

# MEMORANDUM



**TO:** David Early and Bruce Brubaker (Design, Community and Environment)

**FROM:** John Templeton and David Parisi (Parisi Associates)

**DATE:** November 28, 2008

**SUBJECT:** Marinwood Village Trip Generation and Level-of-Service Analysis

This memorandum presents information regarding the estimated number of vehicle-trips that could be generated by the proposed Marinwood Village project, the associated traffic impacts on two nearby intersections, and mitigation measures that can reduce traffic impacts to less-than-significant.

## A. Trip Generation

The proposed project would consist of 92 residential units, comprised of 48 townhouses and 44 condominiums; and 25,980 square feet of retail space, of which 15,100 square feet would be devoted to a grocery store.

Vehicle-trip generation for the proposed land uses was calculated using rates presented in the Institute of Transportation Engineers' *Trip Generation (7<sup>th</sup> Edition)*. As shown in Table 1, the project would be expected to generate about 2,565 daily trips, 163 AM peak hour trips, and 235 PM peak hour trips.

**Table 1: Project Vehicle-trip Generation Estimates**

Land Use	ITE Code	Project		Daily		AM Peak		PM Peak	
		Size	Units	Rate	Total	Rate	Total	Rate	Total
Townhouse	230	48	DU	5.86	281	0.44	21	0.52	25
Condominium	230	44	DU	5.86	258	0.44	19	0.52	23
Specialty Retail	814	10,880	Sq. Ft.	44.32	482	6.84	74	2.71	29
Grocery Store	850	15,100	Sq. Ft.	102.24	1,544	3.25	49	10.45	158
<b>Totals</b>					<b>2,565</b>		<b>163</b>		<b>235</b>

## B. Level-of-Service Analysis

The County of Marin uses the Highway Capacity Manual (HCM) operational procedure for evaluating signalized and unsignalized intersections. The procedure provides estimates of capacity, delay, and level-of-service (LOS). Intersection-wide delay and level-of-service are not defined by the HCM for one-way or two-way stop controlled intersections. In those cases, evaluations are reported on the approaches with the worst delay and level-of-service. HCM level-of-service is measured as a function of vehicle delay, with the corresponding ranges shown in Table 2.

The intersection of Miller Creek Road/Marinwood Avenue is an all-way stop sign-controlled intersection. The southbound approach from US 101 to Miller Creek Road is stop sign-controlled

for left-turn and through movements and yield-controlled for right-turns. There are no traffic controls on Miller Creek Road.

**Table 2. Level of Service Descriptions for Stop Sign-Controlled Intersections**

LOS	Description	Delay per Vehicle Signal (sec.)	Delay per Vehicle Unsignalized (sec.)
A	LOS A describes operations with low control delay, up to 10 seconds per vehicle. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.	< 10	< 10
B	LOS B describes with control delay greater than 10 and up to 20 seconds per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than the LOS A, causing higher levels of delay.	10 - 20	10 - 15
C	LOS C describes operations with control delay greater than 20 and up to 35 seconds per vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles, and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.	20 - 35	15 - 25
D	LOS D describes operations with control delay greater than 35 and up to 55 seconds per vehicle. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, and high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	35 - 55	25 - 35
E	LOS E describes operations with control delay greater than 55 and up to 80 seconds per vehicle. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are common.	55 - 80	35 - 50
F	LOS F describes operations with control delay in excess of 80 seconds per vehicle. This level, considered unacceptable to most drivers, often occurs with over saturation, that is, when arrival flow rates exceed the capacity of lane groups. It may also occur at high V/C ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.	> 80	> 50

*Source: Highway Capacity Manual 2000, Transportation Research Board, National Research Council*

Marin County currently considers an unsignalized intersection to be significantly impacted if a movement of the intersection falls below LOS D. Causing an increase in delay at an intersection at or below LOS E is also considered to be a significant impact.

Vehicle delay and level-of-service were calculated for the following scenarios: existing conditions; existing plus project conditions; and existing plus project plus other planned project conditions. For this study, the Oakview assisted living facility is included as a planned project. The level-of-service results for these three scenarios are shown in Table 3.

At the Miller Creek Road/Marinwood Avenue intersection, the existing LOS F conditions, with overall vehicle delay of 86 seconds, during the AM peak results in substantial congestion. During the PM peak hour, the intersection currently operates acceptably at LOS C. Under existing plus project conditions, AM peak hour conditions would be expected to remain at LOS F, but with average motorist delays increasing by over half a minute, to about 121 seconds. With the project, PM peak hour conditions would degrade to LOS D. The intersection could be mitigated to an impact of less-than-significant (LOS B) with installation of a traffic signal.

The stop sign-controlled movements at the Miller Creek Road/US 101 southbound off-ramp are currently operating at LOS D or better conditions during weekday peak hours. Under existing plus

project conditions, the intersection would degrade to LOS E conditions during the AM peak hour. The intersection can be mitigated to an impact of less-than-significant with installation of a traffic signal.

**Table 3. Intersection Service Levels and Delays**

Peak Period	Existing		Existing + Project		Existing + Project Mitigated		Existing + Project Oakview		Existing + Project Oakview Mitigated	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
<i>Miller Creek Road/US 101 Southbound Ramp</i>										
AM	34.1	D	<b>38.1</b>	<b>E</b>	8.8	A	<b>42.4</b>	<b>E</b>	9.3	A
PM	12.5	B	<b>17.0</b>	<b>C</b>	26.4	C	<b>17.5</b>	<b>C</b>	27.7	C
<i>Miller Creek Road/Marinwood Avenue</i>										
AM	<b>85.5</b>	<b>F</b>	<b>121.3</b>	<b>F</b>	18.9	B	<b>126.4</b>	<b>F</b>	24.5	C
PM	<b>18.8</b>	<b>C</b>	<b>43.9</b>	<b>E</b>	12.6	B	<b>55.1</b>	<b>F</b>	25.8	C

Source: Parisi Associates

Oakview is the only nearby short-term project that has been approved by Marin County. The Oakview Final EIR and Amendment was certified by the Board of Supervisors in January 2005. The project consists of 150 assisted living units accessing Marinwood Avenue and 28 residential units accessing Las Gallinas. The EIR found that the Oakview project caused significant traffic impacts to the intersections of Miller Creek Road/US 101 southbound off-ramp and Miller Creek Road/Marinwood Avenue. Installation of a traffic signal at each intersection was identified as mitigation measure that would reduce the impacts to less-than-significant.

At the intersection of Miller Creek Road/Marinwood Avenue the vehicle delay and level-of-service would be exceeded for the AM and PM peaks under existing plus project plus other projects scenario. During the AM peak hour the intersection would operate at LOS F with average delays of 126 seconds. During the PM peak hour, the intersection would also operate at LOS F, but with average delays of 55 seconds. The intersection could be mitigated to an impact of less-than-significant with installation of a traffic signal.

The Miller Creek Road/US 101 southbound off-ramp would be significantly impacted during the AM peak hour under the existing plus project plus other projects scenario, where the southbound stop sign-controlled movements would operate at LOS F with average motorist delays of 42 seconds. The intersection can be mitigated to an impact of less-than-significant with installation of a traffic signal.