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Tahoe Region Bicycle and Pedestrian Use Models

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As part of the Tahoe Basin Bicycle / Pedestrian Master Plan, LSC Transportation Consultants, Inc. with assistance from Alta Planning has developed linked bicycle and pedestrian use level estimation models for travel corridors in the Tahoe Region. This model is based upon observed facility use levels in the Tahoe Region, data regarding the characteristics of individual facility users, as well as demographic and travel data for the Tahoe region. Note that this model is for relatively urban or inter-community travel corridors, and is not applicable to mountain bike trails.

This model has been developed to meet the following criteria:

- It is fully "transparent," providing the methodology and equations to the TRPA and other interested parties.
- It provides disaggregated estimates of travel corridor estimates by residents versus visitors.
- It reflects the characteristics of nearby land uses, including permanent population and visitor population.
- It reflects differences in specific facility characteristics, such as the presence of road crossings and presence of long sustained grades.
- Annual use level values reflect the "seasonality" of overall demand in the Tahoe Region, given both the winter conditions and the variation in visitor activity levels.

Use models for both bicycle and pedestrian modes have been developed (other users, such as rollerbladers, are included as pedestrians). Due to the lack of adequate pedestrian use data beyond Class I facilities, the pedestrian use model is limited to Class I facilities only. In addition, the bicycle model does not consider Class III facilities, as the data for bicycle use of Class III facilities is very limited and actual use depends on factors such as connectivity to Class I or II facilities that cannot be reflected in this regional model.

The single page to be used by the analyst summarizing the models is shown in Table A. A separate memo entitled "Tahoe Region Bicycle and Pedestrian Use Models User Instructions" provides step-by-step instructions to the analyst that simply wants to apply the model, avoiding the detailed discussion of the methodology development presented below.

Bicycle Use Model

For purposes of this model, all bicyclists are considered to fall into one of three user categories: residents that bicycle directly from their home, visitors that bicycle directly from their place of lodging, and bicyclists (either resident or visitor) that drive to/from the bicycle facility. These categories were developed based on the available existing use data and to reflect the differing factor impacting use by the direct-access versus drive-to-access groups and their very differing impacts.

Figure A presents a flowchart of the overall bicycle use model. For **residents bicycling directly from home**, the model was developed in the following steps:

1. It was first necessary to obtain a quantitative depiction of total trip origin/destination patterns throughout the Tahoe Region. There is not sufficient survey data or traffic counts of actual trips (by all modes) to base this trip origin/destination table on actual trips. However, the TRPA has invested substantial resources to develop an advanced computerized TransCAD model of the Tahoe Region, based upon a series of 250 individual Traffic Analysis Zones (TAZs) encompassing the entire region. One output provided by this model is a table of 192,392 synthesized resident person-trips estimated to occur over the course of a busy current summer day. This table was obtained from TRPA, and used to generate an origin/destination person-trip table reflecting all current trip-making throughout the region. Note that the TransCAD model was not developed to accurately reflect non-auto travel between specific TAZ pairs. It therefore is not possible to directly forecast non-auto travel using the model, rather the model simply provides the best estimate of existing person-trips between each of the individual TAZ pairs.

2. A network of 20 travel corridors were then developed to reflect all major travel corridors throughout the Tahoe Region. These corridors were designed to reflect key origin/destination pairs, as well as to provide a basis for comparison of corridor segments currently under consideration. A map of these corridors is presented as Figure B. Per standard bicycle planning criteria, a corridor width of all TAZs wholly or partially within a half-mile access distance of the center of the corridor were considered to be included in the corridor. Table B presents the correspondence of the TAZs within each corridor. Note that TAZs near the confluence of corridors are considered to be within multiple corridors.

3. The TAZ origin/destination table was then summed to identify the total number of person-trips within each corridor. The results are presented in Table C.

4. The ratio of the observed bicycle use level in each corridor to the total person-trips within each corridor can then be identified, for those corridors for which adequate count data is available. Note that these use counts include both the cyclists observed on a Class I facility as well as those on the adjacent roadway, in order to result in a use forecast for the corridor as a whole. For some of the count locations, it is necessary to estimate cycling activity on the roadway based upon the ratio of roadway to facility use at similar Tahoe locations, as roadway bicyclist counts are not available.

5. As shown in the top portion of Table D, the ratio of observed daily cycling trips to the total corridor travel demand ranges from a low of 0.01 for the US 50 Meyers location to a high of

0.13 for the Truckee River location. There is also a cluster of results in the 0.05 to 0.09 range (for the North Shore, Camp Richardson, West Shore, and El Dorado Beach locations). A caveat should be considered for the Truckee River corridor, however. Review of the TransCAD data indicts that, while the Alpine Meadows and Squaw Valley areas are included in the TAZ system, these areas were not included in the model other than as an "external" to the Tahoe traffic model. These areas are therefore not included in the count of trips internal to Corridor N1. (It is also not possible from the model to disaggregate trips to/from these areas versus the trips traveling beyond Squaw Valley). As a result, the calculated ratio for this corridor is significantly higher than it should be if these additional trips were included in the denominator.

6. A series of factors were then developed that reflect reductions in potential use levels from optimal conditions. A total of eight persons with expertise in the field of bicycle/pedestrian planning or substantial experience in bicycle/pedestrian planning in the Tahoe Region were provided with a form, and asked to estimate the proportion of potential use that would be eliminated based upon a series of factors:

    - Facility Class (I, II or III)

    - Grade of the facility (flat, short sections of relatively low grades, long sections of sustained grades)

    - Facility continuity (breaks in the facility and the presence of cross streets). Note that this reflects the continuity of travel along the facility, and not the network connectivity with adjacent land uses and travel paths.

    - Trail maintenance (good condition, moderate issues that create inconvenience to trail users, poor conditions that reduce safe travel speed)

    - Recreational value (quality of the facility as an enjoyable place for a recreational trip). In general, this reflects trail user's desire for a trip through a relatively undisturbed natural environment. However, the high level of use along the Lake Shore Drive trail in Incline Village indicates that there is also strong interest among trail users in travel along an attractive developed corridor.

    - Trail congestion (the degree to which interference with other trail users reduces the attractiveness of use). The *Highway Capacity Manual* methodology for non-motorized facility level of service was applied.

    The completed individual forms are provided as Appendix A. LSC then reviewed all responses, and identified a single "consensus" value for each factor. In general, the average value was assumed to reflect the consensus. In some cases where one response differed significantly from the consensus of the remainder, outlying values were not included. In some cases where factors differed significantly from the observed variation in usage in Tahoe facilities, these factors were adjusted to better reflect observed conditions. The resulting values are presented in Table E.

7. These factors were then applied to several of the Tahoe Region's better facilities, in order to calibrate the model against observed conditions. As shown in Table F, calibration was conducted against the North Shore Trail, the Camp Richardson Trail, and the West Shore Trail. These locations were chosen as facilities with the adequate available data, and those reflecting the type of facility that better reflect future facilities envisioned for the Tahoe Region. (The Truckee River Trail was not included, due to the issue of the Alpine Meadows/Squaw Valley trip data discussed above.) Appropriate values for each factor were identified from Table E. The specific categories shown in Table E were adhered to, with the exception of the grade factor for the North Shore Trail: while the overall elevation change is less than the 300 feet identified for the highest factor, the length of grade (0.9 miles) makes this grade more onerous than the middle factor. This adjustment from the values shown in Table E yields a better overall model. It also is an example of how specific conditions can be considered by the analyst to improve the estimates for a specific facility. In other words, when the specific characteristics of an individual facility fall between (or beyond) the categories used in Table E, the analyst should use the factors shown in Table E as a guide to the appropriate factor for the specific facility.

8. The various factors were combined into a single overall use reduction factor, in a multiplicative fashion, as also shown in Table F. Specifically, the following equation was applied:

   Overall Reduction Factor =
   1 – ((1 – Facility Class Factor) X
   (1 – Grade Factor) X
   (1 – Facility Continuity Factor) X
   (1 - Maintenance Factor) X
   (1 – Recreational Value Factor) X
   (1 – Congestion Factor))

   Under this equation form, each factor is applied to the remainder of the potential demand remaining after application of the previous factor, ensuring a resultant not exceeding 1.0. [1] The resulting overall reduction factor was then applied to the total maximum potential use level to estimate the modeled daily use figure. The ratio of cyclists to total person-trips was then calibrated (to 2 decimal places) to result in the minimum overall error for the three calibration location. The calibrated ratio of resident bike-to-trail trips to corridor internal person-trips was found to equal 0.12.

9. Multiplying this ratio by the total travel within each corridor yields the maximum potential bicycling use level in each corridor, as shown in Table G.

The resulting model of resident bike-to-facility use has an overall error of 2 percent. On one hand, the model overestimates use levels on the Camp Richardson Trail by 8 percent (33 daily bicyclists), while at the other extreme it underestimates the use level on the West Shore trail by 8 percent (29 daily bicyclists). A discussion of the overall error range of the model as a whole is provided below.

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[1] As an example, combining two factors each of which reduce the potential demand by 50% would result in an overall reduction factor of 1 – ((1-0.5) X (1-0.5)) = 0.75.

The sub-model for **visitors biking to the trail** was developed in a very similar fashion. In Step 1 (above), a separate record of TransCAD visitor person-trips (totaling 342,665 individual trips) was obtained from TRPA, as summarized by corridor in Table C. When compared with the observed use levels (Table D), the visitor use indicates a wider range in the ratio than for resident use, ranging from 0.00 (to the second decimal place) for the US 50 Meyers and Lake Shore Drive locations up to 0.28 for the Truckee River location.

Calibrating against observed visitor bike-to-trail daily volumes at the same three locations (as shown in Table F), the model was found to best fit the observed data with a ratio of 0.11. Resulting overall error was -3 percent, ranging from an 18 percent (or 18 daily trips) overestimate on the North Shore Trail to a 7 percent (29 daily trips) underestimate on the Camp Richardson Trail.

The sub-model for **bicyclists driving to the trail** differs in the initial steps. Given the convenience of auto travel, the demographics or travel origin/destination pattern in the immediate vicinity of each corridor has little or no impact on the number of trail users in this category. Instead, a maximum daily use level was estimated, and then adjusted via calibration to arrive at that value that best matches observed use levels. As shown in Table F, values were applied for the various factors for the three calibration facilities. A value of 480 daily drive-to-trail bicyclists per day was found to best calibrate over the three locations (0 percent overall error). However, the range in error for the individual locations was found to be substantially greater for this user type than for the two bike-to-trial user types. In particular, the modeled use level for the Camp Richardson Trail (408) is 14 percent below the observed use level (476). The greater overall resident and visitor population of the South Shore as a whole probably contributes to this, as well as the fact that there are little "competing" similar long recreational Class I facilities currently available in the South Shore. On the other hand, the model overestimates this use level on the West Shore Trail (174 modeled users versus 114 observed users), which could be a factor of the greater attractiveness of the nearby Truckee River Trail to drive-to-trail cyclists and the impact of the numerous highway crossings and the missing segment near Homewood on the overall attractiveness of this corridor.

In applying the model to potential new facilities on other corridors, it is important to note that this value (480 daily drive-to-trail bicyclists per day) is probably lower for additional facilities in the Tahoe Region. The relationship between the demand for a specific consumer good (in this case, recreational bicycling trips in Tahoe) and the supply of that good (miles of Class I recreational facilities) is best considered as an issue of microeconomics. There are some Tahoe residents and visitors with a high desire for a recreational bicycling experience, many of which are being accommodated by the existing Class I facilities. As the amount (mileage) of these facilities expands, the demand or usage of the facilities can be expected to increase, but at a decreasing rate. The ratio of change in demand over change in supply (or price) is considered to be the "elasticity" of an economic good. Elasticity varies between -1 and +1, where a value of 0 indicates that demand does not change with change in supply, and a value of 1 indicates that the percentage increase in demand is equal to the percentage increase in supply.

Just as the number of cars sold by General Motors would not double if the number of cars available were to double, doubling Tahoe's Class I mileage would not double total drive-to-facility bicycling use levels, as each new mile of trail would attract use by a portion of the resident/visitor population with a lower desire for the activity. This indicates that the elasticity factor is less than +1.0. On the other hand, as new facilities would reduce the "cost" of using such facilities (by reducing the drive distance to the nearest trail) and would also enhance the Tahoe Region's overall reputation as a bicycling destination resort area, the elasticity factor is clearly greater than 0.0.

Unfortunately, there does not appear to be readily-available research as to the observed elasticity factor for similar recreational trips in similar resort settings – in other words, how the expansion of Class I facilities in a similar resort region affected the number of bicyclists driving to the facility network for recreational purposes. For purposes of this study, an elasticity factor of 0.5 has been assumed. This indicates that a new Class I facility in Tahoe would result in an additional drive-to-facility daily use level of 480 X 0.5 = 240 bicyclists per day. Note that some of these new drive-to-facility users may be persons already driving to other existing facilities, indicating that provision of a new facility could *reduce* total use at an existing facility.

Pedestrian Class I Facility Use Model

A similar model was developed to estimate pedestrian use in the Tahoe Region. Due to the lack of data on corridors without Class I facilities, this model is limited to pedestrian activity on Class I facilities. Given that most walk trips are relatively short, it is not necessary to base this analysis on the origin/destination trip table information. Rather, the visitor and resident population within each of the 20 corridors was considered to be the key determinant of overall pedestrian demand (for those not driving to the facility).

The first step is to evaluate a maximum potential trail pedestrian use rate, based upon observed Tahoe use levels. Table I presents estimates of total daily trail use for various Class I facilities in the Tahoe Region, disaggregated based on surveys into the three key user categories discussed above. This table also presents estimates of total population along each of the corridors, based upon demographic data by TAZ provided by TRPA.[2] Dividing use levels by population yields the observed rate of use (daily use per population) for the various use categories:

- For **resident** pedestrians not accessing the trail by car, rates range from a low of 0.00 (rounded to the nearest hundredth) for the Meyers facility to a high of 0.18 for the Lake Shore Drive facility in Incline Village. This latter facility is clearly a unique case, as evidenced by the fact that its rate is more than twice the next highest rate. This facility travels along a uniquely attractive route. On the other extreme, the location of the Meyers facility counts (on the northern end of Meyers) is at the edge of the community, and much of the Meyers area population is far removed from this site[3]. The overall optimal rate was calibrated to be 0.04. Applying this rate to the population of each corridor yields the maximum potential trail use estimates shown in Table J.

