-2	1,101	84	635
6	Riverside County	-14	-1,068	-533	0	76	187	-1,352
	Total	280	-991	-46	73	597	71	-17

Urban Rail

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	442	7,395	274	0	0	0	8,111
2	Other L.A. County	7,102	142,497	7,046	0	0	32	156,676
3	Orange County	403	6,513	479	0	0	0	7,395
4	Ventura County	36	212	0	14	0	0	262
5	San Bernardino County	0	726	0	0	0	0	726
6	Riverside County	0	477	0	0	0	0	477
	Total	7,982	157,820	7,799	14	0	32	173,647

Urban Rail

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	1,143	7,272	40	9	34	3	8,501
2	Other L.A. County	5,530	149,253	1,457	165	667	66	157,139
3	Orange County	147	4,196	92	17	8	0	4,461
4	Ventura County	45	515	35	0	10	0	605
5	San Bernardino County	28	950	7	0	0	0	986
6	Riverside County	6	288	2	0	0	0	296
	Total	6,900	162,474	1,633	192	720	70	171,989

Urban Rail

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	701	-123	-234	9	34	3	390
2	Other L.A. County	-1,572	6,756	-5,589	165	667	35	463
3	Orange County	-255	-2,317	-387	17	8	0	-2,934
4	Ventura County	9	303	35	-14	10	0	344
5	San Bernardino County	28	224	7	0	0	0	260
6	Riverside County	6	-189	2	0	0	0	-181
	Total	-1,082	4,654	-6,166	178	720	38	-1,658

Transitway

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	6,420	9,582	107	0	40	0	16,149
2	Other L.A. County	5,809	24,645	263	0	0	0	30,717
3	Orange County	0	30	0	0	0	0	30
4	Ventura County	0	0	0	0	0	0	0
5	San Bernardino County	35	515	0	0	0	0	550
6	Riverside County	0	11	0	0	0	0	11
	Total	12,264	34,784	370	0	40	0	47,458

Transitway

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	2,781	7,895	151	40	246	1	11,114
2	Other L.A. County	3,943	24,711	669	248	1,883	7	31,461
3	Orange County	111	1,610	15	6	45	0	1,788
4	Ventura County	3	6	0	0	0	0	9
5	San Bernardino County	327	2,476	108	6	24	0	2,941
6	Riverside County	0	6	0	0	0	0	7
	Total	7,165	36,704	944	301	2,198	9	47,321

Transitway

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	-3,639	-1,688	44	40	206	1	-5,035
2	Other L.A. County	-1,866	66	406	248	1,883	7	744
3	Orange County	111	1,580	15	6	45	0	1,758
4	Ventura County	3	6	0	0	0	0	9
5	San Bernardino County	291	1,961	108	6	24	0	2,391
6	Riverside County	0	-5	0	0	0	0	-5
	Total	-5,099	1,921	573	301	2,158	9	-138

Rapid Bus

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	28	1,476	0	0	0	0	1,504
2	Other L.A. County	1,486	22,486	0	0	0	0	23,973
3	Orange County	0	0	0	0	0	0	0
4	Ventura County	0	29	0	0	0	0	29
5	San Bernardino County	0	0	0	0	0	0	0
6	Riverside County	0	0	0	0	0	0	0
	Total	1,514	23,992	0	0	0	0	25,506

Rapid Bus

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	5	1,734	1	0	0	0	1,740
2	Other L.A. County	691	22,741	40	8	6	0	23,485
3	Orange County	1	106	0	0	0	0	106
4	Ventura County	0	12	0	0	0	0	12
5	San Bernardino County	0	1	0	0	0	0	1
6	Riverside County	0	0	0	0	0	0	0
	Total	696	24,593	41	8	6	0	25,344

Rapid Bus

	From\To	1 SR 710 Study Area	2 Other L.A. County	3 Orange County	4 Ventura County	5 San Bernardino County	6 Riverside County	Total
1	SR 710 Study Area	-23	258	1	0	0	0	236
2	Other L.A. County	-796	255	40	8	6	0	-487
3	Orange County	1	106	0	0	0	0	106
4	Ventura County	0	-17	0	0	0	0	-17
5	San Bernardino County	0	1	0	0	0	0	1
6	Riverside County	0	0	0	0	0	0	0
	Total	-818	601	41	8	6	0	-162

TABLE 4
Year 2006 Average Weekday Modeled versus Observed Boardings for Selected Study Area Routes

		2006 Observed			2006 Model			Difference			% Difference		
Operator	**Route**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**
Metrolink	703	-	-	13,003	12,870	1,258	14,128	-	-	1,125	-	-	**9%**

		2006 Observed			2006 Model			Difference			% Difference		
Operator	**Route**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**
Metro Rail - Gold Line	804	11,577	5,201	16,778	13,808	7,498	21,306	2,231	2,297	4,528	**19%**	**44%**	**27%**

		2006 Observed			2006 Model			Difference			% Difference		
Operator	**Route**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**
Metro Bus	38	7,436	4,367	11,803	15,771	6,497	22,268	8,335	2,130	10,465	**112%**	**49%**	**89%**
Metro Bus	45	17,839	10,477	28,317	7,121	1,584	8,705	-10,718	-8,893	-19,612	**-60%**	**-85%**	**-69%**
Metro Bus	70	10,900	6,402	17,302	24,036	12,169	36,205	13,136	5,767	18,903	**121%**	**90%**	**109%**
Metro Bus	76	7,563	4,442	12,005	11,070	6,136	17,206	3,507	1,694	5,201	**46%**	**38%**	**43%**
Metro Bus	78	7,198	4,227	11,426	6,996	3,312	10,308	-202	-915	-1,118	**-3%**	**-22%**	**-10%**
Metro Bus	81	12,907	7,580	20,488	17,232	8,388	25,620	4,325	808	5,132	**34%**	**11%**	**25%**
Metro Bus	90	4,272	2,509	6,781	5,946	1,177	7,123	1,674	-1,332	342	**39%**	**-53%**	**5%**
Metro Bus	94	9,868	5,795	15,663	17,260	5,800	23,060	7,392	5	7,397	**75%**	**0%**	**47%**
Metro Bus	176	1,091	641	1,732	296	175	471	-795	-466	-1,261	**-73%**	**-73%**	**-73%**
Metro Bus	180	12,331	7,242	19,573	8,526	4,891	13,417	-3,805	-2,351	-6,156	**-31%**	**-32%**	**-31%**
Metro Bus	251	14,557	8,550	23,107	13,029	5,019	18,048	-1,528	-3,531	-5,059	**-10%**	**-41%**	**-22%**
Metro Bus	260	11,570	6,795	18,365	17,715	327	18,042	6,145	-6,468	-323	**53%**	**-95%**	**-2%**
Metro Bus	264	532	313	845	16	28	44	-516	-285	-801	**-97%**	**-91%**	**-95%**
Metro Bus	267	1,265	743	2,007	1,447	1,558	3,005	182	815	998	**14%**	**110%**	**50%**
Metro Bus	268	1,584	930	2,515	735	109	844	-849	-821	-1,671	**-54%**	**-88%**	**-66%**

