# NCHRP Project 8-44-2

## Transportation Safety Planning: Forecasting the Safety Impacts in Socio-Demographic Changes and Safety Countermeasures

***Caltrans Research Innovation Presentation***
***March 18th, 2010***
***By***

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***Safe Transportation Research & Education Center***
***UC Berkeley***

SafeTREC Safe Transportation Research & Education Center

ITSBerkeley Institute of Transportation Studies

School of Public Health

# Presentation Overview

- Project Objectives
- Summary of PLANSAFE Software Package
  - PLANSAFE Software
  - PLANSAFE GIS Software
  - PLANSAFE Census Software
- Software Demonstration
- Discussions

# NCHRP 8-44-2 Objectives

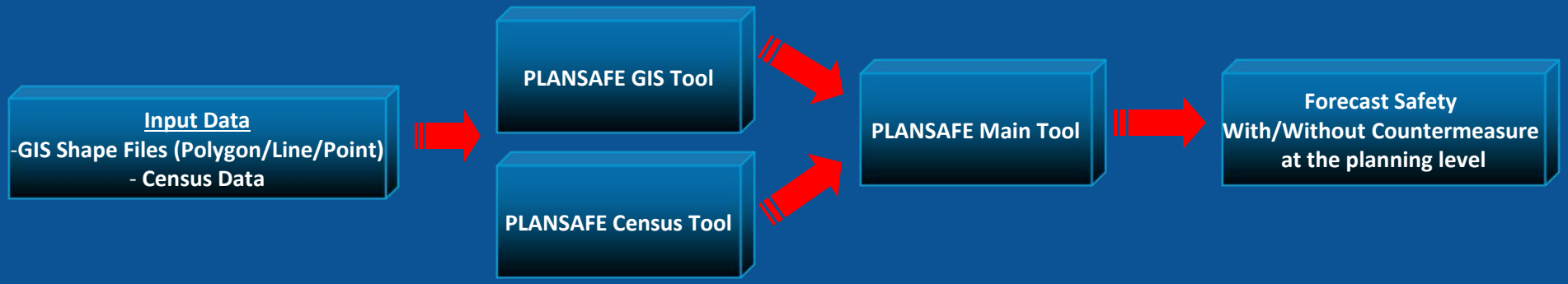
- The main objectives of NCHRP 8-44-2 are to develop:
  - A robust, defensible, and accurate **analytical set of algorithms to forecast the safety impacts of engineering and behavioral countermeasure investments** at the planning-level
  - **User-friendly software**, compatible to the extent possible with planning-level data inputs, to incorporate the analytical procedures for forecasting safety
  - **Guidance materials** to accompany the analytical procedures and software

# Need for Research/Tool

- Predict safety impacts of large-scale projects
  - Safety impacts of future population, schools, transportation infrastructure
- Compare and contrast growth scenarios
  - Infill vs. sprawl, interstate vs. expressways, etc.
- Examine safety impact of region-wide policies/programs
  - Implementing region-wide photo-enforcement for red light running, etc.
- Support *proactive* safety planning

# PLANSAFE Software Package

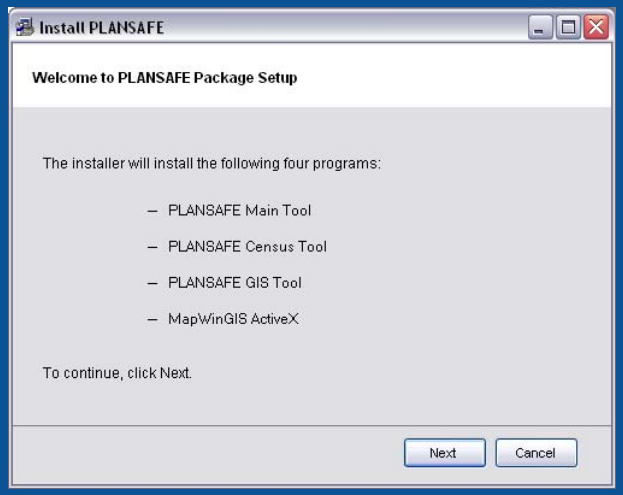
- The research team has developed the Planning Level Safety (PLANSAFE) software package to:
  - Forecast the safety impacts of socio-demographic changes
  - Evaluate engineering and behavioral countermeasures at the planning level
- PLANSAFE consists of the PLANSAFE main software tool and two supplemental tools

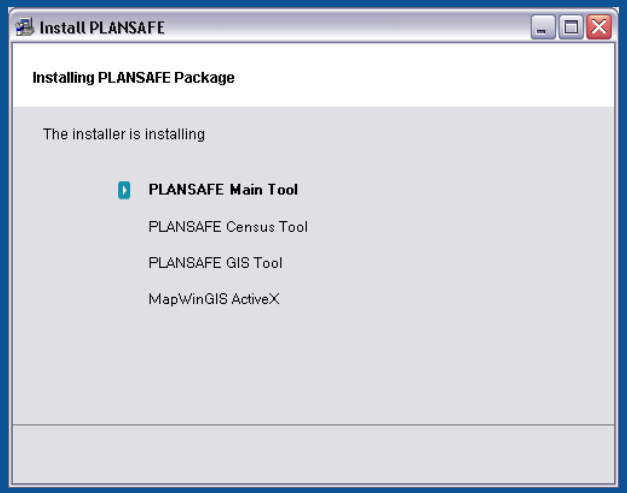



  - PLANSAFE main tool is designed to use the outputs from the two supplemental tools as input data

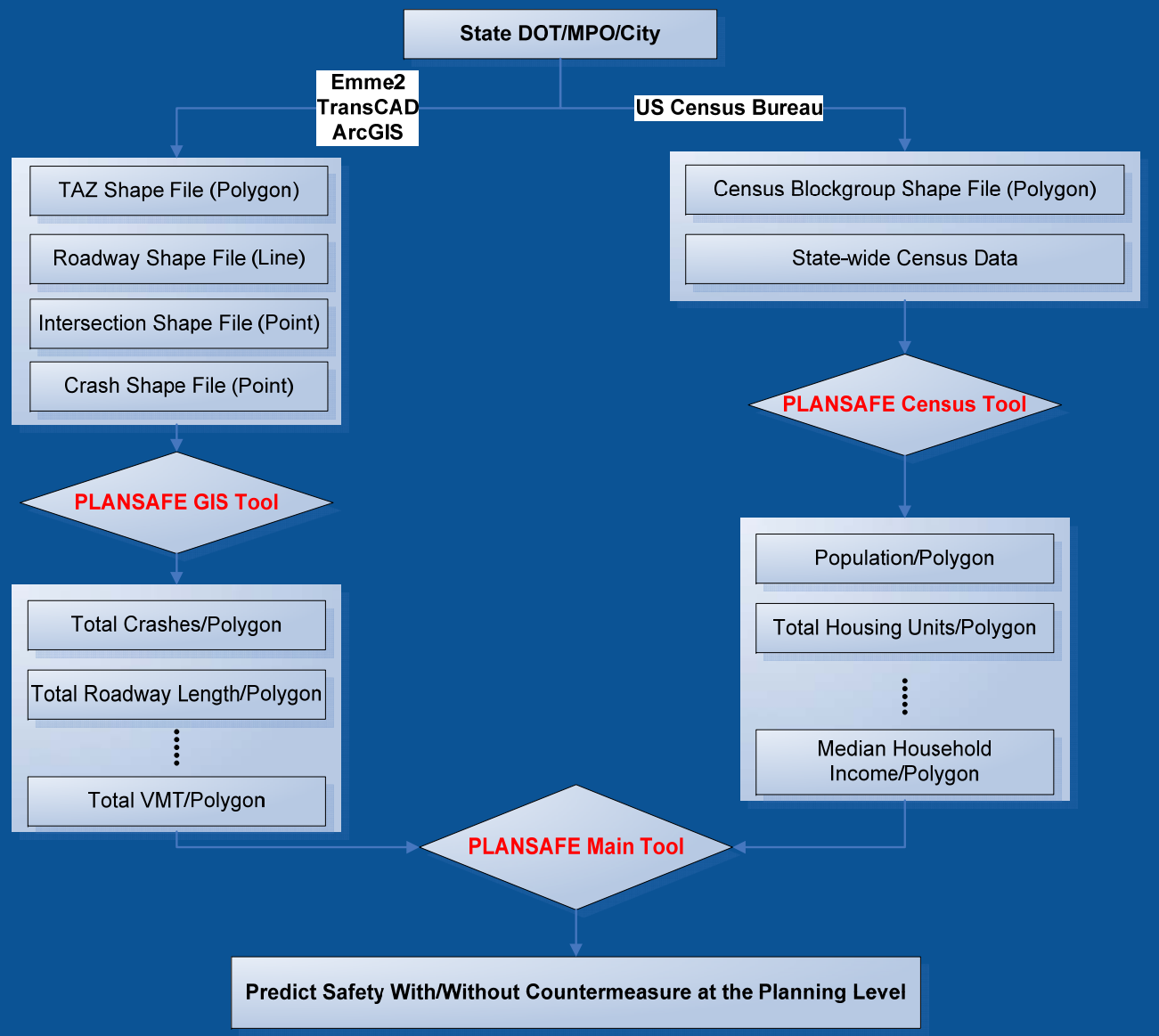
# Installation and System Requirements

- Installation
  - Step 1: Insert the Installation CD
  - Step 2: Double-click the setup.exe
  - Step 3: Install PLANSAFE Components
  - Step 4: Re-start the computer
- System Requirements
  - Microsoft Office Access 2000 or later
  - ArcGIS 9.2 or later
  - MS .NET Framework 2.0 or later
  - (Downloadable)
  - Optimum screen resolution is 1680 by 1050



# PLANSAFE Input and Output Data Flow




crash / roadway

socio demographic

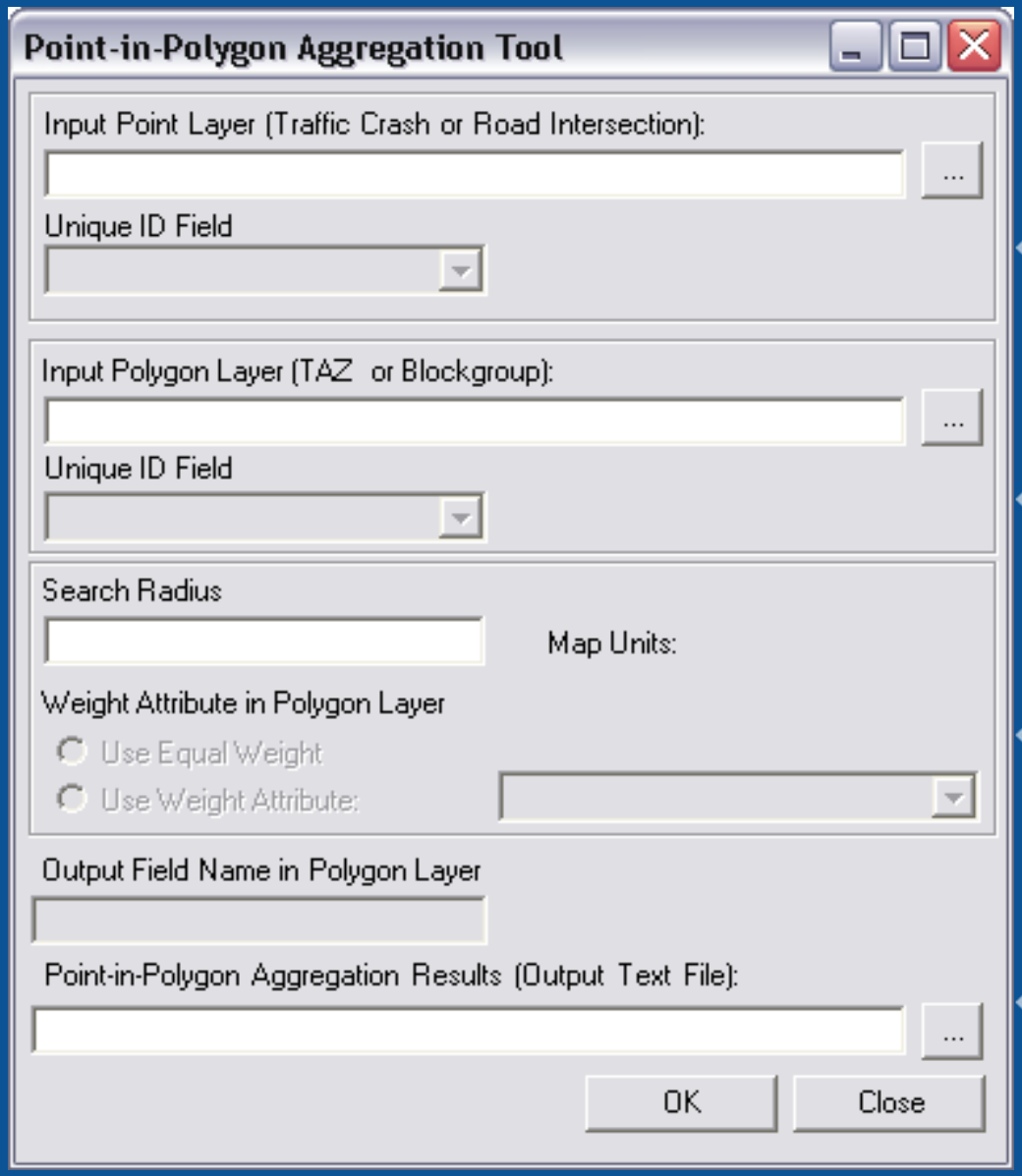
# PLANSAFE Supplemental Tools

# PLANSAFE GIS Tool

- Users can use the PLANSAFE GIS tool to aggregate point or line features by given polygon units or to create intersection point layer

- PLANSAFE GIS tool is made to run within ArcGIS
  1. Point-in-Polygon Aggregation Tool
     - Calculates the number of points in each polygon
       - Total number of crashes/polygon
       - Total number of intersections/polygon
  2. Line-in-Polygon Aggregation Tool
     - Calculates the values of line features, which fall in each polygon
       - Total AADT/polygon
       - Total roadway length/polygon
  3. End-node Integration Tool
     - Creates an intersection point file

# Point-in-Polygon Aggregation Tool




Input point layer such as crashes or intersections

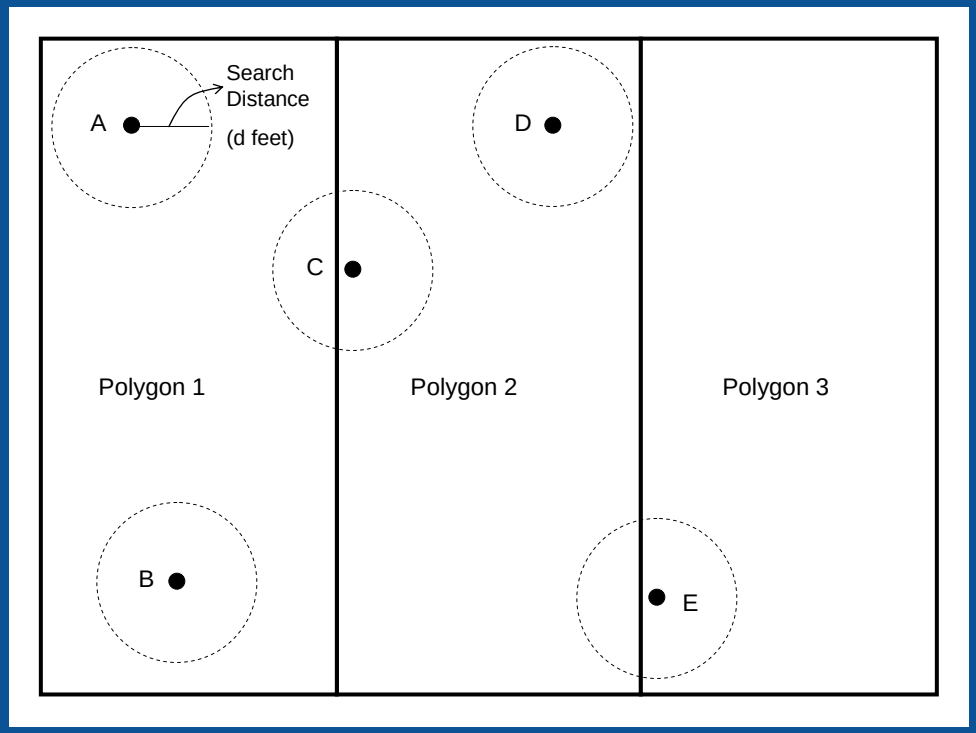
Input polygon layer (TAZ or Census BG)

Define the Search Radius and Weight Attribute to estimate the point-in-polygon portion– the probability that a point is within polygons

Customize aggregation results

# Point-in-Polygon Aggregation Tool (cont'd)

- Due to the spatial inaccuracy of the location of point features, it is often necessary to estimate the probability that a point is within polygons using the search radius
- Points C and E can be assigned to two different polygon features
- The remaining three point features can be assigned to a single polygon feature respectively given the search radius



