EXHIBIT I

FEHR & PEERS
TRANSPORTATION CONSULTANTS

TECHNICAL MEMORANDUM

Date: April 22, 2005

To: Pat Fitzsimmons, Roxanne Namazi and Will Marshall
City of Davis Public Works Department

From: Jaimee Hicks

Subject: ***Fifth Street Corridor Study in Downtown Davis***

1031-2008

In December 2004 Fehr & Peers revised the Fifth Street Corridor Study in response to neighbors' comments. Subsequent to submitting the revised memorandum, Fehr & Peers met with City staff and the neighbors to discuss the analysis and further refinements. The refined analysis results are presented in this memorandum.

BACKGROUND

Fifth Street is a four-lane east-west roadway in downtown Davis. Left-turn lanes are not provided at the intersections due to the limited roadway width. Residents in the area requested revisions to the design of Fifth Street, between B and L Streets, to revise the roadway cross-section to two travel lanes with bicycle lanes and left-turn lanes at all intersections between C and K Streets. This type of roadway treatment is also called a "road diet". The purpose of a road diet is to provide equal treatment to vehicles, pedestrians, and bicyclists by providing facilities for bicycles (bike lanes) and reduce exposure to vehicular traffic for crossing pedestrians. Fehr & Peers was retained by the City of Davis to conduct a traffic operational analysis of the Fifth Street road diet.

To date, Fehr & Peers has attended two public hearings (April 15, 2004 and August 12, 2004) and prepared several technical memorandums documenting the findings of our work for the Fifth Street corridor. In addition, two meetings have been held with the Old North Davis neighbors. In September 2004, Fehr & Peers met with City staff and the residents to provide the neighbors with an opportunity to share their thoughts and provide comments on the traffic analyses conducted to date. One concern was that the traffic analyses used counts conducted during the Farmer's Market and were therefore unreasonably high. New traffic counts were conducted on a non-Farmer's Market night to obtain more-typical volumes. The analyses were revised and the findings were documented in a memorandum dated December 20, 2004. Another meeting was held on March 1, 2005. Neighbors identified additional comments, such as incorporating vehicles using the bike lanes as right-turn pockets at the intersections and redistributing traffic among the north-south streets to balance intersection operations and queuing. This memorandum documents our latest micro-simulation analyses addressing these concerns and an analysis of future (year 2015) operations.

GEOMETRIC ISSUES WITH RIGHT-TURN MOVEMENTS

The neighbors requested that the roadway network be modified to include right-turn pockets on Fifth Street to simulate vehicles using the bike lanes for right turns, as would occur when no bikes are present. Fifth Street has a 50-foot curb-to-curb width. With the road diet, it would contain two 6-foot bike lanes,

one 12-foot travel lane, one 11-foot travel lane, one 11-foot left-turn lane and a four-foot median. Right-turn lanes are usually 10 to 12 feet wide. Since the bike lanes are only 6 feet wide, Fehr & Peers assessed geometric issues associated with this assumption. Figure 1 illustrates the geometric constraints associated with the right-turn movements with either two passenger vehicles adjacent to each other or with a passenger car and a single-unit truck[1]. It was assumed that the vehicle in the through lane would be centered in the lane. As shown, a typical passenger vehicle may not be able to pass the vehicle in the through lane. A larger vehicle, such as an SUV, would block the lane. A single-unit truck or larger vehicle would not be able to fit. One option would be to remove the median and widen the bike lanes to eight feet to better accommodate turning vehicles.

Therefore, the analysis with right-turn lanes assumes that no bikes are present and that either the median is removed and the bike lanes are widened, *or* the through vehicles are in the center of the lane (or to the left of center) and all turning vehicles are passenger vehicles or smaller, which excludes SUVs and delivery trucks. Because it is unlikely that all of these conditions would occur at all times, the analysis with right-turn pockets on Fifth Street tends to understate vehicle delay. This memorandum presents findings both with and without right-turn pockets to show the full-range of likely operations.