		2010 Observed			2006 Model			Difference			% Difference		
Operator	**Route**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**
Foothill (Local)	178	1,993	1,170	3,163	2,191	2,566	4,757	198	1,396	1,594	**10%**	**119%**	**50%**
Foothill (Local)	187	389	228	617	7,090	8,213	15,303	6,701	7,985	14,686	**1724%**	**3498%**	**2380%**
Foothill (Local)	269	319	187	506	136	268	404	-183	81	-102	**-57%**	**43%**	**-20%**
Foothill (Local)	272	206	121	327	120	136	256	-86	15	-71	**-42%**	**12%**	**-22%**
Foothill (Local)	482	2,398	1,408	3,806	274	1,047	1,321	-2,124	-361	-2,485	**-89%**	**-26%**	**-65%**
Foothill (Local)	486	2,955	1,736	4,691	871	3,549	4,420	-2,084	1,813	-271	**-71%**	**104%**	**-6%**
Foothill (Local)	488	1,232	723	1,955	376	392	768	-856	-331	-1,187	**-69%**	**-46%**	**-61%**
Foothill (Local)	492	1,658	974	2,632	2,690	3,120	5,810	1,032	2,146	3,178	**62%**	**220%**	**121%**
Foothill (Local)	690	296	-	296	799	-	799	503	-	503	**170%**	-	**170%**

		Observed (1)			2006 Model			Difference			% Difference		
Operator	**Route**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**
Foothill (Busway)		66,016	8,845	74,861	52,737	10,570	63,307	-7,523	2,559	-4,964	**-11%**	**29%**	**-7%**
Metro (Busway)					5,756	834	6,590						

		2010 Observed			2006 Model			Difference			% Difference		
Operator	**Route**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**
El Monte Trolleys	EM	-	-	2,171	21	103	124	-	-	-2,047	-	-	**-94%**
Pasadena ARTS	PA	-	-	5,298	656	846	1,502	-	-	-3,796	-	-	**-72%**

Note: (1) Foohill (Busway) is from 2001 On-board survey, El Monte Trolley and Pasadena ARTA are 2010 data from respective agencies

Total Selected Routes by Operator in Study Area

		Observed			2006 Model			Difference			% Difference		
Operator		**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**
Metrolink		-	-	13,003	12,870	1,258	14,128	-	-	1,125	-	-	**9%**
Metro Rail		11,577	5,201	16,778	13,808	7,498	21,306	2,231	2,297	4,528	**19%**	**44%**	**27%**
Metro Bus		120,914	71,013	191,928	147,196	57,170	204,366	26,282	-13,843	12,438	**22%**	**-19%**	**6%**
Foothill (Local)		11,445	6,548	17,993	14,547	19,291	33,838	3,102	12,743	15,845	**27%**	**195%**	**88%**
El Monte Busway (Metro + Foothill)		66,016	8,845	74,861	58,493	11,404	69,897	-7,523	2,559	-4,964	**-11%**	**29%**	**-7%**
El Monte Trolleys		-	-	2,171	21	103	124	-	-	-2,047	-	-	**-94%**
Pasadena ARTS		-	-	5,298	656	846	1,502	-	-	-3,796	-	-	**-72%**
Total Selected Routes in Study Area				322,032			345,161			23,129			**7%**

TABLE 5
Year 2006 Average Weekday Modeled Versus Observed Run Times (Minutes)

		2012 Observed		2006 Model		Difference		% Difference	
Operator	Route	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Metrolink	703	90	90	79	79	-11	-11	-13%	-13%

		2012 Observed		2006 Model		Difference		% Difference	
Operator	Route	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Metro Rail - Gold Line	804	29	29	36	36	7	7	23%	23%

		2009 Observed		2006 Model		Difference		% Difference	
Operator	Route	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Metro Bus	38	41	41	37	42	-4	1	-10%	2%
Metro Bus	45	67	75	64	68	-3	-7	-5%	-9%
Metro Bus	70	77	81	69	79	-8	-1	-11%	-2%
Metro Bus	76	79	82	81	76	2	-6	3%	-7%
Metro Bus	78	73	80	70	83	-3	4	-4%	5%
Metro Bus	81	90	100	86	88	-4	-12	-4%	-12%
Metro Bus	90	90	95	112	113	21	18	23%	19%
Metro Bus	94	89	93	111	116	21	23	24%	24%
Metro Bus	176	37	55	55	60	18	5	49%	10%
Metro Bus	180	85	97	77	68	-8	-28	-10%	-29%
Metro Bus	251	64	75	57	55	-7	-20	-11%	-27%
Metro Bus	260	102	112	90	96	-12	-16	-12%	-15%
Metro Bus	264	50	58	45	55	-5	-3	-11%	-6%
Metro Bus	267	64	65	63	73	-2	8	-2%	12%
Metro Bus	268	57	79	61	72	4	-7	7%	-9%
Metro Rapid	751	44	45	51	52	8	7	17%	15%
Metro Rapid	780	92	104	74	78	-17	-26	-19%	-25%

		2012 Observed		2006 Model		Difference		% Difference	
Operator	Route	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
Foothill (Local)	178	84	95	106	81	22	-14	26%	-15%
Foothill (Local)	187	135	141	163	111	28	-30	21%	-21%
Foothill (Local)	269	21	21	21	19	0	-2	0%	-10%
Foothill (Local)	272	43	41	54	41	11	0	26%	0%
Foothill (Local)	482	75	72	78	81	3	9	3%	13%
Foothill (Local)	486	64	62	45	55	-19	-7	-30%	-11%
Foothill (Local)	488	77	78	80	67	3	-11	4%	-14%
Foothill (Local)	492	88	80	115	83	27	3	31%	4%
Foothill (Local)	690	80	-	78	-	-2	-	-3%	-

Improving the modeled bus travel speeds in the study area could potentially improve modeled bus ridership. In the Metro model, bus travel time is determined using "INET" functions that link bus travel time to the highway network travel time, with different functions for peak and off-peak periods, and for different types of bus (local bus, rapid bus, etc). Some test adjustments were made to the INET functions for specific groups of bus lines in the SR 710 Study Area so that the model calibration elsewhere was not significantly affected. These bus speed adjustments did not significantly improve modeled bus boarding estimates in the study area when compared to the observed ridership.

Given this, the INET functions from the original Metro model will be used for the Part 1 forecasts. However, transit model validation will be revisited during the next phase when some of the transit alternatives in the alternatives analysis phase have been either been evaluated and/or refined and the relevant markets and associated transit routes may become more focused.