- Rates for **visitor** pedestrians not accessing the trail by car are shown in the bottom portion of Table I. As indicated, values range from a low of 0.00 for the Meyers location to a high of 0.08 for the Truckee River facility. As discussed above, the Meyers location is far from the

[2] 2008SOCIO.XLS file. The relationship between use levels and the population immediately within a reasonable quarter-mile walk distance of the specific count location was also evaluated, but the population of the corridor as a whole was determined to have a higher correlation to use levels.

[3] As an aside, the relatively low observed residential rate for the popular Camp Richardson trail (0.02) can be attributed to the fact that the count location at Camp Richardson itself is far removed from the large bulk of the corridor's total population in South Lake Tahoe.

actual location of the majority of Meyers visitors lodging location. The calibrated value for this rate was found to be 0.03.

The final use category – **pedestrians driving to the facility** – cannot be directly associated with the population characteristics of the facility environs, as surveys indicate that trail users drive from throughout the Tahoe / Truckee / Carson City / Reno / Sparks region and beyond to access these facilities. Rather, use levels are a factor of the attractiveness of the facility as a recreational or fitness training location. As shown in Table H, the Lake Shore Drive facility in Incline Village is a clear "outlier" with a value more than three times higher than any other facility. Again, this reflects a high level of interest (among both Incline Village residents as well as others) to enjoy a walk along this high-income and high-scenic-quality corridor. Excluding this outlier, the next two highest facilities are very close in daily auto-access use levels: the Camp Richardson Trail at 161 and the Truckee River Trail at 140. Through calibration, the value that results in the best forecasts of overall trail user for this user category was found to be 135 pedestrians per day.

As discussed above regarding bicycling demand, *new* Class I facilities would not generate the same level of additional use as the existing Tahoe Class I facilities. Given the high level of public interest in Class I facilities for bicycling, the tendency for new facilities to generate additional drive-to-walk recreational trips is probably lower than the tendency to generate additional drive-to-bicycle trips. In other words, given the wider availability of high-quality walking opportunities, there is less potential for additional visitors to decide on a trip to Tahoe for a walk along a Class I trail than for a bicycling trip along a Class I trail. A lower elasticity value of 0.3 is therefore assumed. Multiplying 135 times 0.3 yields a maximum feasible daily pedestrian-drive-to-facility figure of 41.

As with the bicycle use model, factors were developed for the various facility characteristics, based upon consensus values provided by a panel of eight individual bicycle planners. These are found in the right-hand portion of Table E. As with the bicycle model, the pedestrian use model was calibrated against observed use figures for the North Shore Trail, the West Shore Trail, and the Camp Richardson Trail. Factoring the maximum potential use levels by the appropriate factors for these facilities and calibrating to minimize overall error yielded the calibrated pedestrian use rates discussed above.

This calibration is shown in the bottom portion of Table F. As indicated, all estimates of use were within 60 pedestrians per day of the observed value. There is a lower level of accuracy of this pedestrian use model than for the bicycle use model, as indicated by the higher percentage of error for the individual trails. This can be attributed at least in part to the relatively short trip length of walking trips as compared to bicycling trips, which can be expected to result in greater variation in use levels over the length of a corridor.

Peak-Hour Use Estimates

The methodology presented above yields estimates of total daily use over a busy summer day. Estimates of peak-hour trail use can be generated by applying a peak-hour-to-daily factor. An evaluation of existing peak hour and daily use levels presented in Table G indicates that, for Tahoe facilities, this factor averages 0.153 for Class I facilities (indicating that 15.3 percent of total daily use occurs during the peak hour) and 0.096 for Class II facilities.

Annual Use Estimates

Total annual use estimates can also be generated by applying an annual-to-daily factor. These factors were calculated to equal 172.8 for facilities maintained year-round (i.e., cleared of snow and ice) and 146.5 for facilities without snow/ice removal (which are the large majority of Tahoe facilities). These factors were identified as follows[4]:

- The proportion of annual to peak month average daily **visitor** bike/ped facility use was estimated based upon monthly variation in lodging utilization in the City of South Lake Tahoe. (Comprehensive data of monthly lodging use for the Tahoe Region as a whole is not available.) As shown in Table K, data was identified for the annual "bicycling season" during which visitors would generally include bicycling in their activities while in Tahoe, assumed to extend from May through October (inclusive). The proportion of visitor use in each month was then calculated, with the highest proportion (23.3 percent) occurring in August. Dividing 1 by the percent of annual use occurring in an average August day (0.233 divided by 31 days per month) yields an annual-to-daily factor of 133.2.

- The proportion of annual to peak month average daily **resident** bike/ped facility use was estimated based upon extensive counts of monthly variation in non-motorized facility usage in three locations that are also in "snow country":

  - Boulder, Colorado – 4 locations
  - Indianapolis, Indiana – 30 locations
  - Carmel, Indiana (an affluent suburb of Indianapolis) – 4 locations

  As also shown in Table K, the weighted average proportion of use in each month ranges from a low of 2.4 percent in December to a high of 14.8 percent in August. Assuming that Tahoe facilities are open year-round, this indicates an annual-to-peak-month-average-day factor for residents of 209.5.

- The most recent rounds of TCPUD and TCORP counts of Tahoe facilities indicate that approximately 52 percent of current facility users are residents of the region (regardless if they drove to the trail or not), while 48 percent are visitors. These values were used to weight the visitor and resident factors, resulting in an overall factor (assuming snow removal) of 172.8.

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[4] As an aside, data generated by the Nustats Travel Mode Share Surveys conducted for TRPA in the summer of 2008 and the winter of 2008 were also reviewed. These studies consisted of intercept surveys of persons at key commercial and recreational sites around the region, rather than surveys along travel corridors. Overall the proportion of persons arriving at the survey sites by bicycle was found to be 3.8 percent and 0.5 percent in summer and winter, respectively. Comparing these two figures, winter bicycle travel mode was 13 percent of summer bicycle travel mode. The proportion of persons walking to their destination was found to be 12.1 percent and 12.3 percent in summer versus winter, respectively, indicating close to an equal level of use. A closer look at the survey results, however, found that they were influenced heavily by the high numbers of persons walking between the South Stateline area and the Heavenly Village area, particularly in winter. This data source provides useful background regarding relative non-auto travel over the course of the year, but is not sufficient to adequately estimate the total annual-to-peak-day factor.

- If snow is not removed from a facility (as is currently the case for virtually all Class I facilities in the Tahoe Region), the use during the winter months is eliminated (ignoring cross-country skiing or snowshoeing use). As a result, the proportion of annual use in the peak summer month increases, as shown in the right-most column of Table K. As a result, the overall annual-to-daily factor drops to 146.5.

Consideration of Other Factors Impacting Trail Usage

The resulting figures shown in the bottom line of Table A should be considered to be reasonable planning-level use estimates for total users at the location of highest use, barring special conditions. One such condition that may occur is reduction in use due to an effective restriction on parking availability.[5] If an effective, enforced parking capacity is put in place at a specific location, the degree to which this caps the drive-to-facility use numbers can be calculated as follows:

Maximum Daily Drive-to-Facility Use =
Parking Capacity (# of vehicles) X
Average Vehicle Occupancy (persons per vehicle) X
Turnover Rate (# vehicles per space per day)

Average vehicle occupancy, per TCORP surveys, averages 2.1 persons per car for bicyclists and 2.5 for pedestrians. Turnover rates for more remote areas (such as the East Shore where visitors tend to stay for the day) have been observed to be roughly 1.33, while more “urban” recreational areas have a turnover rate of approximately 2.5. If the resulting value is less than the total daily bicyclist and pedestrian drive-to-trail use estimate, the daily use estimate should be reduced in the spreadsheet to reflect this cap (total of bicyclists plus pedestrians).

Usage at Peak Location versus Total Users Over the Entire Corridor

It is important to note that the model estimates total use at a single peak location along each segment. Particularly over the course of a long segment with multiple trip generators along its length, the total number of individual users over the entire corridor can be substantially higher. A simple equation to estimate total corridor use is as follows:

Total Corridor Use =
Use at Peak Location X
(Total Corridor Length (miles) / Average Trip Length (miles)) X
(1 + Ratio of Use at Lowest Location to Use at Peak Location) / 2

[5] With the exception of the East Shore beaches, parking availability rarely if ever limits use of Tahoe Region Class I facilities at present. Due in large part to lack of prohibition against summer shoulder parking on state highways and local roadways, even on peak days at busy trailhead locations (such as the 64 Acre Tract in Tahoe City or the south end of the Camp Richardson Trail along Emerald Bay Road in South Lake Tahoe) there is parking available in parking lots, along state highways or other nearby roads within convenient biking distance. While an inconvenience, the few minutes it might take on the busiest days to get from a parked car to the Class I facility does not noticeably reduce actual trail use.

As mentioned above, regionwide TCORP one-way trip length was found to average 2.4 miles for bicycling and 1.5 miles for walking, with detailed values for individual facilities presented in Table C of the Impacts Memo.

As an example, consider a corridor 7.2 miles in length with an average trip length of 2.4 miles, a peak location use estimate of 1,000 bicyclists per day and an estimated use level at the location of lowest use that is 50 percent of that at the peak location. Total bicycle use throughout this facility would be calculated as follows:

Total Corridor Daily Bicycle Use = 1,000 X (7.2 / 2.4) X (1 + 0.50) / 2
= 1,000 X 3.0 X 1.5 / 2
= 2,250 bicyclists per day

Discussion of Error

A substantial potential source of "error" in the model forecasts is simply the day-to-day variation in observed use levels. The best source of information regarding variation in use levels is provided by the TCPUD surveys of West Shore, North Shore and Truckee River Trail usage. These surveys all considered weekdays (Wednesdays or Thursdays) during the first or second weeks of August, between 2005 and 2008, and indicated substantial variation in use level. As an example, for the Truckee River Trail, total daily use ranged from a low of 1,074 total daily users to a high of 1,582. Perhaps the most noticeable indication of the daily variation is a comparison of the use on Wednesday, August 8^{th} of 1,345 (extrapolated from a 5-hour mid-day count) with the use on the following day of 1,074 (also extrapolated from a count over the identical period) – a 20 percent reduction from one day to the next. (Over the same two days, the North Shore usage increased by 6 percent, while the West Shore usage declined by 24 percent). An evaluation of the overall variation in observed usage on all TCPUD trails indicates an error range (at the 95^{th} percentile confidence level) of 23 percent above or below the mean.

As the model was calibrated against only three data points (for the three best Class I facilities in the Tahoe Region), a direct evaluation of observed versus forecast values provides little insight regarding the accuracy of the model. As data is available for *other* days not used in the calibration (from TCORP and TCPUD sources), it is possible to apply the model against the data for these other days to assess how well the model replicates these other data points. This analysis indicates an r-squared value of 0.98 for the bicycle model, and 0.67 for the pedestrian model, indicating that the model explained 98 percent of the variation in bicycle use and 67 percent of the variation in pedestrian use.

Considering both the variation in day-to-day observed trail use and the accuracy of the models when compared to additional counts, a reasonable error range for any one corridor is considered to be ±25 percent for the bicycle model and ±35 percent for the pedestrian model. These ranges are applied in Table A to indicate the high and low ends of the estimate range. As the region-wide use estimates reflect a total of all corridor estimates, the error range for the region-wide totals is substantially smaller, and should be considered to be ±10 percent.

Modifications to the Model

Evaluating Multiple Corridors in a Single Facility

The model can be modified to consider longer segments. The use model for bike-to-facility and walk-to-facility users is based solely on demographics and travel within each individual corridor, and does not take into account the "network effects" whereby facility improvements on one corridor spurs increased use on an adjacent facility. (This was done to avoid double-counting of individual users on multiple corridors when considering the region as a whole and as this analysis for the entire region would add greatly to the complexity of the analysis.) There may be a need to evaluate this network effect for specific projects, particularly where individual travel corridors can form a continuous larger project. This can be accomplished as follows, assuming Corridor A is the corridor for which a use level is desired:

1. From Table L, identify the total resident person-trips from Corridor B to Corridor A. Similarly, identify the total visitor person-trips from Corridor B to Corridor A from Table M.

2. Multiply by the calibrated optimal rate for residents and visitors shown in Table D (for bicycle travel) and Table I (for pedestrian travel).

3. Multiply by the estimated proportion of total demand from Corridor B that would continue into Corridor A, based upon the following:

   - The distance between the end of Corridor B and the analysis point for Corridor A, compared against the proportions of people who make bicycling or walking trips of that length. (See Figure 1 and Figure 2, based on TRPA/TCORP 2007 surveys; detailed values for individual facilities are presented in Table C of the Impacts Memo.)

   - Trip generators (such as schools, employment sites, and recreational sites) that would tend to draw bicyclists and pedestrians from one corridor into another.

   - Geographical barriers (such as Dollar Hill on the North Shore) that would tend to discourage through travel between adjacent corridors.

4. Add the resultant to the intra-corridor maximum feasible demand and enter the sum into the "Maximum Feasible Demand" column of Table A.