# Point-in-Polygon Aggregation Tool (cont'd)

Users can specify the name of the output field containing the total number of points for each polygon

Total number of points

(Aggregation output)

Attributes of polygon

| FID | Shape * | AREA | PERIMETER | POLYID |
|---|---|---|---|---|
| 0 | Polygon | 6376335.5 | 10352.828 | 77 |
| 1 | Polygon | 4250324.5 | 9132.049 | 1226 |
| 2 | Polygon | 6912562.5 | 10536.055 | 1224 |
| 3 | Polygon | 13871686 | 15781.864 | 1228 |
| 4 | Polygon | 6265090 | 12917.516 | 76 |
| 5 | Polygon | 6454627.5 | 10180.45 | 1222 |
| 6 | Polygon | 4144756.25 | 8438.59 | 1220 |
| 7 | Polygon | 3544631 | 7966.104 | 1218 |
| 8 | Polygon | 3543967.5 | 7970.771 | 1216 |
| 9 | Polygon | 10750850 | 13219.017 | 1219 |
| 10 | Polygon | 3516264.25 | 7944.672 | 1213 |
| 11 | Polygon | 7007543.5 | 10592.485 | 1212 |
| 12 | Polygon | 3270328.75 | 8178.086 | 1209 |
| 13 | Polygon | 7072036 | 10631.095 | 1210 |
| 14 | Polygon | 4469283 | 9085.025 | 1193 |
| 15 | Polygon | 6870647.5 | 10465.754 | 1196 |
| 16 | Polygon | 5981093 | 10355.05 | 73 |
| 17 | Polygon | 14021945 | 15867.645 | 1194 |
| 18 | Polygon | 6607122.5 | 10279.858 | 1192 |
| 19 | Polygon | 3824973.5 | 8457.37 | 1191 |
| 20 | Polygon | 3687112.75 | 8158.487 | 1190 |

Record: 1 Show: All Selected Records

Attribute table before running the point-in-polygon aggregation tool

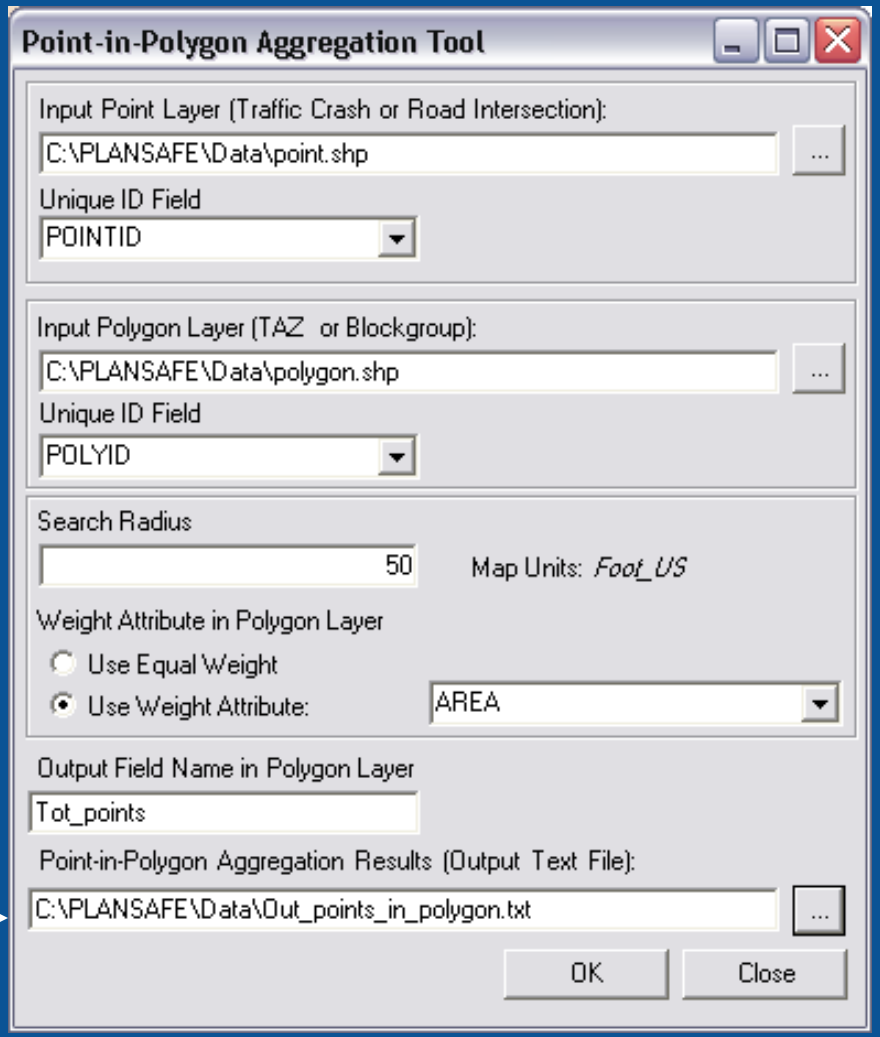
Attributes of polygon

| FID | Shape * | AREA | PERIMETER | POLYID | Tot_points |
|---|---|---|---|---|---|
| 0 | Polygon | 6376335.5 | 10352.828 | 77 | 12.542392 |
| 1 | Polygon | 4250324.5 | 9132.049 | 1226 | 3.278538 |
| 2 | Polygon | 6912562.5 | 10536.055 | 1224 | 8.758634 |
| 3 | Polygon | 13871686 | 15781.864 | 1228 | 20.042786 |
| 4 | Polygon | 6265090 | 12917.516 | 76 | 14.184618 |
| 5 | Polygon | 6454627.5 | 10180.45 | 1222 | 10.688001 |
| 6 | Polygon | 4144756.25 | 8438.59 | 1220 | 6.069003 |
| 7 | Polygon | 3544631 | 7966.104 | 1218 | 6.180357 |
| 8 | Polygon | 3543967.5 | 7970.771 | 1216 | 5.497456 |
| 9 | Polygon | 10750850 | 13219.017 | 1219 | 8.324327 |
| 10 | Polygon | 3516264.25 | 7944.672 | 1213 | 8.759622 |
| 11 | Polygon | 7007543.5 | 10592.485 | 1212 | 13.486252 |
| 12 | Polygon | 3270328.75 | 8178.086 | 1209 | 5.079106 |
| 13 | Polygon | 7072036 | 10631.095 | 1210 | 11.158717 |
| 14 | Polygon | 4469283 | 9085.025 | 1193 | 1.621389 |
| 15 | Polygon | 6870647.5 | 10465.754 | 1196 | 5.826533 |
| 16 | Polygon | 5981093 | 10355.05 | 73 | 5.418352 |
| 17 | Polygon | 14021945 | 15867.645 | 1194 | 13.349809 |
| 18 | Polygon | 6607122.5 | 10279.858 | 1192 | 4.39687 |
| 19 | Polygon | 3824973.5 | 8457.37 | 1191 | 1.821828 |
| 20 | Polygon | 3687112.75 | 8158.487 | 1190 | 3.058777 |

Record: 0 Show: All Selected Records (0

Attribute table after running the point-in-polygon aggregation tool

Select a path to save output text file



# Point-in-Polygon Aggregation Tool (cont'd)

**Output Text File**

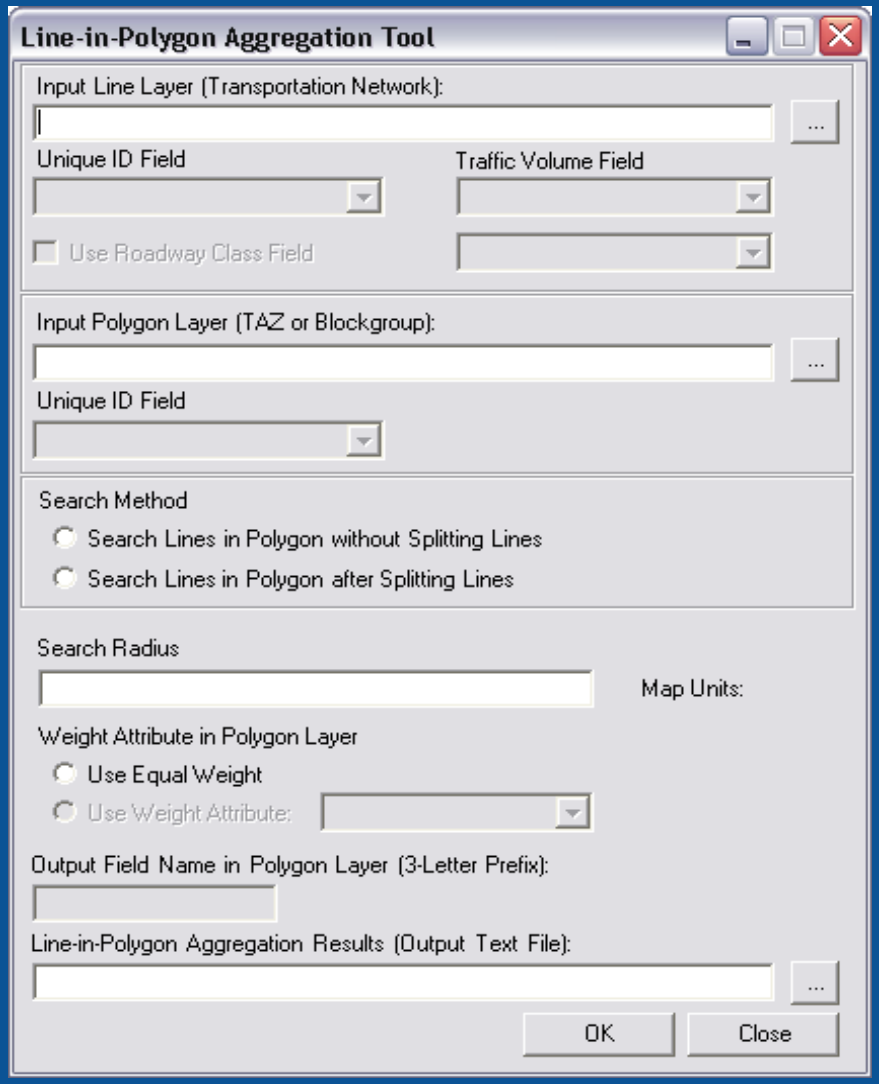
Out_point_in_polygon.txt - WordPad

File Edit View Insert Format Help

```
POINTID,POLYID,Portion
0ZAZBUHF8GWBFD6,947,1
25T02EQADX3VMVI,1228,1
AD5K1DQ0T13THW9,1128,1
S8JJISR86YUEOHK,1213,0.33412471355722
S8JJISR86YUEOHK,1212,0.66587528644278
GE2FO5G1KXY25BC,1213,0.33412471355722
GE2FO5G1KXY25BC,1212,0.66587528644278
H8WPAR8ZBYTJC57,956,1
SM4C8QBB0RVA3QL,1068,0.452225124979706
SM4C8QBB0RVA3QL,1067,0.547774875020294
K72CGYU0KFZLO7O,1012,0.448649325436144
K72CGYU0KFZLO7O,1009,0.551350674563856
7D3H8WAC75B1DNF,1185,0.667842124170765
7D3H8WAC75B1DNF,1151,0.332157875829235
H66OCF2OZR8MYDG,917,0.324015849304383
H66OCF2OZR8MYDG,914,0.675984150695617
0E51KGLNBV8F4QK,1096,0.137770394096433
0E51KGLNBV8F4QK,1128,0.862229605903567
NWZWMZHHIQNTFDS,1218,0.490148866239902
NWZWMZHHIQNTFDS,1190,0.509851133760098
1Z9ZJAOIJZDBI32,1219,1
NXVXUO195KM9TF2,956,1
```

| Variable | Definition |
|---|---|
| POINTID | ID for the selected point layer |
| POLYID | ID for the selected polygon layer |
| Portion | Point-in-polygon portion: the probability that a point is within polygons |

# Line-in-Polygon Aggregation Tool




Input line layer including the traffic volume field (AADT) and roadway class

Input polygon layer (TAZ or Census BG)

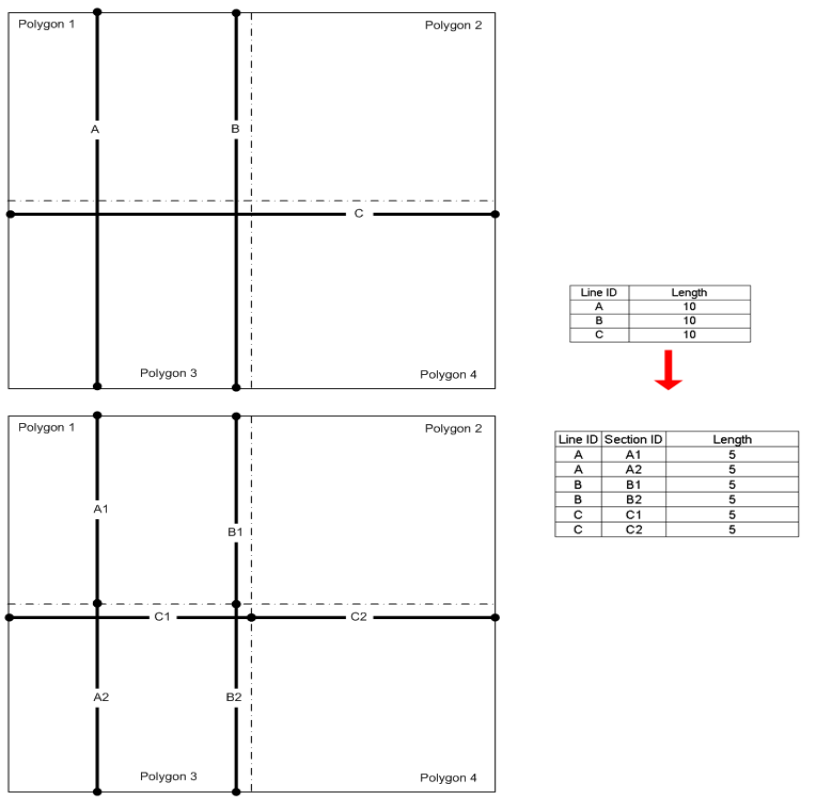
Define the Search Method, Search Radius, and Weight Attribute to estimate the line-in-polygon portion– the probability that a point is within polygons

Customize aggregation results

# Search Lines in Polygon After Splitting Lines

## Step 1

Divide the input line features by given polygon boundaries

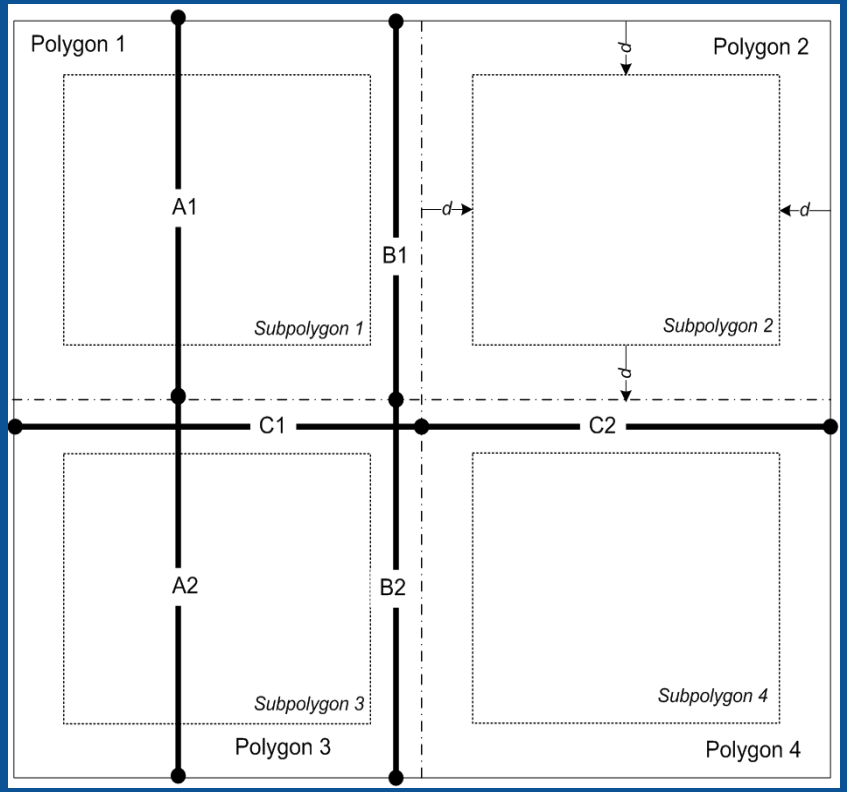



| Line ID | Length |
|---|---|
| A | 10 |
| B | 10 |
| C | 10 |

| Line ID | Section ID | Length |
|---|---|---|
| A | A1 | 5 |
| A | A2 | 5 |
| B | B1 | 5 |
| B | B2 | 5 |
| C | C1 | 5 |
| C | C2 | 5 |