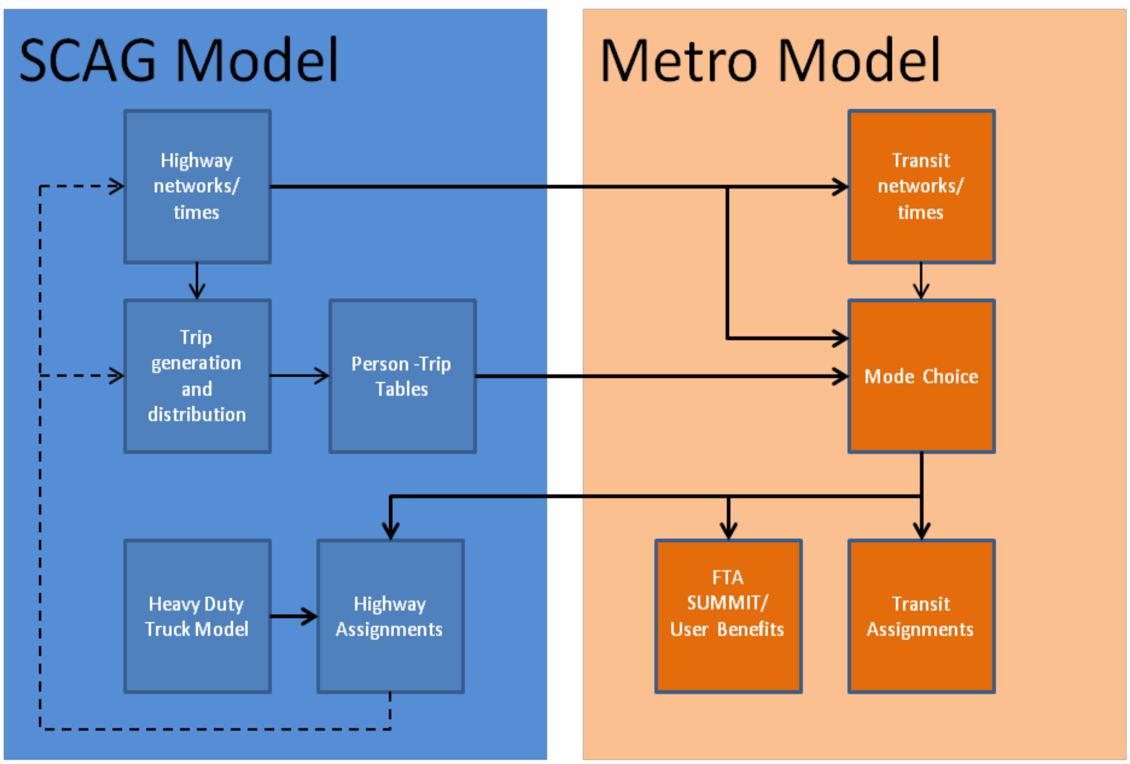
Blended Model Test

A "blended model" approach using the SCAG 2008 RTP model for highway forecasting and the Metro model for transit forecasting is being used to generate forecasts for the SR 710 EIR/EIS. The SCAG and Metro models, while applied individually, have trip table linkages at two places under this approach:

1. The non-work trip tables from the SCAG model are used with the Metro model to account for incremental changes in trip distribution resulting from a "major highway improvement." Because work trips are CTPP based in the Metro model, distribution does not change for home-based work trips.
2. For each model run or alternative, the post-mode choice incremental (defined as the differences between two alternatives) auto trip tables from the Metro model was applied to the SCAG post-mode choice auto trip tables prior to highway assignment. The purpose of this step was to remove new transit riders from the highway trip tables, which will reduce total vehicles on the highway network to reflect auto travelers now using transit. This step was relatively straightforward as the auto classes (Drive alone, Shared Ride 2 persons (SR 2), SR 3+) and highway assignment time periods are the same between the two models. Also, the traffic analysis zone (TAZ) equivalency between the two models is effectively "one to one" in Los Angeles County, where the majority of the transit riders for the build alternatives are expected.

Figure 3 illustrates the "Blended Model" process.

FIGURE 3
Blended Model Process



Tests were run at the two trip table linkages to assess the change in modeled results from the blending of the two models. Table 7 compares the Metro model non-work person trip tables the validation in this memo and after adjustments from the SCAG model validation have been made. Table 8 shows differences in corridor modeled transit boardings between the validation in this memo and a rerun using the new non-work person trip tables. Overall these differences are as expected and small enough not to affect the transit validation.

Table 6
Non-Work Trip Comparison

	Transit Validation 1	Transit Validation 2	Diff	% Diff
HBOPK	14,481,535	14,459,239	-22,296	-0.15%
NHBPK	8,465,947	8,475,469	9,522	0.11%
HBOOP	14,163,157	14,224,528	61,371	0.43%
NHBOP	10,426,251	10,466,145	39,894	0.38%

Where:

Transit Validation 1 = validation run

Transit Validation 2 = validation rerun with Non-Work Trip Tables Adjustment

Non-Work Trip Tables Adjustment =

Non work trip tables from SCAG model corridor validation/Non work trip tables from original SCAG run

TABLE 7
Corridor Boardings Comparison

	Transit Validation 1			Transit Validation 2			Percent Difference		
Operator	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**	**Peak**	**Off-Peak**	**Daily**
Metrolink	12,870	1,258	14,128	12,877	1,258	14,135	0.05%	0.00%	0.05%
Metro Rail - Gold Line	13,808	7,498	21,306	13,864	7,494	21,358	0.41%	-0.05%	0.24%
Total Metro Bus	147,196	57,170	204,366	147,738	56,960	204,698	0.37%	-0.37%	0.16%
Total Foothill	14,547	19,291	33,838	14,594	19,194	33,788	0.32%	-0.50%	-0.15%
Foothill (Busway)	52,737	10,570	63,307	52,896	10,544	63,440	0.30%	-0.25%	0.21%
Metro (Busway)	5,756	834	6,590	5,762	838	6,600	0.10%	0.48%	0.15%
El Monte Trolleys	21	103	124	18	119	137	-14.29%	15.53%	10.48%
Pasadena ARTS	656	846	1,502	663	869	1,532	1.07%	2.72%	2.00%

Where:

Transit Validation 1 = validation run

Transit Validation 2 = validation rerun with Non-Work Trip Tables Adjustment

Non-Work Trip Tables Adjustment =

Non work trip tables from SCAG model corridor validation/Non work trip tables from original SCAG run