5. Conduct the remainder of the analysis as discussed above.

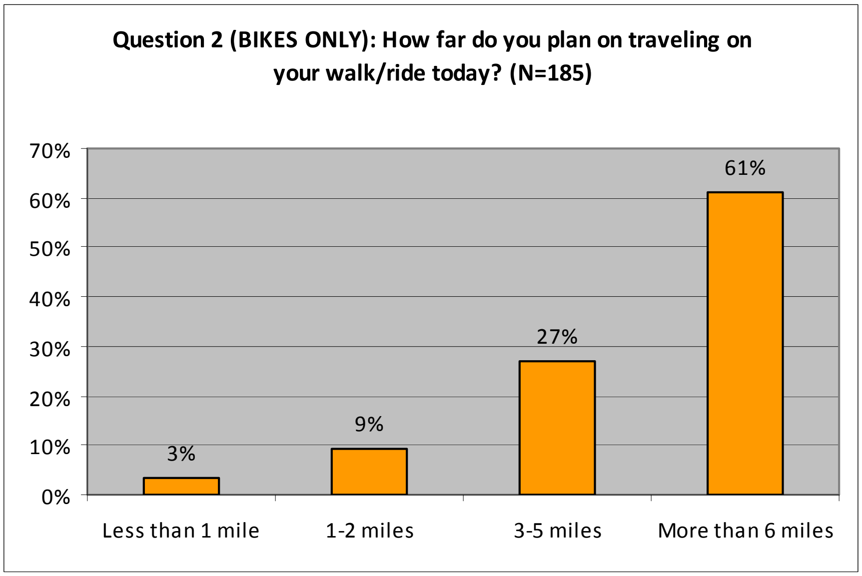


Figure 1. Proportion of bicyclists to take different lengths of trips. TRPA/TCPUD Bike Trail Survey 2007.

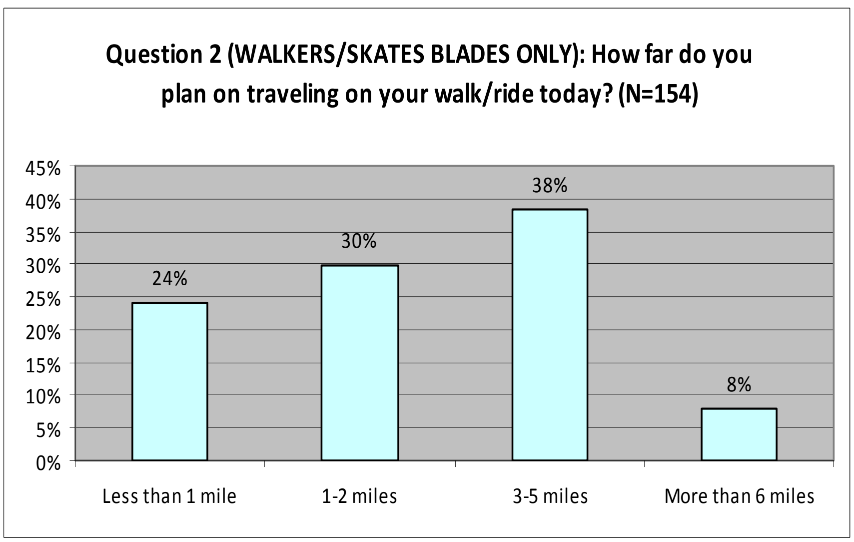


Figure 2. Proportion of walkers to take different lengths of trips. TRPA/TCPUD Bike Trail Survey 2007.

Evaluating Shorter Facilities

This model can also be modified to evaluate use levels for shorter corridors or trail segments than those shown in Figure B, to the level possible given the "coarseness" of the TRPA TransCAD TAZ system. This requires the following individual steps:

1. Identify those TAZs that will be served by the specific trail alignment.

2. Identify the total internal person-trips within the corridor (updating Table C of this memo). This can be accomplished by changing the TAZs identified as comprising the corridor in

rows 28 to 31 of the "Visitors TransCAD" and "Residents TransCAD" pages of the spreadsheet. As the spreadsheets are linked, this will change the values shown in Table D regarding the 1-way cyclist trips.

3. Modifying the pedestrian usage input data requires revising the equations in the "2008 Socio" page to specify the appropriate TAZs. This will in turn result in changes to Table I.

The resulting revised "Maximum Feasible Demand" figures from Tables G and J can then be entered into Table A. It should be stressed that this methodology has only been developed to the TAZ level and that it does not reflect specific bicycle or pedestrian trip generators (such as beach facilities, schools, etc.). As a result, the analyst is encouraged to consider specific local factors as a basis for adjusting these more general results.

Updating the Model

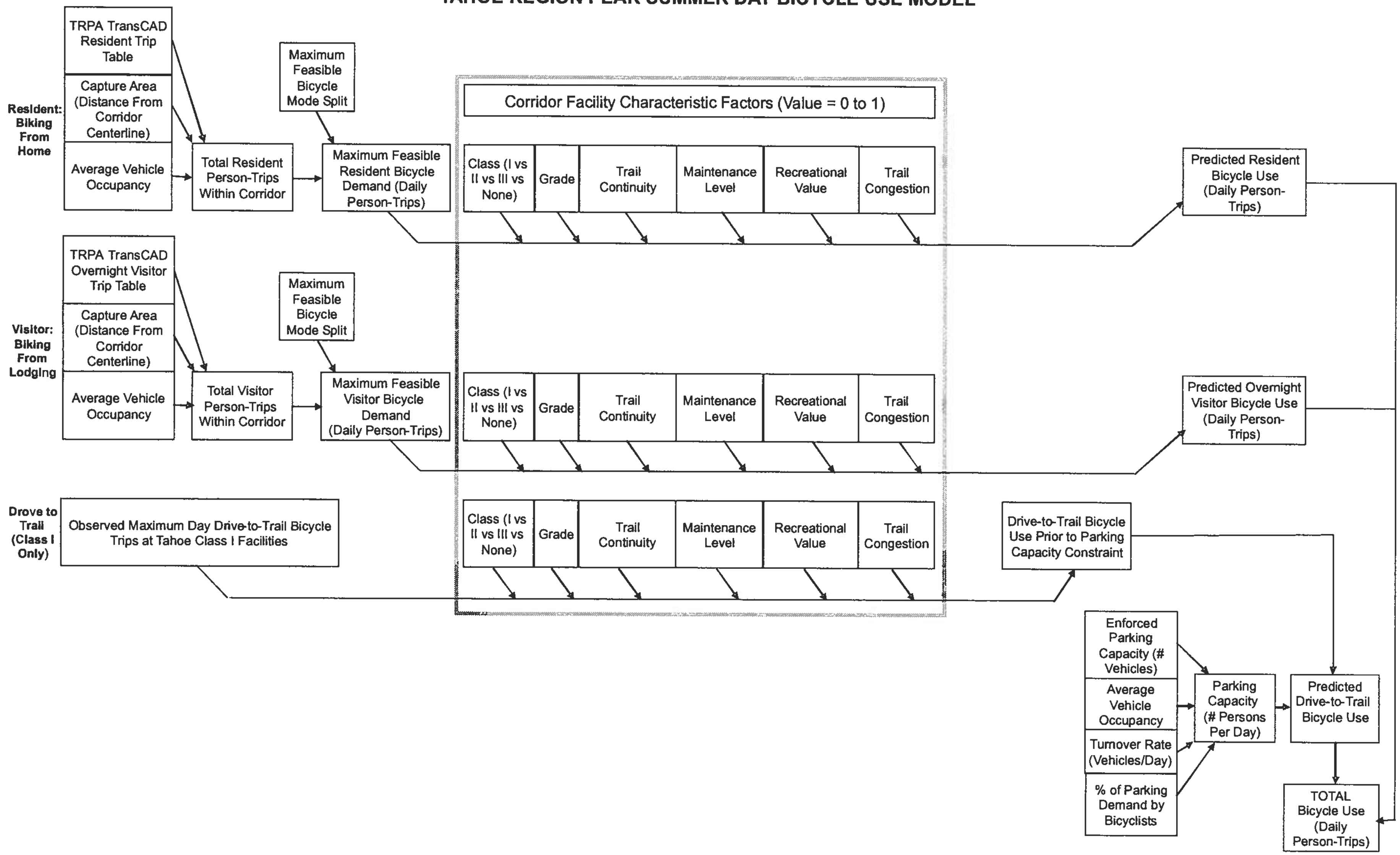
This model can potentially be updated in the future to reflect new observed use data, travel model data, or demographic data:

- **Changes in observed bicycle/pedestrian use levels** can be used in several ways. The values used in Table F for the high quality Class I facilities can be updated, and used to re-calibrate the calibrated optimal rates shown in Tables D and I. If new Class I facilities are constructed, these could also be included in the calibration. In addition, new observed usage values could potentially warrant adjustments to the facility use factors presented in Table E.

- **Updates to the TRPA TransCAD model** regarding existing person-trip tables could be entered into the "Visitors TransCAD" and "Residents TransCAD" sheets. The bicycle use model would then need to be re-calibrated.

- **Updates to TRPA's existing socioeconomic TAZ data file** could be entered into the "2008 Socio" sheet, and the pedestrian use model re-calibrated.

FIGURE A
TAHOE REGION PEAK SUMMER DAY BICYCLE USE MODEL



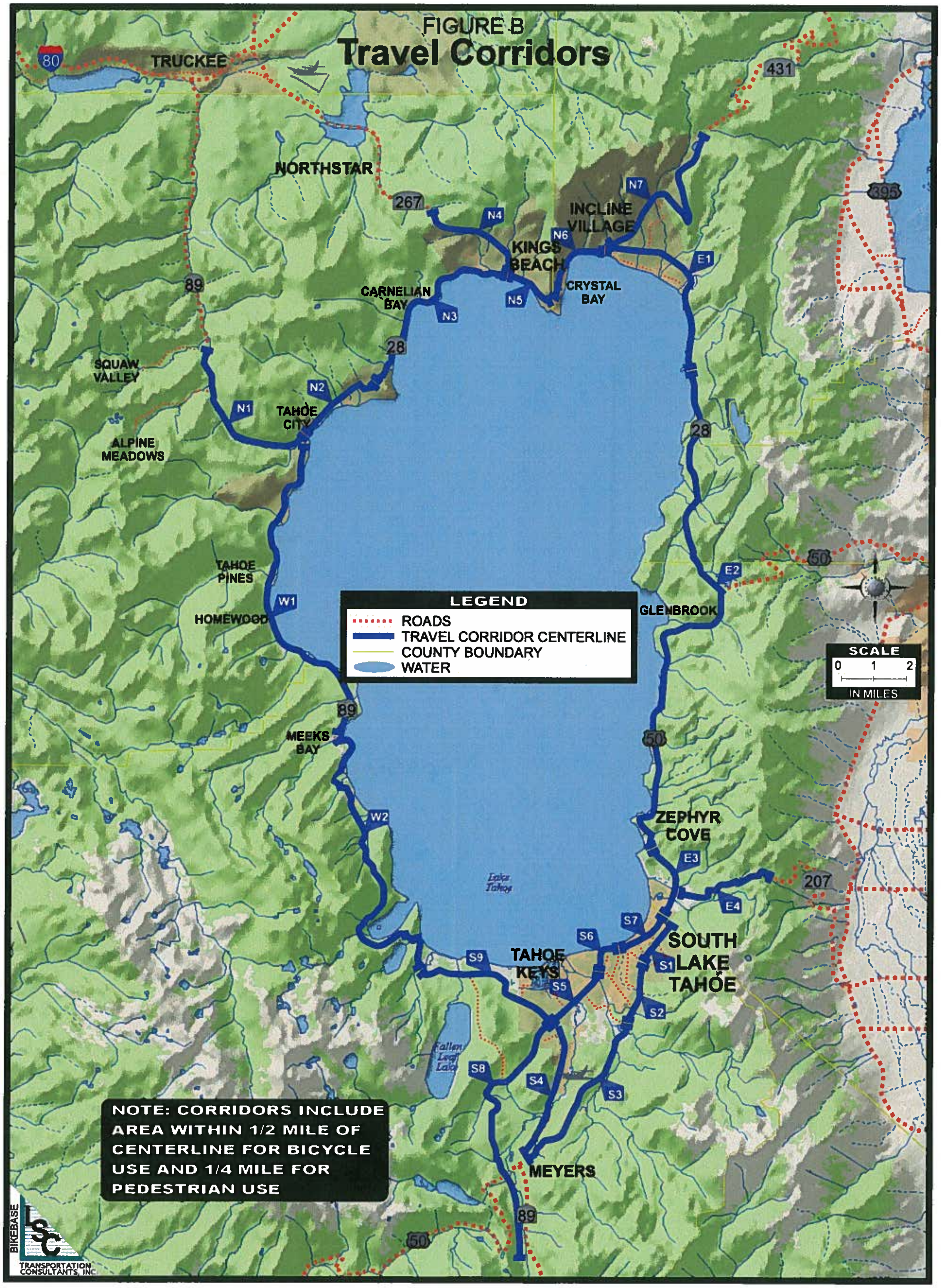


FIGURE B
Travel Corridors
80
TRUCKEE
431
NORTHSTAR
267
N4
N7
INCLINE
VILLAGE
N6
KINGS
BEACH
E1
CRYSTAL
BAY
CARNELIAN
BAY
N5
N3
89
395
28
SQUAW
VALLEY
N2
N1
TAHOE
CITY
28
ALPINE
MEADOWS
TAHOE
PINES
50
E2
W1
HOMEWOOD
GLENBROOK
LEGEND
ROADS
TRAVEL CORRIDOR CENTERLINE
COUNTY BOUNDARY
WATER
SCALE
0 1 2
IN MILES
89
MEEKS
BAY
50
W2
ZEPHYR
COVE
E3
207
E4
S7
S6
S9
TAHOE
KEYS
S1
SOUTH
LAKE
TAHOE
S5
S2
S8
S4
S3
NOTE: CORRIDORS INCLUDE AREA WITHIN 1/2 MILE OF CENTERLINE FOR BICYCLE USE AND 1/4 MILE FOR PEDESTRIAN USE
MEYERS
89
50
BIKEBASE
LSC
TRANSPORTATION CONSULTANTS, INC.

