JACOBS

Submitted to:

Transportation Authority of Marin

Transportation System Performance Monitoring Report - 2010

September 2011
Updated December 2011

Submitted by:

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December 20, 2011

Transportation Authority of Marin
750 Lindaro Street.
San Rafael, CA 94901
Attention: Dianne Steinhauser, Executive Director

Re: Transportation System Monitoring Report - 2010

Dear Ms. Steinhauser:

Jacobs Engineering Group Inc. (Jacobs) is pleased to submit the report for the 2010 Transportation System Monitoring to support the 2010 Congestion Management Program (CMP) for the Transportation Authority of Marin (TAM). This report includes additional data collected in October 2011 to further document High Occupancy Vehicle (HOV) travel times.

Jacobs conducted the 2010 study for TAM utilizing the latest technology for performing CMP studies. Our extensive and unique experience provides a cost-effective and cutting edge process to obtain and analyze traffic data. Jacobs has developed a methodology including GPS and GIS over the past nine years with exciting results. The addition of the GIS linear reference system has added a component that has never before been applied to network analyses. For the first time, TAM now has an extensive database integrated in GIS for easy access and historic comparisons.

TAM has taken a major step forward in having the ability to take the GIS data, in addition to the historic tables, and integrate the digital data with your travel demand model. The speeds, roadway attributes, etc can be conflated with the model to produce a very robust and comprehensive system. This was not available in the past because the methodology used with tables and charts did not produce the value added products of this 2010 study. Jacobs will continue to support TAM to produce the best value that not only meets the intended scope to allow historic comparisons of this project, but produces the results in a form that can be used by many other areas within the county and by its members.

Sincerely,
Jacobs Engineering Group Inc.

Steve T. Taylor, P.E., PTOE
Project Manager

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A. EXECUTIVE SUMMARY

The Transportation Authority of Marin (TAM) has an established Congestion Management Program (CMP) to monitor the transportation network within the county. All roadways included in the CMP network are evaluated for conformity at least every two years.

The goal of the monitoring program is to improve the performance of the transportation system by identifying congested areas and related transportation deficiencies. This information is then used to help prioritize transportation funding decisions in light of system performance, land use factors, multimodal characteristics, and other considerations.

This year's monitoring study was conducted in the fall of 2010 with travel time runs between October and December on approximately 270.1 directional miles of roadways. Of these, 60 directional miles are "official" CMP segments that constitute the adopted monitoring network.

This is the first monitoring cycle during which TAM has used Global Positioning System (GPS) technology integrated in a geographic information system (GIS) to monitor Level of Service (LOS) on the CMP network. The primary tasks completed as part of this study include:

- Mapping of the CMP network
- Travel time data collection
- LOS Analysis

With the 2010 monitoring cycle, TAM is calculating LOS based on two methodologies—Highway Capacity Manual (HCM) 1985 and HCM 2000. This dual reporting facilitates historical comparisons while also reporting LOS based on the more current methodology. For freeways, only HCM 1985 LOS is reported, as the HCM 2000 methodology requires traffic volume information for all unique freeway segments and ramps. Collection of comprehensive freeway traffic volumes is beyond the scope of the CMP monitoring effort. By HCM 1985 standards, only one official freeway segment evaluated during the PM peak period was found to operate at LOS F. That segment is US 101 between SR 131 and Paradise. This segment is grandfathered and therefore requires no deficiency plan.

With the introduction and use of GIS, included in this year's monitoring report, is the ability to determine LOS for various segments and not only the longer segments as determined in the past. Intersection segment results were also calculated in addition to the (generally longer) official CMP segment results. By subdividing the CMP segments into intersection-level results, localized congestion can be quickly identified along the route segment. This helps identify locations of intense congestion. Improvements such as traffic signal upgrade/coordination, dedicated transit lanes, access management, and/or pedestrian and bicycle improvements could be considered for the intersection segments that exhibit high degrees of localized traffic congestion.

B. INTRODUCTION

B.1 History of the Congestion Management Program

TAM has an established CMP to monitor the transportation network within the county. All roadways included in the CMP network are evaluated for conformity at least every two years by the Authority, which is the designated Congestion Management Agency (CMA) for Marin County. The goal of the monitoring program is to improve the performance of the transportation system by identifying congested areas and related transportation deficiencies. This information is then used to help prioritize transportation funding decisions in light of system performance, land use factors, multimodal characteristics, and other considerations.

This year's study was conducted in the fall of 2010 with travel time runs conducted between September and November of 2010. The most recent assessment prior to this study was performed between October and November of 2008. The primary tasks completed as part of this study include:

- Mapping of the CMP network
- Travel time data collection
- Level of Service Analysis

B.2 Study Background

The study was conducted on approximately 270.1 directional miles of roadways in Marin County. Of these, 60.0 directional miles are "official" CMP segments that are a part of the adopted network. The remaining 210.1 directional miles are "additional" segments that were monitored this year to support planning and system management efforts and to take advantage of the methodology used by Jacobs. CMP legislation requires that state highways (including freeways) and principal arterials be included in the CMP network. The network must be useful to track the transportation impacts of land development decisions, as well as to help assess the congestion management implications of proposed transportation projects. TAM's network therefore includes numerous local thoroughfares since most urban traffic occurs on city arterials (rather than on the freeways). **Figure 1** shows the routes that were monitored.

All of the study roadways were evaluated during the PM peak period between the hours of 4:00 PM-6:00 PM. The PM period is the focus of the CMP, while the AM period is included for additional consideration by TAM. The methodology used during the PM period included performing floating car travel time studies, while the AM period was evaluated using private sector data for the first time. A private sector data set was purchased for the month of October which included average speeds of segments for each 5-min interval of the month. For those segments with sufficient sample size, temporal analysis of the variation in speed is now feasible.

The total directional miles and number of route segments for each roadway type are shown in **Table 1**.

Figure 1 – Fall 2010 Monitored Routes

Table 1 – Total Study Miles Summary

Roadway Type	Total Directional Miles	CMP Direction Segment Miles
Arterial - CMP	23.2	23.2
Arterial - Additional	161.2	
Freeway	85.7	36.8
Total	270.1	60.0

This monitoring report focused on the eight performance measures established in the Marin County Congestion Management Program. These performance measures are:

1. Roadway Level of Service (PM peak hour LOS) – Primary CMP Performance Measure
2. Aggregate Peak Hour Travel Time
3. Person Throughput
4. Vehicle Miles Traveled in Congested Conditions
5. Job Housing Balance
6. Transit Frequency / Headway
7. Transit Coordination
8. Pedestrian & Bicycle Investment

As noted, the "Roadway Level of Service" is the primary CMP performance measure; therefore, unless a segment is grandfathered as an existing condition, a mitigation plan is required if the resulting LOS is below the established minimum standard.

The following sections focus on each of the above performance measures with emphasis on the Roadway LOS for the PM peak period. The other items are included to provide some alternative views to help explain the changes in performance and the opportunities for improvement.

C. METHODOLOGY

C.1 Mapping of CMP Network

C.1.1 Global Positioning System (GPS)

Historically, CMP travel time runs were done manually. Jacobs introduced the use of GPS, GIS, and private sector data methodology to TAM in 2010. In general, the equipment used by Jacobs received consistent GPS signals across the County.