Attachment 4
SR 710 EIR/EIS SCAG Truck Model Validation Technical Memorandum

SR 710 EIR/EIS: SCAG Heavy Duty Truck Model Validation Technical Memorandum

PREPARED FOR:	TAC Members
	Michelle Smith/Metro
COPY TO:	Caltrans
PREPARED BY:	CH2M HILL Team
DATE:	April 26, 2012
PROJECT NUMBER:	428908

Introduction

The SCAG Heavy Duty Truck (HDT) model estimates truck trip generation and distribution of the heavy duty trucks within the SCAG region. The HDT model is comprised of three major components:

1. *Internal HDT Model* - The internal HDT model is comprised of trip generation and trip distribution of intra-regional truck trips using procedures similar to those used to generate and distribute person trips. The HDT model forecasts heavy duty trucks in the following three Gross Vehicle Weight (GVW) categories:
   - Light-Heavy (LH) duty trucks (8,500 to 14,000 lbs. Gross Vehicle Weight)
   - Medium-Heavy (MH) duty trucks (14,001 to 33,000 lbs. Gross Vehicle Weight)
   - Heavy-Heavy (HH) duty trucks (more than 33,000 lbs. Gross Vehicle Weight)
2. *External HDT Model* - The external HDT model incorporates trip generation and trip distribution of interregional truck trips based on commodity flow data. The model uses various factors developed from published and survey data to estimate daily truck trips from the annual tonnage flows.
3. *Special Generators* - The special generator model includes the following:
   - *Ports of Long Beach and Los Angeles Truck Trips* - The port truck trips are generated based on the Ports Transportation Analysis Model (PortsTAM). PortsTAM generates bobtail, chassis and container truck trip tables which are aggregated and added to the regional HH duty truck table prior to the traffic assignment.
   - *Airport Truck Trips* - The airport truck trips are generated by the SCAG aviation model for the LH, MH and HH duty trucks for all airports within the SCAG region. The airport truck trip tables are added to the regional heavy duty truck trip tables prior to the traffic assignment.

The HDT truck trips are combined with the auto trip tables and assigned in a multi-vehicle class traffic assignment. The results of traffic assignments for the SCAG model are reported for six vehicle classes:

- Drive alone autos
- Shared ride (2 occupants) autos
- Shared ride (3+ occupants) autos
- LH trucks
- MH trucks
- HH trucks

HDT Model Validation

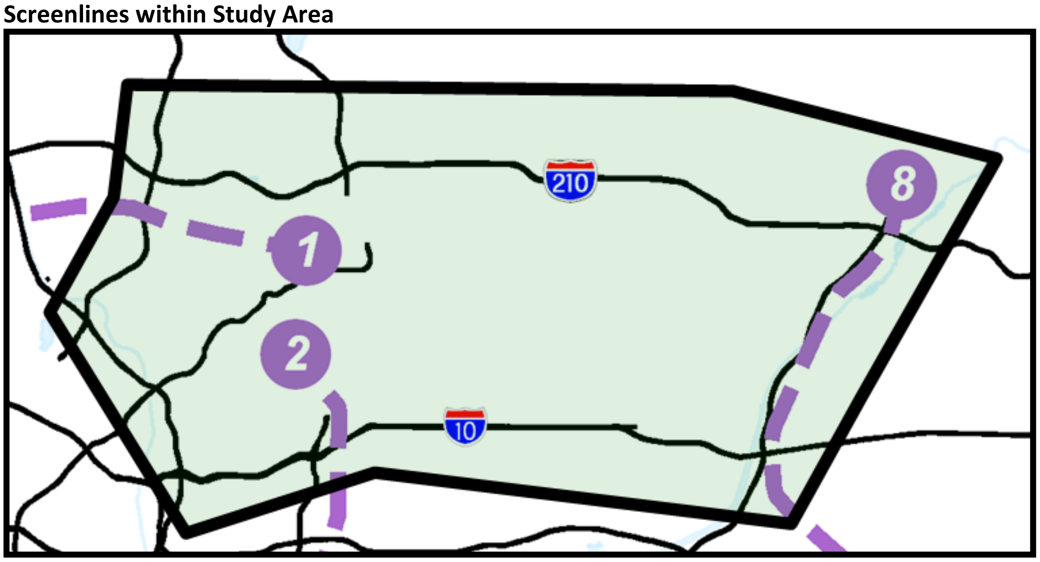
As part of the SR 710 EIR/EIS model development, the HDT component of the model was reviewed and analyzed. The purpose of the review was to assess model validation, focusing on the study area. The validation process is primarily a comparison of model-generated traffic volumes with the observed traffic volumes. Caltrans and the Federal Highway Administration (FHWA) do not have specific guidelines or thresholds of acceptability for the heavy duty truck models. Therefore our approach is to apply Caltrans and FHWA guidelines used in general traffic flow validation. The general model validation guidelines available are the *Caltrans Travel Forecasting Guidelines, November 1992 and Travel Model Improvement Program (TMIP) Model Validation and Reasonableness Checking Manual, September 2010.*

The metrics used to compare the HDT model results with truck counts include:

- Total truck count vs. model comparisons of the AM/PM peak periods and average daily truck traffic on screenlines;
- Corresponding Percent Root Mean Squared Error (%RMSE) of the truck count to model differences; and
- Scatter plots of observed truck volumes versus model volumes.

Due to limited availability of 24-hour vehicle classification counts within the study area, data from the SCAG 2008 regional screenline database were used for the validation checks. The SCAG regional screenlines that cross the SR 710 EIR/EIS study area were used in HDT model validation. The three screenlines shown in Figure 1 are the only screenlines in the study area.