FIGURE C
TAHOE REGION PEAK SUMMER DAY CLASS I PEDESTRIAN USE MODEL

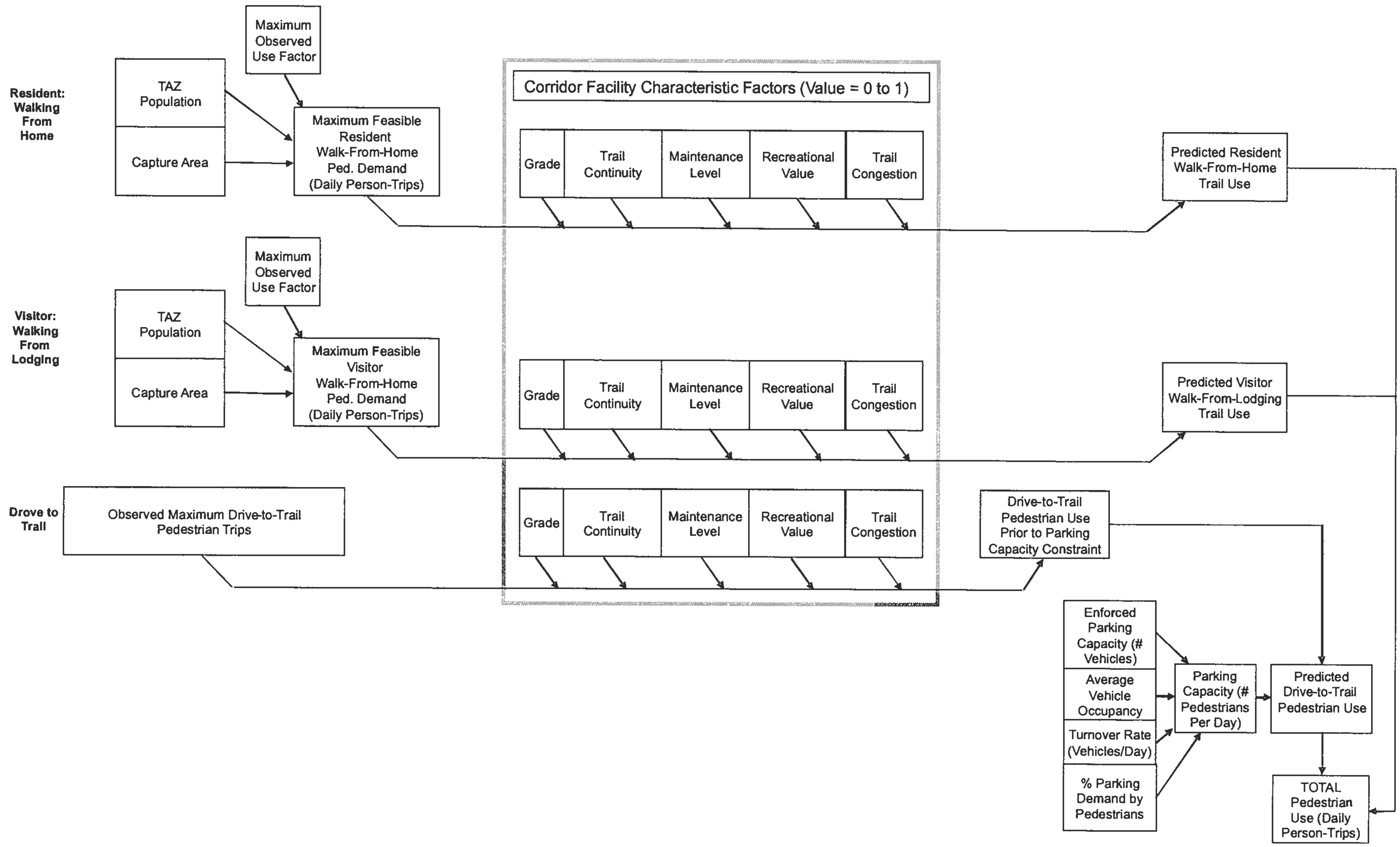


TABLE A: Tahoe Region Bicycle and Pedestrian Corridor Use Model

At Location of Peak Demand in Corridor

Location	
Scenario	
Analyst	

Corridor	Maximum Feasible Demand		Use Factor -- Reduction from Maximum (5): Class	Grade	Continuity	Maint-enance	Recre-ational Value	Conges-tion	Multi-plicative Total	Daily Use Estimate	Peak Hour Factor (6)	Peak Hour Use Estimate	Annual / Daily Factor (7)	Annual Use Estimate
BICYCLISTS														
Resident Bike to Facility		Note 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0				
Visitor Bike to Facility		Note 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0				
Bicyclists Drive to Facility		Note 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0				
Total -- Best Estimate										0		0		0
High End of Estimate Range										*0*		*0*		*0*
Low End of Estimate Range										*0*		*0*		*0*
PEDESTRIANS														
Resident Walk to Facility		Note 3	--	0.00	0.00	0.00	0.00	0.00	0.00	0				
Visitor Walk to Facility		Note 3	--	0.00	0.00	0.00	0.00	0.00	0.00	0				
Pedestrians Drive to Facility		Note 4	--	0.00	0.00	0.00	0.00	0.00	0.00	0				
Total -- Best Estimate										0		0		0
High End of Estimate Range										*0*		*0*		*0*
Low End of Estimate Range										*0*		*0*		*0*
TOTAL -- Best Estimate										0		0		0
High End of Estimate Range										*0*		*0*		*0*
Low End of Estimate Range										*0*		*0*		*0*

Notes

1. From Table G
2. 480 for corridors with an existing Class I facility, 240 for corridors without an existing Class I facility.
3. From Table J
4. 135 for corridors with an existing Class I facility, 41 for corridors without an existing Class I facility.
5. From Table E
6. 0.153 for Class I facility, 0.096 for Class II facility
7. 172.8 for facilities maintained year-round, 146.5 for facilities without snow removal.

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TABLE B: Corridor -- Traffic Analysis Zone Correspondence Table

Corridor		Traffic Analysis Zones
Bicycle		
E1	Incline to Sand Harbor	255 256 261 262 263 264 265 266 267 270 271 272 273 276 278 279 280 281 282 283
E2	Sand Harbor to Round Hill	217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257
E3	Round Hill to Stateline	15 16 201 203 204 213 214 217 218 219 220 221 222
E4	Kingsbury	9 10 200 201 202 203 204 205 207 208 209 210 211 212 213 215 216 221
N1	Truckee River	152 153 154 155 156 157 158 161 162 194 196 197 198
N2	Tahoe City to Dollar Hill	153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 t70 171 172
N3	Dollar Hill to Kings Beach	167 168 169 170 174 176 177 178 179 180 182 187 189 190
N4	Brockway	182 183 184 185 186 187 188 189 190 199
N5	Kings Beach to Crystal Bay	182 189 190 191 192 296 297
N6	Crystal Bay to Incline Village	191 192 262 263 264 265 271 272 273 275 276 277 278 279 280 281 282 283 284 288 289 290 291 292 293 294 295 296 297
N7	Mt Rose	262 263 264 265 269 270 271 272 273 274 275 276 278 279 280 281 282 283 284 285 286 287
S1	Pioneer Trail Corridor North	9 10 11 12 13 200 201 202 203
S2	Pioneer Trail Corridor Central	12 14 23 24 26 32 33 34 36
S3	Pioneer Trail Corridor South	32 33 34 65 66 67 68 69 70 71 74 75 76 77 78 79 84 85 86 91 96 97 98
S4	Meyers to Y	49 50 56 59 60 62 75 76 80 81 82 84 85 86 91 96 97 98
S5	Y to Al Tahoe	20 21 27 28 29 31 37 38 39 40 41 43 48 49 50 56 58 59 62
S6	Al Tahoe to Ski Run	11 12 18 19 20 21 22 24 25 27 28 29 37 39
S7	Ski Run to Stateline	9 10 11 12 13 15 16 18 19 24 200 202
S8	Y to Christmas Valley	47 49 50 54 56 57 58 59 62 82 83 87 88 91 92 93 94 95 96 99 100 101 161 ###
S9	Camp Rich to Y	45 46 49 54 55 56 58 59 60 62 80 103 t04 105 106 112 113
W1	Wye to Meeks Bay	124 125 128 129 130 131 133 134 135 136 137 138 139 140 141 142 143 144 145 148 149 150 151 152 153 154 t55 156 158 t62
W2	Meeks Bay to Camp Rich	104 106 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126
Pedestrian		
E1	Incline to Sand Harbor	255 256 261 262 264 265 266 267 270 271 272 273 276 278 279 280 282
E2	Sand Harbor to Round Hill	217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 240 241 242 243 244 245 247 249 250 251 252 253 254 255 256 257
E3	Round Hill to Stateline	201 203 204 217 219 221 222
E4	Kingsubry	9 10 200 201 202 203 204 205 208 210 211 212 213 215
N1	Truckee River	153 154 155 158 161 162 194 196 197
N2	Tahoe City to Dollar Hill	155 156 157 158 159 160 162 164 165 166 167 168 169 171 172
N3	Dollar Hill to Kings Beach	168 169 174 176 177 178 180 182 187
N4	Brockway	182 183 184 186 188 190 199
N5	Kings Beach to Crystal Bay	182 189 190 191 192 296 297
N6	Crystal Bay to Incline Village	265 272 275 276 277 278 279 280 281 282 288 289 290 291 292 293 294 295 296 297
N7	Mt Rose	265 269 270 271 272 273 274 276 278 279 280 281 282 283 284 285 286 287
S1	Pioneer Trail Corridor North	9 10 11 12 13 200 201 202 203
S2	Pioneer Trail Corridor Central	12 14 23 24 26 32 33 34 36
S3	Pioneer Trail Corridor South	32 33 34 65 66 67 68 69 71 75 76 77 78 79 84 85 96 97
S4	Meyers to Y	49 56 59 60 62 75 76 80 81 82 84 85 91 96 97 98
S5	Y to Al Tahoe	20 21 27 28 29 31 37 38 39 40 41 43 48 50 56 58 62
S6	Al Tahoe to Ski Run	11 12 18 19 20 21 24 25 27 28 29 37 39
S7	Ski Run to Stateline	9 10 11 12 13 18 19 24 200 202
S8	Y to Christmas Valley	47 49 50 56 57 58 59 62 82 83 87 88 91 92 93 94 95 96 99 100 101 161 109
S9	Camp Rich to Y	46 49 54 56 62 103 104 105 106 112 113
W1	Wye to Meeks Bay	125 128 129 130 131 133 134 135 136 137 138 139 140 t41 142 143 144 149 150 151 153 154
W2	Meeks Bay to Camp Rich	112 113 114 115 116 117 118 119 120 121 122 123 124 125

TABLE C: Total Internal Person-Trips Within Corridors

Corridor	Peak Summer Daily Person-Trips (All Modes)	
	Residents	Visitors
E1	7,628	11,465
E2	2,068	2,772
E3	3,238	19,328
E4	6,976	24,048
N1	1,336	964
N2	4,733	3,513
N3	5,437	2,970
N4	2,359	1,328
N5	3,411	1,867
N6	9,528	5,615
N7	10,179	8,705
S1	7,935	41,019
S2	3,020	1,261
S3	3,204	401
S4	4,986	1,663
S5	11,551	4,289
S6	4,001	3,809
S7	11,414	32,275
S8	6,093	1,344
S9	5,921	4,277
W1	4,981	3,815
W2	16	501

Source: TRPA TransCAD Model.

TABLE D: Evaluation of Existing Bicycling Rates

Excluding Bicyclists Driving to Trail

		Daily # of Cyclists Not Driving to Corridor			Total Daily Person-Trips Within Corridor	Ratio of Cyclists to Person-Trips
	Corridor	On Trail	On Road	Total		
RESIDENTS						
Lake Shore Drive Incline	E1	184	5	189	7,628	0.02
Elks Point Rd	E3	71	12	83	3,238	0.03
Truckee River 64 Acres	N1	172	6	178	1,336	0.13
North Shore Lake Forest	N2	211	36	247	4,733	0.05
US 50 Meyers	S3	15	16	31	3,204	0.01
El Dorado Beach	S6	303	51	354	4,001	0.09
Camp Richardson	S9	383	10	393	5,921	0.07
West Shore Kaspian	W1	344	9	353	4,981	0.07
Calibrated Optimal Rate (See Text)						*0.12*
VISITORS						
Lake Shore Drive Incline	E1	46	1	47	11,465	0.00
Elks Point Rd	E3	71	12	83	19,328	0.00
Truckee River 64 Acres	N1	258	10	268	964	0.28
North Shore Lake Forest	N2	83	14	97	3,513	0.03
US 50 Meyers	S3	30	30	60	401	0.15
El Dorado Beach	S6	202	34	236	3,809	0.06
Camp Richardson	S9	401	11	411	4,277	0.10
West Shore Kaspian	W1	181	5	186	3,815	0.05
Calibrated Optimal Rate (See Text)						*0.11*

Note: Including bicyclists on both trail and adjacent road. Number on road is estimated for the Lake Shore Drive Incline, Elks Point Road, El Dorado Beach and Camp Richardson locations.

TABLE E: Bicycle/Pedestrian Facility Use Factors

For use in Tahoe Basin Bicycle Pedestrian Master Plan

Starting from the trail usage that would occur from a "perfect" non-motorized facility (Class I, continual, no street crossings, flat, great maintenance, through an area with high recreational value (woods, shoreline), no trail congestion), what reduction in the proportion of usage would be eliminated based upon the following factors, for each user type?