Before performing the travel time runs, all roadways were mapped using GPS technology. The Haicom-BT Bluetooth receiver was mounted on a vehicle and used in the mapping. The receiver uses differential GPS (DGPS) to provide position information to sub-meter accuracy. These receivers were used in combination with the controlling software developed by Jacobs while driving each roadway to inventory all roadway attributes related to speed.

The data collection process was made more efficient by collecting data electronically using GPS technology. The methodology provided TAM with background mapping and traffic-related elements that can be integrated with the agency's GIS/travel demand model for future use.

C.1.2 Mapping Runs

The roadway mapping was done in-vehicle using the Haicom-BT GPS equipment and software. Mapping was done in one direction for each roadway segment during off-peak periods.

Certain traffic elements were recorded such as the posted speed limit, presence of traffic signals, number of through lanes, and construction areas. This information could be used later to determine the segment lengths and theoretical travel times, and to provide better insight into the resulting travel time runs.

C.2 Travel Time Data Collection

Travel time runs were conducted using the floating car method. In the floating car method, the driver of the test vehicle "floats" with the traffic by attempting to safely pass as many vehicles as pass the test vehicle.

Travel time runs were conducted during the morning and afternoon peak periods on all roadway segments. Runs were only conducted on Tuesdays, Wednesdays, or Thursdays, and school district spring break periods were avoided. A minimum of three (3) runs were made in each direction during each peak period. During the travel time runs, the Haicom BT GPS equipment recorded position and time at one-second intervals into a Dell Personal Digital Assistant (PDA) using Bluetooth technology. The driver of the test vehicle drove the speed

limit if no other cars were present and at the school zone speed limit if a school zone speed limit was in effect at the time of the travel time run.

C.3 Video on Mapping Runs

The roadway segments were videotaped during the mapping process in order to provide a reference of the conditions. The digital videos were later linked to the GIS results for future reference. This provides a video log of the CMP network roadways. These video logs can be invaluable for future tasks such as asset management where all traffic items can easily be viewed.

D. EVALUATION

D.1 LOS Analysis – HCM 1985

In order to be consistent with the past methodology and performance measures of previous monitoring studies, the 2010 analyses continued the use of the LOS criteria included in the 1985 HCM. The LOS thresholds are described in detail in the following sections including Table 2 and the summary of results in Table 3.

D.2 Other Performance Measures Results

Apart from average speeds aggregated to the CMP route segments level, intersection segment level average speeds were also calculated in 2010 for all routes. These results are available in the GIS tables provided to TAM.

An example from the 2010 monitoring cycle that illustrates the utility of Intersection Segment level results is presented here in the form of a subsection of the CMP network. The segments included as official CMP segments are illustrated in **Figure 2**. If the analysis focused only on these segments, much of the corridors highlighted would be missed. Historically, the balance of the corridors have not been included in the CMP, but it is useful for TAM to be aware of the surrounding conditions and how they influence each other. **Figure 3** include all the various "intersection level" segments that can now be evaluated using the methodology applied in the 2010 Monitoring Study.

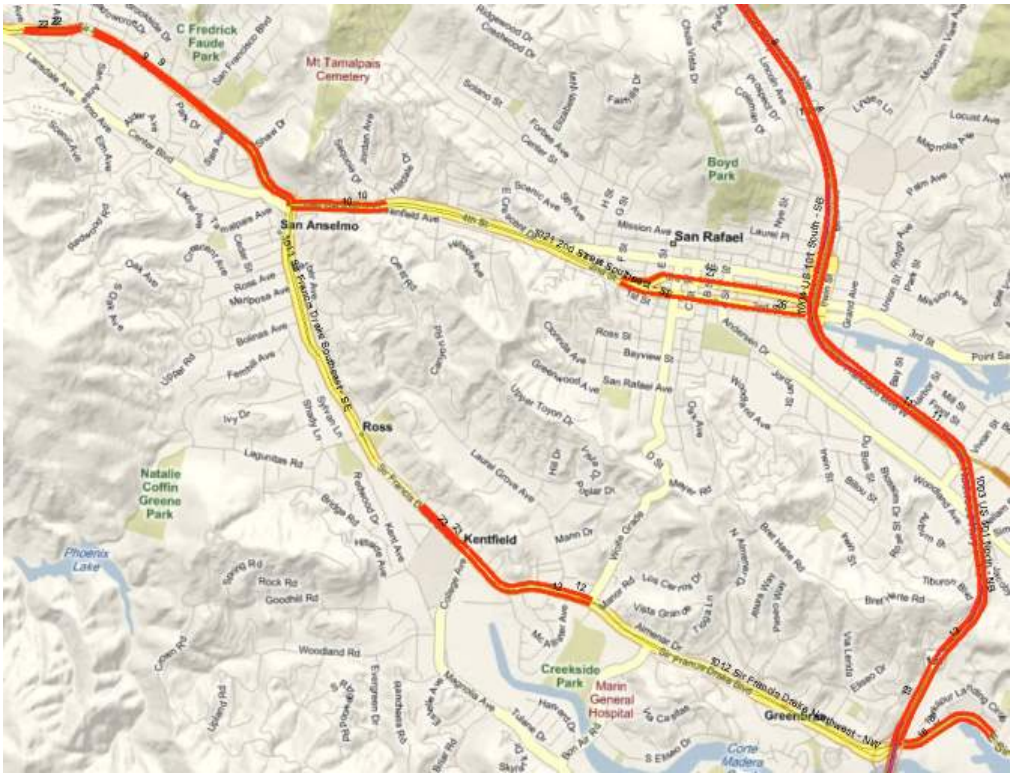

Figure 2 – CMP Segments

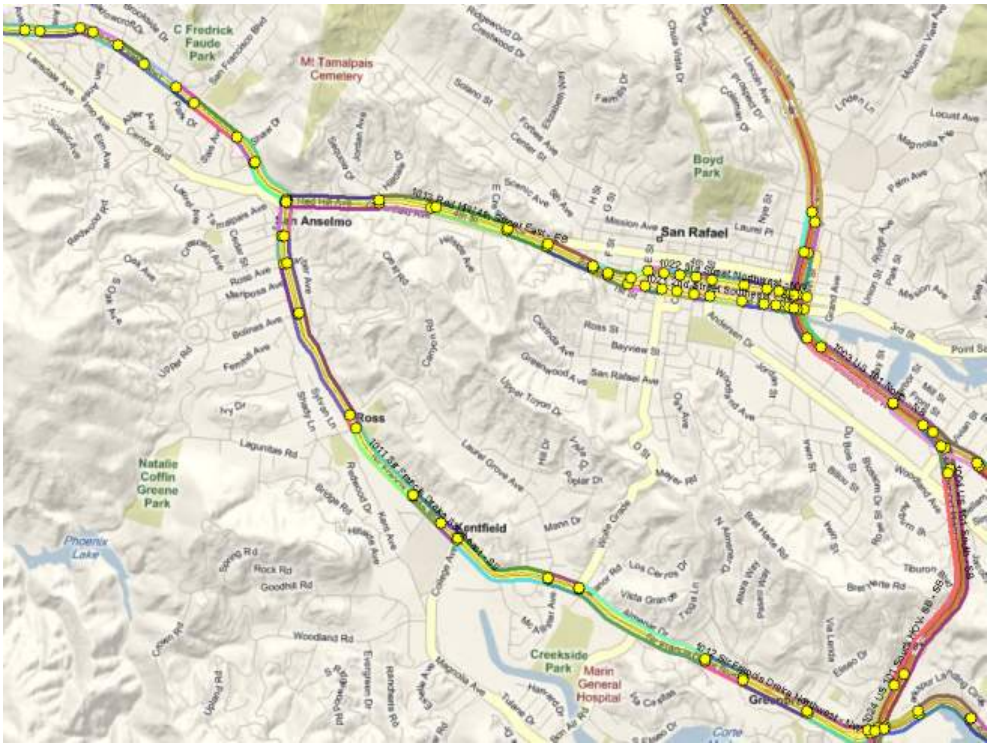

Figure 3 – Intersection Segments

E. ROADWAY LEVEL OF SERVICE (LOS)

E.1 Traffic Flow

The HCM defines capacity as "…the maximum hourly rate at which persons or vehicles reasonably can be expected to traverse a point or a uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions."