ANALYSIS

The findings presented in this memorandum primarily reflect two changes from previous memorandums. First, the micro-simulation model used to evaluate traffic operations was modified to reflect the use of the bike lanes for right turns from Fifth Street. To do this, short (50-foot) right-turn pockets were included along Fifth Street at all intersections within the study area. It should be noted, however, that this assumption tends to underestimate vehicle delay as discussed above. It was also assumed that vehicles heading northbound on E Street would be able to use a short (40-foot) right-turn pocket. This assumes that no vehicles are parked curb side on the east side of E Street for approximately 50 feet south of Fifth Street. This would only benefit right-turners when two or fewer vehicles are queued waiting to turn left or continue straight.

The second major change is the added analysis with projected traffic volumes for 2015 for conditions with and without the road diet. A sensitivity analysis was conducted to determine whether re-assigning traffic among the north-south streets would affect the results.

Analysis Scenarios

The scenarios reflected in this memorandum are:

1. **December 2004** – This scenario includes the Fifth Street corridor with its lane configuration and signal operations as of December 2004; that is, two lanes in each direction without dedicated left-turn pockets and permitted phasing at the F and G Street intersections. This scenario is included for comparison purposes only.
2. **Existing with Four Travel Lanes** – This scenario includes Fifth Street with its current lane configuration and split phasing at F and G Streets. In other words, the eastbound Fifth Street and westbound Fifth Street approaches at each intersection operate with separate green signal phases, allowing left-turn movements in either direction to operate under protected conditions (i.e., left-turning motorists do not have to yield to oncoming traffic). The signals are timed to

[1] Vehicle dimensions were obtained from AASHTO (American Association of State Highway and Transportation Officials) and represent vehicle type P (which represents a typical passenger vehicle) and vehicle type SU (which represents a typical single-unit delivery truck).

provide coordinated progression in the peak direction, which is eastbound during the PM peak hour, between A Street and G Street. This scenario represents existing signal conditions as of February 2005.

3. **Road Diet with Right-Turn Pockets** – This scenario includes one travel lane in each direction between B Street and L Street. Left-turn pockets would be provided at each intersection, and protected left-turn phasing would be implemented at the Fifth Street/F Street and Fifth Street/G Street intersections. The signals would be timed to provide coordinated progression in both directions between A Street and G Street. Bike lanes would also be included in each direction of travel. Also assumed were de facto right-turn pockets along Fifth Street and a right-turn pocket northbound on E Street. This scenario assumes that no bikes are present and that either the median is removed and the bike lanes are widened, *or* that the through vehicles are in the center of the lane (or to the left of center) and all turning vehicles are passenger vehicles or smaller, which excludes SUVs and delivery trucks.

4. **Road Diet** – This scenario is the same as Scenario 3 but without right-turn pockets. This scenario represents operations when bikes are present in the bike lanes *or* when trucks or other large vehicles are in the travel lanes therefore not allowing the right-turn movements from Fifth Street to occur concurrently with the through movements.

5. **Future (2015) with Four Travel Lanes** - This scenario assumes existing geometries and signal operations (two lanes in each direction without dedicated left-turn pockets and split phasing at the F and G Street intersections), but assumes growth in the City of Davis to Year 2015. This growth includes land uses as approved in the City's General Plan plus growth contained in the UC Davis Long Range Development Plan. It does not include Covell Village or Target.

6. **Future (2015) Road Diet with Right-Turn Pockets** – This scenario represents future road diet operations with the de facto right-turn lanes.

7. **Future (2015) Road Diet** – This scenario represents future road diet operations when bikes are present in the bike lanes *or* when trucks or other large vehicles are in the travel lanes therefore not allowing the right-turn movements from Fifth Street to occur concurrently with the through movements.

Analysis Results

Weekday PM peak hour travel times on Fifth Street throughout the study corridor, as well as intersection delay and level of service (LOS), were estimated for each scenario using SimTraffic, a micro-simulation software. The results are presented in Table 1. For signalized intersections, delay and LOS are reported as an average for all movements at the intersection. For unsignalized intersections, delay and LOS are reported for the worst-case movement of the stop-controlled approaches only. Year 2015 volumes were projected using the City's travel demand model. Growth rates were extracted and applied to the existing volumes. Generally, eastbound travel is expected to increase by 13 percent, and westbound travel is expected to increase by 25 percent. Increased travel between downtown and areas to the north would result in traffic increases on the north-south streets ranging between 2 percent and 14 percent.