		Bicyclists			Pedestrians		
		Residents Biking from Home	Visitors Biking from Lodging	Bicyclists Driving to Facility	Residents Walking from Home	Visitors Walking from Lodging	Walkers Driving to Facility
Facility Class	Class 1, attaining AASHTO standards	0%	0%	0%	0%	0%	0%
	Class 2, attaining standards for lane width	35%	55%	85%	Note 1	Note 1	Note 1
	Class 3, on street with acceptable width and traffic volumes	Note 2	Note 2	Note 2	Note 1	Note 1	Note 1
Grade	Flat or only short sections of gentle grade <4%	0%	0%	0%	0%	0%	0%
	Grades of 4%-8%, extending for no more than a few hundred yards	10%	30%	30%	10%	30%	30%
	Long sections of sustained maximum AASHTO grade, with total elevation change exceeding 300 feet	40%	60%	65%	20%	36%	37%
Facility Continuity	No breaks in trail or cross streets	0%	0%	0%	0%	0%	0%
	Infrequent crossings of low volume residential streets and driveways (<4 per mile)	0%	0%	0%	0%	0%	0%
	Frequent crossing of low volume residential streets and driveways (>4 per mile)	10%	15%	15%	4%	7%	16%
	Unprotected crossing of busy (ADT > 10,000) street (including crossings with striped crosswalk only)	22%	29%	40%	17%	35%	35%
	Protected crossing of busy (ADT >10,000) street (signal or roundabout)	14%	16%	18%	5%	10%	10%
	Breaks in facility continuity requiring travel along state highway or other busy street.	35%	44%	49%	36%	48%	54%
Maintenance	High -- No sand on trail or pavement deformities	0%	0%	0%	0%	0%	0%
	Medium -- Condition is an inconvenience, but not a safety hazard	11%	10%	10%	5%	5%	5%
	Poor -- Trail condition reduces safe travel speed	43%	41%	52%	8%	7%	7%
Recreational Value	High -- Shoreline, river corridor, dense woods	0%	0%	0%	0%	0%	0%
	Medium -- Scenery mixed with urban uses	9%	18%	30%	9%	24%	28%
	Low -- Urban corridor	21%	33%	75%	15%	36%	51%
Trail Congestion (Note 2)	None -- LOS A (< 40 passing events per hour)	0%	0%	0%	0%	0%	0%
	Low -- LOS B or C (40 to 100 passing events per hour)	13%	6%	4%	10%	5%	5%
	Moderate -- LOS D or E (100 to 195 passing events per hour)	26%	10%	8%	23%	8%	13%
	High -- LOS F (>195 passing events per hour)	40%	19%	15%	30%	8%	8%

Note 1: Pedestrian demand only evaluated for Class I facilities.
Note 2: Bicyclist demand only evaluated for Class I and II facilities.
Note 3: See Highway Capacity Manual 2000 Chapter 19: Bicycle Methodology. For example, 40 passenger events per hour reflects that an individual user would overtake, be overtaken, or be passed in the opposing direction by 40 other individuals over the course of an hour (or 1 every 1.5 minutes).

TABLE F: Calibration of Bicycle and Pedestrian Use Model

At Location of Peak Demand in Corridor

Corridor		Observed Value	Maximum Feasible Demand	Use Factor -- Reduction from Maximum: Class	Grade	Continuity	Maint-enance	Recreation-al Value	Conges-tion	Multiplicative Total	Modeled Use	Error (Modeled - Observed): #	%
BICYCLISTS													
Resident Bike to Trail													
N2	Tahoe City to Dollar Hill	247	570	0.00	0.25	0.10	0.00	0.21	0.13	0.53	265	18	7%
S9	South Y to Spring Creek	393	710	0.00	0.00	0.00	0.00	0.00	0.40	0.40	426	33	8%
W1	Tahoe City to Meeks Bay	353	600	0.00	0.10	0.22	0.11	0.00	0.13	0.46	325	-29	-8%
	Total	994									1,016	22	2%
Visitor Bike to Trail													
N2	Tahoe City to Dollar Hill	97	390	0.00	0.45	0.15	0.00	0.33	0.06	0.70	115	18	18%
S9	South Y to Spring Creek	411	470	0.00	0.00	0.00	0.00	0.00	0.19	0.19	383	-29	-7%
W1	Tahoe City to Meeks Bay	186	420	0.00	0.30	0.29	0.10	0.00	0.06	0.58	177	-9	-5%
	Total	695									675	-20	-3%
Bicyclists Drive to Trail													
N2	Tahoe City to Dollar Hill	45	480	0.00	0.48	0.15	0.00	0.75	0.04	0.89	51	6	14%
S9	South Y to Spring Creek	476	480	0.00	0.00	0.00	0.00	0.00	0.15	0.15	408	-68	-14%
W1	Tahoe City to Meeks Bay	114	480	0.00	0.30	0.40	0.10	0.00	0.04	0.64	174	60	52%
	Total	636									634	-2	0%
PEDESTRIANS													
Resident Walk to Trail													
N2	Tahoe City to Dollar Hill	104	80	--	0.15	0.04	0.00	0.15	0.10	0.38	50	-54	-52%
S9	South Y to Spring Creek	129	260	--	0.00	0.00	0.00	0.00	0.30	0.30	182	53	41%
W1	Tahoe City to Meeks Bay	82	120	--	0.10	0.17	0.05	0.00	0.10	0.36	76	-6	-7%
	Total	315									308	-7	-2%
Visitor Walk to Trail													
N2	Tahoe City to Dollar Hill	41	100	--	0.33	0.07	0.00	0.36	0.05	0.62	38	-3	-8%
S9	South Y to Spring Creek	135	140	--	0.00	0.00	0.00	0.00	0.08	0.08	129	-6	-5%
W1	Tahoe City to Meeks Bay	43	180	--	0.30	0.35	0.05	0.00	0.05	0.59	74	31	73%
	Total	219									241	22	10%
Pedestrians Drive to Trail													
N2	Tahoe City to Dollar Hill	28	135	--	0.34	0.16	0.00	0.51	0.05	0.74	35	8	27%
S9	South Y to Spring Creek	161	135	--	0.00	0.00	0.00	0.00	0.08	0.08	124	-36	-23%
W1	Tahoe City to Meeks Bay	27	135	--	0.30	0.35	0.05	0.00	0.05	0.59	55	28	104%
	Total	215									215	-1	0%

TABLE H: Existing Daily Bicyclist and Pedestrian Usage by Facility and User Category

Facility	Location	Facility Type	Estimated Peak Summer Daily Use (7AM to 7PM) on Facility: Total	Bicyclists: Total	Bicyclists: Resident: Bike to Trail	Bicyclists: Visitor: Bike to Trail	Bicyclists: Drive to Trail	Walker/Other: Total	Walker/Other: Resident: Walk to Trail	Walker/Other: Visitor: Walk to Trail	Walker/Other: Drive to Trail	Daily Bicyclists on Adjacent Street	Total Daily Bicyclists in Corridor	Total Peak Hour Facility Use
North Shore Trail	State Recreation Area, E. of Lighthouse Center	Class I	606	377	186	146	45	229	113	89	28	51	428	91
North Shore Trail	Lake Forest, at N. End of Lake Forest Rd.	Class I	546	366	211	83	72	180	104	41	35	50	416	79
West Shore Trail	64 Acres, S Boundary	Class I	916	797	142	241	415	118	21	36	62	16	813	147
West Shore Trail	Kaspian, at Restrooms	Class I	792	640	344	181	114	152	82	43	27	14	654	106
Truckee River Trail	64 Acres, Near Bike Bridge	Class I	1,246	1,000	172	258	570	246	42	63	140	16	1,016	219
El Dorado Beach	US 50 150 feet east of Lakeview, on the bike path	Class I	693	541	303	202	36	152	85	57	10	--	--	120
Camp Richardson	Camp Richardson Resort sign	Class I	1,685	1,260	383	401	476	425	129	135	161	--	--	273
Elks Point Road	Northwest corner of Elks Point Road/U.S. 50	Class I	357	171	71	71	28	186	78	78	31	--	--	49
Incline Lakeshore Path	In front of Incline Beach	Class I	1,856	364	184	46	133	1,492	756	189	547	--	--	253
National Ave.	At TV Rec Area at National Ave./SR28	None	231	--	--	--	--	--	--	--	--	104	--	0
US 50	At Santa Fe Drive in Meyers (Sawmill Bike Path)	Class I	70	56	15	30	11	14	4	8	2	46	102	12
Helen Avenue Trail	Behind McDonalds Near South Y	Class I	183	117	--	--	--	66	--	--	--	--	--	16
Pioneer Trail	Trout Creek	Class II	293	161	--	--	--	132	--	--	--	0	161	26
Pioneer Trail	Stateline S. of US 50	Class II	611	70	--	--	--	541	--	--	--	300	370	61
SR 89	N. of US 50 (Alpina Café)	Class III	205	205	--	--	--	0	--	--	--	0	205	--
US 50	West of Stateline	Sidewalk	5,952	238	--	--	--	5,714	--	--	--	80	318	910
US 50	S. of Airport	None	--	--	--	--	--	--	--	--	--	27	27	--
Total: Existing Tahoe Region Class I Facilities			8,950	5,690	2,055	1,694	1,941	3,260	1,443	753	1,064	--	--	--

Source: Table A in Appendix B of the Impacts Memorandum, based in turn on MOST RECENT surveys and counts conducted by TCORP, TCPUD and TRPA.
Note 1: Daily figures for many locations are estimates based upon limited available hourly counts, as shown in Table A of Appendix B of the Impacts Memorandum.

TABLE G: Evaluation of Potential Bicycling Demand

At Location of Peak Demand in Corridor, Excluding Bicyclists Driving to Trail

Corridor		Daily Corridor Total Person-Trips		1-Way Cyclist Trips -- Peak Summer Day	
		Resident	Visitor	Non-Driver Resident	Non Driver Visitor
E1	Incline to Sand Harbor	7,628	11,465	1,370	1,260
E2	Sand Harbor to Round Hill	2,068	2,772	250	300
E3	Round Hill to Stateline	3,238	19,328	390	2,130
E4	Kingsbury Grade	6,976	24,048	840	2,650
N1	Truckee River Corridor	1,336	964	172	258
N2	Tahoe City to Dollar Hill	4,733	3,513	570	390
N3	Dollar Hill to Kings Beach	5,437	2,970	650	330
N4	Kings Beach to Brockway Summit	2,359	1,328	280	150
N5	Kings Beach to Crystal Bay	3,411	1,867	410	210
N6	Crystal Bay to Incline	9,528	5,615	1,140	620
N7	Incline to Mt. Rose	10,179	8,705	1,220	960
S1	Pioneer Trail Corridor - Stateline to Ski Run	7,935	41,019	950	4,510
S2	Pioneer Trail Corridor - Ski Run to Trout Creek	3,020	1,261	360	140
S3	Pioneer Trail Corridor - Trout Creek to Meyers	3,204	401	380	40
S4	Meyers to South Y	4,986	1,663	600	180
S5	South Y to Al Tahoe	11,551	4,289	1,390	470
S6	Al Tahoe to Ski Run	4,001	3,809	480	420
S7	US 50 Corridor - Ski Run to Stateline	11,414	32,275	1,370	3,550
S8	South Y to Meyers via Tahoe Paradise	6,093	1,344	730	150
S9	South Y to Spring Creek	5,921	4,277	710	470
W1	Tahoe City to Meeks Bay	4,981	3,815	600	420
W2	Meeks Bay to Spring Creek	16	501	0	60
TOTAL REGIONWIDE				14,862	19,668

TABLE I: Evaluation of Existing Pedestrian Rates

Excluding Pedestrians Driving to Trail

	Corridor	Daily # of Pedestrians Not Driving to Trail	Population Within Walk Distance of Trail	Ratio of Pedestrians to Population
RESIDENTS				
Lake Shore Drive Incline	E1	756	4139	0.18
Elks Point Rd	E3	78	3430	0.02
Truckee River 64 Acres	N1	42	505	0.08
North Shore Lake Forest	N2	104	2092	0.05
US 50 Meyers	S3	4	6768	0.00
El Dorado Beach	S6	85	5622	0.02
Camp Richardson	S9	129	6412	0.02
West Shore Kaspian	W1	82	2878	0.03
Recommended Optimal Rate				*0.04*
VISITORS				
Lake Shore Drive Incline	E1	189	4049	0.05
Elks Point Rd	E3	78	9151	0.01
Truckee River 64 Acres	N1	63	760	0.08
North Shore Lake Forest	N2	41	2447	0.02
US 50 Meyers	S3	8	2165	0.00
El Dorado Beach	S6	57	6041	0.01
Camp Richardson	S9	135	3608	0.04
West Shore Kaspian	W1	43	4392	0.01
Recommended Optimal Rate				*0.03*

TABLE J: Evaluation of Potential Walking Demand

At Location of Peak Demand in Corridor, Excluding Pedestrians Driving to Trail

		Population		1-Way Pedestrian Trips -- Peak Summer Day		
Corridor		Resident	Visitor	Non-Driver Resident	Non Driver Visitor	Total
E1	Incline to Sand Harbor	4,139	4,049	750	160	910
E2	Sand Harbor to Round Hill	2,738	2,244	110	90	200
E3	Round Hill to Stateline	3,430	9,151	140	370	510
E4	Kingsbury Grade	2,965	5,931	120	240	360
N1	Truckee River Corridor	505	760	20	30	50
N2	Tahoe City to Dollar Hill	2,092	2,447	80	100	180
N3	Dollar Hill to Kings Beach	4,185	3,253	170	130	300
N4	Kings Beach to Brockway Summit	2,449	1,333	100	50	150
N5	Kings Beach to Crystal Bay	2,767	2,124	110	80	190
N6	Crystal Bay to Incline	4,420	4,401	180	180	360
N7	Incline to Mt. Rose	5,287	4,191	210	170	380
S1	Pioneer Trail Corridor - Stateline to Ski Run	3,261	14,582	130	580	710
S2	Pioneer Trail Corridor - Ski Run to Trout Creek	5,458	2,396	220	100	320
S3	Pioneer Trail Corridor - Trout Creek to Meyers	6,768	2,165	270	90	360
S4	Meyers to South Y	6,533	2,508	260	100	360
S5	South Y to Al Tahoe	8,710	3,595	350	140	490
S6	Al Tahoe to Ski Run	5,622	6,041	220	240	460
S7	US 50 Corridor - Ski Run to Stateline	4,686	17,693	190	710	900
S8	South Y to Meyers via Tahoe Paradise	7,255	2,562	290	100	390
S9	South Y to Spring Creek	6,412	3,608	260	140	400
W1	Tahoe City to Meeks Bay	2,878	4,392	120	180	300
W2	Meeks Bay to Spring Creek	91	1,331	0	50	50
TOTAL REGIONWIDE				4,300	4,030	8,330

TABLE K: Evaluation of Annual/Daily Factors for Tahoe Facilities

	Visitor		Resident				
						Percent of Total Annual	
Month	*South Lake Tahoe Lodging Room Nights During Bicycling Season (1)*	Percent of Total Annual by Month	*Boulder, CO -- Avg of 4 Locations (2)*	Carmel, IN -- Avg of 4 Locations (3)	Indianapolis, IN -- Avg of 30 Locations (3)	Assuming Snow Removal	Assuming No Snow Removal (4)
Jan	0	0.0%	218	15,000	2,466	2.4%	0.0%
Feb	0	0.0%	170	14,500	4,901	3.7%	0.0%
Mar	0	0.0%	412	23,750	6,174	5.0%	0.0%
Apr	0	0.0%	581	49,750	12,992	10.5%	0.0%
May	32,500	10.6%	598	45,750	14,478	11.0%	14.5%
Jun	47,580	15.5%	756	51,500	16,886	12.7%	16.8%
Jul	68,345	22.3%	822	53,500	19,453	14.2%	18.8%
Aug	71,325	23.3%	822	52,250	20,678	14.8%	19.5%
Sep	51,525	16.8%	707	44,250	17,030	12.3%	16.2%
Oct	35,080	11.5%	509	28,250	8,741	6.7%	8.8%
Nov	0	0.0%	302	19,500	5,021	4.1%	5.4%
Dec	0	0.0%	203	16,000	2,715	2.6%	0.0%
Total Annual	306,355	100.0%	6,099	414,000	131,536	100.0%	100.0%
Ratio of Annual to Peak Month Average Day		133.2				209.5	158.9
Proportion of Total Tahoe Users		0.48				0.52	0.52
Overall Annual/Peak Day Factor						172.8	146.5

Note 1: Source -- City of South Lake Tahoe. Visitor bicycling season assumed to extend from May through October.
Note 2: *Estimating Annual Bicycle Volumes on Multi-Use Paths in Boulder*, Lewin, Amy.
Note 3: Source -- Alta Consulting, Inc.
Note 4: Trails assumed to be effectively open from May through November.