## Step 2

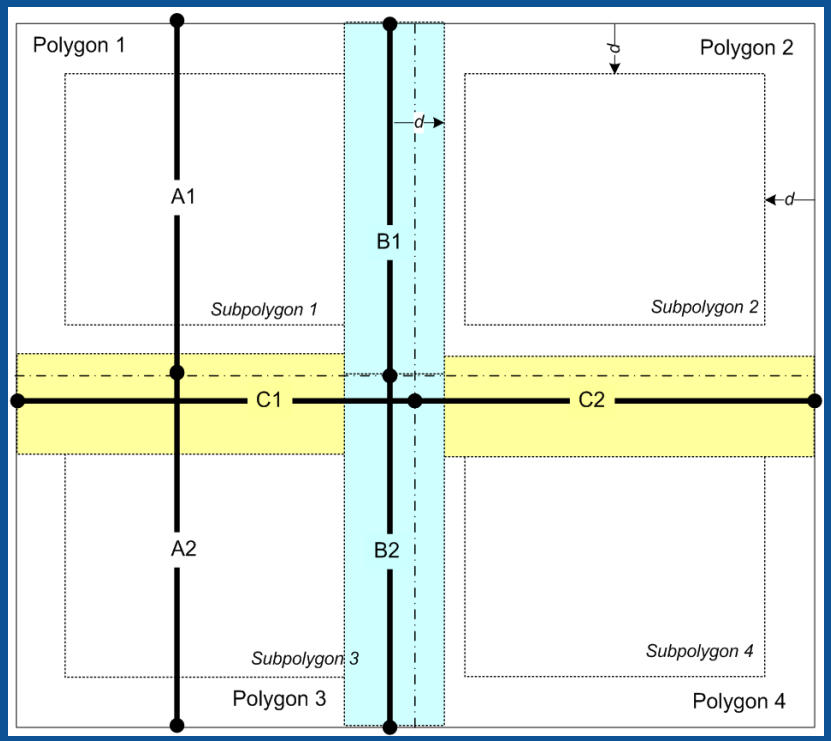
Create sub-polygons within each polygon using the search radius



# Search Lines in Polygon After Splitting Lines (cont'd)

## Step 3

Create buffers for the divided lines using the search radius if they do not touch the sub-polygons created in step 2




## Line-in-Polygon Weight Matrix

| Line \ Polygon | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| A1 | 1 | 0 | 0 | 0 |
| A2 | 0 | 0 | 1 | 0 |
| B1 | 1 | 1 | 0 | 0 |
| A2 | 0 | 0 | 1 | 1 |
| C1 | 1 | 0 | 1 | 0 |
| C2 | 0 | 1 | 0 | 1 |

Note: The matrix element for line *i* and polygon *j* becomes 1 if the buffer of the line *i* intersects with the polygon *j*

# Outputs from Line-in-Polygon Aggregation Tool: Polygon Shape File

Polygon ID

Total roadway length

Total AADT

Total VMT

Total number of points

Roadway length by class

Attributes of polygon

| POLYID | Tot_points | AGGWLen | AGGWTrf | AGGWVMT | AGGWLen_14 | AGGWLen_17 | AGGWLen_16 | AGGWLen_12 | AGGWLen_19 | AGGWLen_11 | AGGWTrf_14 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 77 | 12.542392 | 7213.58124 | 1148145.666667 | 662280597.956 | 2409.120965 | 959.21624 | 0 | 0 | 1343.34594 | 2501.898095 | 261481.166667 |
| 1226 | 3.278538 | 2801.724101 | 139085.25 | 73700621.600869 | 1848.801664 | 952.922437 | 0 | 0 | 0 | 0 | 96392.25 |
| 1224 | 8.758634 | 8665.016366 | 264980.916667 | 292822761.287 | 4924.984097 | 3740.032269 | 0 | 0 | 0 | 0 | 152439.416667 |
| 1228 | 20.042786 | 8451.855495 | 182125.25 | 204865641.992 | 2059.037051 | 2464.535439 | 3928.283005 | 0 | 0 | 0 | 71331.5 |
| 76 | 14.184618 | 7827.876801 | 336235.666667 | 118797637.611 | 2638.478969 | 1135.315449 | 536.482419 | 0 | 3517.599964 | 0 | 274390.666667 |
| 1222 | 10.688001 | 5905.54339 | 258153.666667 | 177407263.774 | 3261.697592 | 2643.845798 | 0 | 0 | 0 | 0 | 186292.083333 |
| 1220 | 6.069003 | 5973.19541 | 282434.666667 | 192850757.14 | 3926.717962 | 2046.477448 | 0 | 0 | 0 | 0 | 207213.083333 |
| 1218 | 6.180357 | 4139.595627 | 329068 | 134796413.108 | 2657.17111 | 1482.424517 | 0 | 0 | 0 | 0 | 265698 |
| 1216 | 5.497456 | 4881.06152 | 380530.833333 | 162684958.862 | 3183.473512 | 1697.588008 | 0 | 0 | 0 | 0 | 314881 |
| 1219 | 8.324327 | 10346.412274 | 803931.166667 | 367184732.01 | 4145.285381 | 5499.124867 | 0 | 702.002025 | 0 | 0 | 230677.166667 |
| 1213 | 8.759622 | 3849.98359 | 261502.833333 | 133552725.784 | 2525.744453 | 1324.239137 | 0 | 0 | 0 | 0 | 230212.5 |
| 1212 | 13.486252 | 3915.571916 | 176142.833333 | 106042143.677 | 1861.895723 | 2053.676193 | 0 | 0 | 0 | 0 | 132866.5 |
| 1209 | 5.079106 | 3131.051878 | 309259.166667 | 192323339.282 | 566.388753 | 550.161411 | 1326.799926 | 687.701788 | 0 | 0 | 149555 |
| 1210 | 11.158717 | 6597.604304 | 256527.75 | 183362549.613 | 1947.253757 | 2999.192979 | 1651.157567 | 0 | 0 | 0 | 93838 |
| 1193 | 1.621389 | 4149.527986 | 121240.666667 | 80093071.335386 | 2516.592074 | 1632.935912 | 0 | 0 | 0 | 0 | 75710.666667 |
| 1196 | 5.826533 | 5178.719109 | 192321.083333 | 132956153.75 | 2356.199041 | 2822.520068 | 0 | 0 | 0 | 0 | 94741.166667 |
| 73 | 5.418352 | 9076.411851 | 762762.833333 | 716905967.905 | 1097.260028 | 710.043191 | 0 | 0 | 4182.42309 | 3086.685542 | 96238.333333 |
| 1194 | 13.349809 | 8535.062672 | 267867.333333 | 230539434.029 | 3832.176811 | 2465.580697 | 2237.305163 | 0 | 0 | 0 | 159073.416667 |
| 1192 | 4.39687 | 3512.99582 | 146077.833333 | 94252970.329868 | 1786.662223 | 1726.333597 | 0 | 0 | 0 | 0 | 89177.833333 |
| 1191 | 1.821828 | 4915.259143 | 265246.916667 | 121116161.474 | 2277.495447 | 2637.763696 | 0 | 0 | 0 | 0 | 97358.666667 |
| 1190 | 3.058777 | 2701.075598 | 218718.5 | 66045478.150959 | 986.138825 | 1714.936773 | 0 | 0 | 0 | 0 | 61725.5 |

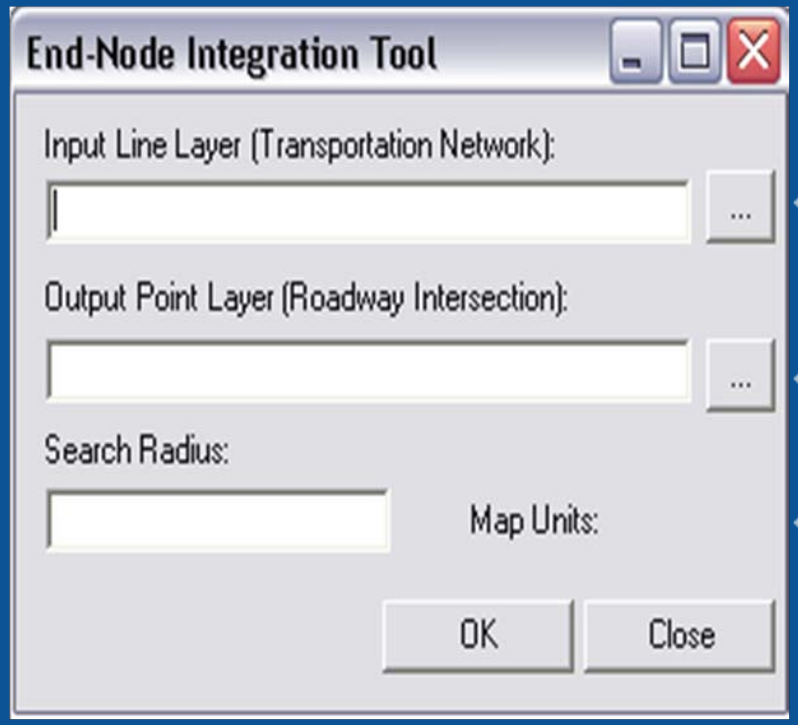
Record: 1 Show: All Selected Records (0 out of 115 Selected) Options

Aggregation results from the point-in-polygon aggregation tool

Aggregation results from the line-in-polygon aggregation tool

# End-node Integration Tool

- This tool allows the user to set a tolerance which searches for duplicate end-nodes (intersections)



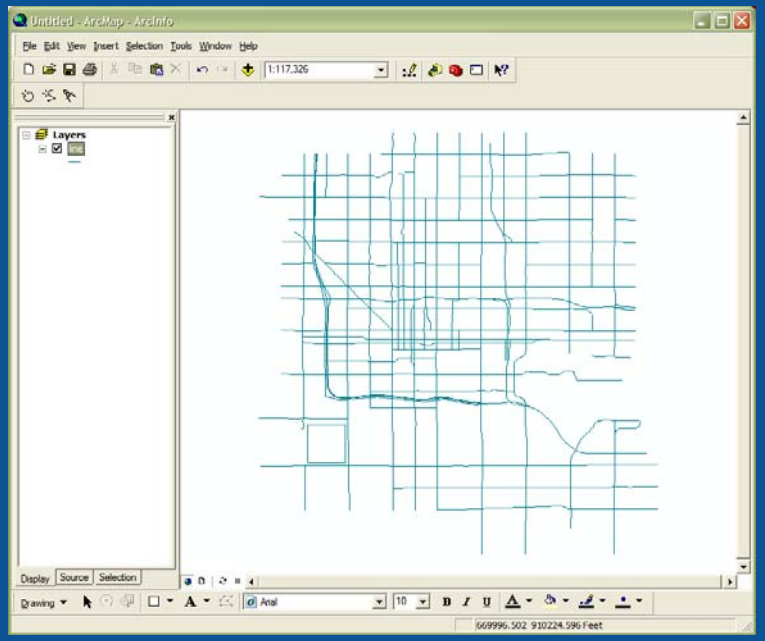

Input line layer without the intersection layer

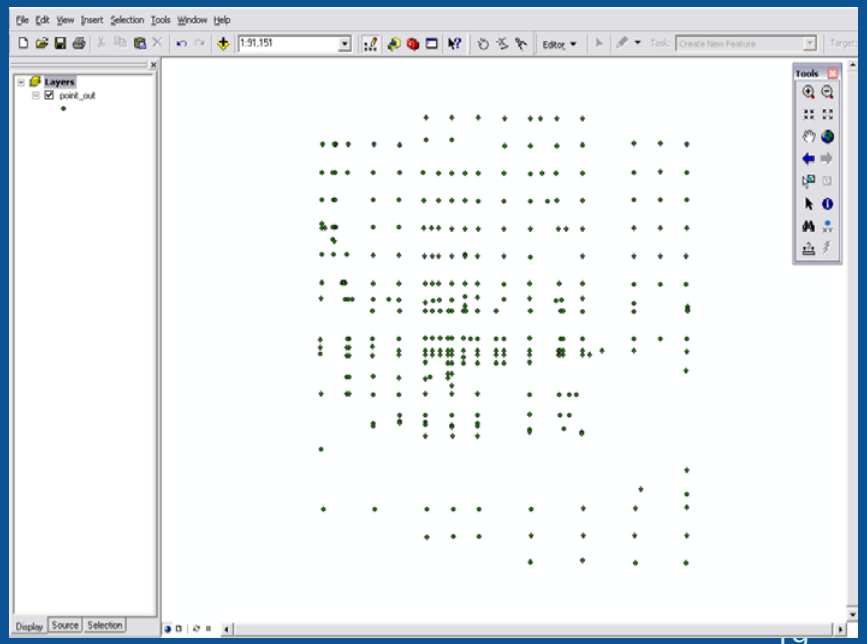
Output point layer

Define the Search Radius to detect points

# End-node Integration Tool (cont'd)

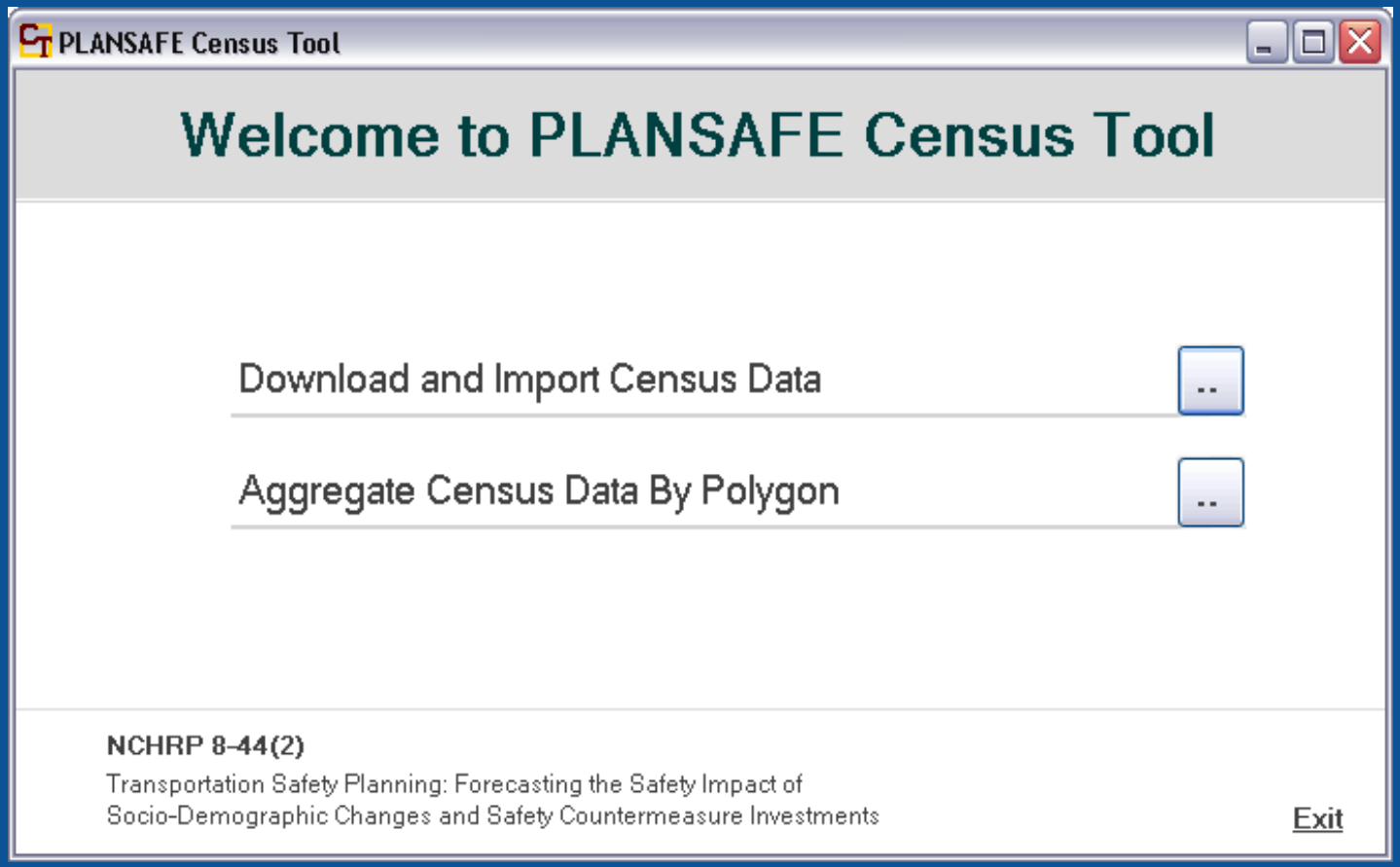
- 4 Steps to integrate end-nodes
  1. Find duplicate points that have the same coordinates
  2. Remove one of the duplicate points at the identical locations
  3. Create circular buffers surrounding the remaining points
  4. Integrate two end-nodes if the buffers are intersecting