The vehicle capacity and operational characteristics of a roadway are a function of a number of elements including: the number of lanes and lane widths, shoulder widths, roadway alignment, access, traffic signals, grades, and vehicle mix. Generally, roadways with wider travel lanes, fewer traffic control devices, straight alignments, etc. allow faster travel speeds and therefore greater vehicle flow per unit time.

E.2 Level of Service (LOS)

The HCM defines LOS as "…a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience."

"Six LOS are defined for each type of facility that has analysis procedures available. Letters designate each level, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions and the driver's perception of those conditions."

In accordance with CMP legislation, the county and city governments are required to show that all CMP route segments within their jurisdiction are operating at or above the CMP traffic LOS standard. Section 65089(b)(1)(B) of the California Government Code states that "In no case shall the LOS standards established be below the LOS E or the current level, whichever is farthest from LOS A. When the level of service on a segment or at an intersection fails to attain the established level of service standard, a deficiency plan shall be adopted pursuant to section 65089.4."

For LOS Monitoring purposes, the CMP segments are categorized by exempt or non-exempt status:

- Exempt – segments which were at LOS F during the first monitoring cycle (1991 or 1992/93) are legislatively exempted from the LOS E standard;
- Non-exempt - all other segments. If a non-exempt segment fails for three consecutive CMP cycles, it is classified as deficient.

Figure 4 shows the grandfathered segments in Marin County**.**

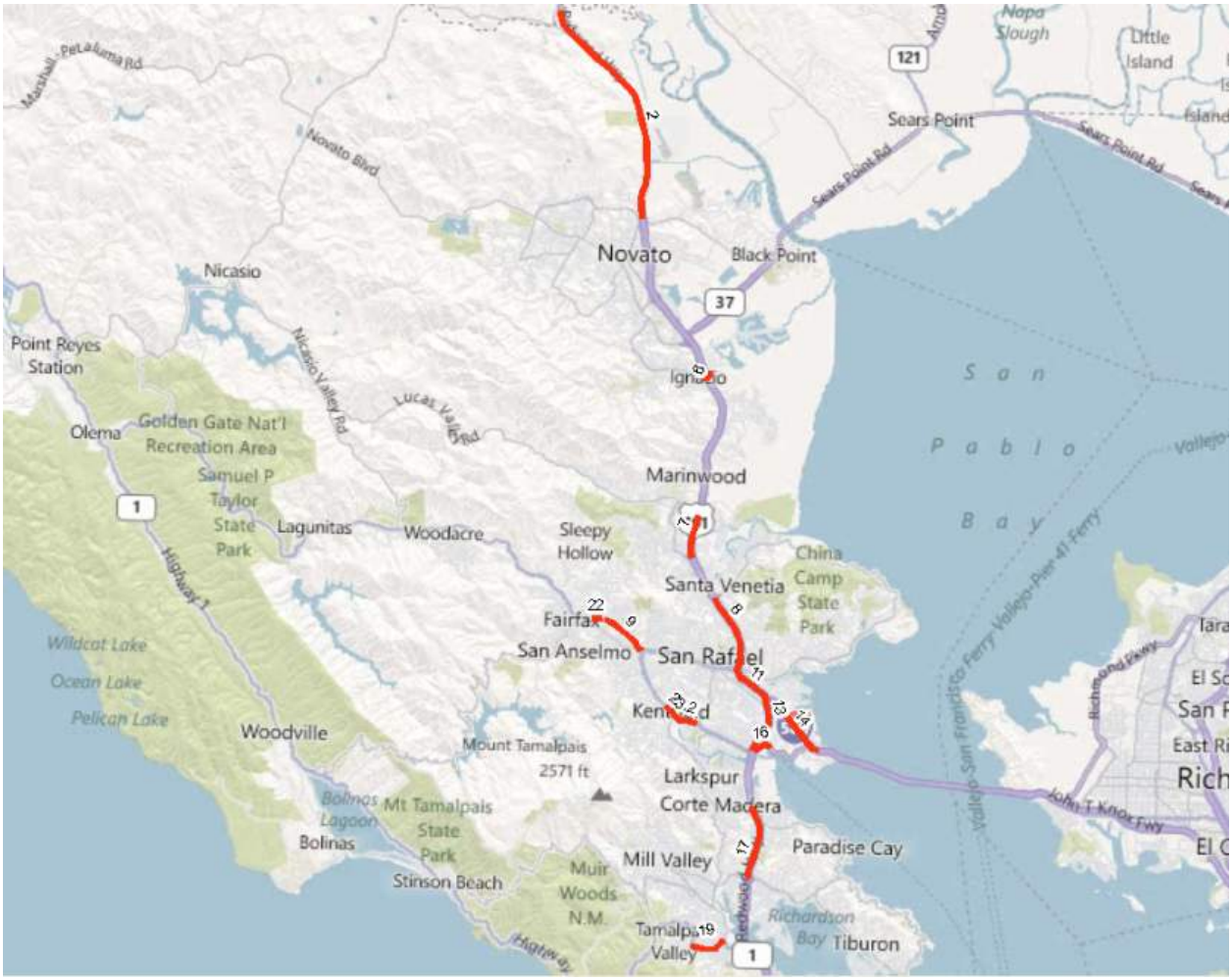

Figure 4 – PM Grandfathered Segments

All CMP network segments were evaluated in the Fall 2010 monitoring cycle. Additional segments were also monitored for the first time for reference and planning purposes; these additional segments are not subject to performance requirements.

All freeway and arterial segments in the network, **Figure 5**, were monitored using the floating vehicle method (see section C.2), which allows for determination of LOS on the basis of average operating speed. TAM primarily uses the 1985 methodology to monitor LOS on the CMP network, as this methodology was utilized in the baseline monitoring cycle and is necessary to maintain historical comparisons, identify exempt segments, and monitor potential network deficiencies. The specific methodologies used for monitoring freeway and arterial segments are listed below per HCM definitions:

- **Freeway Segments (HCM 1985 - Chapter 3)** – All freeway segments were evaluated using the "basic freeway sections" methodology of HCM 1985 where the LOS for each freeway segment was determined using its average travel speed.

  Freeway LOS was not calculated based on HCM 2000 methodology. In order to evaluate all freeway segments using the HCM 2000 methodology, the volumes on all freeway sections (mainline) with distinct characteristics (e.g., quantity of lanes), as well as on entrances and exits would be required. It was not feasible to collect freeway volume data within the limited study budget; therefore, no LOS on the freeway segments were calculated using HCM 2000 criteria.