Table L: Total Daily Resident Person-Trips Between Corridors

From Corridor	To Corridor																					
	E1	E2	E3	E4	N1	N2	N3	N4	N5	N6	N7	S1	S2	S3	S4	S5	S6	S7	S8	S9	W1	W2
E1	7628	58	18	48	69	207	1116	720	1091	7979	8560	41	27	14	17	36	37	44	22	14	117	1
E2	56	2068	1625	2266	0	1	27	19	22	59	56	1995	603	357	309	1003	795	2243	364	349	9	1
E3	26	1656	3238	4602	4	5	13	8	10	35	35	5035	2057	992	821	2260	2371	5736	1003	907	19	3
E4	41	2271	4707	6976	4	11	20	12	20	52	58	6152	2850	1805	1581	3502	3254	7082	1891	1772	40	14
N1	71	1	4	3	1336	2213	501	107	134	122	98	4	2	3	5	18	3	4	11	9	2089	7
N2	202	2	4	9	2190	4733	1702	388	492	359	251	9	5	4	7	29	6	10	18	13	3184	18
N3	1208	12	7	27	643	1883	5437	3088	3901	2426	1440	22	7	5	6	14	6	23	11	8	751	6
N4	821	8	6	16	121	384	3317	2359	2944	1729	989	15	4	2	3	10	6	15	4	2	158	0
N5	1132	12	6	17	127	433	3668	2600	3411	2406	1360	17	5	3	6	15	5	17	12	8	193	0
N6	7943	58	33	49	107	357	2223	1530	2333	9528	9170	41	26	17	25	41	23	46	35	29	190	2
N7	8559	54	28	54	81	268	1345	878	1341	9212	10179	47	22	20	18	37	36	58	24	20	155	2
S1	46	2016	5197	6033	7	14	20	10	15	43	54	7935	4269	2211	1843	4318	4636	9390	2268	2085	45	15
S2	28	624	2080	2816	1	3	5	1	3	28	21	4284	3020	1172	888	2631	3108	5465	992	1033	15	6
S3	17	359	982	1972	4	4	3	1	3	18	21	2363	1128	3204	3030	3206	1401	2882	2233	1704	19	4
S4	12	308	810	1660	11	13	3	0	2	13	13	1866	874	3040	4986	5775	1286	2288	4882	4412	61	11
S5	35	954	2221	3590	16	23	18	11	17	35	33	4363	2641	3198	5775	11551	4224	5611	7192	7176	111	21
S6	48	791	2372	3352	1	6	7	3	6	27	36	4770	3104	1353	1286	4205	4001	6269	1652	1628	19	5
S7	53	2245	5854	6933	7	17	22	11	16	50	68	9353	5482	2735	2284	5614	6119	11414	2781	2607	52	19
S8	16	375	990	1934	14	18	10	3	7	19	14	2258	988	2286	4900	7207	1653	2769	6093	5639	71	24
S9	12	359	946	1777	13	17	7	3	5	13	9	2066	1026	1778	4466	7166	1625	2573	5594	5921	85	24
W1	139	6	17	51	2188	3311	668	173	227	233	180	58	12	25	49	116	28	69	58	60	4981	70
W2	1	2	8	12	10	17	7	1	1	2	2	18	5	6	18	34	10	24	24	26	70	16

Source: TRPA TransCAD Model.

TABLE M: Total Daily Visitor Person-Trips Between Corridors

From Corridor	To Corridor																					
	E1	E2	E3	E4	N1	N2	N3	N4	N5	N6	N7	S1	S2	S3	S4	S5	S6	S7	S8	S9	W1	W2
E1	11465	796	525	964	399	823	1110	542	1445	8528	10939	835	126	141	278	356	253	805	286	479	676	132
E2	1206	2772	3521	3654	122	329	471	217	409	1073	1146	3407	317	357	634	1009	818	2417	466	822	432	243
E3	1681	3414	19328	19528	247	613	661	310	1061	2070	1653	22245	2035	837	1497	2679	4999	18028	1415	2787	807	581
E4	1457	2970	19004	24048	241	671	641	314	1197	2148	1389	26048	1660	652	1406	2603	4388	21072	1349	2509	663	593
N1	484	139	131	176	964	1649	572	273	384	516	478	138	61	34	71	168	82	156	62	152	1276	127
N2	1599	378	326	657	1708	3513	1687	648	996	1578	1574	371	212	178	324	659	310	446	401	562	2114	335
N3	3478	595	663	853	989	2200	2970	1660	2373	2929	3489	625	152	235	438	614	391	710	440	569	1533	252
N4	1646	332	343	465	275	771	1920	1328	1732	1617	1594	327	56	96	167	239	152	339	164	248	530	103
N5	1658	275	309	469	262	731	1742	1181	1867	1870	1613	351	57	98	192	259	140	349	198	240	516	96
N6	6705	366	250	629	181	420	737	433	1408	5615	6530	443	79	77	150	188	115	413	163	257	337	64
N7	9001	658	374	773	347	665	930	444	1143	7085	8705	671	133	122	219	237	207	659	215	332	566	93
S1	2449	4283	34352	36488	457	1077	856	431	1985	3667	2343	41019	3024	1123	2175	3903	7619	31057	2025	3881	1316	740
S2	304	551	2352	1828	92	176	122	60	216	439	292	2368	1261	139	373	671	1932	3320	312	454	235	119
S3	477	449	921	962	74	276	214	100	249	467	487	900	198	401	657	800	512	861	405	744	269	204
S4	609	697	1585	1732	85	260	208	123	257	613	577	1708	354	585	1663	2535	945	1911	1262	1932	376	365
S5	844	1120	2923	3104	203	514	465	186	442	992	860	3015	574	531	1995	4289	1955	3094	1820	2653	574	465
S6	965	1401	7598	6645	180	441	340	166	522	1198	1046	7654	1543	464	1006	2363	3809	7438	794	1343	548	367
S7	2928	4630	36796	37000	499	1214	993	521	2208	4212	2843	41144	4152	1389	2575	4664	9743	32275	2255	4383	1532	849
S8	692	607	1603	1733	103	296	200	112	244	795	686	1753	303	419	1294	1942	904	1862	1344	2026	391	329
S9	985	1176	3159	3148	183	446	418	216	421	1010	931	3300	468	642	2379	3652	1416	3230	2242	4277	684	662
W1	2210	601	883	1068	1774	3249	1584	646	1102	1977	2158	857	351	445	679	1034	557	761	640	1073	3815	425
W2	628	522	1577	1477	208	481	234	118	209	604	600	1461	214	309	585	915	653	1125	539	1661	652	501

Source: TRPA TransCAD Model.

Appendix A

Individual Bicycle/Pedestrian Facility Use Factors Sheets

Bicycle/Pedestrian Facility Use Factors

For use in Tahoe Basin Bicycle Pedestrian Master Plan

Responder Matt Lasky
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Phone #: 510 540 5008 x104

Starting from the trail usage that would occur from a "perfect" non-motorized facility (Class I, continual, no street crossings, flat, great maintenance, through an area with high recreational value (woods, shoreline), no trail congestion), what reduction in the proportion of usage would be eliminated based upon the following factors, for each user type?

		Bicyclists			Walkers/Bladers/Etc.			
		Residents Biking from Home	Visitors Biking from Lodging	Bicyclists Driving to Facility	Residents Walking from Home	Visitors Walking from Lodging	Walkers Driving to Facility	Comments
Facility Class	Class 1, attaining AASHTO standards	0%	0%	0%	0%	0%	0%	
	Class 2, attaining standards for lane width	40%	65%	80%	Note 1	Note 1	Note 1	
	Class 3, on street with acceptable width and traffic volumes	65%	75%	90%	Note 1	Note 1	Note 1	I assume bicyclists rarely drive to on-street facilities
Grade	Flat or only short sections of gentle grade <4%	0%	0%	0%	0%	0%	0%	
	Grades of 4%-8%, extending for no more than a few hundred yards	20%	20%	25%	10%	10%	0%	
	Long sections of sustained maximum AASHTO grade, with total elevation change exceeding 300 feet	50%	60%	65%	20%	30%	30%	
Facility Continuity	No breaks in trail or cross streets	0%	0%	0%	10%	10%	0%	Bicyclists want long sections of trail (path) without interuptions as do pedestrians. No breaks prevent access points and it takes longer for peds to travel to access points that are further away
	Infrequent crossings of low volume residential streets and driveways (<4 per mile)	10%	10%	10%	0%	0%	0%	
	Frequent crossing of low volume residential streets and driveways (>4 per mile)	30%	20%	20%	-5%	0%	0%	Peds walking from home have more access points, hence (-).
	Unprotected crossing of busy (ADT > 10,000) street (including crossings with striped crosswalk only)	30%	30%	30%	10%	10%	10%	
	Protected crossing of busy (ADT >10,000) street (signal or roundabout)	30%	30%	30%	15%	10%	15%	Higher for bikes than peds because they don't like waiting at signals
	Breaks in facility continuity requiring travel along state highway or other busy street.	40%	50%	40%	20%	30%	30%	
Maintenance	High -- No sand on trail or pavement deformities	0%	0%	0%	0%	0%	0%	
	Medium -- Condition is an inconvenience, but not a safety hazard	30%	20%	25%	15%	10%	15%	
	Poor -- Trail condition reduces safe travel speed	40%	20%	40%	10%	0%	0%	Does safe travel speed matter for pedestrians? I would assume the majority are using Class I for recreation and not transportation so travel speed is not important. People driving to walk don't need a high travel speed. Redefine
Recreational Value	High -- Shoreline, river corridor, dense woods	0%	0%	0%	0%	0%	0%	Bicyclists and pedestrians prefer pleasant outdoor environments
	Medium -- Scenery mixed with urban uses	10%	30%	20%	20%	30%	25%	
	Low -- Urban corridor	20%	40%	40%	20%	45%	30%	
Trail Congestion (Note 2)	None -- LOS A (< 40 passing events per hour)	10%	0%	0%	0%	0%	0%	
	Low -- LOS B or C (40 to 100 passing events per hour)	10%	0%	10%	0%	0%	0%	
	Moderate -- LOS D or E (100 to 195 passing events per hour)	20%	10%	40%	15%	10%	20%	
	High -- LOS F (>195 passing events per hour)	30%	15%	60%	25%	10%	30%	

Note 1: Pedestrian demand only being evaluated for Class I facilities.
Note 2: See Highway Capacity Manual 2000 Chapter 19: Bicycle Methodology. For example, 40 passenger events per hour reflects that an individual user would overtake, be overtaken, or be passed in the opposing direction by 40 other individuals over the course of an hour (or 1 every 1.5 minutes).

Bicycle/Pedestrian Facility Use Factors

For use in Tahoe Basin Bicycle Pedestrian Master Plan

Respondent:	Ian
Email:	
Phone #:	

Starting from the trail usage that would occur from a "perfect" non-motorized facility (Class I, continual, no street crossings, flat, great maintenance, through an area with high recreational value (woods, shoreline), no trail congestion), what reduction in the proportion of usage would be eliminated based upon the following factors, for each user type?

