MEMO

To: Amber Evans, City of Berkeley Redevelopment Agency

Date: July 23, 2008

From: Robert Betts

Subject: West Berkeley Circulation Master Plan Improvement Projects and Evaluation Methodology

Amber-
The following memo includes a summary of the proposed West Berkeley transportation improvement projects and a description of the methodology used to evaluate and rank these projects as part of Task 4 of the Circulation Master Plan.

Step 1: Identify Projects

The list of proposed transportation improvement projects taken into consideration for this planning effort was collected from a number of sources including:

- Recommendations from existing planning documents (City of Berkeley Pedestrian Plan, Bike Plan, Community-Based Transportation Plan, etc.);
- Recommended mitigation measures from existing traffic impact studies for approved or proposed developments;
- Suggestions from City of Berkeley Staff;
- Suggestions from the West Berkeley PAC;
- Suggestions from the general public; and
- Consultant recommendations.

In total, over 250 projects were collected and compiled into a detailed matrix. These initial projects were then screened and refined to include only those that were specific to the West Berkeley study area and appropriate based on the scope of this study.

The next refinement process to the projects organized these into short-term (2015) and long-term (2030) projects. This assignment was based primarily on the estimated need for the improvement (from the existing and future conditions analysis) and the size and implementation time of the project.

Once organized into short- and long-term projects, improvements were then classified as either a primary or secondary improvement. A primary improvement is suggested to directly address a transportation problem within the network and secondary projects are typically required to achieving the objective of the primary project. Secondary projects can also address a transportation improvement but may be put into the secondary classification based on its dependence on the implementation of the larger project.

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Figures 1-5 attached to this memo display the projects and their location within the West Berkeley study area. In total, 69 short term and 29 long term primary projects are included. The majority of projects are classified and shown in the figures as either roadway geometry projects (paving/striping) or traffic control (signals/stop signs) improvements. Other improvements that do not fit into the previously mentioned categories are attached in a separate section.

Step 2: Evaluation

The proposed improvements shown in Figures 1-5 will be ranked in an evaluation process to determine the priority of the projects relative to each other. The process being used to complete this task is based on a **benefit to cost ratio** of each primary project. The components and methodology for assessing these two measures are described in detail below.

Cost

Cost will be assigned to each improvement project on a 1-10 scale, with lower cost projects receiving a lower value and higher cost projects receiving a higher value. Ranges would be assigned similar to those in the table below.

Cost Score	Estimated Cost of Project
1	$ 0 – 5,000
2	$ 5,001 – 10,000
3	$ 10,001 – 25,000
4	$ 25,001 – 50,000
5	$ 50,001 - 100,000
6	$ 100,001 – 250,000
7	$ 250,001 – 500,000
8	$ 500,001 – 1,000,000
9	$ 1,000,001 – 5,000,000
10	$5,000,000 +

Benefits

The benefits of each improvement project will be calculated using four basic evaluation criteria:

- Performance (Operating and Environmental)
- Safety
- Livability (Comfort and Convenience)
- Network Resilience

Within each of these criteria, all primary travel modes will be assessed. These modes include:

- Auto (West Berkeley trips and regional trips)[1]
- Commercial Vehicles (only West Berkeley)[2]
- Transit
- Bikes
- Pedestrians

Benefits will be scored for each mode within each of the four evaluations using a -10 to +10 range. This score will be assigned using quantitative and qualitative data. The Performance criterion will be the only fully quantitative measure while the others will be more subjective and

[1] Using the estimates generated by the regional travel model, auto travel will be further broken down by West Berkeley auto travel and regional travel.

[2] Commercial vehicle trips will be estimated based on location of the trip within the network (existing land use) and existing heavy vehicle traffic compositions. This category pertains only to West Berkeley commercial vehicles and places regional commercial vehicles into the regional auto category.

qualitative. Five classifications are available for assignment to each of the qualitative measures including:

- Significantly improves
- Improves
- Neutral benefit
- Impacts
- Significantly impacts

This approach allows each of the modes to have its own rating scale relative to the range of benefits identified within the assessment.