TABLE 1
FIFTH STREET CORRIDOR OPERATIONS COMPARISON
(WEEKDAY PM PEAK HOUR)

Direction/Intersection	Existing Volumes				Future 2015 Volumes		
	Dec. 2004	4 Lanes	2 Lanes w/RT Pockets	2 Lanes	4 Lanes	2 Lanes w/RT Pockets	2 Lanes
Travel Times (Differences Compared to Existing Geometrics – 4 Lanes in minutes:seconds)[1]							
Eastbound Direction	2:49	3:17	3:09 (-0:08)	3:45 (+0:28)	3:54	4:24 (+0:30)	5:32 (+1:38)
Westbound Direction	2:31	3:14	2:33 (-0:41)	2:41 (-0:33)	4:17	3:02 (-1:15)	3:44 (-0:33)
Intersection Operations (Average Delay[2]/Level of Service)							
A Street – All approaches to signal	11 / B	10 / A	10 / A	9 / A	10 / B	38 / D	34 / C
B Street – All approaches to signal	24 / C	22 / C	28 / C	28 / C	26 / C	40 / D	42 / D
C Street – Northbound stopped approach	12 / B	11 / B	26 / D	25 / C	15 / B	**>50 / F**	**>50 / F**
C Street – Southbound stopped approach	9 / A	7 / A	16 / C	17 / C	14 / B	**>50 / F**	**>50 / F**
D Street – Northbound stopped approach	15 / B	16 / C	35 / D	47 / E	20 / C	**>50 / F**	**>50 / F**
D Street – Southbound stopped approach	16 / C	16 / C	34 / D	29 / D	21 / C	**>50 / F**	**>50 / F**
E Street – Northbound stopped approach	20 / C	26 / D	32 / D	**>50 / F**	**>50 / F**	**>50 / F**	**>50 / F**
E Street – Southbound stopped approach	16 / C	14 / B	17 / C	28 / D	21 / C	**>50 / F**	**>50 / F**
F Street – All approaches to signal	16 / B	32 / C	26 / C	28 / C	44 / D	33 / C	36 / D
G Street – All approaches to signal	14 / B	26 / C	19 / B	23 / C	34 / C	21 / C	35 / C
I Street – Northbound stopped approach	11 / B	16 / C	18 / C	16 / C	16 / C	26 / D	**>50 / F**
I Street – Southbound stopped approach	12 / B	15 / B	18 / C	18 / C	18 / C	38 / E	**>50 / F**
J Street – Northbound stopped approach	19 / C	13 / B	25 / C	28 / D	19 / C	41 / E	**>50 / F**
J Street – Southbound stopped approach	14 / B	11 / B	23 / C	33 / D	16 / C	32 / D	**>50 / F**
K Street – Northbound stopped approach	21 / C	25 / C	**>50 / F**	**>50 / F**	**>50 / F**	**>50 / F**	**>50 / F**
K Street – Southbound stopped approach	36 / E	29 / D	37 / E	**>50 / F**	46 / E	**>50 / F**	**>50 / F**
L Street – All approaches to signal	25 / C	24 / C	25 / C	29 / C	29 / C	37 / D	41 / D

Note:
1. Travel time is measured between A Street and L Street and considers only through traffic.
2. Average control delay in seconds per vehicle.

Source: Fehr & Peers, 2005.

Travel Times

Travel times represent the average amount of time for all through vehicles to travel on Fifth Street between B and L Streets. Left-turn lanes are not provided with the four-lane cross-section scenarios. Therefore, the travel times for these scenarios include the delay caused to through vehicles due to vehicles waiting to turn left from the through lanes. Left-turn lanes will be added with the road diet scenarios and therefore their reported travel times do not include any left-turn delay.

Implementation of split phasing at F and G Streets has resulted in travel time increases of 28 seconds in the eastbound direction and 43 seconds in the westbound direction compared to previous conditions. However, it should be noted that the split phasing allows left-turn movements in either direction at these locations to operate under protected conditions.