- **Arterial Segments (HCM 1985 - Chapter 11)** – All arterial segments were evaluated using the "urban and suburban arterials" methodology of the HCM 1985 where LOS is based on the average through-vehicle travel speed for the segment. The arterial segments used by TAM for CMP purposes (called "CMP Segments") span several blocks and include multiple signals and/or stop controlled intersections. If an intersection segment is defined as a segment from one controlled intersection to the next, the CMP segments are a collection of consecutive intersection segments. Jacobs methodology of travel time estimation can calculate average speeds at the intersection segment level and these data can be aggregated to calculate the average speeds at the CMP segment level. The average speed on each CMP segment is computed as the ratio of total length of the segment to the sum of average travel time on each individual intersection segment within the CMP segment. The average travel time on each intersection segment is computed as the arithmetic mean of travel times of individual floating car runs on that segment. The travel times of individual floating car runs are calculated by measuring the time taken by a floating car to travel from the middle of one controlled intersection to the middle of the next controlled intersection. The average speed thus accounts for time in motion and time spent at the signals or stop signs.

Table 2 shows the relationship between average travel speed and level of service by arterial classification and basic freeways according to HCM 1985. There are three arterial classes defined by Chapter 11 of HCM 1985, based on the arterial's function and design. Within each class, there is also a range of free flow speeds to consider. In order to maintain

consistency with historic values, established minimums, and grandfathered standards, the 1985 HCM values are used as the basis of comparison in this Monitoring Study. Historically, it appears that all arterials have been assigned as Class III. Class III arterials are either urban principal arterials or intermediate to urban minor arterials. Typical Urban design represents an arterial with little or no control of access from driveways. It is an undivided one-way or two-way facility with two or more lanes. If a principal arterial has intermediate design it is assigned Class II and if a minor arterial has this design it is assigned Class III. If a principal arterial or a minor arterial has typical urban design it is assigned Class III. It is recommended to begin assessment of the newly released 2010 HCM to transition with the next evaluation cycle in 2012. Specifically, freeway LOS continues to be determined primarily with density while surface streets (multi-lane highways and arterials) will focus more on percent free flow speed (approximated using speed limit in most cases). In order to accurately determine LOS using current HCM criteria, additional data will need to be collected for the freeways including volumes and creation of new segments where the attributes are consistent throughout a segment (number of lanes, lane widths, shoulder widths, no entrance or exit ramps, etc).

Table 2 –Level of Service (HCM 1985)

Roadway Type	**Arterial III**	**Basic Freeway**
Free Flow Speed (mph) Range	**35 to 25**	
Typical Free Flow Speed (mph)	**27**	
	Level of Service	
A	≥ 25	≥ 60
B	20-25	57-60
C	13-19	54-56
D	10-13	47-53
E	7-9	30-46
F	< 7	< 30

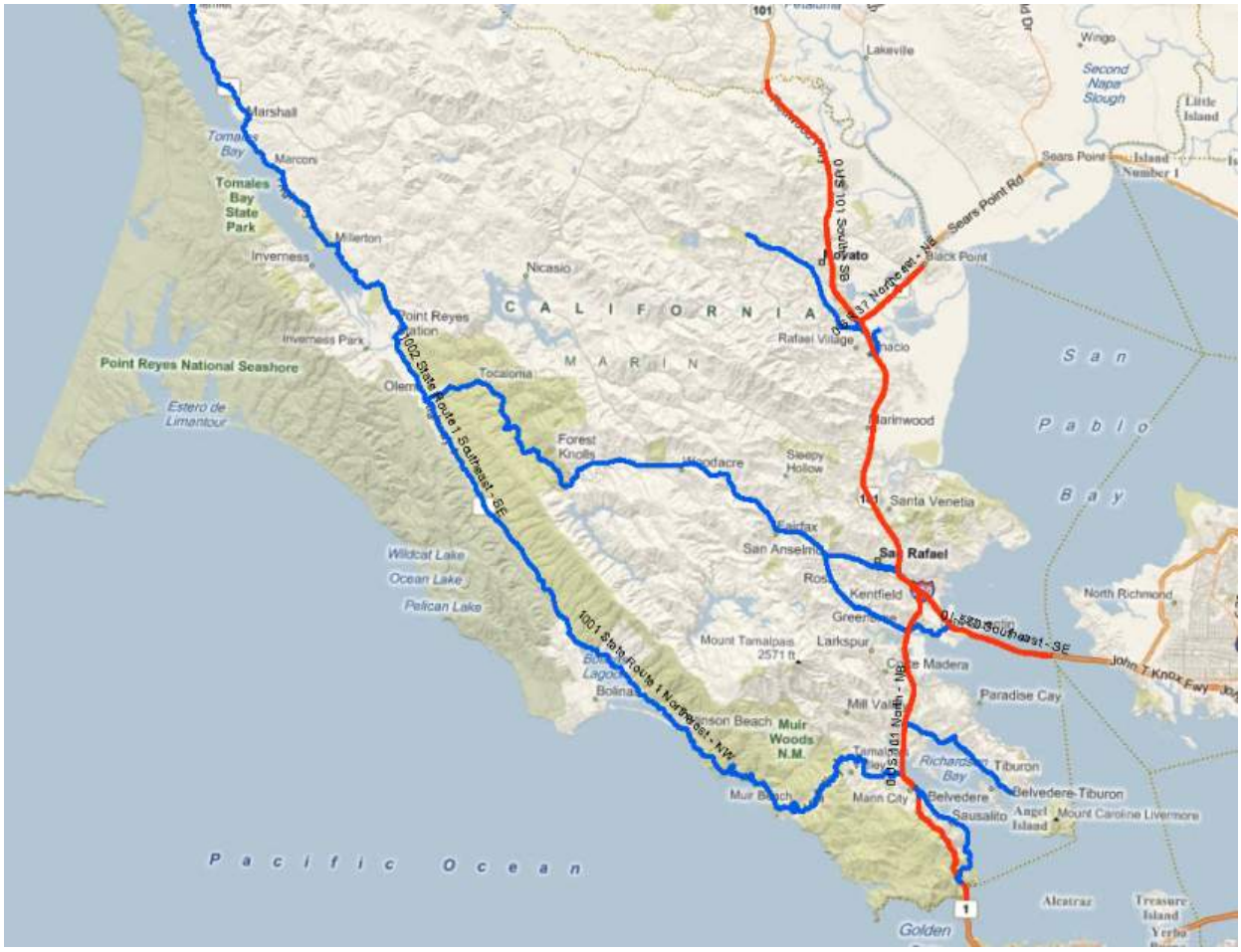

*Figure 5 – Fall 2010 Segment Classifications – **Red** Basic Freeways and **Blue** Class III Arterials (HCM 1985)*

E.3 Roadway Segment LOS Analysis Results

Table 3 summarizes the current year roadway segment LOS. Additionally, **Figures 6 and 7** illustrate the results graphically while at the same time comparing the peak and off-peak directions (commute vs. non-commute). As highlighted in Table 3, the only segment that was found to be below the established minimum was US 101 between SR 131 and Paradise. This same segment is also grandfathered in from the 1991 base study, therefore, a deficiency plan is not necessary for this or any segments based on the 2010 PM Peak period monitoring.