Scores for each of the criteria will also be based on relative use (existing or future) of the facility or mode where the improvement is suggested. For example, a pedestrian improvement that has a high safety rating but has relatively few pedestrians would rate similarly to a project with a medium safety rating and a higher usage of pedestrians.

Below is a description of the various factors considered in the four evaluation criteria.

Performance

Projects will be evaluated using two different measures of performance which include operating performance and environmental performance. Operating performance relates to the level of delay experienced by the user and will be measured in terms of *person delay.* Environmental performance relates to the benefit the improvement has on reducing harmful greenhouse gas (GHG) emissions from vehicles and will be measured in terms of *pounds of greenhouse gas emissions*. Both measures will be obtained using estimates from the traffic model and/or the Highway Capacity Manual methodologies.

Person delay is a direct output from the model and will be estimated for auto, commercial vehicle, bus, bike and pedestrians for all applicable improvements. Estimates for auto and transit occupancies will be needed to quantify the person delay. These will be estimated using background data collected from AC Transit and the Bay Area Travel Survey.

Greenhouse gas emissions will be estimated based on another direct output from the simulation model - fuel consumption[3]. Methodologies for estimates of GHG emissions from fuel consumption will be based on the EPA's Code of Federal Regulations which is consistent with the Intergovernmental Panel on Climate Change (IPCC) guidelines. This model roughly assumes 8.8 kilograms (or 19.4 pounds) of CO_2 is produced with the consumption of each gallon of gasoline. Since CO_2 is assumed to produce 95% of all GNG emissions, the total amount of CO_2 emissions is then multiplied by 100/95 to obtain a total estimate for GHGs.

Once delay and emissions have been calculated, scores will be assigned to each interval based on the change in delay and emissions, similar to the cost table described earlier. Unlike the cost scores, performance scores will contain negative values, as they decrease the performance of an intersection or arterial.

Safety

Safety attributes will be assessed on a number of different levels for each of the modes and will consider existing accident data. Safety attributes are focused on both actual and perceived safety by users of the transportation network. Scores will focus on minimizing conflict between modes, minimizing conflict within modes and improving safety conditions of facilities (operating, waiting, storage). Below is a list of considerations specific to each mode:

Auto and Commercial Vehicles

[3] This assessment does not take into consideration any increases in the use of alternative fuels that produce fewer GHGs

- Conflict points between modes – primarily auto vs. rail/transit
- Conflict points for autos
    - Occurrences where drivers need to accept or reject gaps in traffic in order to complete a turning maneuver
    - Uncontrolled intersections
    - Unsafe sight distances or other occurrences of obstructed views for motorists
- Operating conditions of roadway facilities

Transit:

- Conflict points between modes – primarily transit/rail vs. auto
- Conflict points for transit
    - Occurrences where drivers need to accept or reject gaps in traffic in order to complete a turning maneuver
    - Uncontrolled intersections
    - Unsafe sight distances or other occurrences of obstructed views for motorists
- Passenger waiting environments – stops and stations
    - Adequate Lighting
    - Security monitoring staff/devices

Bikes

- Conflict points between modes – primarily bike vs. auto, commercial vehicle and transit/rail
    - Occurrences where cyclists need to accept or reject gaps in traffic
    - Uncontrolled intersections
    - Unsafe sight distances or other occurrences of obstructed views for cyclists
- Operating condition of bicycle facilities
- Signage and marking to notify motorists of bicycle presence
- Security of bike storage facilities

Pedestrians

- Conflict points between modes – primarily pedestrian vs. auto, commercial vehicles, transit/rail and bikes
- Operating conditions of pedestrian facilities
- ADA compliance issues

<u>Livability (Comfort and Convenience)</u>

The livability criterion refers to the ability to increase the desirability of the study area to live, work and visit. (Although safety is a significant aspect of livability, it is included under its own category.) Comfort and convenience of the employees, residents and visitors to the area and their ability to easily use a given mode for their desired trip is evaluated under this category. Attributes evaluated in this evaluation criterion include the cost of using a given mode, the ease to access or use that mode, the ability to store or park that mode, and the minimization of any other discomforts experienced while using that mode of travel. General aesthetics are also included in this assessment. Below are some of the specific attributes considered for comfort and convenience as they relate to each of the transportation modes:

Auto and Commercial Vehicles

- Directness of roadway network/ability to make necessary turns
- Commercial vehicle network that channels truck traffic on appropriate facilities and minimizes their intrusion of residential areas
- Appropriate speeds for the roadway facility (arterial ≤ 35 mph, residential ≤ 25 mph)
- Directional signage, wayfinding and roadway markings
- Availability and proximity of parking and/or loading
- Cost of use

Transit:

- Network configuration (distance to/from stops, service to major activity centers, connectivity to local and regional transit options, etc.)
- Comfortable passenger loads

- Reliability of service
- Comfortable stations (shelter, lighting, separation from traffic, etc.)
- Real-time information and wayfinding
- Cost of use

Bikes

- Directional signage, wayfinding and roadway markings for cyclists
- Directness of routes and paths for cyclists
- Separation from traffic
- Number of impedances (stops/crossings) along a path or route
- Cost of use

Pedestrians

- Pedestrian environment (streetscape)
- Shelter and lighting
- Directness and completeness of sidewalk network
- Opportunities to cross traffic
- Separation from traffic
- Cost of use

Network Resilience

The transportation network in West Berkeley is a critical system in the city responsible for a number of vital functions including:

- Moving people and goods
- Facilitating emergency response services (police, fire, medical, etc.)
- Facilitating public services (garbage and recycling, utility repair and maintenance, etc.)
- Facilitating commercial and business transport

Network resilience refers to the ability of the transportation network to perform these critical functions under variable, uncertain and extreme conditions. These critical conditions may be a product of either internal factors or those external to Berkeley which could include:

- Congestion of a network link
- Failure of a network link (roadway, bridge, rail)
- Shortage of a critical resource such as petroleum

Congestion, and the approach to dealing with congestion, is perhaps the most crucial component to maintaining a resilient, functional transportation network. Based on the existing and future conditions analysis of the traffic conditions in the area, roadway capacity for vehicles is at or near capacity. Without significant physical expansion of the roadway system, which is viewed as highly infeasible without significant impacts and/or takings, auto traffic conditions and congestion will continue to worsen. Thus to improve the resilience of the network West Berkeley will need to continue to diversify their transportation system and provide balanced opportunities for people to walk, cycle, rideshare, careshare and travel by transit. This can be achieved through improvements that reduce vehicle miles traveled (VMT) and increase the attractiveness of walking, cycling, ridesharing, carsharing and using transit. The following are examples of measures that support increases in network resilience:

Auto and Commercial Vehicles

- Reduction of VMT
- Providing carshare opportunities
- Encouraging ridesharing

Transit

- Improving frequencies and spans of services of existing services
- Introducing new transit options, particularly links to Downtown and regional transit services
- Creating transit travel times that compete with auto travel times

Bikes

- Prioritizing bike crossings along the arterial network and links to transit
- Improving bike treatments along the existing roadway network
- Providing bikeshare programs

Pedestrians

- Prioritizing pedestrian treatments at arterial crossings, railway crossings and near public services (transit stops and stations, parks, schools, senior center, etc.)
- Improving pedestrian treatments at roadway crossings

Weighting

Each of the improvements would be given a score (-10 to +10) for each mode, based on whether the project supports or impacts each of the evaluation criteria. Each of the criteria will then be weighted based on the relative importance of the individual criterion. The sum of these weightings would always equal one, so giving the criterion equal weighting would compute a value of 0.25 for each of the four criteria. This weighting will be assigned by the PAC and applied after the improvements have been scored.