FIGURE 1
SCAG Regional Screenlines within Study Area



Traffic Assignment Model Results

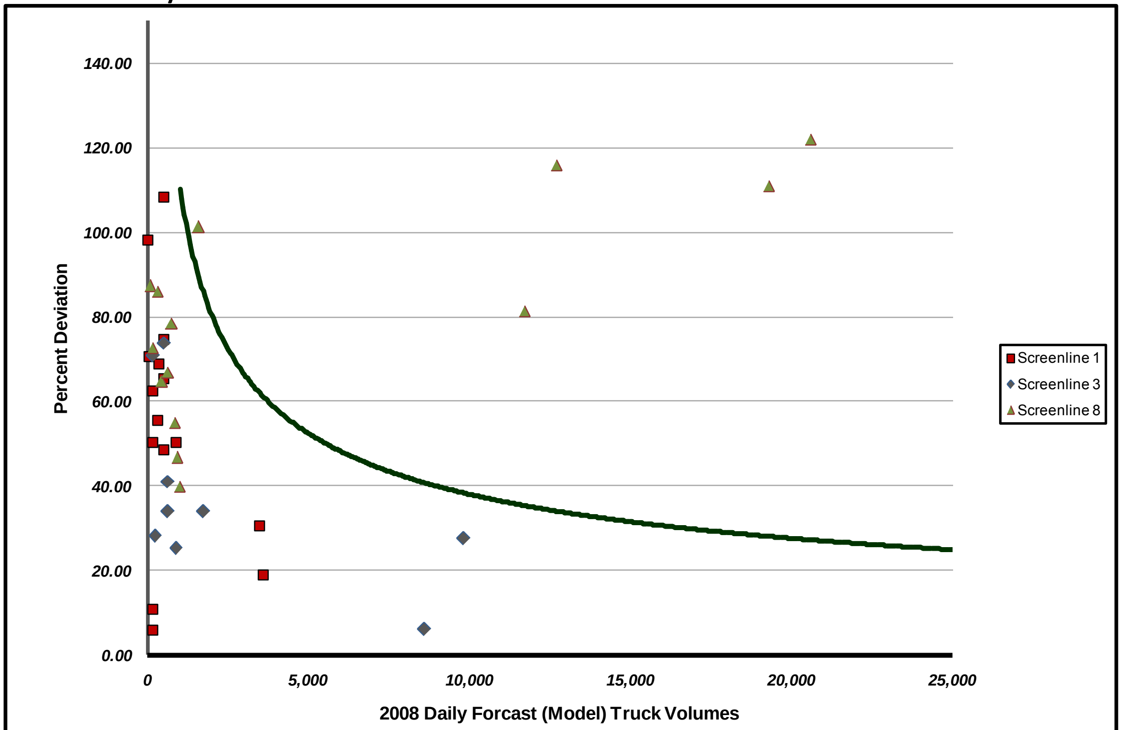
This section of the report is a summary of the model validation results. A comparison of AM/PM peak periods and daily link truck traffic volumes are presented in Figures 2 to 4 and Tables 1 to 3. The truck traffic volumes mostly meet the requirement of the maximum desirable error link criteria with the exception of daily forecast truck volumes on I-10 and I-215 (screenline #8) and PM peak period truck traffic volumes on the westbound direction of I-10 and I-215 (screenline #8).

- The %RMSE is a statistical measure that corrects for the sign of the error. For example, in a set of validation results, sometimes the difference between counts and model results will be positive and sometimes they will be negative. %RMSE adjusts for sign difference and thus provides a better measure for overall error rates.
- Guidelines set for RMSE in the Caltrans and TMIP documents are rather general and varied based on the midpoint of the link volume group. Therefore the study team set a RMSE goal to be below 30% on a daily basis

and 40% for the peak periods. The AM/PM peak periods and daily %RMSE are also included in Tables 1 to 3. The screenlines do not meet the recommended %RMSE.

- In addition to the link-based screenline comparison and %RMSE analysis, system-wide statistics to assess the validity of model forecast traffic assignment was examined. The R^2 (coefficient of determination, or the goodness of the fit) shows how well the model-generated traffic volumes correlate with the observed data. The R^2 results are presented in Figures 2 to 4. The Caltrans guideline value for system-wide R^2 is greater than or equal to 0.88[(1)]. The daily, AM and PM one-way peak period R^2 results are presented in Figures 5 to 7. The screenlines do not meet the minimum R^2 of 0.88.