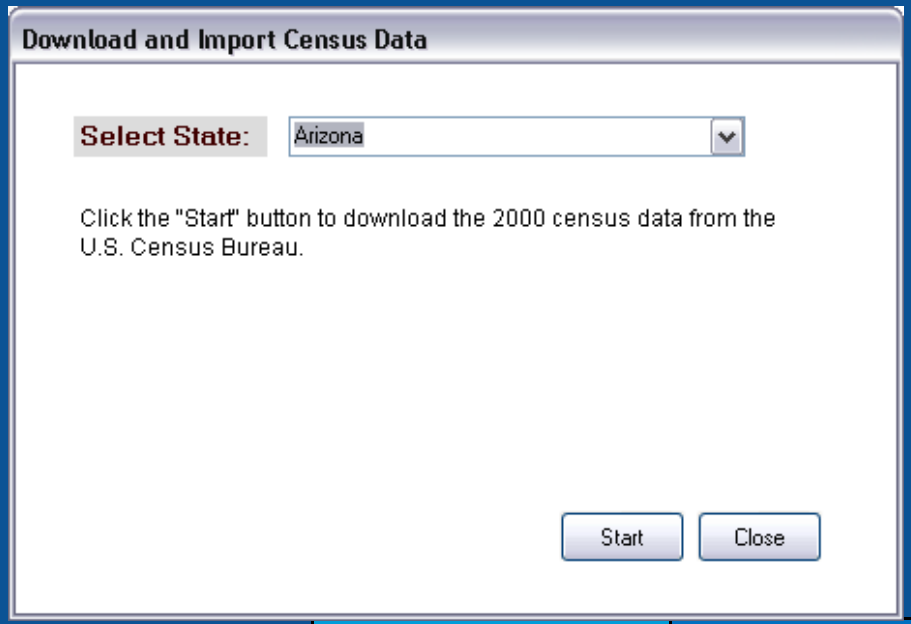



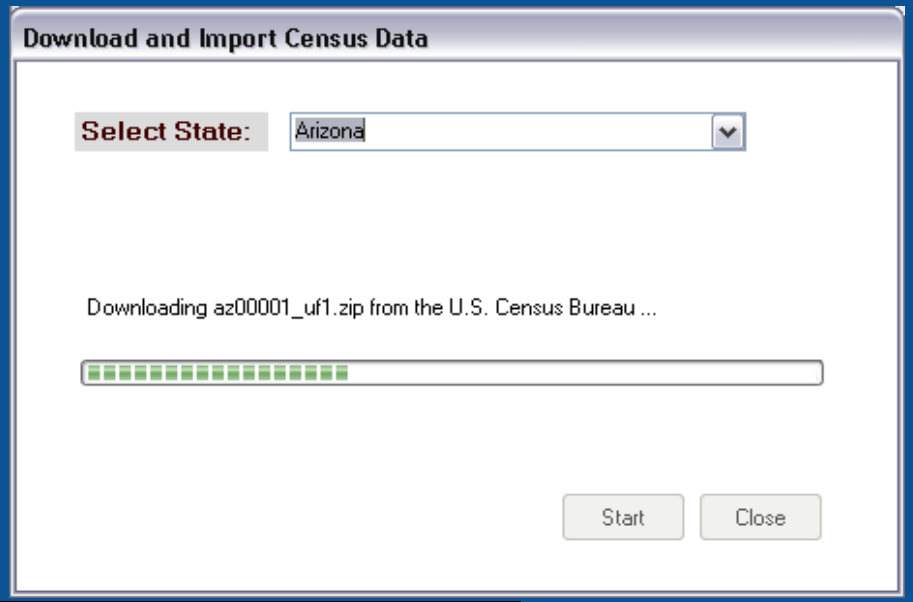
- Import the 2000 Census data from the U.S. Census Bureau website and aggregate the Census data by Polygon

# PLANSAFE Census Tool



# Download and Import Census Data

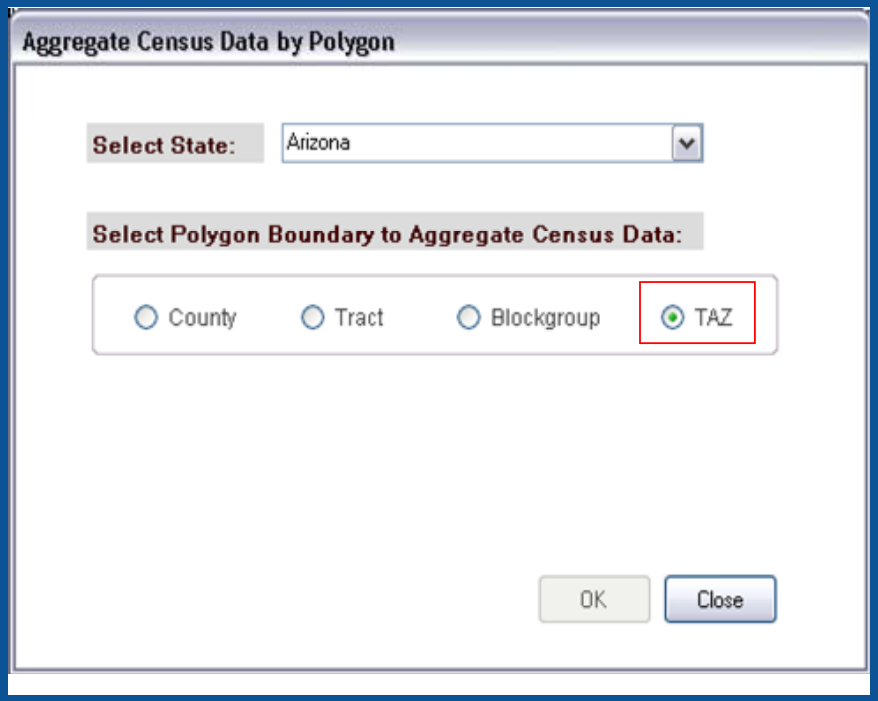


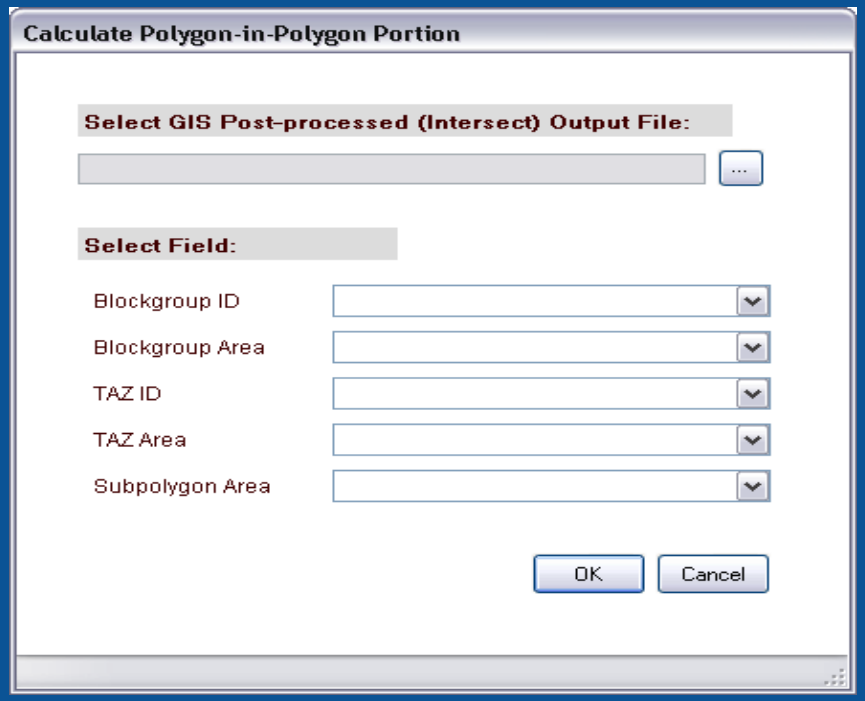




| File | Downloaded Census Information |
|---|---|
| ss00001.uf1 | Total population and Urban/rural population. |
| ss00002.uf1 | Population by race, age, sex |
| ss00003.uf1 | Number of families |
| ss00037.uf1 | Housing units and Occupied housing units by tenure |
| ss00001.uf3 | Population of household type by relationship, age, and so on |
| ss00003.uf3 | Population of workers between 16 and older |
| ss00004.uf3 | Population of disabilities by age and sex |
| ss00005.uf3 | Population of employed civilians between 16 and older by occupation |
| ss00006.uf3 | Household income |

# Aggregate Census Data by TAZ Boundary

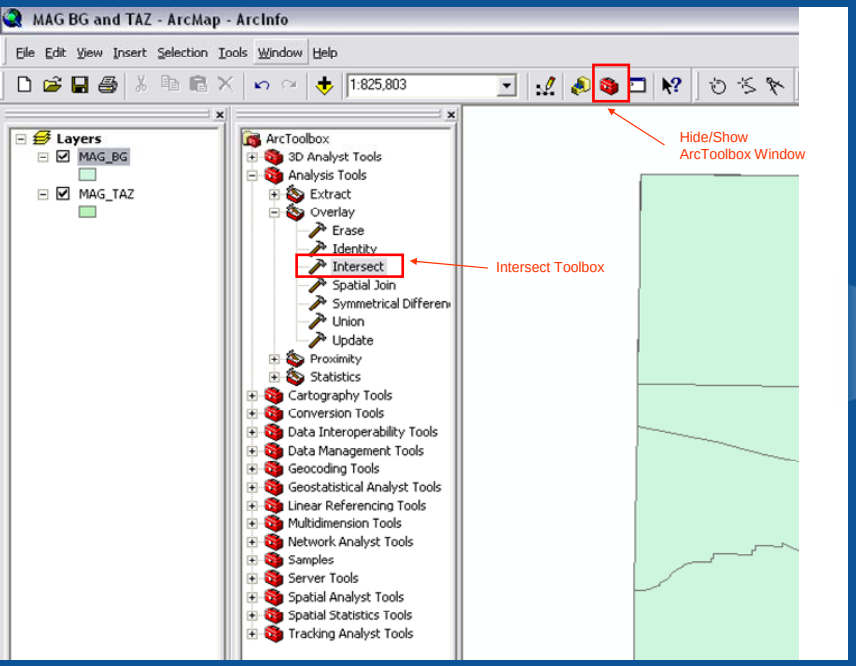
- When users want to aggregate the census information by TAZ, which often cross the boundaries of census BGs (or vice versa), PLANSAFE census tool requires users to submit a GIS manipulation results to create the polygon-in-polygon table

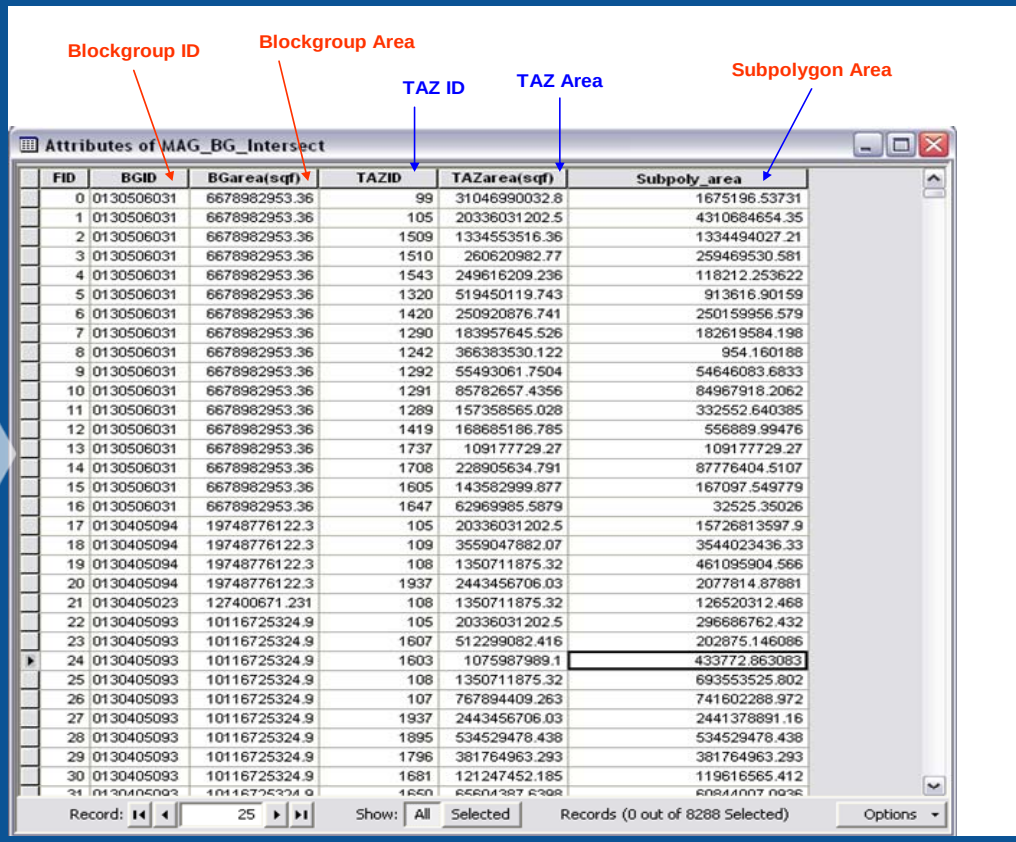


# Polygon-in-Polygon Table

- To obtain the polygon-in-polygon area table in ArcGIS, users can use the "Intersect tool" in ArcToolbox




| FID | BGID | BGarea(sqf) | TAZID | TAZarea(sqf) | Subpoly_area |
|---|---|---|---|---|---|
| 0 | 0130506031 | 6678982953.36 | 99 | 31046990032.8 | 1675196.53731 |
| 1 | 0130506031 | 6678982953.36 | 105 | 20336031202.5 | 4310684654.35 |
| 2 | 0130506031 | 6678982953.36 | 1509 | 1334553516.36 | 1334494027.21 |
| 3 | 0130506031 | 6678982953.36 | 1510 | 260620982.77 | 259469530.581 |
| 4 | 0130506031 | 6678982953.36 | 1543 | 249616209.236 | 118212.253622 |
| 5 | 0130506031 | 6678982953.36 | 1320 | 519450119.743 | 913616.90159 |
| 6 | 0130506031 | 6678982953.36 | 1420 | 250920876.741 | 250159956.579 |
| 7 | 0130506031 | 6678982953.36 | 1290 | 183957645.526 | 182619584.198 |
| 8 | 0130506031 | 6678982953.36 | 1242 | 366383530.122 | 954.160188 |
| 9 | 0130506031 | 6678982953.36 | 1292 | 55493061.7504 | 54646083.6833 |
| 10 | 0130506031 | 6678982953.36 | 1291 | 85782657.4356 | 84967918.2062 |
| 11 | 0130506031 | 6678982953.36 | 1289 | 157358565.028 | 332552.640385 |
| 12 | 0130506031 | 6678982953.36 | 1419 | 168685186.785 | 556889.99476 |
| 13 | 0130506031 | 6678982953.36 | 1737 | 109177729.27 | 109177729.27 |
| 14 | 0130506031 | 6678982953.36 | 1708 | 228905634.791 | 87776404.5107 |
| 15 | 0130506031 | 6678982953.36 | 1605 | 143582999.877 | 167097.549779 |
| 16 | 0130506031 | 6678982953.36 | 1647 | 62969985.5879 | 32525.35026 |
| 17 | 0130405094 | 19748776122.3 | 105 | 20336031202.5 | 15726813597.9 |
| 18 | 0130405094 | 19748776122.3 | 109 | 3559047882.07 | 3544023436.33 |
| 19 | 0130405094 | 19748776122.3 | 108 | 1350711875.32 | 461095904.566 |
| 20 | 0130405094 | 19748776122.3 | 1937 | 2443456706.03 | 2077814.87881 |
| 21 | 0130405023 | 127400671.231 | 108 | 1350711875.32 | 126520312.468 |
| 22 | 0130405093 | 10116725324.9 | 105 | 20336031202.5 | 296686762.432 |
| 23 | 0130405093 | 10116725324.9 | 1607 | 512299082.416 | 202875.146086 |
| 24 | 0130405093 | 10116725324.9 | 1603 | 1075987989.1 | 433772.863083 |
| 25 | 0130405093 | 10116725324.9 | 108 | 1350711875.32 | 693553525.802 |
| 26 | 0130405093 | 10116725324.9 | 107 | 767894409.263 | 741602288.972 |
| 27 | 0130405093 | 10116725324.9 | 1937 | 2443456706.03 | 2441378891.16 |
| 28 | 0130405093 | 10116725324.9 | 1895 | 534529478.438 | 534529478.438 |
| 29 | 0130405093 | 10116725324.9 | 1796 | 381764963.293 | 381764963.293 |
| 30 | 0130405093 | 10116725324.9 | 1681 | 121247452.185 | 119616565.412 |
| 31 | 0130405093 | 10116725324.9 | 1650 | 66604387.6398 | 60844007.0936 |