Step 3: Benefit/Cost Scoring

The final "score" received by each of the improvements will be the benefit to cost ratio. Projects within each of the five modes (auto -West Berkeley trips and regional trips, commercial vehicles-only West Berkeley, transit, bikes, and pedestrians) will then be ranked against each other to arrive at the top long term and short term priorities of that type. Then the relative priority of implementing projects serving each mode must be considered, as well as strategies to address prioritizing roadway capacity for local access versus regional spillover (trips neither starting nor ending in Berkeley. An initial process for packing has been proposed as follows:

Step 4: Packaging

Three different ranked lists will be calculated which are based on the following scenarios:

1. Accommodate and support all modes of travel including West Berkeley and Regional trips
2. Accommodate existing and projected West Berkeley trips and discourage regional through traffic
3. Accommodate and support transit, bicycle and pedestrian travel, including West Berkeley and regional trips

Scenario 1 will calculate total benefit by summing all the columns of the improvement matrix. Scenario 2 will only consider the auto and commercial vehicle columns of the matrix. Scenario 3 will only sum the auto (West Berkeley) and commercial vehicle columns and then subtract the auto (regional) column. Scenario 4 will add up the transit, bike and pedestrian columns only. The table on the page shows an example of how the matrix is set-up and calculated.

Step 5: Final Screening - (Fundability and Ability to Implement)

The identified improvement projects will be scored and ranked based on the various scenarios to allow a side by side comparison of the primary projects. The final screening of the improvements will take two additional factors into consideration; *fundability* and *ability to implement*. These two factors are critical to the success of the projects and developing a plan that both addresses the existing and future needs of the transportation network and is feasible to implement. Prior to this step projects may remain in the screening list that may not be included in the Final Plan.

	Benefit																																			
Weighting*	W_1						W2						W3						W4						W5						W6	W7	W8		
	Performance (Operational)						Performance (Environmental)						Safety**						Livability (Comfort and Convenience)**						Network Resilience**						Relative Use	Auto Parking Impacts	Cost of Use	Cost to Implement	
Improvement	Auto		CV	Transit	Bike	Ped	Auto		CV	Transit	Bike	Ped	Auto		CV	Transit	Bike	Ped	Auto		CV	Transit	Bike	Ped	Auto		CV	Transit	Bike	Ped					
	WB	Reg.					WB	Reg.					WB	Reg.					WB	Reg.					WB	Reg.									
# 1	A_1	B_1	C_1	D_1	E_1	F_1	A_2	B_2	C_2	D_2	E_2	F_2	A_3	B_3	C_3	D_3	E_3	F_3	A_4	B_4	C_4	D_4	E_4	F_4	A_5	B_5	C_5	D_5	E_5	F_5	U	P	CU	Cost	
# 2																																			
# 3																																			

	Scenario 1	Scenario 2	Scenario 3
	Total	Reduce Cut Through	TDM
Improvement			
# 1	$((A_1+B_1+C_1+D_1+E_1+F_1)(W_1)+(A_2+B_2+C_2+D_2+E_2+F_2)(W_2)+((A_3+B_3+C_3+D_3+E_3+F_3)(U))(W_3)+((A_4+B_4+C_4+D_4+E_4+F_4)(U)(P)(CU))(W_4))+((A_5+B_5+C_5+D_5+E_5+F_5)(W_5)$ / Cost	$((A_1-B_1+C_1)(W_1)+(A_2-B_2+C_2)(W_2)+(A_3-B_3+C_3)(W_3)+((A_4-B_4+C_4)(U)(CU))(W_4))+(A_5-B_5+C_5)(W_5))$ / Cost	$((D_1+E_1+F_1)(W_1)+(D_2+E_2+F_2)(W_2)+((D_3+E_3+F_3)(U)(P))(W_3)+((D_4+E_4+F_4)(CU))(W_4))+((D_5+E_5+F_5)(U)(P)(CU))(W_5)$ / Cost
# 2			
# 3			

* to be adjusted based on the PAC's input
** Scores for each of the qualitative criteria were assigned based on five different ratings including: significantly improves, improves, neutral benefit, impacts and significantly impacts. These ratings were then factored based on relative use by each of the modes.

WB- West Berkeley Trips
Reg. – Regional Trips
CV- Commercial Vehicles

Scores will be -10 to +10