FIGURE 2
Link Based Daily Traffic Truck Volume Validation



Source: Caltrans Travel Forecasting Guidelines, 1992, Figure 3.9

(1) *Caltrans Travel Forecasting Guidelines, November 1992, Page 67.*

FIGURE 3
Link Based AM Peak Period Truck Traffic Volume Validation

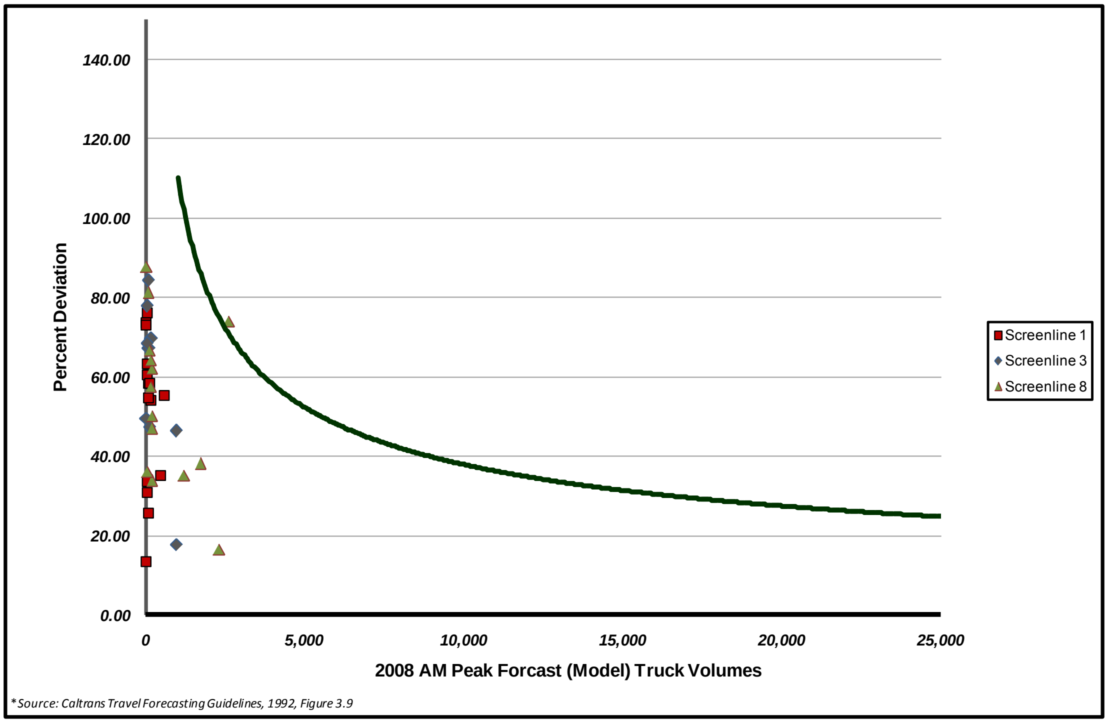


FIGURE 4
Link Based PM Peak Period Truck Traffic Volume Validation

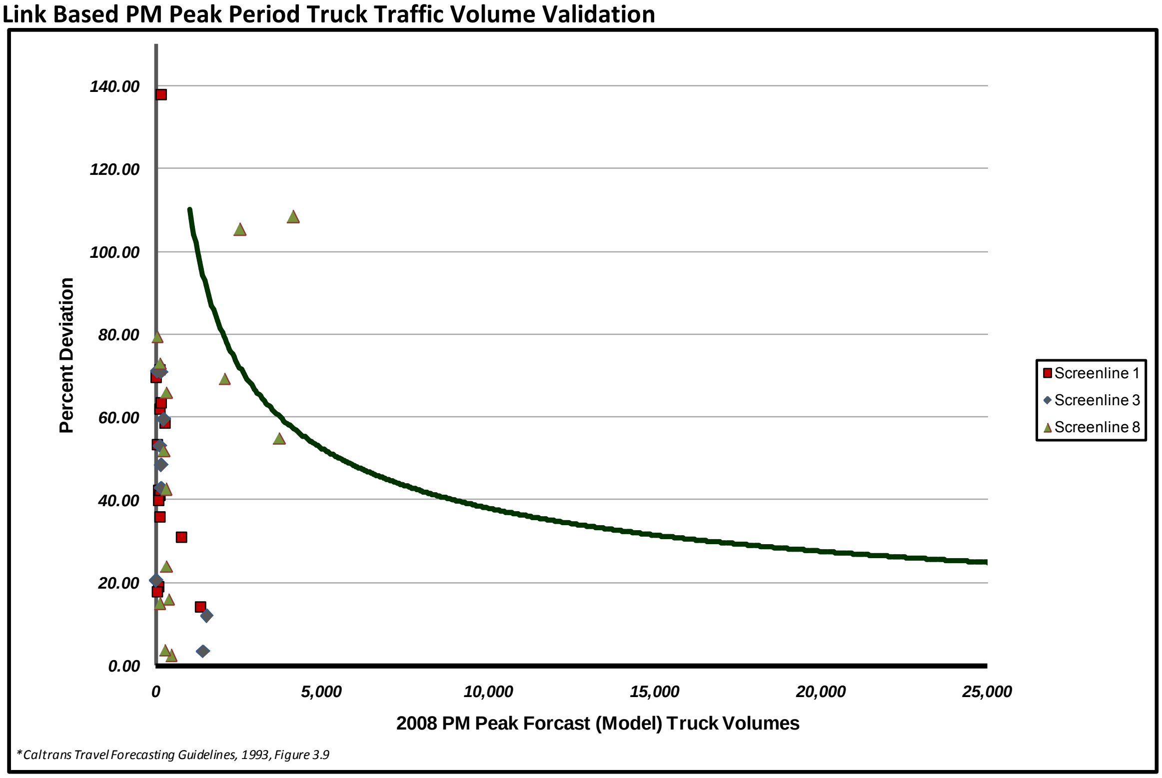


TABLE 1
Daily Peak Period Traffic Volume (Model vs. Truck Count) Comparison

Screenline	Location	Counts	Model	Diff	Diff%
1	GOODWIN AVE	193	172	-21	-11%
1	SAN FERNANDO RD	2,033	519	-1,514	-74%
1	S CENTRAL AVE	1,461	508	-953	-65%
1	S BRAND BLVD	954	492	-462	-48%
1	S GLENDALE AVE	1,086	339	-747	-69%
1	S ADAMS ST	137	40	-97	-71%
1	S CHEVY CHASE DR	353	176	-177	-50%
1	S VERDUGO RD	398	150	-248	-62%
1	S2 (GLENDALE FWY) SB	4,996	3,471	-1,525	-31%
1	S2 (GLENDALE FWY) NB	4,445	3,608	-837	-19%
1	ELLENWOOD DR	318	6	-312	-98%
1	EAGLE ROCK BLVD	704	314	-390	-55%
1	TOWNSEND AVE	142	150	8	6%
1	N FIGUEROA ST	1,754	871	-883	-50%
1	N AVENUE 64	249	518	269	108%
	TOTAL	*19,223*	*11,336*	*-7,887*	*-41%*
	RMSE				*58%*
2	HUNTINGTON DR N	1,057	623	-434	-41%
2	HUNTINGTON DR N	1,970	514	-1,456	-74%
2	CONCORD AVE	178	228	50	28%
2	W MISSION RD	1,166	871	-295	-25%
2	W VALLEY BLVD	2,608	1,722	-886	-34%
2	W HELLMAN AVE	552	161	-391	-71%
2	I 10 (SAN BERNARDINO FWY) WB	8,090	8,592	502	6%
2	I 10 (SAN BERNARDINO FWY) EB	7,692	9,819	2,127	28%
2	CASUDA CANYON DR	93	271	178	191%
2	MONTEREY PASS RD	945	623	-322	-34%
	TOTAL	*24,351*	*23,425*	*-926*	*-4%*
	RMSE				*37%*
8	Royal Oaks Dr	636	81	-555	-87%
8	E Huntington Dr	1,640	985	-655	-40%
8	I- 210 (Foothill Fwy) WB	9,270	20,581	11,311	122%
8	I- 210 (Foothill Fwy) EB	9,146	19,294	10,148	111%
8	Arrow Highway	1,227	433	-794	-65%
8	Live Oak Ave	1,714	914	-800	-47%
8	Rivergrade Rd	784	1,577	793	101%
8	Los Angeles St	1,898	631	-1,267	-67%
8	Ramona Blvd	1,882	847	-1,035	-55%
8	I-10 (San Bernardino Fwy) WB	6,459	11,712	5,253	81%
8	I-10 (San Bernardino Fwy) EB	5,880	12,695	6,815	116%
8	E Temple Ave	2,114	295	-1,819	-86%
8	N Puente Ave	3,457	744	-2,713	-78%
8	Orange Ave	586	160	-426	-73%
	TOTAL	*46,693*	*70,949*	*24,256*	*52%*
	RMSE				*144%*