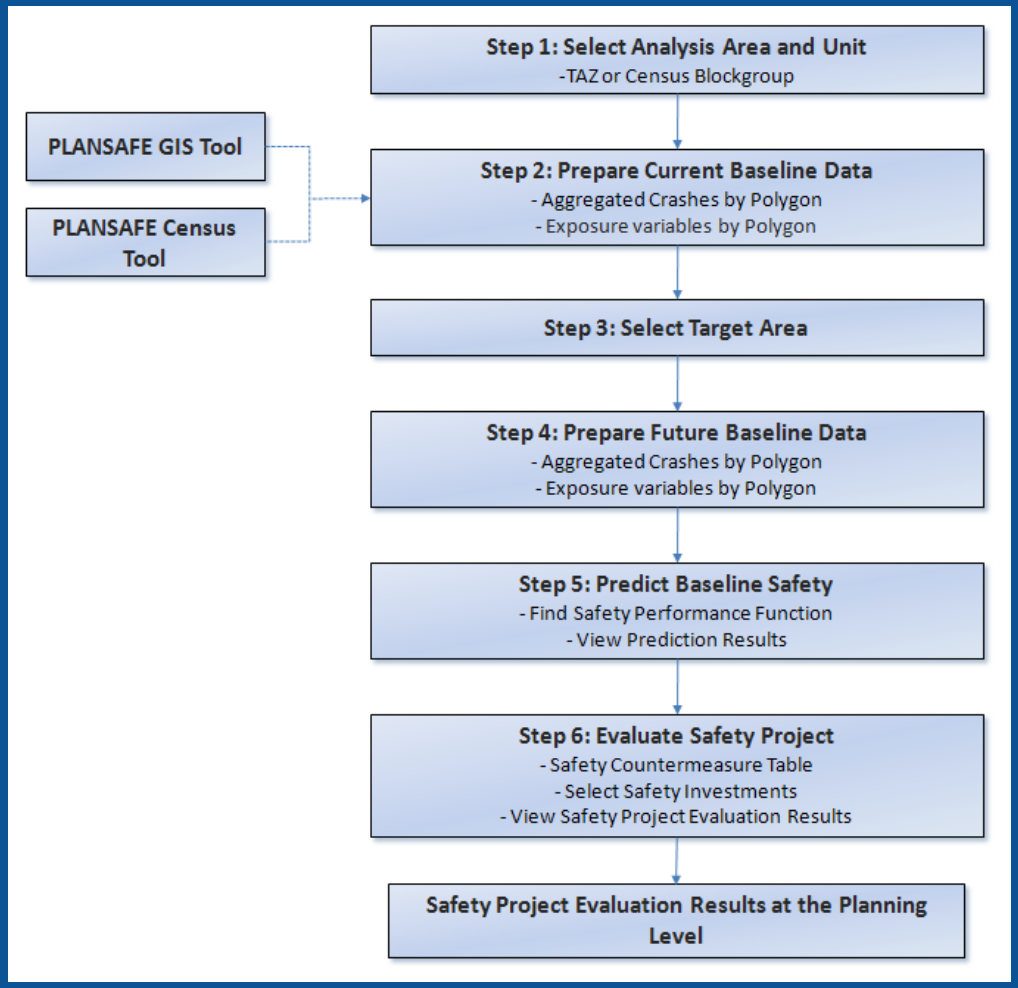
# Aggregate Census Data by TAZ Boundary

- Using the Polygon-in-polygon table, the census data can be aggregated by TAZ boundary

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TAZ_ID | AREALAND | AREAWATER | POPTOT | POPMIN | POPMALE | POP00_15 | POP16_64 | POP65 | HU | HU_OCC | HU_OCC02 | HU_OCC03 | FAMILIES | HH_INC |
| 2 | 1 | 11778 | 0 | 7 | 1 | 4 | 0 | 4 | 3 | 4 | 4 | 3 | 1 | 0 | 7317 |
| 3 | 10 | 65307 | 0 | 39 | 7 | 23 | 2 | 24 | 13 | 25 | 23 | 19 | 3 | 3 | 7317 |
| 4 | 100 | 1412863 | 0 | 2852 | 1710 | 1435 | 926 | 1739 | 187 | 863 | 811 | 124 | 175 | 644 | 25241 |
| 5 | 101 | 682864 | 0 | 1032 | 142 | 513 | 130 | 715 | 187 | 497 | 468 | 171 | 176 | 212 | 29741 |
| 6 | 102 | 1207276 | 69365 | 610 | 152 | 306 | 117 | 394 | 99 | 332 | 286 | 115 | 95 | 146 | 34160 |
| 7 | 103 | 1010972 | 0 | 1034 | 566 | 410 | 240 | 705 | 89 | 269 | 238 | 47 | 52 | 179 | 22746 |
| 8 | 104 | 1010196 | 0 | 517 | 131 | 234 | 71 | 322 | 124 | 250 | 239 | 81 | 90 | 143 | 44249 |
| 9 | 105 | 897953 | 0 | 2505 | 1525 | 1227 | 750 | 1496 | 259 | 850 | 762 | 162 | 177 | 564 | 22749 |
| 10 | 106 | 632187 | 0 | 769 | 72 | 372 | 109 | 573 | 87 | 410 | 381 | 151 | 133 | 174 | 42318 |
| 11 | 107 | 320145 | 0 | 605 | 268 | 311 | 161 | 414 | 30 | 271 | 244 | 89 | 59 | 133 | 21934 |
| 12 | 108 | 452734 | 0 | 1011 | 428 | 547 | 226 | 721 | 64 | 559 | 478 | 220 | 121 | 191 | 18694 |
| 13 | 109 | 500243 | 0 | 1183 | 486 | 620 | 265 | 860 | 58 | 592 | 536 | 234 | 137 | 231 | 20987 |
| 14 | 11 | 30963 | 0 | 46 | 12 | 28 | 1 | 37 | 8 | 44 | 38 | 32 | 5 | 2 | 11443 |
| 15 | 110 | 832299 | 766 | 890 | 396 | 417 | 266 | 546 | 78 | 325 | 291 | 65 | 66 | 214 | 25120 |
| 16 | 111 | 726410 | 0 | 805 | 311 | 405 | 185 | 509 | 111 | 276 | 265 | 48 | 82 | 200 | 30291 |
| 17 | 112 | 600190 | 0 | 443 | 282 | 260 | 115 | 289 | 39 | 118 | 99 | 19 | 20 | 75 | 18778 |
| 18 | 113 | 649922 | 0 | 1612 | 404 | 824 | 287 | 1234 | 91 | 864 | 803 | 340 | 269 | 308 | 20886 |
| 19 | 114 | 1692105 | 0 | 991 | 519 | 506 | 245 | 630 | 116 | 310 | 289 | 60 | 75 | 219 | 29714 |
| 20 | 115 | 493608 | 0 | 570 | 55 | 267 | 67 | 353 | 150 | 319 | 292 | 117 | 117 | 144 | 48747 |
| 21 | 116 | 1859780 | 0 | 2932 | 900 | 1382 | 563 | 2117 | 252 | 1201 | 1125 | 254 | 386 | 712 | 39445 |
| 22 | 117 | 1412299 | 0 | 135 | 47 | 76 | 21 | 86 | 28 | 97 | 67 | 29 | 25 | 29 | 15690 |
| 23 | 118 | 651059 | 0 | 1101 | 145 | 521 | 171 | 767 | 163 | 616 | 572 | 267 | 178 | 221 | 27234 |
| 24 | 119 | 355525 | 0 | 109 | 68 | 57 | 36 | 62 | 11 | 32 | 28 | 3 | 7 | 24 | 14635 |
| 25 | 12 | 13747 | 0 | 21 | 6 | 13 | 0 | 17 | 4 | 20 | 17 | 14 | 2 | 1 | 11628 |
| 26 | 120 | 645243 | 0 | 1313 | 211 | 641 | 196 | 981 | 136 | 715 | 668 | 278 | 227 | 285 | 37072 |
| 27 | 121 | 653807 | 0 | 317 | 44 | 143 | 60 | 194 | 63 | 149 | 136 | 43 | 46 | 80 | 83101 |
| 28 | 122 | 662120 | 0 | 127 | 16 | 59 | 18 | 78 | 31 | 64 | 56 | 13 | 28 | 37 | 71827 |
| 29 | 123 | 650504 | 0 | 1971 | 443 | 998 | 277 | 1594 | 100 | 1133 | 1051 | 475 | 374 | 340 | 19719 |
| 30 | 124 | 815537 | 0 | 1805 | 313 | 902 | 213 | 1397 | 195 | 1077 | 980 | 473 | 328 | 325 | 27142 |
| 31 | 125 | 316137 | 0 | 32 | 12 | 18 | 5 | 20 | 7 | 22 | 15 | 6 | 6 | 7 | 15641 |
| 32 | 126 | 973301 | 1 | 1040 | 410 | 536 | 272 | 694 | 74 | 527 | 456 | 188 | 115 | 228 | 21747 |
| 33 | 127 | 870103 | 0 | 1772 | 711 | 835 | 426 | 890 | 456 | 937 | 727 | 230 | 261 | 458 | 24591 |
| 34 | 128 | 1692275 | 0 | 1485 | 450 | 701 | 217 | 1092 | 176 | 810 | 724 | 298 | 229 | 323 | 39184 |
| 35 | 129 | 1550251 | 100988 | 380 | 114 | 189 | 81 | 261 | 38 | 162 | 148 | 39 | 55 | 96 | 36534 |
| 36 | 13 | 195549 | 0 | 117 | 23 | 66 | 7 | 72 | 38 | 72 | 67 | 52 | 10 | 10 | 9280 |
| 37 | 130 | 455438 | 0 | 787 | 328 | 427 | 199 | 549 | 39 | 410 | 348 | 147 | 92 | 162 | 15943 |

# Software Demonstration and Discussion

# Analysis Steps in PLANSAFE Main Tool




- PLANSAFE provides users with five steps to forecast the safety impacts of socio-demographic changes and safety countermeasure investments
- It is highly recommended that users conduct the safety project evaluation analysis sequentially from step 1 to step 6

# Startup Screen: Select Analysis Area and Unit

**Analysis Steps**

File

1. **Select Analysis Area and Unit**
2. Prepare Current Baseline Data
3. Select Target Area
4. Prepare Future Baseline Data
5. Predict Baseline Safety
   a. Find Safety Performance Function
   b. View Predicted Baseline Safety
6. Evaluate Safety Project
   a. Safety Countermeasure Table
   b. Select Safety Investments
   c. View Evaluation Results

## Welcome to PLANSAFE

**NCHRP-8-44 (2)**
**Transportation Safety Planning**

Forecasting the Safety Impacts of Socio-Demographic Changes and Safety Countermeasure Investments

**Select Analysis Area and Unit**

| | | | |
|---|---|---|---|
| State: | | County: | |
| Jurisdiction: | | Analysis Unit: | Traffic Analysis Zone |

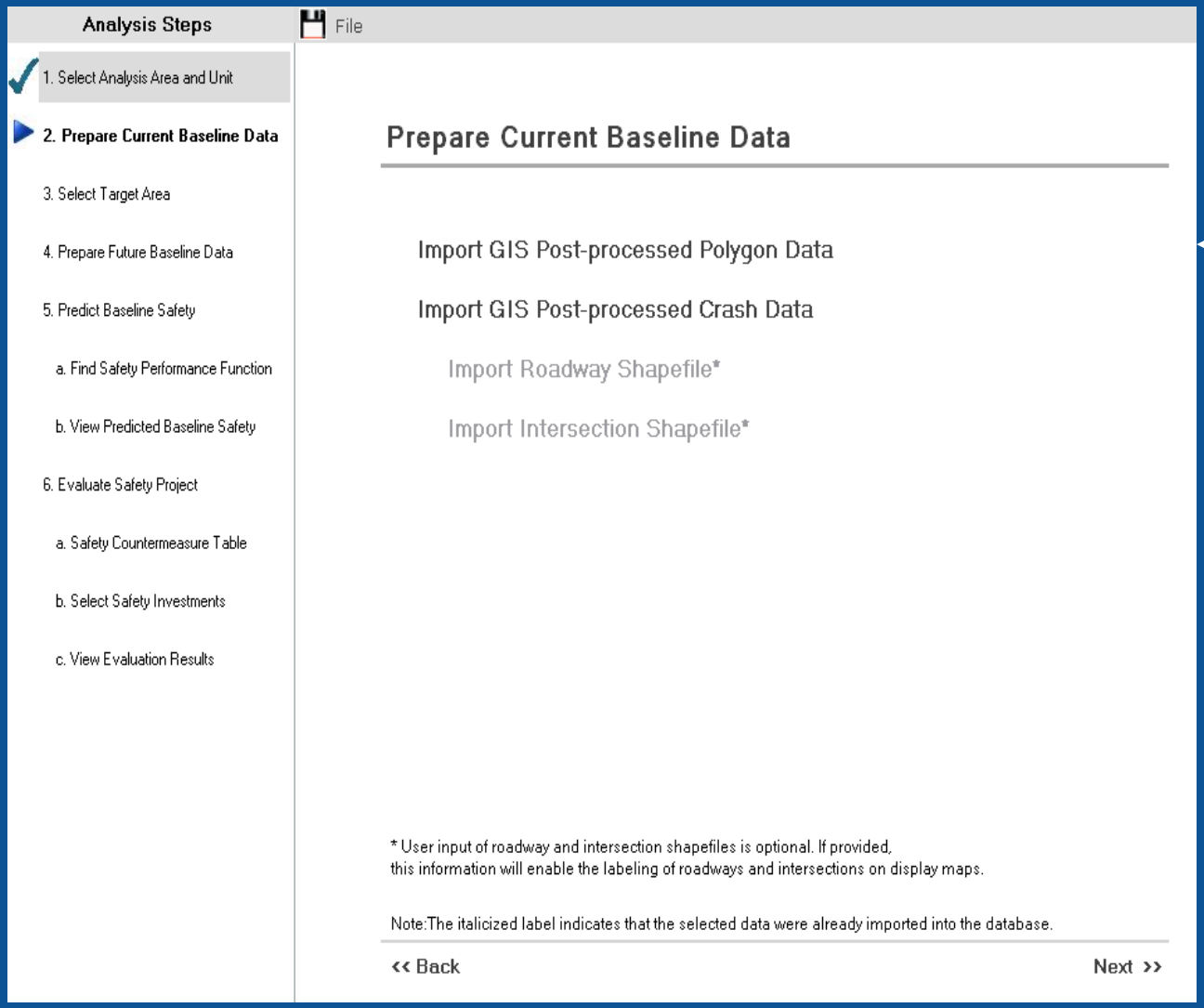
PLANSAFE is a predictive transportation planning tool that is intended to aid in regional and sub-regional planning activities. It is a sketch planning tool that is meant to provide guidance on broad level safety investments and does not have a sufficient level of accuracy for project level investment decisions. It is appropriate for corridor level project assessment and larger. It is not suitable for micro-scale analysis and should not be used for this purpose.

