APPENDIX B: TRIP GENERATION METHODOLOGY

B.1 WEST BERKELEY SPECIFIC TRIP GENERATION

The trip generation step of the future conditions modeling process was defined to estimate the number of new vehicle trips generated by the future land use development assumptions for the 2015 and 2030 scenarios. Within these two scenarios, the future conditions model has three tiers of project classifications which include:

- Tier 1 - Approved projects
- Tier 2 - Pending projects; and
- Tier 3 - 2030 projects.

For the purposes of the WBCMP, the 2015 analysis includes the approved and pending projects while the 2030 conditions reflect approved, pending and 2030 buildout projects.

These tiers of projects were each added to the modeling work to best reflect the actual trip generation of the project and to maintain consistency with Office of Transportation and Planning practices. Tier 1 and 2 projects are relatively well defined projects with a well defined size and use. In some cases, a travel demand management (TDM) plan was included in the proposal or as a condition of approval.

While Tier 1 and 2 projects are relatively well defined projects, Tier 3 projects are less defined and are simply blanket estimates at a study area TAZ level. These yet to be defined projects required City staff to make some general estimates for the use and size of the project based on existing zoning, allowable uses and development intensity. All projects and their resulting trips are shown in Table A3 which is included in Appendix A.

B.1.1 METHODOLOGY

The following five step process was used to produce the final trip generation for each project and TAZ in the Future Conditions analysis for West Berkeley.

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12 These four land use categories correspond to the zones within the Traffix model that also contain individual trip distribution parameters.
INster Figure B1: West Berkeley Land Use
B. TRIP GENERATION METHODOLOGY

Step 1: Determine the size of the future development/project. Future development estimates were identified based on the residential and non-residential components for each project. Residential developments were described in terms of net new dwelling units, and non-residential were described in terms of net new square feet (1,000 gross sq. ft). The non-residential uses were further defined based on the specific nature of the use for the trip generation step and then reclassified as an office, manufacturing/industrial, or commercial/retail use. This assignment process creates four general land use categories2, as shown in Figure B1.

Step 2: Assign the development/project ITE trip generation rates. Once specific land use categories were assigned to the new developments, trip generation rates from the Institute of Transportation Engineers (ITE) manual (7th Ed.) were assigned to each new project to determine how many peak hour trips would be generated. Dwelling units or 1,000 sq. ft. for each of the projects were multiplied by the AM and PM peak hour generation rates for weekday and weekend3 conditions suggested in the ITE manual. This step generated the base ITE trips using the published trip generation rates.

Step 3: Adjust ITE estimates for vehicle trips to more accurately reflect West Berkeley travel behavior. Once base ITE peak hour trips were assigned to the two weekday and two weekend analysis hours, adjustments were made to each of the trip totals to reflect West Berkeley specific conditions. This step was required to more accurately reflect the actual trip making behaviors of those who live, work, and shop in West Berkeley. Observations made to create the ITE trip generation rates were primarily conducted in suburban conditions where off-street parking is required and auto use is the dominant mode of travel. Nationwide, the City of Berkeley has some of the highest rates of commuters traveling to work by bike (6%) and walking to work (16%). Comparisons of West Berkeley to the rest of the City and the national averages in the Existing Conditions Report shows very similar results of non-auto commute behaviors. These progressive commute patterns require a deeper level of adjustment to take into consideration the difference of commuters in West Berkeley.

The process used to adjust the ITE rates included the assignment of a TAZ-specific adjustment based on the existing travel behavior of those who live, work, and/or shop in that TAZ. This process was developed using a process similar to that is used by the City of Berkeley to estimate transportation impact fees on a per trip basis. The procedure was refined by WBCMP to allow weekday and weekend rates to be adjusted and to include more detailed travel behavior information for multiple sources of data collection.