TABLE 2
AM Peak Period Traffic Volume (Model vs. Truck Count) Comparison

Screenline	Location	Counts	Model	Diff	Diff%
1	GOODWIN AVE	30	39	9	31%
1	SAN FERNANDO RD	330	152	-178	-54%
1	S CENTRAL AVE	237	56	-181	-76%
1	S BRAND BLVD	191	80	-111	-58%
1	S GLENDALE AVE	186	84	-102	-55%
1	S ADAMS ST	28	7	-21	-74%
1	S CHEVY CHASE DR	80	32	-48	-61%
1	S VERDUGO RD	80	29	-51	-63%
1	S2 (GLENDALE FWY) SB	1,280	571	-709	-55%
1	S2 (GLENDALE FWY) NB	720	466	-254	-35%
1	ELLENWOOD DR	59	16	-43	-73%
1	EAGLE ROCK BLVD	96	64	-32	-34%
1	TOWNSEND AVE	27	23	-4	-14%
1	N FIGUEROA ST	278	115	-163	-58%
1	N AVENUE 64	54	68	14	26%
	TOTAL	*3,676*	*1,803*	*-1,873*	*-51%*
	RMSE				*87%*
2	HUNTINGTON DR N	212	112	-100	-47%
2	HUNTINGTON DR N	427	67	-360	-84%
2	CONCORD AVE	29	85	56	195%
2	W MISSION RD	241	79	-162	-67%
2	W VALLEY BLVD	555	169	-386	-70%
2	W HELLMAN AVE	84	26	-58	-68%
2	I 10 (SAN BERNARDINO FWY) WB	1,766	946	-820	-46%
2	I 10 (SAN BERNARDINO FWY) EB	1,150	946	-204	-18%
2	CASUDA CANYON DR	9	13	4	50%
2	MONTEREY PASS RD	157	35	-122	-78%
	TOTAL	*4,630*	*2,479*	*-2,151*	*-46%*
	RMSE				*70%*
8	Royal Oaks Dr	114	14	-100	-88%
8	E Huntington Dr	296	196	-100	-34%
8	I- 210 (Foothill Fwy) WB	1,983	2,309	326	16%
8	I- 210 (Foothill Fwy) EB	1,499	2,609	1,110	74%
8	Arrow Highway	374	159	-215	-58%
8	Live Oak Ave	373	186	-187	-50%
8	Rivergrade Rd	122	198	76	62%
8	Los Angeles St	350	117	-233	-67%
8	Ramona Blvd	337	179	-158	-47%
8	I-10 (San Bernardino Fwy) WB	1,236	1,707	471	38%
8	I-10 (San Bernardino Fwy) EB	891	1,205	314	35%
8	E Temple Ave	464	87	-377	-81%
8	N Puente Ave	431	154	-277	-64%
8	Orange Ave	99	63	-36	-36%
	TOTAL	*8,569*	*9,184*	*615*	*7%*
	RMSE				*63%*

TABLE 3
PM Peak Period Traffic Volume (Model vs. Truck Count) Comparison

Screenline	Location	Counts	Model	Diff	Diff%
1	GOODWIN AVE	63	90	27	42%
1	SAN FERNANDO RD	626	260	-366	-59%
1	S CENTRAL AVE	438	126	-312	-71%
1	S BRAND BLVD	219	129	-90	-41%
1	S GLENDALE AVE	297	113	-184	-62%
1	S ADAMS ST	45	14	-31	-70%
1	S CHEVY CHASE DR	106	64	-42	-40%
1	S VERDUGO RD	106	86	-20	-19%
1	S2 (GLENDALE FWY) SB	1,093	755	-338	-31%
1	S2 (GLENDALE FWY) NB	1,542	1,324	-218	-14%
1	ELLENWOOD DR	91	42	-49	-53%
1	EAGLE ROCK BLVD	178	114	-64	-36%
1	TOWNSEND AVE	45	37	-8	-18%
1	N FIGUEROA ST	478	175	-303	-63%
1	N AVENUE 64	60	143	83	138%
	TOTAL	*5,387*	*3,471*	*-1,916*	*-36%*
	RMSE				*53%*
2	HUNTINGTON DR N	294	168	-126	-43%
2	HUNTINGTON DR N	544	158	-386	-71%
2	CONCORD AVE	55	145	90	163%
2	W MISSION RD	298	154	-144	-48%
2	W VALLEY BLVD	591	240	-351	-59%
2	W HELLMAN AVE	183	53	-130	-71%
2	I 10 (SAN BERNARDINO FWY) WB	1,472	1,421	-51	-3%
2	I 10 (SAN BERNARDINO FWY) EB	1,723	1,519	-204	-12%
2	CASUDA CANYON DR	22	18	-4	-20%
2	MONTEREY PASS RD	288	135	-153	-53%
	TOTAL	*5,470*	*4,011*	*-1,459*	*-27%*
	RMSE				*37%*
8	Royal Oaks Dr	164	34	-130	-79%
8	E Huntington Dr	424	323	-101	-24%
8	I- 210 (Foothill Fwy) WB	1,983	4,132	2,149	108%
8	I- 210 (Foothill Fwy) EB	2,396	3,713	1,317	55%
8	Arrow Highway	322	373	51	16%
8	Live Oak Ave	469	458	-11	-2%
8	Rivergrade Rd	263	273	10	4%
8	Los Angeles St	503	243	-260	-52%
8	Ramona Blvd	540	310	-230	-43%
8	I-10 (San Bernardino Fwy) WB	1,223	2,071	848	69%
8	I-10 (San Bernardino Fwy) EB	1,234	2,533	1,299	105%
8	E Temple Ave	501	136	-365	-73%
8	N Puente Ave	952	325	-627	-66%
8	Orange Ave	90	103	13	15%
	TOTAL	*11,064*	*15,027*	*3,963*	*36%*
	RMSE				*104%*