Help Exit Continue >>

# Select Analysis Area and Unit (cont'd)

- State/County/Jurisdiction
  - Choose state/county/jurisdiction name or
  - Type state/county/jurisdiction in the combo box
    - This screen affects report output at this stage; but will influence the analysis in subsequent versions
- Analysis Unit
  - Census Block Group (BG) and Traffic Analysis Zone (TAZ)
    - Since PLANSAFE will apply different models depending upon analysis unit, users should select analysis unit
    - Although a TAZ often consists of one or more BGs, a TAZ is not always greater than a BG

# Prepare Current Baseline Data




Users must submit the current baseline datasets in the Prepare Current Data Screen

(GIS Shape files and a text file)

# Current Baseline Data: Import GIS Post-processed Polygon Data

GIS Shape File

Polygon ID

Total number of crashes

Total number of intersections

Total roadway length

Total AADT

Total VMT

Total Population between 16 and 64

Attributes of Tempe_Polygon

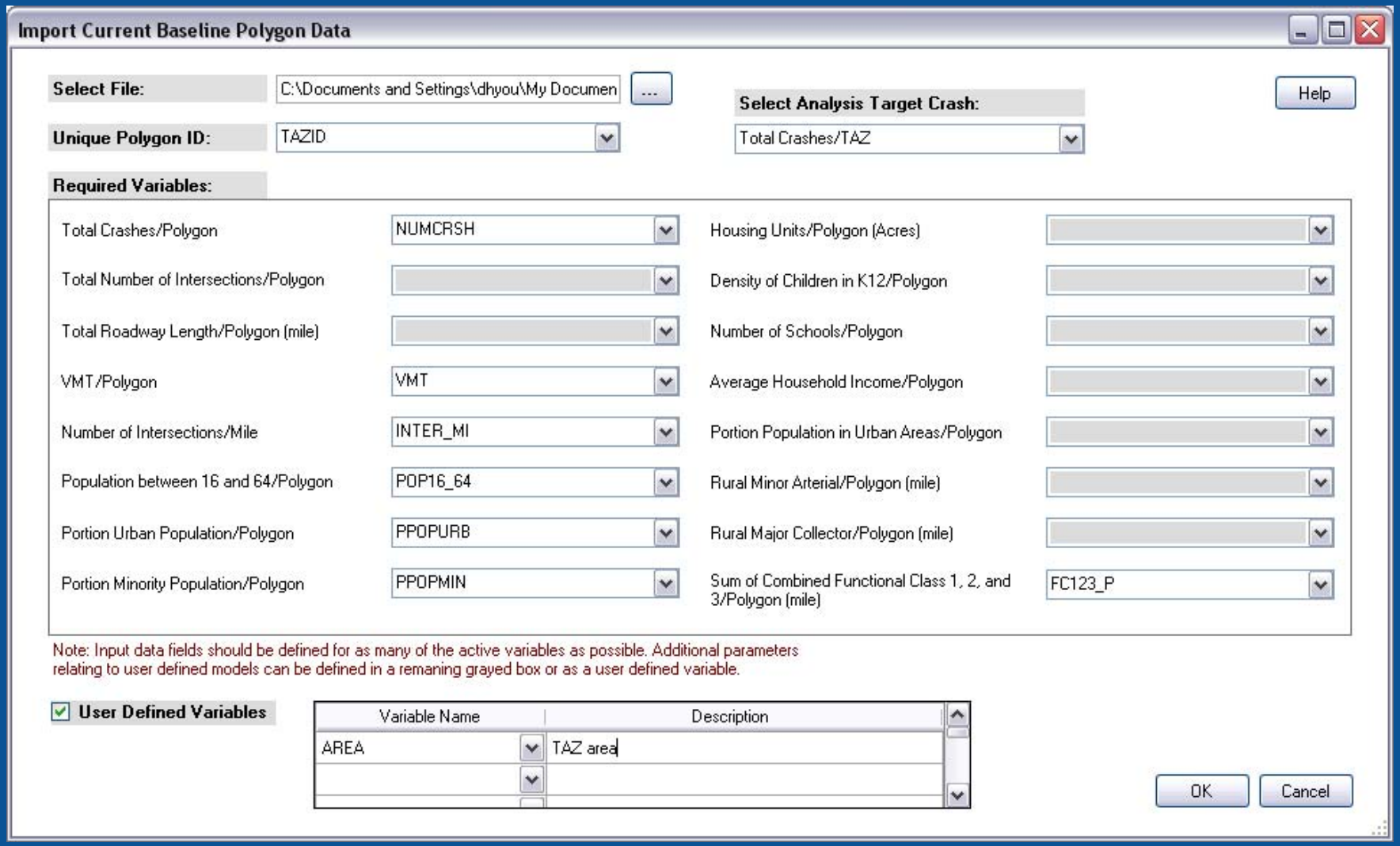
| FID | Shape | AREA | PERIMETER | TAZID | NUMCRSH | NUMINTER | AGGWLEN | AGGWTRF | AGGWVMT | POP16_64 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Polygon | 14712270 | 19148.55 | 1092 | 32 | 0.25 | 7168.6 | 44556.648 | 32789.791 | 2457 |
| 1 | Polygon | 27413938 | 23913.32 | 1185 | 100.917 | 3.333 | 17028.017 | 264440.124 | 75285.889 | 2415 |
| 2 | Polygon | 10864016 | 16285.94 | 1187 | 73.083 | 1 | 10850.433 | 163279.183 | 40952.165 | 1705 |
| 3 | Polygon | 20652994 | 21666.91 | 1191 | 15.833 | 0.833 | 6828.384 | 49671.25 | 18579.941 | 66 |
| 4 | Polygon | 4572701 | 8820.78 | 1204 | 21.333 | 0.333 | 3812.037 | 30661.167 | 17627.105 | 2 |
| 5 | Polygon | 7295393.5 | 14138.66 | 1205 | 25.5 | 1.167 | 8917.066 | 69571.75 | 27502.504 | 1 |
| 6 | Polygon | 6634580.5 | 12420.48 | 1225 | 31.25 | 1.583 | 10463.434 | 186393.367 | 27304.936 | 2 |
| 7 | Polygon | 6012130 | 10232.72 | 1237 | 15.917 | 1.083 | 7209.627 | 111344.283 | 18997.444 | 4 |
| 8 | Polygon | 25802154 | 20129.27 | 1275 | 55.25 | 1.167 | 6903.045 | 115412.833 | 23208.93 | 249 |
| 9 | Polygon | 4771708 | 8761.82 | 1277 | 5 | 0 | 3846.527 | 30055.533 | 2001.884 | 3 |
| 10 | Polygon | 6544187.5 | 10040.97 | 1279 | 35.5 | 0.5 | 4661.108 | 109853.05 | 13323.256 | 722 |
| 11 | Polygon | 13137386 | 15571.45 | 1280 | 48.083 | 1.083 | 8804.744 | 244003.367 | 37566.23 | 177 |
| 12 | Polygon | 27500366 | 20819.69 | 1282 | 112.167 | 3.833 | 16600.522 | 573682.517 | 38982.598 | 373 |
| 13 | Polygon | 3713557.5 | 8982.95 | 1287 | 2.583 | 0.333 | 2847.035 | 36995.8 | 6240.873 | 361 |
| 14 | Polygon | 5162773 | 10058.1 | 1292 | 75.417 | 0.833 | 3738.497 | 26783.7 | 16445.826 | 602 |
| 15 | Polygon | 3527726.75 | 8987.48 | 1293 | 70.833 | 0.833 | 4900.843 | 31597.983 | 21130.68 | 138 |
| 16 | Polygon | 9141476 | 12339.36 | 1294 | 68.5 | 0.333 | 2867.89 | 9799.583 | 11232.99 | 2502 |
| 17 | Polygon | 8245463.5 | 11453.84 | 1295 | 56.5 | 0.917 | 5304.494 | 31867.583 | 23825.223 | 2619 |
| 18 | Polygon | 6889112.5 | 10931.73 | 1296 | 100.667 | 0.5 | 4956.993 | 42360.933 | 27530.496 | 822 |
| 19 | Polygon | 6442170 | 10198.16 | 1300 | 24.667 | 1.167 | 6236.36 | 255724.5 | 9903.899 | 44 |
| 20 | Polygon | 13710132 | 15648.41 | 1302 | 110.25 | 1.083 | 16994.986 | 71329.983 | 48197.456 | 188 |

Attainable from *Point-in-Polygon Aggregation Tool* and *End-node Integration Tool*

Attainable from *Line-in-Polygon Aggregation Tool*

Attainable from *Census Tool*

PLANSAFE GIS and Census Tools


Import Current Baseline Polygon Data
Select File:
C:\Documents and Settings\dhyou\My Documen
...
Help
Unique Polygon ID:
TAZID
Select Analysis Target Crash:
Total Crashes/TAZ
Required Variables:
Total Crashes/Polygon
NUMCRSH
Total Number of Intersections/Polygon
Total Roadway Length/Polygon (mile)
VMT/Polygon
VMT
Number of Intersections/Mile
INTER_MI
Population between 16 and 64/Polygon
POP16_64
Portion Urban Population/Polygon
PPOPURB
Portion Minority Population/Polygon
PPOPMIN
Housing Units/Polygon (Acres)
Density of Children in K12/Polygon
Number of Schools/Polygon
Average Household Income/Polygon
Portion Population in Urban Areas/Polygon
Rural Minor Arterial/Polygon (mile)
Rural Major Collector/Polygon (mile)
Sum of Combined Functional Class 1, 2, and 3/Polygon (mile)
FC123_P
Note: Input data fields should be defined for as many of the active variables as possible. Additional parameters relating to user defined models can be defined in a remaning grayed box or as a user defined variable.
User Defined Variables
Variable Name
Description
AREA
TAZ area
OK
Cancel

# Current Baseline Data: Import GIS Post-processed Crash Data

## Post-processed Text File

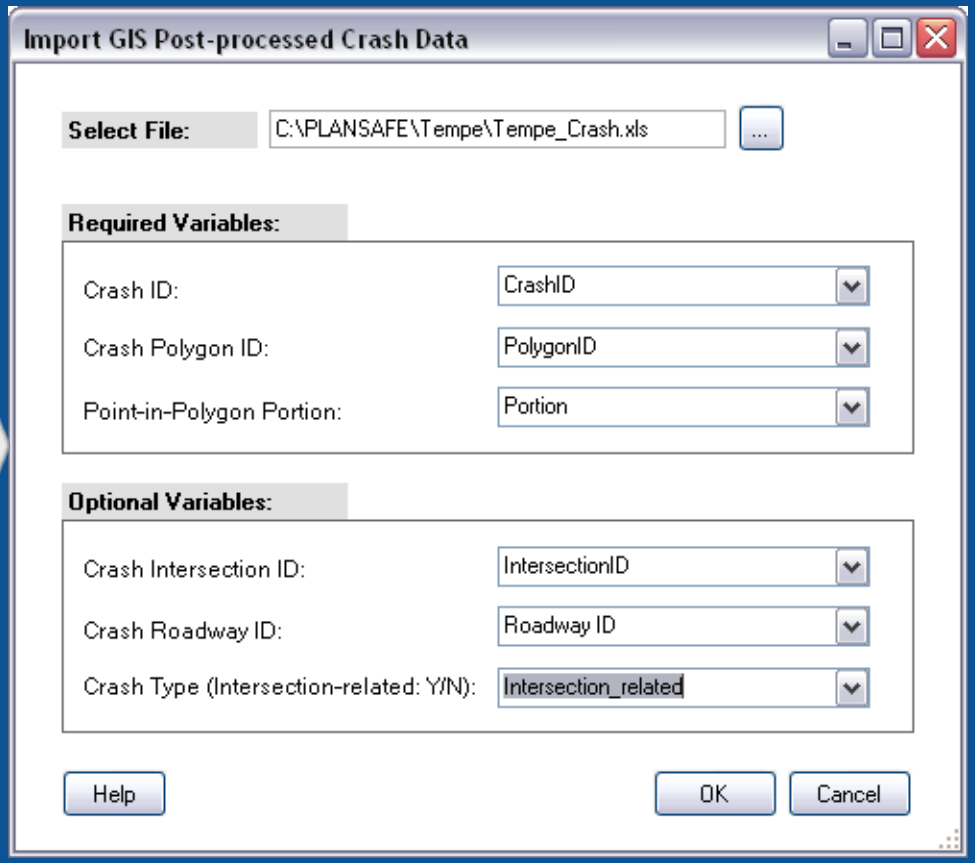
Crash ID
Crash Polygon ID
Point-in-Polygon Portion
Crash Intersection ID
Crash Roadway ID
Crash Type (Intersection-related)

| CrashID | PolygonID | Portion | IntersectionID | Roadway ID | Intersection_related |
|---|---|---|---|---|---|
| 1 | 1339 | 0.25 | 2895 | 12443 | Y |
| 1 | 1282 | 0.25 | 2895 | 12443 | Y |
| 1 | 1342 | 0.25 | 2895 | 12443 | Y |
| 1 | 1302 | 0.25 | 2895 | 12443 | Y |
| 2 | 1275 | 0.25 | 2896 | 12447 | Y |
| 2 | 1295 | 0.25 | 2896 | 12447 | Y |
| 2 | 1347 | 0.25 | 2896 | 12447 | Y |
| 2 | 1345 | 0.25 | 2896 | 12447 | Y |
| 3 | 1337 | 0.5 | | 12433 | N |
| 3 | 1300 | 0.5 | | 12433 | N |
| 4 | 1481 | 1 | | 13710 | Y |
| 5 | 1483 | 0.33 | 3157 | 13777 | Y |
| 5 | 1447 | 0.33 | 3157 | 13777 | Y |
| 5 | 1448 | 0.33 | 3157 | 13777 | Y |

Required Fields

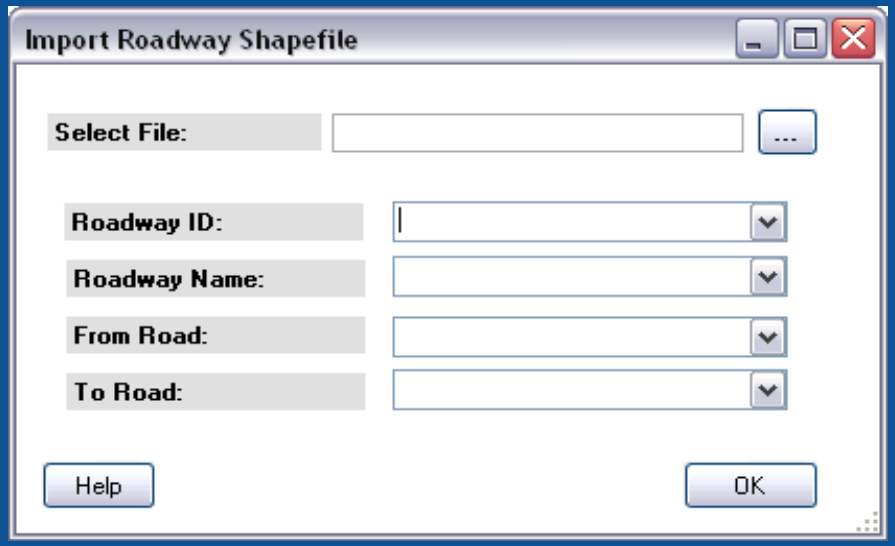
Optional Fields

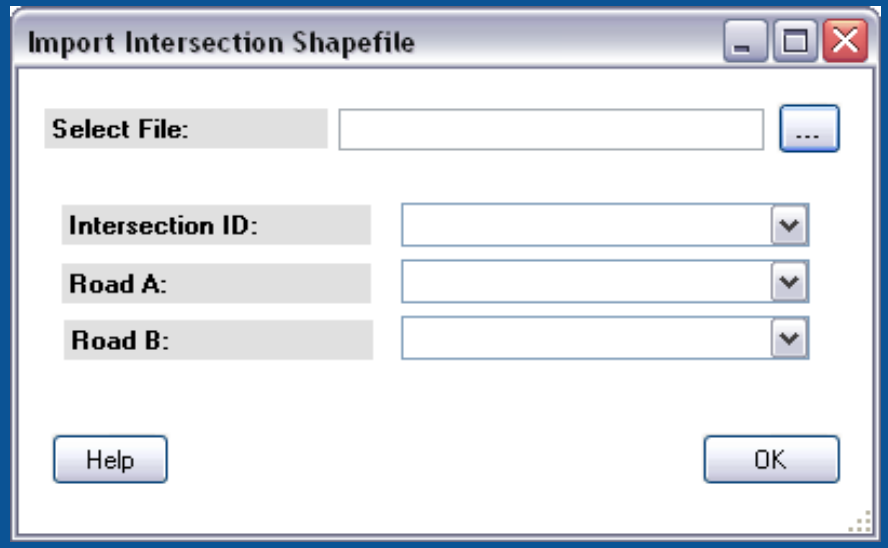
PLANSAFE GIS Tool



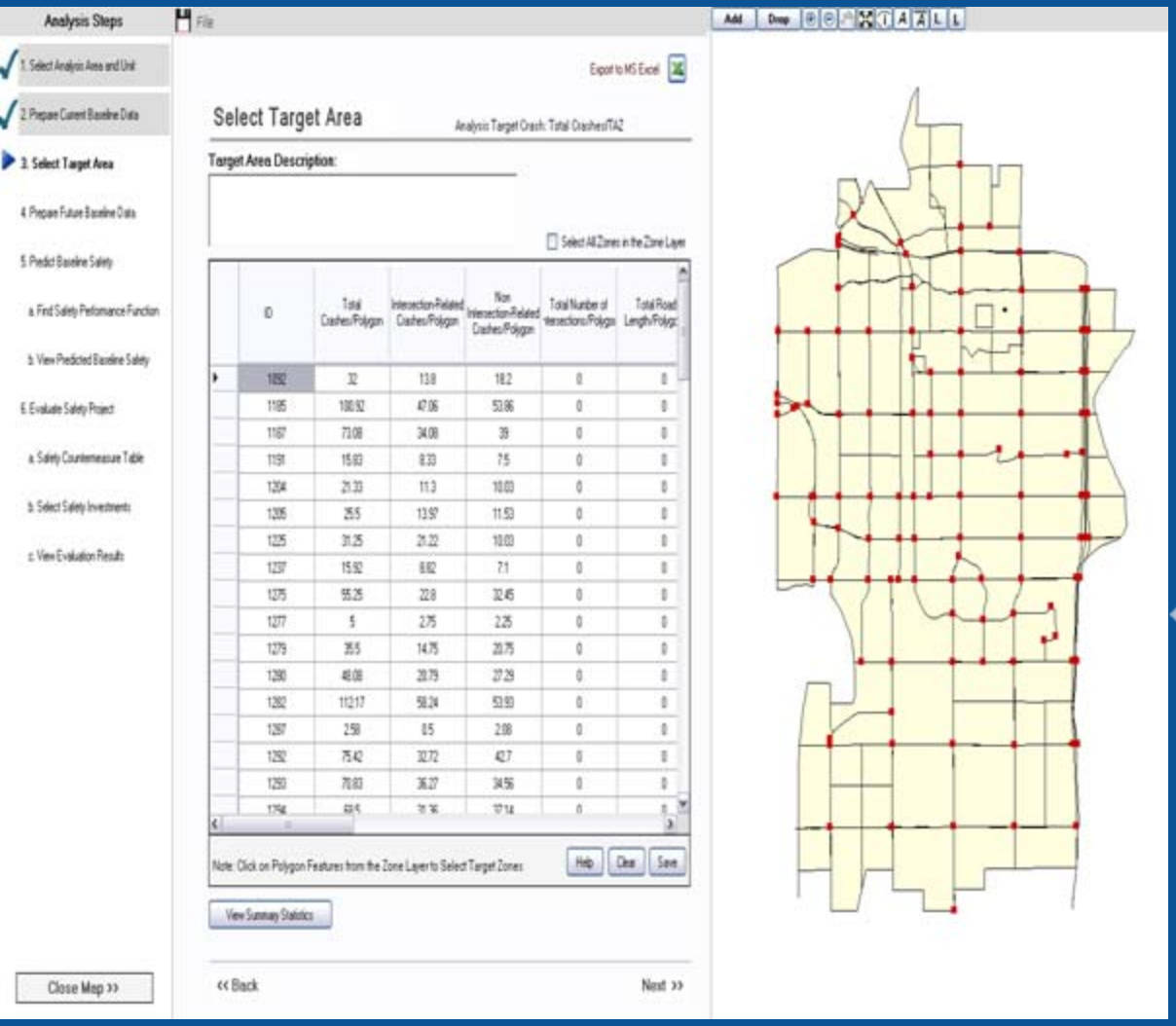
# Current Baseline Data: Import Roadway/Intersection Shape Files