The two data sources used to determine local travel behavior in West Berkeley were:

3 It is assumed that weekend peak hour trip generation is the same for midday and PM conditions in the future conditions analysis.
B. TRIP GENERATION METHODOLOGY

- **2000 US Census** Summary File 3 data showing journey to work information for those age 18+ who live in one of the seven block groups (from three different Tracts) in West Berkeley; and

- **2000 MTC Bay Area Travel Survey (BATS)** showing trip making data for home-based work, shopping, social/recreational, and school trips, as well as non-home-based trips for three MTC TAZs in West Berkeley

These surveys provide insight into travel behavior to and from West Berkeley. Results from these surveys allowed trip generation rates to be modified based on the associated land use.

Using the survey data, the adjustment process for each TAZ underwent a five step process.

**Step 3.1: Convert vehicle trips to person trips.** Existing auto trips calculated using the ITE rates (Step 2) were adjusted to appropriate estimates of total person trips. The following general assumptions needed to be made prior to proceeding with this calculation:

- Carpools contain 2.25 persons per vehicle,
- 90% of all auto trips were made by single occupant vehicles and the remaining 10% were made by carpooling vehicles, and
- 5% of all trips made by vehicles are made by alternative modes (transit, bike, walking).

With these assumptions in place, the ITE vehicle trips were factored by a multiple of 1.18 which is calculated by:

\[
1.05 (0.9 + (0.1*2.2)) = 1.18
\]

**Step 3.2: Estimate Percentages of weekday and weekend Work Based Trips for residential land use category.** Estimates were made using Bay Area wide travel results from the 2000 BATS survey that 40% of trips made during the weekday and 7% of trips made during the weekend were home-based work trips.

**Step 3.3: Convert person trips back to auto trips using West Berkeley neighborhood adjustment rates.** The neighborhood adjustment rates calculated for each of the study area TAZs shows the proportion of auto trips made compared to the total number of trips made. Using the data sources identified above, non-motorized travel as a percentage of total trips was calculated. Table C-2 shows the resulting percentage of trips completed by auto and carpool as a percentage of total trips.
Table B-1: Trip Generation Adjustments (without corridor assumptions)

<table>
<thead>
<tr>
<th>Land Use Category</th>
<th>Weekday</th>
<th>Weekend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resident Commutes</td>
<td>Resident Errands/Misc.</td>
</tr>
<tr>
<td>Residential</td>
<td>59%(^1)</td>
<td>84%(^2)</td>
</tr>
<tr>
<td>Office/Manufacturing/Industrial</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Commercial/Retail</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Sources:  
1. 2000 Census Journey to Work Data – Total trips from West Berkeley (excluding home based work and non-home based trips),
2. 2000 BATS Survey – Total trips from West Berkeley (excluding home based work and non-home based trips)
3. 2000 BATS Survey – Home based work trips to West Berkeley
4. 2000 BATS Survey – Home based shop trips to West Berkeley

NA – Not Applicable

Recognizing that conditions in West Berkeley are not all uniform in terms of access to transit, pedestrian network, and neighborhood retail options, an additional adjustment was applied. This adjustment was applied to those TAZs along the University Ave. corridor and San Pablo Ave. corridor where transit service is the highest and where neighborhood commercial/retail opportunities exist. This adjustment was termed the “corridor” adjustment.

To determine the difference between the corridor adjustment and the non-corridor adjustment, the software application Urbemis was used. Urbemis is designed to estimate motor vehicle emissions from trips generated by new developments. A module of the program allows trip generation adjustment percentages to be obtained from various geographic inputs including availability of transit service, residential and employment densities, and presence of neighborhood serving retail. Applying West Berkeley specific inputs to this model showed the TAZs located along the San Pablo and University Ave. corridors had adjustments that were on average 10% higher than those of non-corridor TAZs.