Table 3 – CMP Roadway Segment Monitoring Results (PM LOS)

Study Roadway Segment Monitoring Results (PM LOS)
Marin County CMP Transportation System Performance Monitoring Study - 2010

Route	Segment	New Seg #	Dir.	From	To	Length (mi)	Avg Travel Time (sec)	Avg Travel Time (min)	Link Avg Speed (mph)	LOS	Arterial / Fwy (ART/FWY)	Min LOS Std	Grand Fathered
State Route 1	25	1A	NB	US 101	Tennessee Valley	0.3	36	0.60	30.0	A	ART	D	
			SB				44	0.73	24.5	B	ART	D	
	19	1B	EB	Alamonte	Northern	0.8	105	1.75	27.4	A	ART	D	Y
			WB				102	1.70	28.2	A	ART	D	Y
	1	1C	NB	SFD	Pt. Reyes	2.1	200	3.33	37.8	A	ART	D	
			SB				195	3.25	38.8	A	ART	D	
SR 37	5	2A	EB	US 101	Atherton	2.3	136	2.27	60.9	A	FWY	E	
			WB				122	2.03	67.9	A	FWY	E	
US 101	21	3A	NB	North of GG	Spencer	2.0	142	2.37	50.7	D	FWY	E	
			SB				130	2.17	55.4	C	FWY	E	
	17	3B	NB	SR 131	Paradise	1.7	310	5.17	19.7	F	FWY	E	Y
			NB HOV				127	2.11	48.4	D	FWY	E	Y
			SB				92	1.53	66.5	A	FWY	E	Y
	13	3C	NB	SFD	I-580	1.3	90	1.50	52.0	D	FWY	E	Y
			NB HOV				72	1.19	65.5	A	FWY	E	
			SB				77	1.28	60.8	A	FWY	E	Y
	11	3D	NB	I-580	Mission	1.1	86	1.43	46.0	E	FWY	E	Y
			NB HOV				60	1.01	65.6	A	FWY	E	
			SB				57	0.95	69.5	A	FWY	E	Y
	8	3E	NB	Mission	N. San Pedro	1.6	126	2.10	45.7	E	FWY	E	Y
			NB HOV				85	1.42	67.8	A	FWY	E	
			SB				92	1.53	62.6	A	FWY	E	Y
	7	3F	NB	Freitas Parkway	Lucas Valley	1.0	71	1.18	50.7	D	FWY	E	Y
			NB HOV				51	0.85	70.6	A	FWY	E	
			SB				61	1.02	59.0	B	FWY	E	Y
	2	3G	NB	Atherton	Sonoma County Line	5.3	605	10.08	31.5	E	FWY	E	Y
			SB				298	4.97	64.0	A	FWY	E	Y
SR 131	18	4A	EB	Redwood Frontage	Strawberry	0.5	52	0.87	34.6	A	ART	D	
			WB				76	1.27	23.7	B	ART	D	
I-580	15	5A	EB	SFD	R-S Bridge	0.7	53	0.88	47.5	D	FWY	E	
			WB				46	0.77	54.8	C	FWY	E	
	14	5B	EB	Bellam	SFD	1.4	73	1.22	69.0	A	FWY	E	Y
			WB				70	1.17	72.0	A	FWY	E	Y
Novato Blvd	3	6A	NB	San Marin	Eucalyptus	0.4	50	0.83	28.8	A	ART	D	
			SB				46	0.77	31.3	A	ART	D	
	24	6B	NB	Grant	Diablo	0.7	128	2.13	19.7	C	ART	D	
			SB				159	2.65	15.8	C	ART	D	
	4	6C	NB	Sunset Parkway	US 101	1.1	126	2.10	31.4	A	ART	D	
			SB				120	2.00	33.0	A	ART	D	
Bel Marin Keys Blvd	6	7A	EB	US 101	Commercial	0.3	55	0.92	19.6	C	ART	D	Y
			WB				33	0.55	32.7	A	ART	D	Y
Sir Francis Drake (SFD)	22	8A	EB	Butterfield	Willow	0.2	47	0.78	15.3	C	ART	D	Y
			WB				63	1.05	11.4	D	ART	D	Y
	9	8B	EB	San Anselmo	Red Hill	1.1	269	4.48	14.7	C	ART	D	Y
			WB				201	3.35	19.7	C	ART	D	Y
	23	8C	EB	College	Toussin	0.3	85	1.42	12.7	D	ART	D	Y
			WB				48	0.80	22.5	B	ART	D	Y
	12	8D	EB	College	Wolfe Grade	0.6	90	1.50	24.0	B	ART	D	Y
			WB				71	1.18	30.4	A	ART	D	Y
	16	8E	EB	US 101	E. Larkspur Landing	0.4	81	1.35	17.8	C	ART	D	Y
			WB				125	2.08	11.5	D	ART	D	Y
Red Hill / 4th St	10	9A	EB	SFD	Hillsdale	0.4	45	0.75	32.0	A	ART	D	
			WB				150	2.50	9.6	E	ART	D	
2nd Street	26	9B	EB	Miramar/1st St	US 101	0.8	180	3.00	16.0	C	N/A	N/A	
3rd Street	27	9C	WB	US 101	Miramar/1st St	0.8	178	2.97	16.2	C	N/A	N/A	
Bridgeway	20	10A	NB	Gate 5	Gate 6	0.2	67	1.12	10.7	D	ART	D	
			SB				27	0.45	26.7	A	ART	D	

Source:
2010 - Jacobs Engineering traffic survey
Surveys were conducted with the floating car method in October and November 2010. Individual travel times are shown in seconds.