Implementation of the proposed road diet with two travel lanes, left-turn pockets, and bike lanes but assuming that the bike lanes are always available for right-turn movements would result in reduced travel times on Fifth Street compared to current conditions. Evaluation of the road diet with bikes present in the bike lanes, and therefore conditions where right-turning vehicles would have to use the travel lanes show that the travel times in the eastbound direction (the direction with the higher traffic volumes during the PM peak hour) would increase by about 30 seconds and travel times in the westbound direction would decrease by the same amount. Actual conditions with the road diet would be a combination of these two scenarios. Therefore, the road diet with the reduced number of travel lanes and the added left-turn lanes would result in reduced travel time in the westbound direction but slight increases in travel times in the eastbound direction during the weekday PM commute period with existing volumes.

Future conditions were evaluated with increased traffic volumes. The results show that with the road diet, travel times would increase in the eastbound direction by more than 30 seconds and up to 1 minute and 38 seconds in comparison to travel times with the four-lane cross-section. Travel times would decrease by at least 33 seconds and no more than 1 minute and 15 seconds in the westbound direction.

Only travel times for east-west traffic on Fifth Street are included in the analysis. The road diet will also affect north-south travel on the cross streets. These effects are discussed via the intersection operations presented in the next section.

Intersection Operations

Table 1 also reports delay and LOS at each intersection. Level of Service (LOS) F conditions are shown in bold. For December 2004 conditions (Four Lanes), all intersections operate at LOS C or better, except the southbound K Street approach, which operates at LOS E. The cause of the long delay is vehicle queuing at the L Street intersection, which prevents motorists on K Street from turning onto eastbound Fifth Street.

Implementation of split phasing at the F Street and G Street intersections (which is the current operation along the Fifth Street corridor) creates more vehicle delay at these two locations, dropping the LOS from B to C. Changes at the other intersections are minimal.

Under the road diet scenario with de fact right-turn pockets, there are fewer gaps in traffic on Fifth Street due to the lane reduction resulting in longer delays for all of the side-street stopped-controlled movements. Specifically, the northbound approaches on D Street and E Street would experience about 20 seconds and 23 seconds of added delay per vehicle, respectively. The delay is even higher assuming no right-turns from the bike lanes, with an increase of 30 seconds and 70 seconds at these intersections, respectively. In response to the congestion, some motorists may choose a different route to leave the downtown area. For example, instead of using congested E Street to access Fifth Street, they may use B Street, C Street, or travel east of the railroad tracks. The shifting of traffic may reduce the congestion at D Street and E Street.

Also presented in Table 1 are PM peak hour conditions with growth to Year 2015. This growth includes approved land uses in the City's General Plan as well as growth contained in the UC Davis Long Range Development Plan. This growth does not include Covell Village or Target. With the four-lane option, two intersection approaches are projected to operate at LOS F, the northbound approaches at E and K Streets.

Traffic growth in the corridor and the road diet would result in LOS F operations at C Street, D Street, E Street, and K Street (both with and without right-turn pockets). At I Street and J Street the northbound and southbound approaches would experience LOS D and E conditions with the project assuming right-turns from the bike lane, and LOS F conditions assuming no right-turns.

CONCLUSIONS

Geometric changes due to the road diet will cause reduced travel times in the westbound direction and increased travel times in the eastbound direction. The magnitudes of these changes are about the same. However, the predominant direction of traffic flow in the PM peak hour is in the eastbound direction. Therefore the overall travel times on Fifth Street will be higher with the road diet.

Intersection operations will worsen with the road diet. The road diet will reduce number of gaps in the traffic flow on Fifth Street. Therefore, vehicles on the north-south streets will have to wait longer to turn left or right or to cross Fifth Street. The increases in delays are exacerbated under future conditions when traffic volumes are higher[2].

If you have any questions about the information presented in this memorandum, please contact Jaimee Hicks.

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[2] Fehr & Peers conducted a sensitive analysis to determine whether diverting traffic from one north-south street to another would affect the results. The K street approaches are projected to operate at LOS F under conditions with existing volumes and the road diet. Diverting some of the traffic to other streets would increase the delay at those intersections but would not improve the level of service a K Street to a better level. Under future conditions with the road diet, a large number of the intersections are projected to operate at LOS F. Therefore, there would be little opportunity for traffic to divert to intersections with better operations.