		Bicyclists			Walkers/Bladers/Etc.			
		Residents Biking from Home	Visitors Biking from Lodging	Bicyclists Driving to Facility	Residents Walking from Home	Visitors Walking from Lodging	Walkers Driving to Facility	Comments
Facility Class	Class 1, attaining AASHTO standards	0%	0%	0%	0%	0%	0%	
	Class 2, attaining standards for lane width				Note 1	Note 1	Note 1	
	Class 3, on street with acceptable width and traffic volumes				Note 1	Note 1	Note 1	
Grade	Flat or only short sections of gentle grade <4%	0%	0%	0%	0%	0%	0%	
	Grades of 4%-8%, extending for no more than a few hundred yards	5%	8%	0%	0%	0%	0%	
	Long sections of sustained maximum AASHTO grade, with total elevation change exceeding 300 feet	15%	0%	0%	0%	0%	0%	I do not believe that this would be a deterrent for visitors or folks driving to the facility as this is a pretty inconsequential climb and most folks would not know if was there as it would typical not be visible from a starting point
Facility Continuity	No breaks in trail or cross streets	0%	0%	0%	0%	0%	0%	I do not believe that pedestrians would be deterred from using a multi-use pathway with this minimal number of crossings.
	Infrequent crossings of low volume residential streets and driveways (<4 per mile)	0%	0%	0%	-20%	0%	0%	I do not believe that pedestrians would be deterred from using a multi-use pathway with this minimal number of crossings.
	Frequent crossing of low volume residential streets and driveways (>4 per mile)	10%	20%	20%	-20%	0%	0%	I do not believe that pedestrians would be deterred from using a multi-use pathway with this minimal number of crossings.
	Unprotected crossing of busy (ADT > 10,000) street (including crossings with striped crosswalk only)	10%	20%	30%	5%	10%	10%	
	Protected crossing of busy (ADT >10,000) street (signal or roundabout)	5%	10%	15%	0%	0%	0%	It seems that waiting for one pedestrian crossing interval is not much of a deterrent.
	Breaks in facility continuity requiring travel along state highway or other busy street.	10%	20%	30%	20%	30%	50%	This on the other hand, is rather more unpleasant for pedestrians than it is for bicyclists. One walks slower than one bicyclists so exposure is longer for any state highway/arterial segment.
Maintenance	High -- No sand on trail or pavement deformities	0%	0%	0%	0%	0%	0%	Pedestrians are pretty unaffected by poor pavement quality. A small percentage are wheel chair users and most affected.
	Medium -- Condition is an inconvenience, but not a safety hazard	5%	10%	15%	0%	0%	0%	
	Poor -- Trail condition reduces safe travel speed	25%	50%	75%	5%	5%	5%	
Recreational Value	High -- Shoreline, river corridor, dense woods	0%	0%	0%	0%	0%	0%	This assumes a basic anti-urban stance that does not hold for many recreational bicyclists these days. Witness frequent bicycle tourism in Paris, New York, Portland and other cities in which recreational riders ride along urban streets for access to a variety of cultural institutions
	Medium -- Scenery mixed with urban uses	0%	10%	20%	-20%			A fair number of pedestrian using a multi-use pathway meeting Class I standards are using it to get somewhere as it is not a great "hiking" experience so I think the prescence of urban uses is going to be an attractor
	Low -- Urban corridor	0%	20%	40%				
Trail Congestion (Note 2)	None -- LOS A (< 40 passing events per hour)	0%	0%	0%	0%	0%	0%	
	Low -- LOS B or C (40 to 100 passing events per hour)	5%	5%	5%				
	Moderate -- LOS D or E (100 to 195 passing events per hour)	10%	10%	10%				
	High -- LOS F (>195 passing events per hour)	50%	20%	20%				People making utilitarian trips are going to be most bothered by this congestion. Visitors and people driving to the trail are not likely repeat users and will not be deterred from a one time or infrequent visit to a congested facility

Note 1: Pedestrian demand only being evaluated for Class I facilities.
Note 2: See Highway Capacity Manual 2000 Chapter 19: Bicycle Methodology. For example, 40 passenger events per hour reflects that an individual user would overtake, be overtaken, or be passed in the opposing direction by 40 other individuals over the course of an hour (or 1 every 1.5 minutes).

Bicycle/Pedestrian Facility Use Factors

For use in Tahoe Basin Bicycle Pedestrian Master Plan

Respondent: Lauren Ledbetter
Email: laurenledbetter@altaplanning.com
Phone #: 510-540-5008 x 103

Starting from the trail usage that would occur from a "perfect" non-motorized facility (Class I, continual, no street crossings, flat, great maintenance, through an area with high recreational value (woods, shoreline), no trail congestion), what reduction in the proportion of usage would be eliminated based upon the following factors, for each user type?

		Bicyclists			Walkers/Bladers/Etc.				
		Residents Biking from Home	Visitors Biking from Lodging	Bicyclists Driving to Facility	Residents Walking from Home	Visitors Walking from Lodging	Walkers Driving to Facility	Comments	
Facility Class	Class 1, attaining AASHTO standards	0%	0%	0%	0%	0%	0%	Number of people driving to facility ranges from about 20% to about 80%, with an average of 20 to 30%, based on Lake Tahoe Basin Bike Trail Survey, July 2007, TRPATCORP	
	Class 2, attaining standards for lane width	71%/1	71%/1	95%/2	Note 1	Note 1	Note 1	1/ Six shared use path counts showed 140 bicyclists/hour, 3 on-street counts showed 40 bicyclists/hour. Lake Tahoe Basin Bike Trail Survey, July 2007, TRPATCORP	2/ I can't imagine a bicyclist driving to a bike lane, but I can imagine, and have seen, bicyclists driving to the start of a road ride
	Class 3, on street with acceptable width and traffic volumes	71%/1	71%/1	85%/2	Note 1	Note 1	Note 1	1/ see note above.	2/ see note above
Grade	Flat or only short sections of gentle grade <4%	0%	0%	0%	0%	0%	0%		
	Grades of 4%-8%, extending for no more than a few hundred yards	20%	10%	10%	15%	15%	20%	1/ Assume that visitors don't know the area, and therefore would not necessarily avoid steeper grades.	
	Long sections of sustained maximum AASHTO grade, with total elevation change exceeding 300 feet	25%	20%	20%	10%	10%	30%	1/ Walkers are less affected by steep grades. I would adjust this number based on the percentage of people with mobility impairments and/or the percentage of elderly people	
Facility Continuity	No breaks in trail or cross streets	0%	0%	0%	0%	0%	0%		
	Infrequent crossings of low volume residential streets and driveways (<4 per mile)	-15%	-15%	-15%	0%	0%	0%	2/ Increased connectivity increases the number of residents walking or biking to the trail from home and from lodging.	
	Frequent crossing of low volume residential streets and driveways (>4 per mile)	-20%	-20%	-20%	-25%	-25%	0%	2/ Increased connectivity increases the number of residents walking or biking to the trail from home and from lodging.	
	Unprotected crossing of busy (ADT > 10,000) street (including crossings with striped crosswalk only)	25%	25%	25%	20%	20%	20%		
	Protected crossing of busy (ADT >10,000) street (signal or roundabout)	20%	20%	20%	15%	15%	15%	Roundabout will be a detriment to bicyclists more than pedestrians.	
	Breaks in facility continuity requiring travel along state highway or other busy street.	70%	70%	90%	70%	70%	90%	Assume visitors will stop and turn around once the trail breaks. This also depends on where the volumes are measured--before or after the break, and how long the break is. I would divide up a trail	
Maintenance	High – No sand on trail or pavement deformities	0%	0%	0%	0%	0%	0%		
	Medium – Condition is an inconvenience, but not a safety hazard	10%	10%	10%	2%	2%	2%	Peds are less affected by pavement condition than bicyclists.	
	Poor – Trail condition reduces safe travel speed	70%	70%	70%	10%	10%	10%	Should keep in mind pedestrians who use wheelchairs and those pushing strollers.	
Recreational Value	High – Shoreline, river corridor, dense woods	0%	0%	0%	0%	0%	0%		
	Medium – Scenery mixed with urban uses	-20%	-20%	-10%	-20%	-20%	3000%	this may be the best of both worlds--access to trail from urban area and access to nice scenery.	
	Low – Urban corridor	-20%	-20%	80%	-20%	-20%	50%	urban corridors don't necessarily reduce use. More people would potentially use a facility in an urban corridor.	
Trail Congestion (Note 2)	None – LOS A (< 40 passing events per hour)	0%	0%	0%	0%	0%	0%	This is sort of cyclical reasoning. A trail with a high LOS will have a higher number of users. People are attracted to other people, but there is a point at which people will divert away from a trail due to	
	Low – LOS B or C (40 to 100 passing events per hour)	25%	5%	5%	35%	5%	5%	Pedestrians being passed by lots of high-speed bicyclists will avoid the facility.	
	Moderate – LOS D or E (100 to 195 passing events per hour)	50%	10%	10%	65%	10%	10%		
	High – LOS F (>195 passing events per hour)	80%	20%	20%	80%	20%	20%	At this point, I think you will see a peak in the number of people diverted to other facilities or not making the trip at all.	

Note 1: Pedestrian demand only being evaluated for Class I facilities.
Note 2: See Highway Capacity Manual 2000 Chapter 19: Bicycle Methodology. For example, 40 passenger events per hour reflects that an individual user would overtake, be overtaken, or be passed in the opposing direction by 40 other individuals over the course of an hour (or 1 every 1.5 minutes).

Bicycle/Pedestrian Facility Use Factors

For use in Tahoe Basin Bicycle Pedestrian Master Plan

Respondent: Hannah Kappel
Email:
Phone #:

Starting from the trail usage that would occur from a "perfect" non-motorized facility (Class I, continual, no street crossings, flat, great maintenance, through an area with high recreational value (woods, shoreline), no trail congestion), what reduction in the proportion of usage would be eliminated based upon the following factors, for each user type?

		Bicyclists			Walkers/Bladers/Etc.			
		Residents Biking from Home	Visitors Biking from Lodging	Bicyclists Driving to Facility	Residents Walking from Home	Visitors Walking from Lodging	Walkers Driving to Facility	Comments
Facility Class	Class 1, attaining AASHTO standards	0%	0%	0%	0%	0%	0%	
	Class 2, attaining standards for lane width	10%/1	28%/2	85%/3	Note 1	Note 1	Note 1	1/ Dill and Gliebe: commuters do not tend to go out of their way to use bike lanes 2/ Children comprise approximately 8% of recreational trips (source: Outdoor Industry Association) 3/ Who drives to a bike lane?
	Class 3, on street with acceptable width and traffic volumes	20%/1	28%	90%/3	Note 1	Note 1	Note 1	Dill and Gliebe: Only 19% of utilitarian cyclists; travel is on streets without bicycle facilities 3/ Based on ratio of existing counts on SR 28 to NBPD demand model projection for new trail facility
Grade	Flat or only short sections of gentle grade <4%	0%	0%	0%	0%	0%	0%	
	Grades of 4%-8%, extending for no more than a few hundred yards							Dill found that people out for social/recreational trips, and those for shopping/dining/personals are slightly more likely to desire avoiding hills, although it is not a high priority for any purpose. (6th
	Long sections of sustained maximum AASHTO grade, with total elevation change exceeding 300 feet							
Facility Continuity	No breaks in trail or cross streets	0%	0%	0%	0%	0%	0%	
	Infrequent crossings of low volume residential streets and driveways (<4 per mile)							
	Frequent crossing of low volume residential streets and driveways (>4 per mile)							
	Unprotected crossing of busy (ADT > 10,000) street (Including crossings with striped crosswalk only)							
	Protected crossing of busy (ADT >10,000) street (signal or roundabout)							
	Breaks in facility continuity requiring travel along state highway or other busy street.							
Maintenance	High – No sand on trail or pavement deformities	0%	0%	0%	0%	0%	0%	
	Medium – Condition is an inconvenience, but not a safety hazard							
	Poor – Trail condition reduces safe travel speed							
Recreational Value	High – Shoreline, river corridor, dense woods	0%	0%	0%	0%	0%	0%	
	Medium – Scenery mixed with urban uses							
	Low – Urban corridor							
Trail Congestion (Note 2)	None – LOS A (< 40 passing events per hour)	0%	0%	0%	0%	0%	0%	
	Low – LOS B or C (40 to 100 passing events per hour)							
	Moderate – LOS D or E (100 to 195 passing events per hour)							
	High – LOS F (>195 passing events per hour)							

Note 1: Pedestrian demand only being evaluated for Class I facilities.
Note 2: See Highway Capacity Manual 2000 Chapter 19: Bicycle Methodology. For example, 40 passenger events per hour reflects that an individual user would overtake, be overtaken, or be passed in the opposing direction by 40 other individuals over the course of an hour (or t every t.5 minutes).

Bicycle/Pedestrian Facility Use Factors

For use in Tahoe Basin Bicycle Pedestrian Master Plan

Respondent:	Garrett Villanueva
Email:	gvillanueva@fs.fed.us
Phone #:	543-2762

Starting from the trail usage that would occur from a "perfect" non-motorized facility (Class I, continual, no street crossings, flat, great maintenance, through an area with high recreational value (woods, shoreline), no trail congestion), what reduction in the proportion of usage would be eliminated based upon the following factors, for each user type?

		Bicyclists			Walkers/Bladers/Etc.			
		Residents Biking from Home	Visitors Biking from Lodging	Bicyclists Driving to Facility	Residents Walking from Home	Visitors Walking from Lodging	Walkers Driving to Facility	Comments
Facility Class	Class 1, attaining AASHTO standards	0%	0%	0%	0%	0%	0%	
	Class 2, attaining standards for lane width	25%	50%	35%	35%	50%	45%	
	Class 3, on street with acceptable width and traffic volumes	40%	60%	40%	40%	65%	50%	
Grade	Flat or only short sections of gentle grade <4%	0%	0%	0%	0%	0%	0%	
	Grades of 4%-8%, extending for no more than a few hundred yards	15%	25%	10%	15%	40%	10%	
	Long sections of sustained maximum AASHTO grade, with total elevation change exceeding 300 feet	35%	50%	50%	30%	50%	40%	
Facility Continuity	No breaks in trail or cross streets	0%	0%	0%	0%	0%	0%	
	Infrequent crossings of low volume residential streets and driveways (<4 per mile)	0%	0%	0%	0%	0%	0%	
	Frequent crossing of low volume residential streets and driveways (>4 per mile)	5%	15%	15%	10%	10%	10%	
	Unprotected crossing of busy (ADT > 10,000) street (including crossings with striped crosswalk only)	20%	25%	20%	15%	20%	15%	
	Protected crossing of busy (ADT >10,000) street (signal or roundabout)	15%	20%	15%	10%	15%	15%	
	Breaks in facility continuity requiring travel along state highway or other busy street.	30%	50%	50%	35%	75%	50%	
Maintenance	High – No sand on trail or pavement deformities	0%	0%	0%	0%	0%	0%	
	Medium – Condition is an inconvenience, but not a safety hazard	5%	5%	5%	5%	5%	5%	
	Poor -- Trail condition reduces safe travel speed	10%	25%	15%	10%	10%	10%	I would think this would have a greater effect on inexperienced users and also depend upon a users expectation of the trail.
Recreational Value	High -- Shoreline, river corridor, dense woods	0%	0%	0%	0%	0%	0%	
	Medium -- Scenery mixed with urban uses	5%	15%	0%	10%	20%	0%	
	Low – Urban corridor	15%	30%	20%	25%	50%	35%	
Trail Congestion (Note 2)	None -- LOS A (< 40 passing events per hour)	0%	0%	0%	0%	0%	0%	
	Low – LOS B or C (40 to 100 passing events per hour)	10%	10%	10%	15%	10%	10%	
	Moderate – LOS D or E (100 to 195 passing events per hour)	20%	10%	10%	15%	10%	10%	
	High – LOS F (>195 passing events per hour)	50%	25%	25%	25%	15%	15%	It would seem that trails have a maximum capacity at which point, very little additional use occurs.