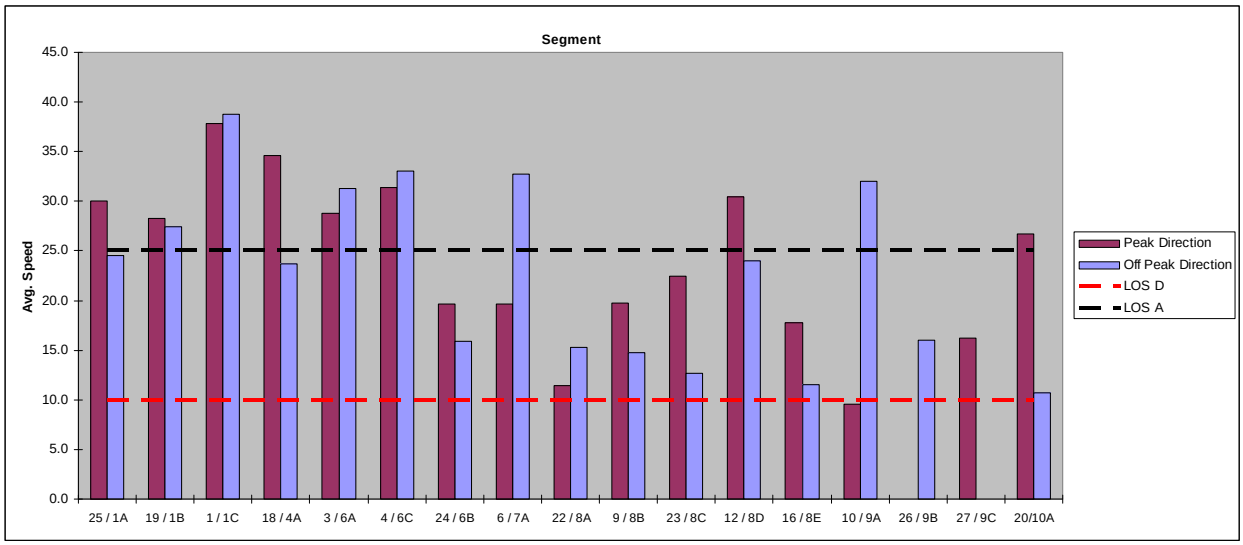

Figure 6 – Arterial Segment LOS Analysis – PM Peak Period

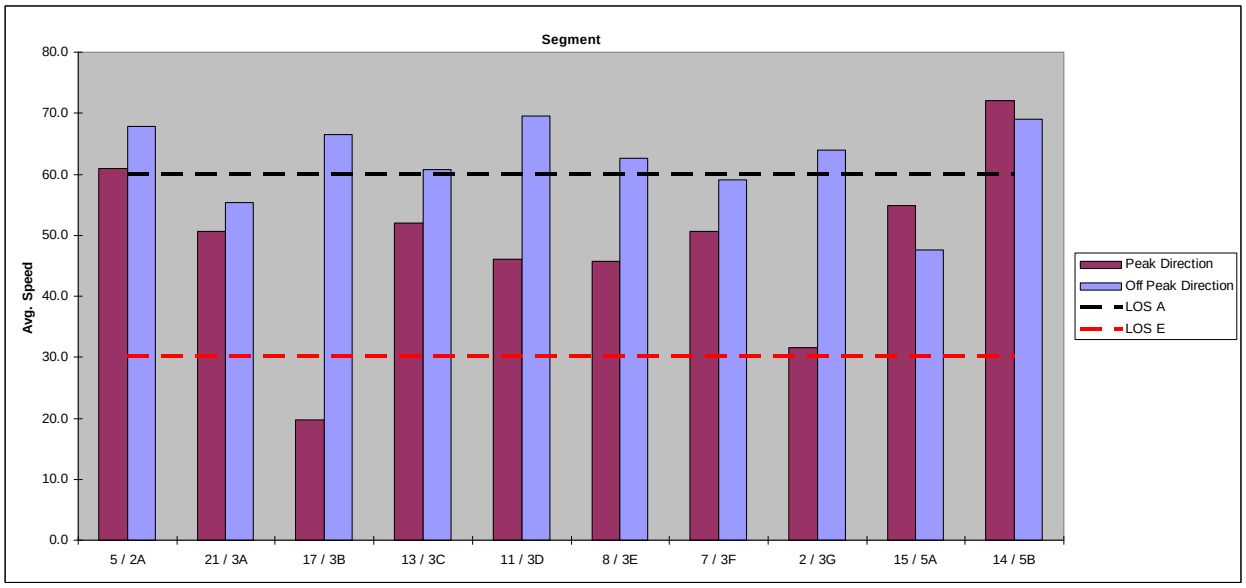

Figure 7 – Freeway / Highway Segment LOS Analysis – PM Peak Period

Table 4 includes a summary of the historic results since 1997. In addition to the LOS results, the study year is footnoted with changes in methodology. As noted, beginning in 2006, the approach was changed to include the determination of LOS through floating car studies in place of volume and V/C. This inherently introduces variations in results, while other changes may be explained through capital improvements, construction, use of transit and other modes, and reduction in traffic volumes due to the economy. As shown, the results appear to be much improved this year, and much of that can be attributed to lighter volumes than in recent years.

Table 4 – Historic Trend of Roadway Segment LOS (PM Peak Period)

Historic Trend of Roadway Segment LOS (PM Peak Period)
Marin County CMP Transportation System Performance Monitoring Study - 2010

Route	Segment	New Seg #	Peak Direction	From	To	Length	* 1997	* 1999	* 2001	* 2003	* 2005	*** 2006	*** 2008	*** 2010	Min LOS Std	Grand Fathered
State Route 1	25	1A	NB	US 101	Tennessee Valley	0.3	N/A	N/A	N/A	N/A	N/A	N/A	B	A	D	
	19	1B	WB	Alamonte	Northern	0.8	D	D	D	C	F	B	A	A	D	Y
	1	1C	NB	SFD	Pt. Reyes	2.1	A	A	A	A	A	A	A	A	D	
SR 37	5	2A	EB	US 101	Atherton	2.3	C	C	C	C	C	A	B	A	E	
US 101	21 **	3A	NB	North of GG	Spencer	2.0	D	D	D	C	C	A	A	D	E	
	17 **	3B	NB	SR 131	Paradise	1.7	C	D	D	C	F	F	F	F	E	Y
	13 **	3C	NB	SFD	I-580	1.3	D	D	F	F	F	F	E	D	E	Y
	11	3D	NB	I-580	Mission	1.1	F	F	D	F	F	F	E	E	E	Y
	8	3E	NB	Mission	N. San Pedro	1.6	F	F	D	F	F	C	F	E	E	Y
	7 **	3F	NB	Freitas Parkway	Lucas Valley	1.0	D	D	D	C	E	A	A	D	E	Y
	2	3G	NB	Atherton	Sonoma County Line	5.3	F	F	E	F	D	E	F	E	E	Y
SR 131	18	4A	EB	Redwood Frontage	Strawberry	0.5	C	C	C	C	C	A	A	A	D	
I-580	15	5A	WB	SFD	R-S Bridge	0.7	C	C	F	E	C	F	E	C	E	
	14	5B	WB	Bellam	SFD	1.4	B	A	B	B	F	E	E	A	E	Y
Novato Blvd	3 **	6A	NB	San Marin	Eucalyptus	0.4	A	A	A	A	A	B	C	A	D	
	24 **	6B	NB	Grant	Diablo	0.7	E	F	D	C	E	C	B	C	D	
	4 **	6C	NB	Sunset Parkway	US 101	1.1	A	A	A	A	A	A	A	A	D	
Bel Marin Keys Blvd	6	7A	EB	US 101	Commercial	0.3	E	F	E	C	C	B	C	C	D	Y
Sir Francis Drake (SFD)	22 **	8A	WB	Butterfield	Willow	0.2	F	F	F	F	F	D	F	D	D	Y
	9	8B	WB	San Anselmo	Red Hill	1.1	F	E	F	E	E	C	C	C	D	Y
	23	8C	WB	College	Toussin	0.3	F	F	E	F	F	C	D	B	D	Y
	12	8D	WB	College	Wolfe Grade	0.6	B	C	C	C	B	C	A	A	D	Y
	16	8E	EB	US 101	E. Larkspur Landing	0.4	E	F	F	F	C	F	E	C	D	Y
Red Hill / 4th St	10	9A	WB	SFD	Hillsdale	0.4	D	D	D	D	C	B	D	E	D	
2nd Street	26	9B	EB	Miramar/1st St	US 101	0.8	N/A	N/A	N/A	N/A	N/A	N/A	C	C	N/A	
3rd Street	27	9C	WB	US 101	Miramar/1st St	0.8	N/A	N/A	N/A	N/A	N/A	N/A	D	C	N/A	
Bridgeway	20 **	10A	SB	Gate 5	Gate 6	0.2	B	C	B	C	B	B	C	A	D	

Source:
2010 - Jacobs Engineering traffic survey
* Summary of 1997-2008 Results from 2008 CMP Monitoring Report Table 5
** As indicated in 2008 CMP Monitoring Report, segments were modified in 2007
*** Methodology changed beginning with the 2006 Study to using floating car travel times in place of volumes and V/C
The reported LOS rankings represent the PM Peak commute directions

F. AGGREGATE PEAK HOUR TRAVEL TIME

The CMP is not only to focus on vehicular performance, but on multi-modal operations. TAM has historically included a summary of travel times by mode (single-occupant vehicles, high-occupancy vehicles using car-pool lane, and public transit buses) along four corridors within the county as listed below:

- US 101 between the Marin-Sonoma County Line and the Transit Center at Heatherton Street in San Rafael,
- US 101 between the San Rafael Transit Center and the Golden Gate Bridge,
- Sir Francis Drake Boulevard between Butterfield Road and US 101, and
- Red Hill Avenue between Sir Francis Drake Boulevard and the San Rafael Transit Center.