These results were then incorporated into the adjustment shown in Table C-3 to obtain corridor and non-corridor adjustments. This was done by adding 6.5% to the adjustments for non-corridor TAZs and subtracting 6.5% from the corridor adjustments, resulting in a difference of 13% between the corridor and non-corridor TAZs.
Table B-2: Trip Generation Adjustments (with corridor assumptions)

<table>
<thead>
<tr>
<th>Land Use Category</th>
<th>Weekday</th>
<th></th>
<th></th>
<th>Weekend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Corridor</td>
<td>Non-Corridor</td>
<td>Corridor</td>
</tr>
<tr>
<td></td>
<td>Resident Commutes</td>
<td>78%</td>
<td>91%</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Resident Errands/Misc.</td>
<td>65%</td>
<td>65%</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>Commuters and Shoppers to W. Berkeley</td>
<td>52%</td>
<td>52%</td>
<td>52%</td>
</tr>
</tbody>
</table>

NA – Not Applicable

The results of these adjustments show reductions in ITE trip generation rates from between 52% and 1%. Home-based work trips by those residents of West Berkeley who live in the TAZs along San Pablo Ave. and University Ave. are expected to be half of the published ITE rate. On the other hand, shopping trips to West Berkeley from residents outside West Berkeley are expected to be the same as the published ITE rates for commercial and retail uses. Since a much smaller percentage of resident commute trips on the weekend are for work purposes, the weekend corridor and non-corridor percentages are closer to ITE rates.

It is important to note that while these adjustments to the ITE rates do deviate from the average rate, nearly all adjusted trip generation rates lie within the range of observations by the ITE. The graphs attached at the end of this Appendix show where these adjusted ITE rates fall within the range of observed rates. The figures show the West Berkeley adjusted rates in the red box and the ITE observed as the black line. As seen in these figures, while most categories are on the low end of the rates, West Berkeley rates are still within the observed values for nearly all categories. Residential uses for resident work trips from the study area show rates which are the closest to the low end of the observed ITE rates. However, commercial rates and weekend residential rates using the proposed trip adjustments show rates that are closer to the mean of the ITE rates.

**Step 3.4: Assign neighborhood adjustments to their respective TAZ.** Assigning the neighborhood adjustments to the study area TAZ simply required assigning corridor rates to those TAZs along San Pablo Ave. and University Ave. and assigning non-corridor rates to those TAZs not along these corridors.

**Step 3.5: Apply the adjustments to the appropriate trip generation values.** This final step in the adjustment process took the new trips generated by the ITE rates and multiplied then by the appropriate adjustment factors. This was done based on the TAZ that the project is located in and the general land use category it is assigned to.
Step 4: Apply Pass-by Percentages. Once neighborhood adjustments were applied, the peak hour trips were modified to reflect the percentage of these trips that are considered pass-by trips. Pass-by trips are intermediate stops by existing traffic volumes that choose to access a new project. This traffic is already on the network and is not a new trip generated by the new project to the adjacent street. The San Diego Association of Government’s (SANDAG) pass-by rates were used for both weekday and weekend conditions.

Step 5: Split trips to show entering/exiting percentages. The final step in estimating trip generation was to determine the number of new trips that would be entering and exiting the project during the specific peak hour period. These distributions were obtained from the ITE trip generation manual for AM and PM weekday conditions and peak hour weekend conditions. The peak hour weekend distribution was applied to both midday and PM volumes.

B.2 REGIONAL THROUGH TRAFFIC TRIP GENERATION

In addition to the trips generated by new development in West Berkeley, regional through traffic growth was also addressed. An annual growth factor of 1.5% was applied to all volumes along the major regional arterials, including Gilman St., University Ave., Ashby Ave., San Pablo Ave., West Frontage Rd., and Eastshore Highway. This rate was calculated through a select link analysis using the regional demand model. This process selects the regional arterial (i.e. University Ave.) and then estimates those trips with origins and destinations external to the West Berkeley study area. These trips are considered through trips.

This analysis compared the 2005 and 2030 model forecasts for through trips for all regional arterials to define net volume changes (delta). Using this delta value and a 25 year period, an exponential growth equation was used which resulted in the average growth of 1.5% annually.
B. TRIP GENERATION METHODOLOGY

Insert all trip adjustment diagrams