Note 1: Pedestrian demand only being evaluated for Class I facilities.
Note 2: See Highway Capacity Manual 2000 Chapter 19: Bicycle Methodology. For example, 40 passenger events per hour reflects that an individual user would overtake, be overtaken, or be passed in the opposing direction by 40 other individuals over the course of an hour (or 1 every 1.5 minutes).

Bicycle/Pedestrian Facility Use Factors

For use in Tahoe Basin Bicycle Pedestrian Master Plan

Respondent:	Karen Fink
Email:	kfink@trpa.org
Phone #:	775-589-5204

Starting from the trail usage that would occur from a "perfect" non-motorized facility (Class I, continual, no street crossings, flat, great maintenance, through an area with high recreational value (woods, shoreline), no trail congestion), what reduction in the proportion of usage would be eliminated based upon the following factors, for each user type?

		Bicyclists			Walkers/Bladers/Etc.			
		Residents Biking from Home	Visitors Biking from Lodging	Bicyclists Driving to Facility	Residents Walking from Home	Visitors Walking from Lodging	Walkers Driving to Facility	Comments
Facility Class	Class 1, attaining AASHTO standards	0%	0%	0%	0%	0%	0%	
	Class 2, attaining standards for lane width	10%	30%	85%	Note 1	Note 1	Note 1	I'm not accounting for children, because I don't know what the proportion of children to adults is. But for children, I would say the reduction is more like 85%.
	Class 3, on street with acceptable width and traffic volumes	10%	40%	95%	Note 1	Note 1	Note 1	I am sticking with the assumption that we are starting from a "perfect" facility--i.e., a Class I, that serves useful destinations. I'm assuming that the rider doesn't have a choice between a Class I or a Class III, and I'm also assuming that the Class III isn't out of the way, or hard to find.
Grade	Flat or only short sections of gentle grade <4%	0%	0%	0%	0%	0%	0%	
	Grades of 4%-8%, extending for no more than a few hundred yards	20%	20%	20%	20%	40%	50%	
	Long sections of sustained maximum AASHTO grade, with total elevation change exceeding 300 feet	50%	60%	75%	50%	75%	80%	
Facility Continuity	No breaks in trail or cross streets	0%	0%	0%	0%	0%	0%	
	Infrequent crossings of low volume residential streets and driveways (<4 per mile)	0%	0%	5%	0%	0%	5%	
	Frequent crossing of low volume residential streets and driveways (>4 per mile)	20%	20%	80%	10%	20%	60%	Tricky to decide how to make the choice--if there is no alternative, more people would use the facility, even though it may have many crossings. If there is an alternative, like a bike lane, then riders might switch to the bike lane. I'm having to assume there is no alternative.
	Unprotected crossing of busy (ADT > 10,000) street (including crossings with striped crosswalk only)	40%	50%	50%	40%	50%	75%	
	Protected crossing of busy (ADT >10,000) street (signal or roundabout)	10%	15%	25%	10%	15%	25%	
	Breaks in facility continuity requiring travel along state highway or other busy street.	50%	60%	75%	60%	70%	85%	
Maintenance	High – No sand on trail or pavement deformities	0%	0%	0%	0%	0%	0%	
	Medium – Condition is an inconvenience, but not a safety hazard	15%	25%	60%	10%	20%	30%	Assuming people using the facility know ahead of time about the bad maintenance condition.
	Poor – Trail condition reduces safe travel speed	80%	70%	95%	50%	60%	95%	
Recreational Value	High – Shoreline, river corridor, dense woods	0%	0%	0%	0%	0%	0%	
	Medium – Scenery mixed with urban uses	20%	25%	50%	35%	40%	65%	To make these estimates (and some of the ones above), I am assuming that Residents coming from home are an even mix of recreational users and those using the trail for errands or commuting.
	Low – Urban corridor	50%	25%	75%	15%	20%	85%	This one was really difficult. It depends if the facility is low in scenic value because it just goes by houses, or if it goes by commercial areas. If it goes by commercial areas, I don't think you would necessarily see the percentage drop that I indicated, because you might have a lot more people who want to use the corridor for utilitarian purposes. There could be an even higher demand for shopping than for recreation.
Trail Congestion (Note 2)	None – LOS A (< 40 passing events per hour)	0%	0%	0%	0%	0%	0%	
	Low – LOS B or C (40 to 100 passing events per hour)	20%	10%	10%	5%	5%	20%	
	Moderate – LOS D or E (100 to 195 passing events per hour)	50%	10%	15%	20%	5%	20%	
	High – LOS F (>195 passing events per hour)	70%	20%	30%	20%	5%	25%	

Note 1: Pedestrian demand only being evaluated for Class I facilities.
Note 2: See Highway Capacity Manual 2000 Chapter 19: Bicycle Methodology. For example, 40 passenger events per hour reflects that an individual user would overtake, be overtaken, or be passed in the opposing direction by 40 other individuals over the course of an hour (or 1 every 1.5 minutes).

Bicycle/Pedestrian Facility Use Factors

For use in Tahoe Basin Bicycle Pedestrian Master Plan

Respondent:	PE
Email:	peichar@tahoe.ca.gov
Phone #:	543-6046

Starting from the trail usage that would occur from a "perfect" non-motorized facility (Class I, continual, no street crossings, flat, great maintenance, through an area with high recreational value (woods, shoreline), no trail congestion), what reduction in the proportion of usage would be eliminated based upon the following factors, for each user type?

		Bicyclists			Walkers/Bladers/Etc.			
		Residents Biking from Home	Visitors Biking from Lodging	Bicyclists Driving to Facility	Residents Walking from Home	Visitors Walking from Lodging	Walkers Driving to Facility	Comments
Facility Class	Class 1, attaining AASHTO standards	0%	0%	0%	0%	0%	0%	
	Class 2, attaining standards for lane width	30%	40%	20%	Note 1	Note 1	Note 1	
	Class 3, on street with acceptable width and traffic volumes	10%	40%	20%	Note 1	Note 1	Note 1	Poor class 3 signage limits connectivity - harder for tourists to find the way, locals more adept
Grade	Flat or only short sections of gentle grade <4%	0%	15%	20%	0%	20%	15%	
	Grades of 4%-8%, extending for no more than a few hundred yards	20%	40%	30%	30%	40%	35%	grade is big obstacle to use
	Long sections of sustained maximum AASHTO grade, with total elevation change exceeding 300 feet	40%	60%	50%	30%	50%	40%	
Facility Continuity	No breaks in trail or cross streets	0%	0%	0%	0%	0%	0%	
	Infrequent crossings of low volume residential streets and driveways (<4 per mile)	0%	0%	0%	0%	0%	0%	
	Frequant crossing of low volume residential streets and driveways (>4 per mile)	5%	15%	15%	5%	5%	5%	
	Unprotected crossing of busy (ADT > 10,000) street (including crossings with striped crosswalk only)	10%	20%	15%	10%	t5%	15%	
	Protected crossing of busy (ADT >10,000) street (signal or roundabout)	10%	15%	15%	10%	15%	15%	
	Breaks in facility continuity requiring travel along state highway or other busy street.	25%	30%	30%	20%	20%	20%	I would think this would casue more disruption, but I see people doing it all the time: because there is no other chice, unlessyou don't ride at all.
Maintenance	High – No sand on trail or pavement deformities	0%	0%	0%	0%	0%	0%	
	Medium – Condition is an inconvenience, but not a safety hazard	10%	10%	10%	10%	10%	10%	
	Poor – Trail condition reduces safe travel speed	30%	10%	15%	10%	10%	10%	I think maintenance may be more of a local deterant, bucasue we know how bad it is. Tourists don't know until they get there, and if its too bad, they don't come back.
Recreational Value	High – Shoreline, river corridor, dense woods	0%	0%	0%	0%	0%	0%	
	Medium – Scenery mixed with urban uses	0%	0%	0%	0%	0%	0%	
	Low – Urban corridor	10%	20%	20%	10%	15%	15%	
Trail Congestion (Note 2)	None – LOS A (< 40 passing events per hour)	0%	0%	0%	0%	0%	0%	
	Low – LOS B or C (40 to 100 passing events per hour)	10%	10%	10%	15%	10%	10%	I think locals are more negativly influenced by crowding as we are not used to it, get off my bike traill
	Moderate – LOS D or E (100 to 195 passing events per hour)	20%	10%	10%	15%	10%	10%	
	High – LOS F (>195 passing events per hour)	40%	20%	10%	15%	10%	10%	couldn't this also be taken as a measure of success? If they are crowded, they are being used!

Note 1: Pedestrian demand only being evaluated for Class I facilities.
Note 2: See Highway Capacity Manual 2000 Chapter 19: Bicycle Methodology. For example, 40 passenger events per hour reflects that an individual user would overtake, be overtaken, or be passed in the opposing direction by 40 other individuals over the course of an hour (or 1 every 1.5 minutes).

Bicycle/Pedestrian Facility Use Factors

For use in Tahoe Basin Bicycle Pedestrian Master Plan

Respondent: Gordon

Starting from the trail usage that would occur from a "perfect" non-motorized facility (Class I, continual, no street crossings, flat, great maintenance, through an area with high recreational value (woods, shoreline), no trail congestion), what reduction in the proportion of usage would be eliminated based upon the following factors, for each user type?

		Bicyclists			Walkers/Bladers/Etc.			
		Residents Biking from Home	Visitors Biking from Lodging	Bicyclists Driving to Facility	Residents Walking from Home	Visitors Walking from Lodging	Walkers Driving to Facility	Notes
Facility Class	Class 1, attaining AASHTO standards	0%	0%	0%	0%	0%	0%	
	Class 2, attaining standards for lane width	30%	60%	90%	NA	NA	NA	Few users will drive to use a Class II or III facility. Walking model is intended for Class I facility only.
	Class 3, on street with acceptable width and traffic volumes	40%	75%	t00%	NA	NA	NA	
Grade	Flat or only short sections of gentle grade <4%	0%	0%	0%	0%	0%	0%	
	Grades of 4%-8%, extending for no more than a few hundred yards	5%	15%	15%	5%	10%	10%	Many visitors are aware of conditions prior to their trip, as they (1) are one of the many repeat visitors to the area, (2) gain info from friends/family, or (3) gain info from trails guides.
	Long sections of sustained maximum AASHTO grade, with total elevation change exceeding 300 feet	50%	70%	80%	25%	40%	40%	Many recreational cyclists are apt to avoid long grades, particularly those with kids or elderly in the group.
Facility Continuity	No breaks in trail or cross streets	0%	0%	0%	0%	0%	0%	This factor not intended to reflect accessibility between trail and adjacent land uses, but rather the degree to which the continuity for persons traveling along the facility is interrupted.
	Infrequent crossings of low volume residential streets and driveways (<4 per mile)	0%	0%	0%	0%	0%	0%	
	Frequent crossing of low volume residential streets and driveways (>4 per mile)	5%	5%	10%	0%	0%	5%	
	Unprotected crossing of busy (ADT > 10,000) street (Including crossings with striped crosswalk only)	20%	30%	40%	20%	30%	40%	As visitors and persons driving to the facility make more discretionary trips, they are more sensitive to this factor.
	Protected crossing of busy (ADT >10,000) street (signal or roundabout)	5%	5%	5%	0%	2%	2%	
	Breaks in facility continuity requiring travel along state highway or other busy street.	20%	25%	30%	30%	40%	50%	
Maintenance	High -- No sand on trail or pavement deformities	0%	0%	0%	0%	0%	0%	
	Medium -- Condition is an inconvenience, but not a safety hazard	5%	0%	5%	0%	0%	0%	
	Poor -- Trail condition reduces safe travel speed	20%	20%	30%	5%	5%	5%	Walkers are less sensitive to this factor.
Recreational Value	High -- Shoreline, river corridor, dense woods	0%	0%	0%	0%	0%	0%	
	Medium -- Scenery mixed with urban uses	20%	30%	40%	20%	30%	50%	
	Low -- Urban corridor	30%	60%	80%	40%	50%	90%	Visitors are more sensitive to this factor, though those lodged nearby are more "captive" than persons driving.
Trail Congestion (Note 2)	None -- LOS A (< 40 passing events per hour)	5%	5%	0%	0%	0%	0%	Some serious cyclists will always choose the road.
	Low -- LOS B or C (40 to 100 passing events per hour)	10%	5%	8%	0%	0%	0%	Pedestrians less sensitive to trail congestion
	Moderate -- LOS D or E (100 to 195 passing events per hour)	15%	8%	12%	10%	3%	6%	
	High -- LOS F (>195 passing events per hour)	20%	10%	15%	15%	5%	10%	Residents will be more sensitive to trail congestion than visitors.

Note 1: Pedestrian demand only being evaluated for Class I facilities.
Note 2: See Highway Capacity Manual 2000 Chapter 19: Bicycle Methodology. For example, 40 passenger events per hour reflects that an individual user would overtake, be overtaken, or be passed in the opposing direction by 40 other individuals over the course of an hour (or 1 every 1.5 minutes).