With regard to the car-pool lane on US 101, in previous years it was not continuous through the limits described. The gap in the HOV limits was recently closed and for the first time, the full length of the HOV was traveled for this report from SR 37 to SR 1. Previously, the southbound lane began south of SR 37 and ends north of San Pedro Road. It then started again south of I-580 and ended again near SR 1. The southbound lane is active between 6:30 a.m. and 8:30 a.m. and is open to all traffic for the remainder of the day (off-peak direction). In the northbound direction, it is active from 4:30 – 7:00 p.m. There are no car-pool lanes in either direction on Sir Francis Drake Boulevard and Red Hill Avenue. **Table 5** illustrates the travel time results by mode (Auto on general purpose lanes, HOV in car-pool lane, and transit via various bus routes as indicated).

Table 5 – Corridor Peak Period Travel Time Monitoring Results

Corridor Peak Period Travel Time Monitoring Results (minutes)
Marin County CMP Transportation System Performance Monitoring Study - 2010

			2006			2008			2010		
			Auto	HOV	Bus	Auto	HOV	Bus	Auto	HOV	Bus
US 101 - North	AM	NB	18	18	45(A)	17	N/A	46(A)	15	N/A	44(A)
San Rafael Transit Center - Sonoma County Line		SB	30	29	66(A)	47	24	68(A)	21	18	46(A)
	PM	NB	25	26	51(A)	26	24	63(A)	23	21	43(A)
		SB	19	N/A	52(A)	22	N/A	59(A)	15	N/A	61(A)
US 101 - South	AM	NB	13	N/A	40(B)	12	N/A	43(A)	11	N/A	45(B)
San Rafael Transit Center - GG Bridge		SB	13	13	31(B)	12	11	36(A)	12	11	45(E)
	PM	NB	19	17	47(B)	25	17	48(A)	20	13	88(B)
		SB	12	N/A	35(B)	12	N/A	50(A)	11	N/A	50(E)
Sir Francis Drake Blvd	AM	NWB	12	N/A		11	N/A	N/A	11	N/A	N/A
Butterfield - US 101		SEB	17	N/A	31(C)	18	N/A	33	9	N/A	24(C)
	PM	NWB	14	N/A	26(C)	17	N/A	21	16	N/A	18(F)
		SEB	12	N/A		13	N/A	N/A	18	N/A	N/A
Red Hill Ave	AM	NWB	7	N/A	17(D)	6	N/A	13(D)	5	N/A	13(D)
SFD - San Rafael Transit Center		SEB	7	N/A		7	N/A	N/A	5	N/A	13(D)
	PM	NWB	7	N/A	19(D)	8	N/A	13(D)	9	N/A	13(D)
		SEB	7	N/A		7	N/A	N/A	6	N/A	13(D)

Source:
2010 HOV - Jacobs Engineering collected additional AM and PM HOV travel times in October 2011 for the full limits (SR 1 to SR 37) to represent the conditions after the "gap closure" expansion
2010 - Jacobs Engineering traffic survey (AM travel times are from Inrix and PM are from GPS travel time runs)
2006 & 2008 - TAM Transportation System Performance Monitoring Study
Transit travel times were estimated based on bus schedules
All reported times are in minutes
(A) Estimated based on commute bus Route 70 & 80 between San Rafael Transit Center - Petaluma Depot
(B) Estimated based on commute bus Route 70 & 80 from San Rafael Transit Center and Golden Gate Bridge Toll Plaza
(C) Estimated based on commute bus Route 24 between Bank and US 101/Lucky Drive Bus Pad
(D) Estimated based on commute bus Route 23 between San Rafael Transit Center and SFD/Center Street Hub instead of the Butterfield Intersection in 2006
(E) Estimated based on commute bus Route 70 & 80 from San Rafael Transit Center and SF Civic Center (GG time is not published)
(F) Estimated based on commute bus Route 24 between Center and US 101/Lucky Drive Bus Pad (Bank not a stop in NB PM)

G. PERSON THROUGHPUT

The objective of this performance measure is to document the number of persons that move along various corridors in the available modes during the PM Peak Period in the peak commute direction. The corridors that have historically been evaluated include:

- US 101 Northbound between I-580 and Central San Rafael
- US 101 Northbound between SR 131 and Paradise Drive
- US 101 Northbound North of Atherton
- Sir Francis Drake Boulevard Northwestbound East of Wolf Grade
- Sir Francis Drake Boulevard Northwestbound North of Red Hill Road
- Red Hill Avenue Northwestbound East of Sir Francis Drake Boulevard

The modes considered and shown in **Table 6**, include the estimated occupants using transit on the routes within the limits described, observed occupancy of vehicles, and occupancy of the organized van pool system.

Table 6 – Person Throughput Monitoring Results (PM Peak Period)

Person Throughput Monitoring Results - (PM Peak Hour)
Marin County CMP Transportation System Performance Monitoring Study - 2010

	2008					2010					
	Transit Person	Auto Person	Van Pool Person	Total Person	% Chg (2006-2008)	Transit Person	Auto Person	HOV Lane	Van Pool Person	Total Person	% Chg (2008-2010)
US 101 - NB I-580 - Central San Rafael	120	11,721	135	11,976	49.92%	320	7,896	1,506	47	8,263	-31.00%
US 101 - NB SR 131 - Paradise Drive	640	8,895	72	9,607	18.43%	1,400	6,397	2,226	47	7,844	-18.35%
US 101 - NB North of Atherton	520	4,099	135	4,754	2.99%	320	3,232	N / A	93	3,645	-23.34%
Sir Francis Drake Blvd - NWB East of Wolf Grade	190	2,017	24	2,231	-13.56%	266	1,395	N / A	93	1,754	-21.40%
Sir Francis Drake Blvd - NWB North of Red Hill	190	1,845	47	2,082	-26.46%	304	2,285	N / A	0	2,589	24.33%
Red Hill Avenue - NWB East of SFD Blvd	228	2,103	23	2,354	21.59%	228	2,094	N / A	0	2,322	-1.36%

Source:
2010 - Jacobs traffic survey (December 15-16, 2010 430-515 PM - Dark after 5 and unable to accurate count occupants, the 5:15-5:30 interval is extrapolated)
2006 & 2008 - TAM Transportation System Performance Monitoring Study (Peak Hour)
The above analysis is for the PM peak commute direction only (i.e. leaving SF and/or US 101)
Transit persons for SFD and Red Hill were estimated based on bus schedules and an estimated load of 38-person/bus
Transit persons for US 101 was estimated based on bus schedules and an estimated load of 40-person/bus
511.org vanpool division provided vanpool data (Christy Garland - garland@rideshare.511.org)

H. VEHICLE MILES TRAVELED ON CONGESTED HIGHWAYS

As included in the 2008 Marin County CMP Monitoring Study, the objective of this performance measure is to identify the number of vehicles that travel on congested roadways currently and 25 years from now. Given the model years, the data for this performance measure is being incorporated directly from the 2008 Monitoring Study.