- The two options for importing the roadway or intersection shape files become visible when users submit the crash roadway ID or the crash intersection ID when importing the GIS post-processed crash data



# Select Target Area



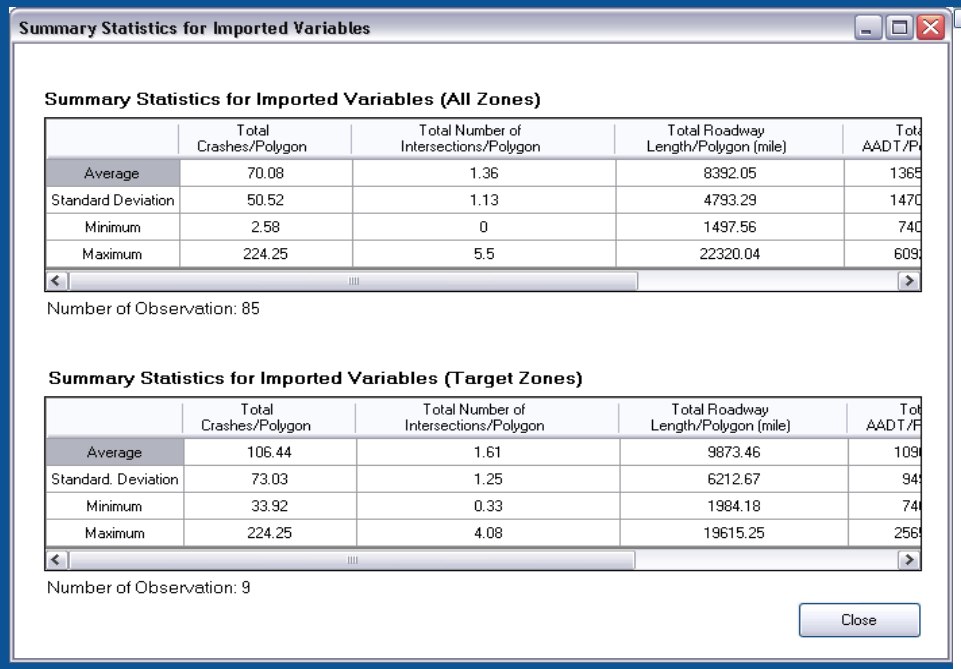

- Selecting target area enables users to perform more detailed investigation of safety by using subsets of polygon features in the entire study area

Select Target Area from Data Table or Map and click the "Save" button

# Select Target Area (cont'd)

View Summary Statistics

Draw the Color Theme Map (e.g. crash frequency)



Summary Statistics for Imported Variables

Summary Statistics for Imported Variables (All Zones)

| | Total Crashes/Polygon | Total Number of Intersections/Polygon | Total Roadway Length/Polygon (mile) | Tot AADT/P |
|---|---|---|---|---|
| Average | 70.08 | 1.36 | 8392.05 | 1365 |
| Standard Deviation | 50.52 | 1.13 | 4793.29 | 1470 |
| Minimum | 2.58 | 0 | 1497.56 | 740 |
| Maximum | 224.25 | 5.5 | 22320.04 | 609 |

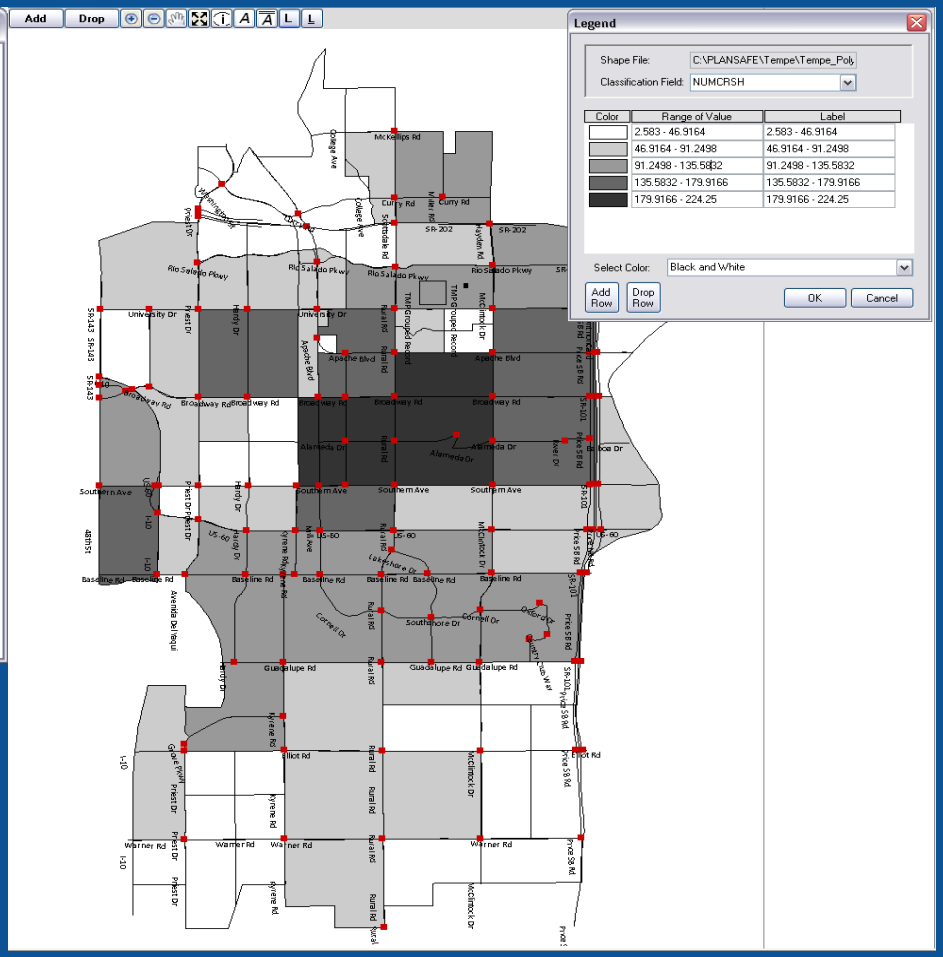
Number of Observation: 85

Summary Statistics for Imported Variables (Target Zones)

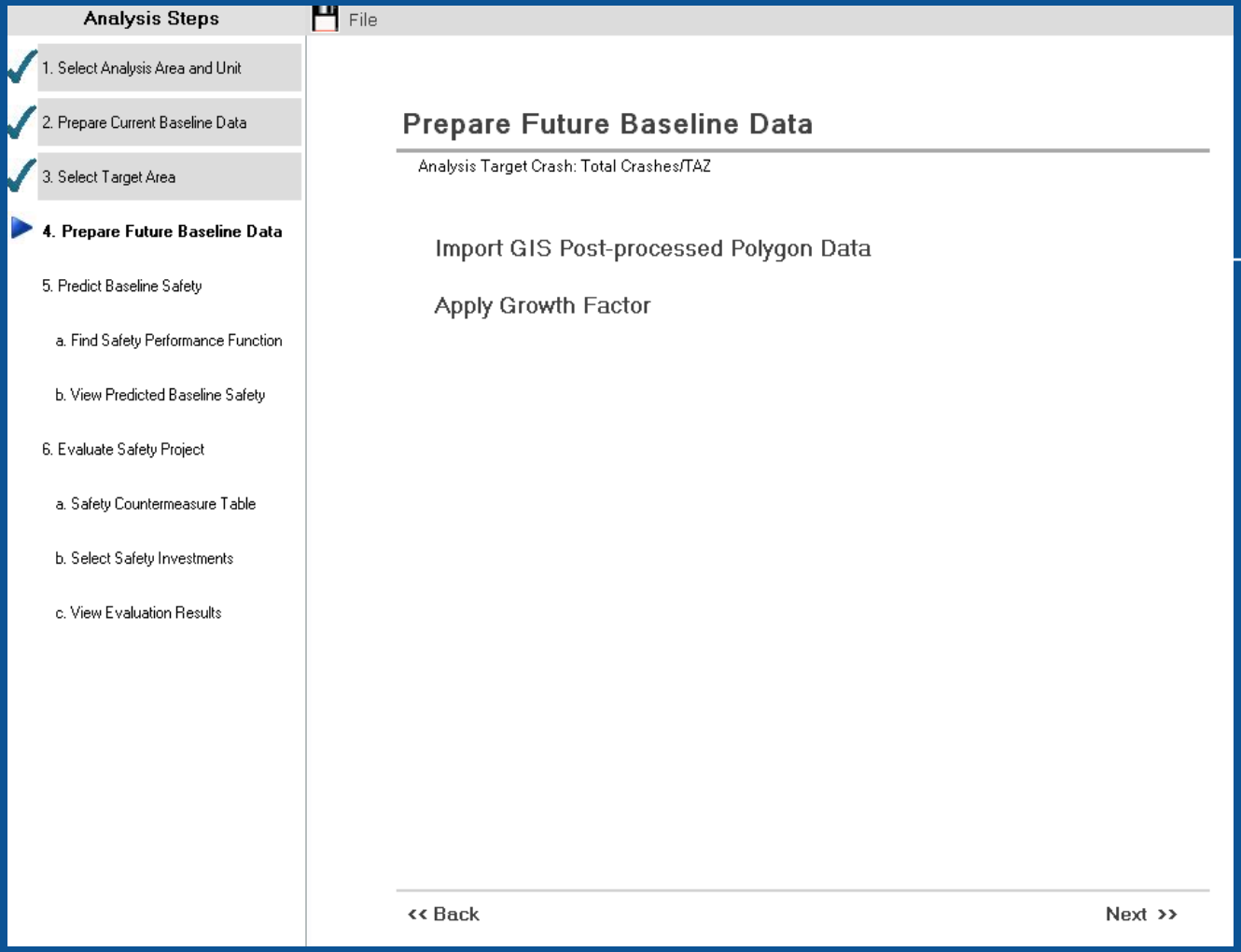
| | Total Crashes/Polygon | Total Number of Intersections/Polygon | Total Roadway Length/Polygon (mile) | Tot AADT/P |
|---|---|---|---|---|
| Average | 106.44 | 1.61 | 9873.46 | 109 |
| Standard. Deviation | 73.03 | 1.25 | 6212.67 | 94 |
| Minimum | 33.92 | 0.33 | 1984.18 | 74 |
| Maximum | 224.25 | 4.08 | 19615.25 | 256 |

Number of Observation: 9

Close



# Prepare Future Baseline Data

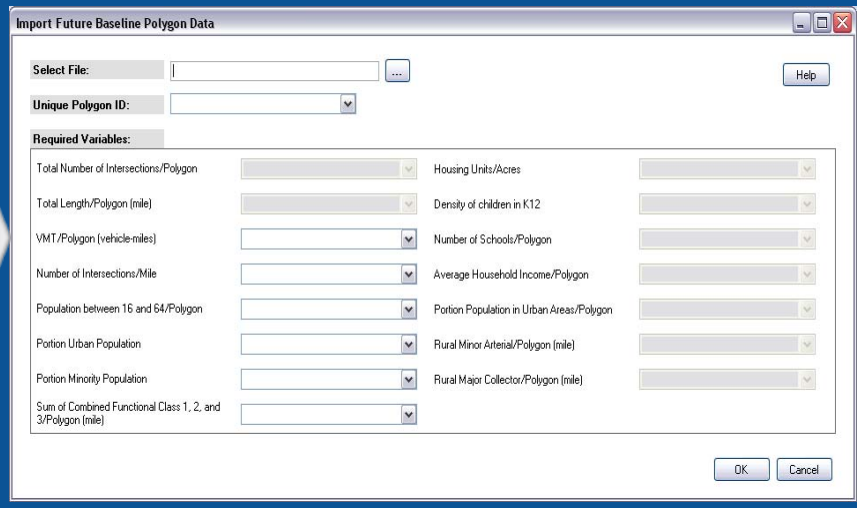



Users must submit the future baseline datasets in the Prepare Future Baseline Data Screen

(GIS Shape files)

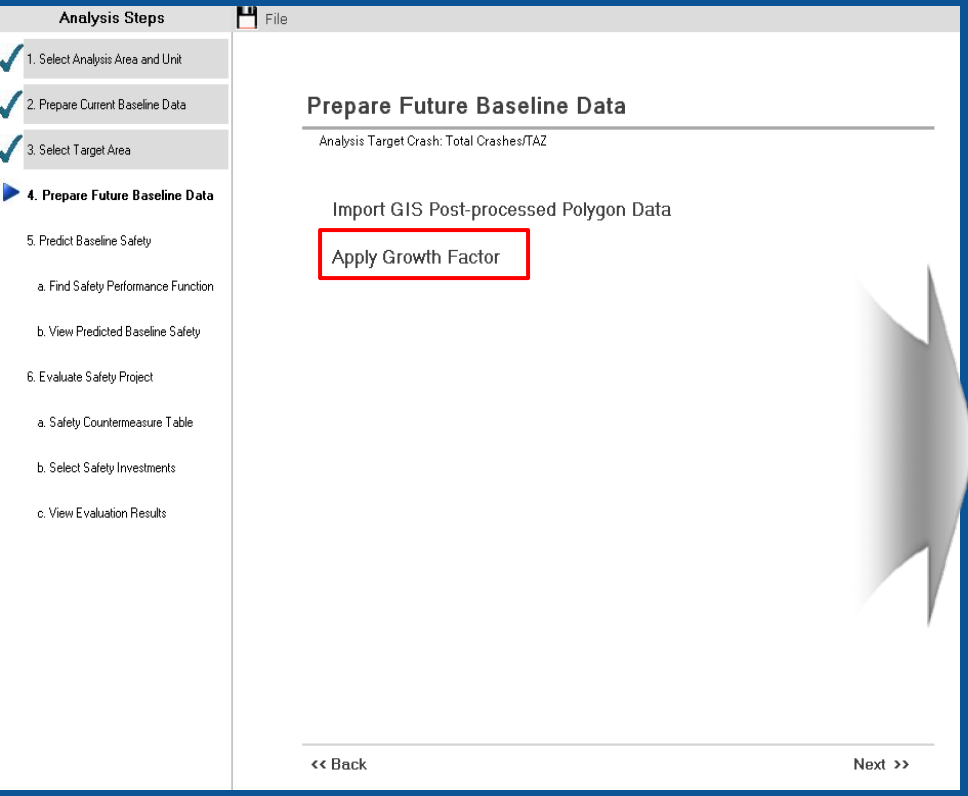
# Future Baseline Data: Import GIS Post-processed Polygon Data

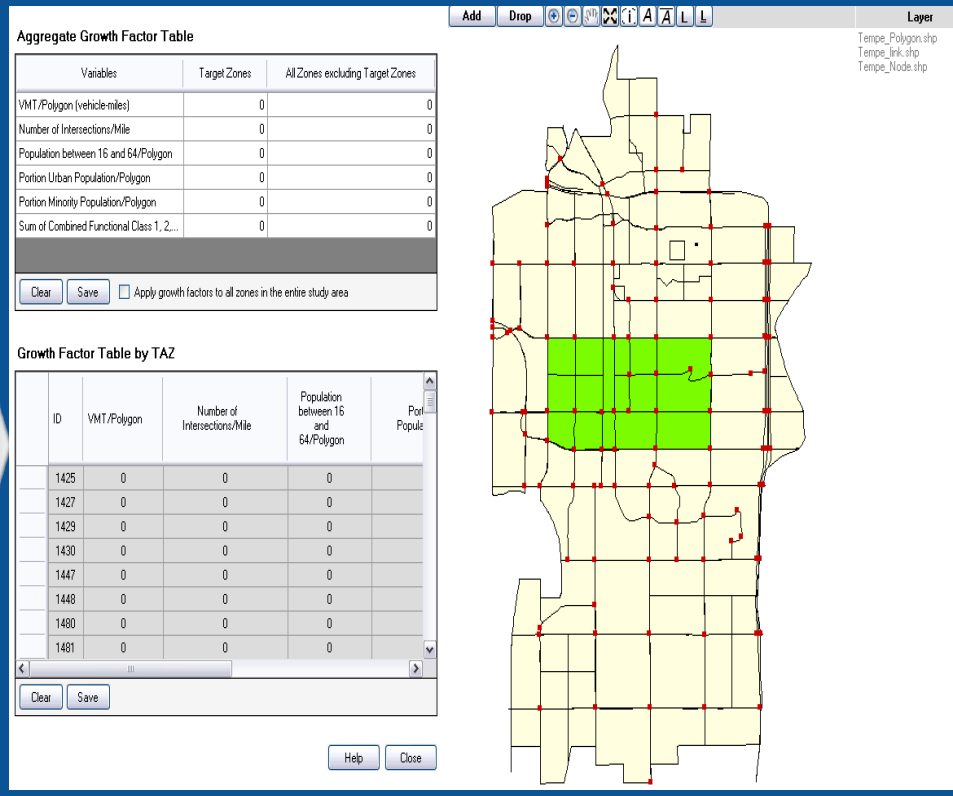
- PLANSAFE requires users to submit the future baseline data, which represent future transportation supply and demand under a future growth scenario