FIGURE 5
Daily Truck Traffic Volume R^2

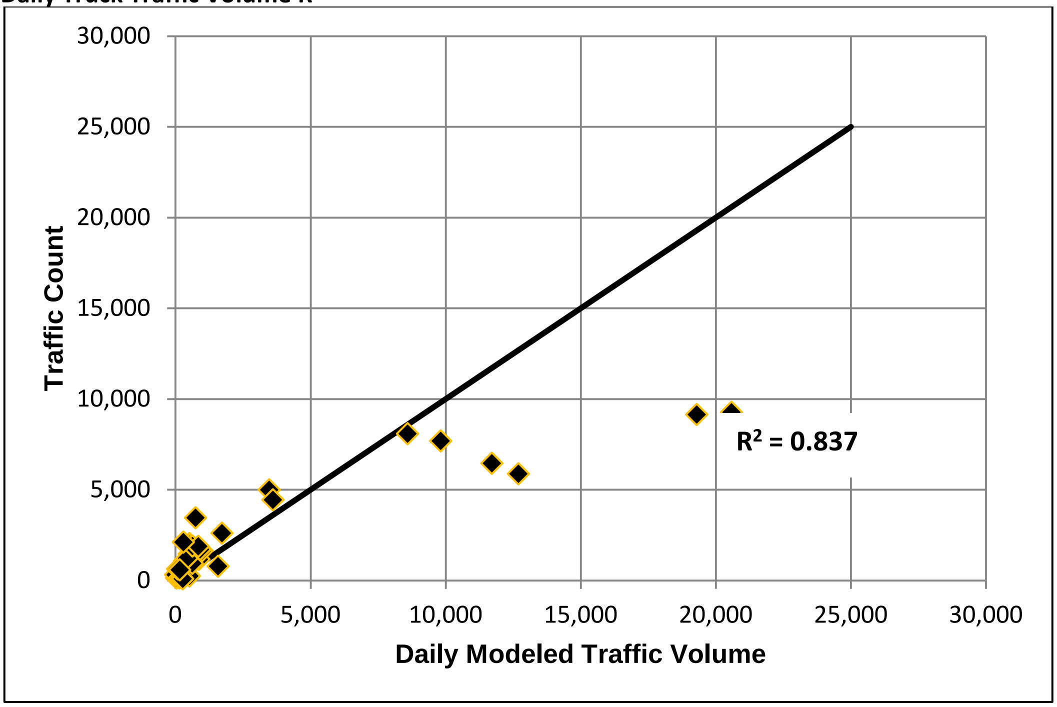


FIGURE 6
AM Peak Period Truck Traffic Volume R2

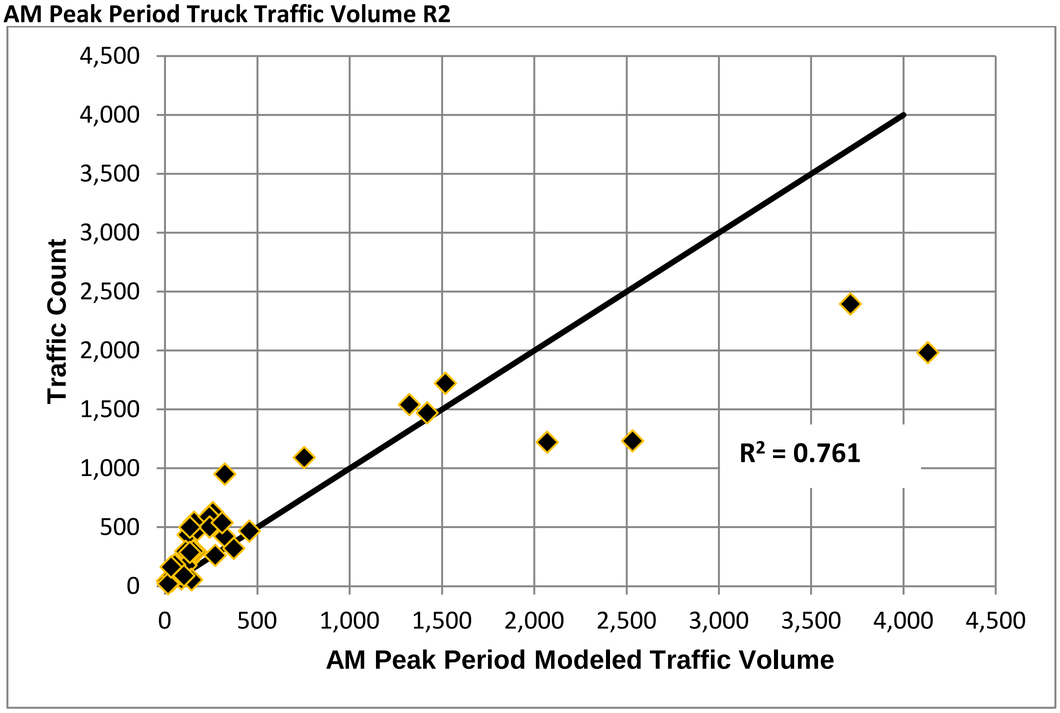
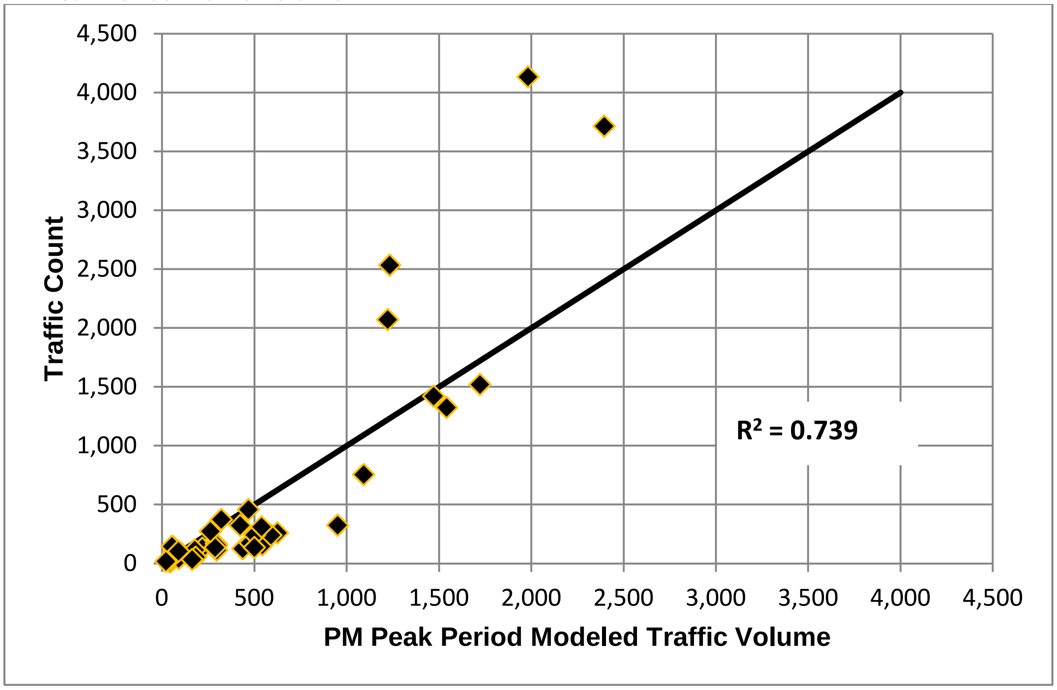


FIGURE 7
PM Peak Period Traffic Volume R2



Conclusions

The TMIP Model Validation and Reasonableness Checking Manual provides guidance and checks for each step of the modeling process but generally stop short of specifying pass fail criteria for model performance. The document states that:

> *The definition of an acceptable threshold should be a local decision and needs to balance the resources and time available for model development with the decisions that will be supported by the travel forecast obtained using the model.*
>
> *The term "threshold" rather than "standard" will generally be used throughout this manual. The term standard connotes a formal definition of acceptance: "The standard has been met, therefore the model is valid." While it is important to match base year observations for validation, simple matching of traffic counts, for instance, is not sufficient to establish the validity of a travel model. Quality model validation must test all steps of the travel model and also should test model sensitivity. If standards are set for models by agencies or model reviewers, it is beneficial that they not convey a formal definition of acceptance but, rather to help set boundaries or levels of confidence regarding the use of travel forecasts for studies[(4)].*

The HDT model validation exercise reveals that HDT model generally doesn't meet the threshold criteria and standards of model validation. Under these circumstances, it is necessary to develop additional methods to ensure the future forecast traffic volumes more closely match base year traffic counts and patterns. The common methodology is to post-process the model traffic volumes.

The post-processing method is integrated within the model so the entire system takes full advantage of what the model does well, while recognizing the need to use base year traffic count data that is directly comparable with base year traffic forecasts. For the purpose of this study, the post-processing methodology will be based on accepted industry standards including the *National Cooperative Highway Research Program* (*NCHRP*) 255 Report. As part of this effort, additional truck data will be collected to provide a basis for post-processing.

[(4)] Cambridge Systematics, Inc., *Travel Model Validation and Reasonableness Checking Manual- Second Edition*, 2010, PP 1-9.