This performance measure helps in developing long-range transportation and land use planning, and other public policies that would affect travel patterns in the County. This projection is obtained from the Marin County Traffic Model forecasts for 2030 for the Marin County Area. For 2008, the Marin County Traffic Model indicated that vehicle miles travel data has not changed since 2006 cycle year. Congested roadway is defined as roadway segments with a ranking of LOS "F" and V/C > 1.

Table 7 – Vehicle Miles Traveled on Congested Roadway Monitoring Results

Vehicle Miles Traveled on Congested Roadway Monitoring Results Marin County CMP Transportation System Performance Monitoring Study - 2010			
	2005	**2030**	**% Chg**
Total PM Peak Vehicle Miles Traveled	593,974	802,961	35.2%
Total PM Peak Vehicle Miles Traveled in Congested Conditions	56,712	222,710	292.7%
Percent Vehicle Miles Traveled in Congested Conditions	9.5%	27.7%	190.5%
Source: 2008 - TAM Transportation System Performance Monitoring Study 2008 Monitoring Study referenced the use of the Marin County Traffic Model - TAM Traffic Model and ABAG's Projections 2003			

As shown in **Table 7**, vehicle miles traveled by 2030 will increase by 35.2%, and the total number of vehicle miles traveled on congested roadways will increase by 292.7%. The Marin County CMP has not established goals, objectives, or minimum standards for this performance measure. This information is provided to assist in long-range transportation and land use planning.

I. JOBS / HOUSING BALANCE

As included in the 2008 Marin County CMP Monitoring Study, the objective of this performance measure is to evaluate the current and projected balance between jobs and housing in the Bay Area including Marin County. Given the model years, the data for this performance measure is being incorporated directly from the 2008 Monitoring Study.

Commute traffic is a major load on the regional transportation system as workers must travel from their homes in one community to work in another community. A balance between jobs and housing within a community or area generally means there is the potential for workers to find jobs within their own communities, meaning shorter commutes. This would in turn reduce the need to travel (or travel long distance) and subsequently reduce traffic congestion on the regional transportation system.

A jobs / employed resident ratio of 1 would be a perfect balance as it means all employed residents could potentially work in the same community where they live. A jobs / employed residents ratio > 1, such as San Francisco County, means the community has more jobs than employed residents and must import workers from other counties. The higher the ratio is above 1, the more workers a community must import. As such, in the Bay Area, the morning commute traffic clow gravitates toward San Francisco from the suburban towns and cities while in the afternoon the pattern reverses.

For Marin County, the jobs / employed resident ratios area 1.11, 1.08, and 1.08 respectively for 2005, 2020, and 2035. These ratios are improving but many Marin County workers still must travel to other counties to work and must rely on the area's regional transportation system. This information is reported in TAM's 2011 Marin Congestion Management Update, which will be available at http://www.tam.ca.gov/ in fall 2011.

The Marin County CMP has not established goals or standards for this measure.

J. TRANSIT HEADWAY

This performance measure evaluates the headways, or the interval between buses, on various routes serving Marin County. As headways decrease, the use of transit becomes more convenient and many times the ridership increases. With increase ridership on transit, the number of private vehicles on the roadway decreases and the levels of congestion are improved. **Table 8** compares transit headway along major travel corridors during the PM commute hours. All intervals are in the commute direction and are for those routes either leaving or arriving at the Transit Center at 3rd Street / Heatherton Street in San Rafael or a station / stop nearest to the Transit Center. The Marin CMP has not established goals or minimum standards for this performance measure.

Table 8 – Transit Headway Monitoring Results

Transit Headway Monitoring Results (PM Period)
Marin County CMP Transportation System Performance Monitoring Study - 2010

Route		Headways 2004	2006	2008	2010
	Golden Gate Transit Basic Service				
10	Marin City - San Francisco	30	22-31	30	60
26	San Francisco - San Anselmo (Via San Rafael)	30	11-15	31-31	N/A
40	San Rafael - Richmond	20	23-30	60	60
70	Novato - San Francisco (Included in Route 80)	30	61-65	60	60
80	Santa Rosa - San Francisco	30	61-65	60	60
	Golden Gate Transit Commute Service				
2	Marin City/Sausalito - San Francisco	10	15-20	30	30
4	Mill Valley - San Francisco	15	5-15	6-31	5-30
8	Tiburon/Belvedere - San Francisco	25	30-46	25	1/day
18	Kenfield (College of Marin) - San Francisco	15	14-29	9-30	10-30
24	Inverness/Fairfax - San Francisco	10	7-30	8-30	10-30
26	Sleepy Hollow/San Anselmo - San Francisco	25	15-33	31-32	N/A
27	San Francisco - San Rafael				60
38	Terra Linda - San Francisco	15	21-32	30-32	28-30
44	Lucas Valley - San Francisco	25	29-58	25-33	57
54	San Marin/Novato - San Francisco	10	15	3-33	10-32
56	San Marin/Novato - San Francisco	10	15-33	26-30	21-30
71	Santa Rosa - San Rafael	30	60-75	30-60	23-123
75	Santa Rosa - San Rafael	30	27-42	30-66	N/A
97	San Rafael - San Francisoco (Via Larkspur Ferry Terminal)		1 / day	N/A	N/A (AM Only)
	Golden Gate Transit Local Service				
21	Kenfield - Mill Valley	30	N/A	N/A	N/A
22	San Rafael - Sausalito	60	8-31	30	30-60
23	Fairfax - Marin Civic Center	30	30	29-31	60
29	San Rafael - San Anselmo	30	N/A	30	60
35	San Rafael - Canal Area	30	4-30	10-20	10-30
	Marin Transit Service				
221	Corte Madera - Larkspur	N/A	N/A	65	65
233	San Rafael - Marin Civic Center - San Venetia	N/A	N/A	60	60-85
259	Marin Civic Center - Northgate Mall - Marinwood	N/A	N/A	60	60

Source:
Golden Gate Transit District (goldengatetransit.org), Marin Transit (marintransit.org)
2004-2008 - 2008 TAM Transportation System Performance Monitoring Study
All headways / intervals are in minutes.

K. TRANSIT COORDINATION

This performance measure evaluates the connectivity of transit routes as to the coordination and convenience to the patron of Marin County.

This information is reported in TAM's 2011 Marin Congestion Management Update, which will be available at http://www.tam.ca.gov/ in fall 2011.

L. PEDESTRIAN AND BICYCLE PROJECTS

This performance measure evaluate the availability of and planning for alternative modes including bicycles and pedestrians within Marin County.

This information is reported in TAM's 2011 Marin Congestion Management Update, which will be available at http://www.tam.ca.gov/ in fall 2011.