# Future Baseline Data: Apply Growth Factor

- When the future baseline transportation network and the census information are not available, users can select the option "Apply Growth Factor" for preparing the future baseline data



# Future Baseline Data: Apply Growth Factor (cont'd)

- Enter Growth Factor
  - Apply a uniform growth factor for a group of zones in the entire study area
    - For example, if traffic volume for all zones is expected to increase by 10% from the current baseline to the future baseline, users should enter "10" in the column labeled "All Zones" and click the "Save" button
- Update Growth Factor Table
  - Apply different growth factors for each polygon feature in the entire study area

**Aggregate Growth Factor Table**

| Variables | All Zones |
|---|---|
| VMT/Polygon (vehicle-miles) | 10 |
| Number of Intersections/Mile | 10 |
| Population between 16 and 64/Polygon | 15 |
| Portion Urban Population/Polygon | 10 |
| Portion Minority Population/Polygon | 10 |
| Sum of Combined Functional Class 1, 2,... | 10 |

Clear | Save | ☑ Apply growth factors to all zones in the entire study area

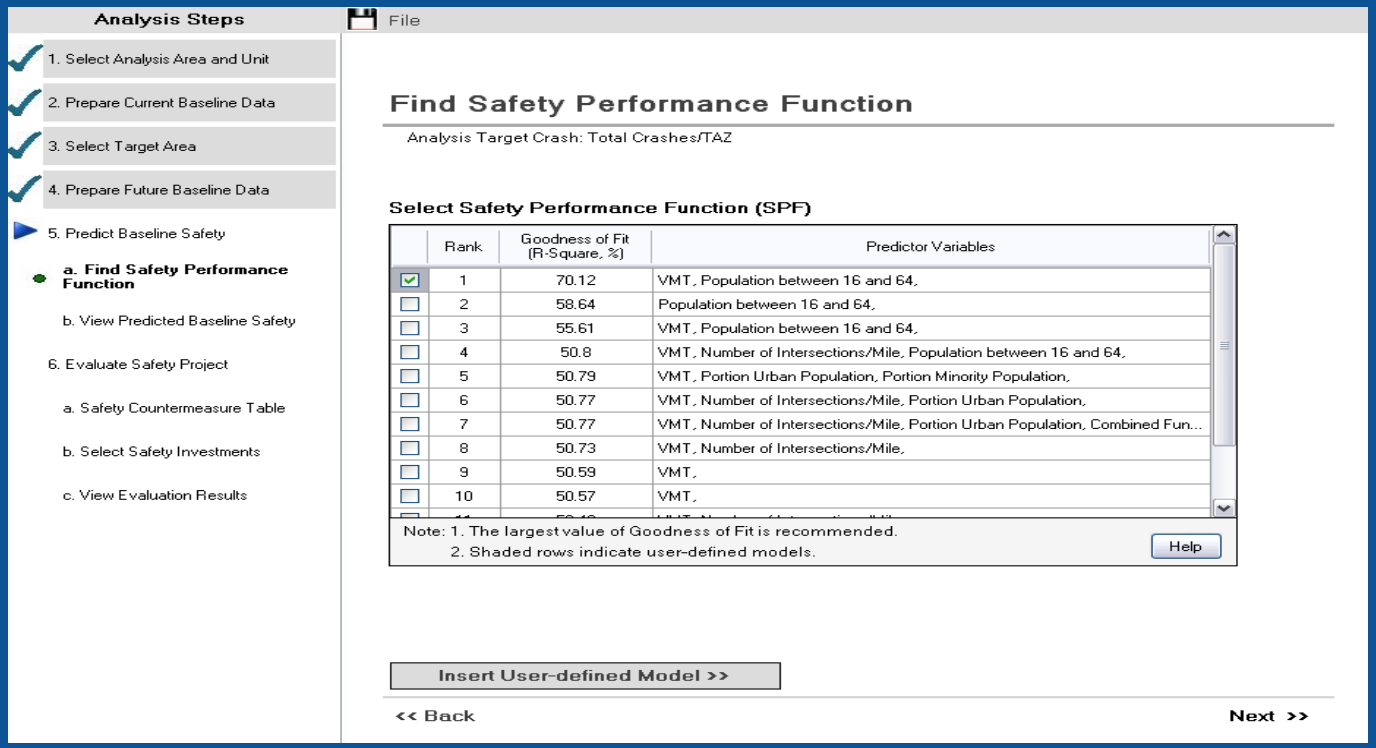
**Growth Factor Table by TAZ**

| | ID | VMT/Polygon | Number of Intersections/Mile | Population between 16 and 64/Polygon | Port Popula |
|---|---|---|---|---|---|
| | 1430 | 10 | 10 | 10 | |
| | 1429 | 10 | 10 | 10 | |
| | 1425 | 10 | 10 | 10 | |
| | 1672 | 7 | 5 | 5 | |
| | 1671 | 5 | 5 | 5 | |
| | 1670 | 5 | 5 | 5 | |
| | 1669 | 5 | 5 | 5 | |
| | 1668 | 5 | 5 | 5 | |

Clear | Save

# Predict Baseline Safety: Find Safety Performance Function

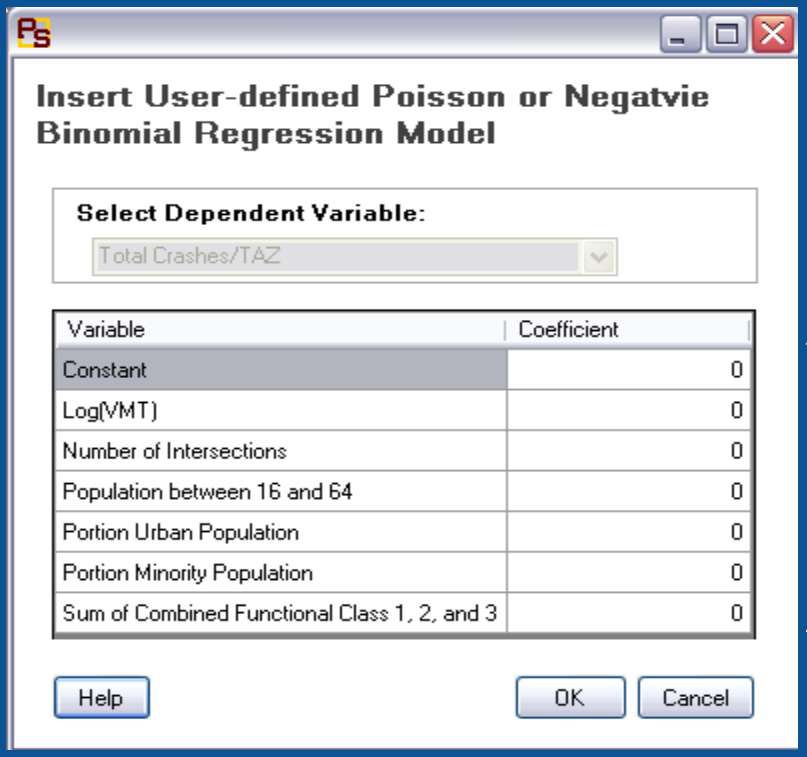
- Select Safety Performance Function
  - PLANSAFE will show users a list of the pre-developed SPFs for the selected dependent variables




* BCF= the sum of the observed crashes/the sum of the estimated crashes

# Predict Baseline Safety: Find Safety Performance Function (cont'd)

- User-Defined Model
  - Users also can use their own SPFs to forecast safety by clicking a box next to "Insert User-defined Model": users must enter the coefficients for each variable, where the regression model has an exponential mean function (i.e. exp(**X**β))




The variables available in the user-defined model box are the same as those that users imported with the current baseline polygon data

File

Export to MS Excel

## Predicted Baseline Safety

Analysis Target Crash: Total Crashes/TAZ

| Polygon ID | Expected Crash Frequency (Current Baseline) | Predicted Crash Frequency (Future Baseline) |
|---|---|---|
| 1425 | 186.25 | 226.1 |
| 1427 | 184.96 | 222.82 |
| 1481 | 107.72 | 121.63 |
| 1480 | 96.13 | 107.38 |
| 1483 | 80.29 | 88.36 |
| 1429 | 29.75 | 31.01 |
| 1447 | 24.17 | 25.19 |
| 1430 | 21.91 | 22.84 |
| 1448 | 19.79 | 20.63 |
| 1385 | 232.33 | 259.75 |
| 1345 | 230.41 | 259.05 |
| 1552 | 217.25 | 241.37 |
| 1551 | 199.55 | 219.09 |
| 1339 | 190.62 | 211.34 |
| 1426 | 192.06 | 209.99 |
| 1555 | 188.52 | 209.87 |
| 1500 | 169.16 | 184.01 |
| 1600 | 151.34 | 166.81 |
| 1522 | 151.14 | 162.84 |
| 1382 | 137.41 | 147.66 |
| 1185 | 111.91 | 119.22 |
| 1520 | 106.23 | 111.58 |

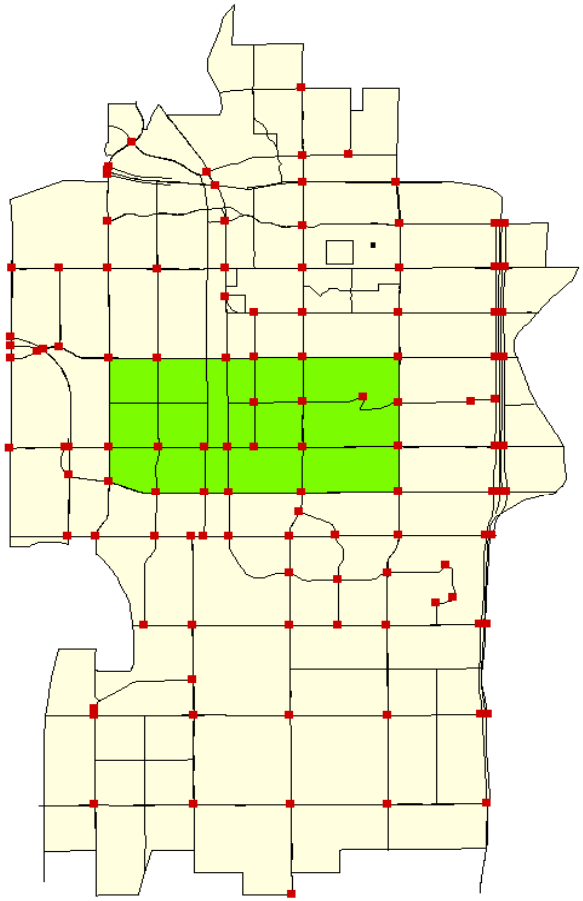
| | Target Zones | All Zones |
|---|---|---|
| Expected Crash Frequency (Current Baseline): | 750.97 | 5957.25 |
| Predicted Crash Frequency (Future Baseline): | 865.96 | 6409.94 |
| Change in Safety Due to Socio-Demographic Growth (%)*: | 15.31 % | 7.6 % |

* Positive value indicates increase in crash due to Socio-Demographic Growth

<< Back

Next >>

Add Drop



# View Predicted Baseline Safety (cont'd)

- Highlighted polygon features on the top of the table indicate the target Area that users selected in the previous step
- The change in safety due to socio-demographic growth (%)
  - e.g. the baseline safety in the target zones (i.e. target area) increases by 15.31% due to the socio-demographic growth from the current baseline to the future baseline

**Predicted Baseline Safety**

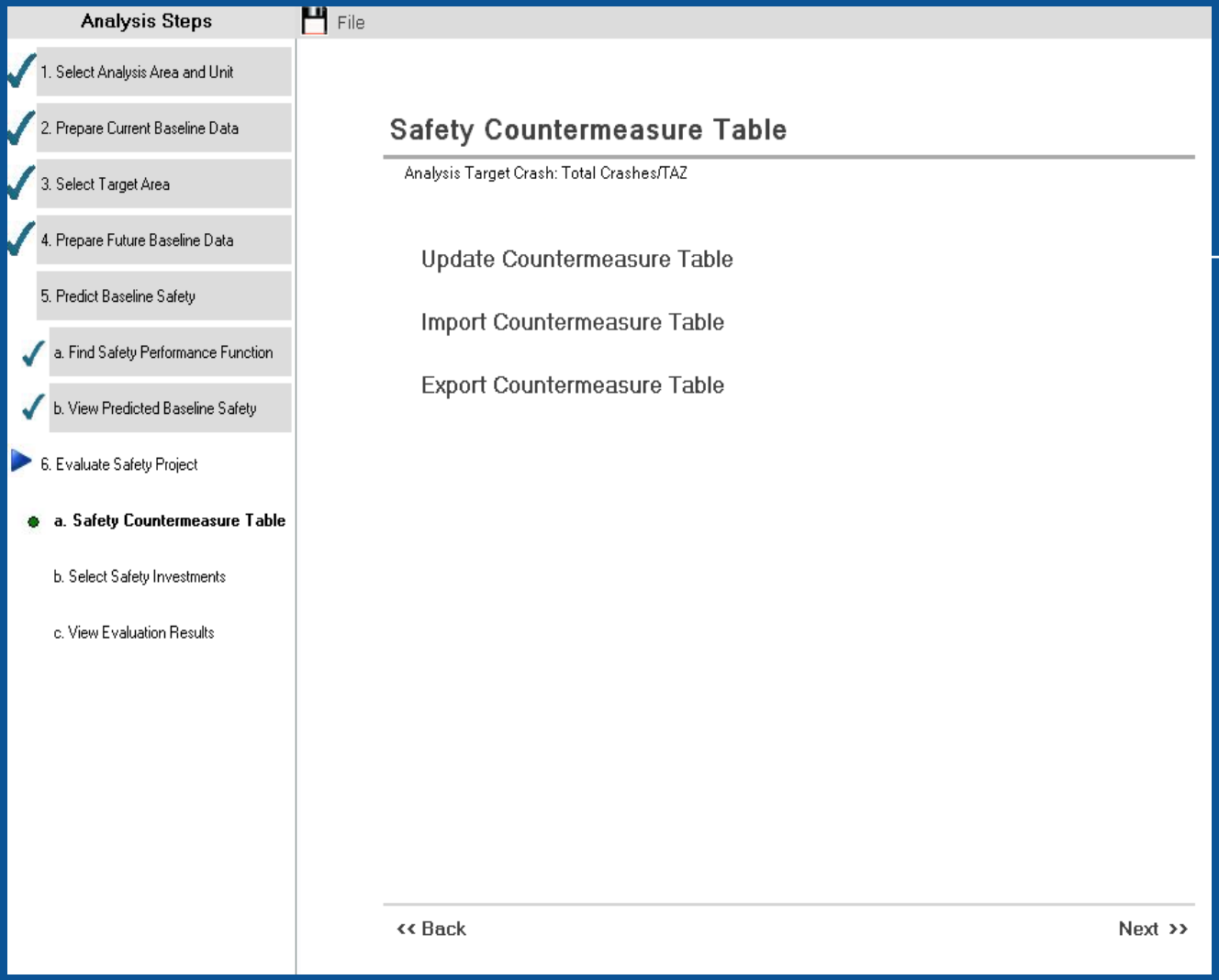
Analysis Target Crash: Total Crashes/TAZ

| Polygon ID | Expected Crash Frequency (Current Baseline) | Predicted Crash Frequency (Future Baseline) |
|---|---|---|
| 1425 | 186.25 | 226.1 |
| 1427 | 184.96 | 222.82 |
| 1481 | 107.72 | 121.63 |
| 1480 | 96.13 | 107.38 |
| 1483 | 80.29 | 88.36 |
| 1429 | 29.75 | 31.01 |
| 1447 | 24.17 | 25.19 |
| 1430 | 21.91 | 22.84 |
| 1448 | 19.79 | 20.63 |
| 1385 | 232.33 | 259.75 |
| 1345 | 230.41 | 259.05 |
| 1552 | 217.25 | 241.37 |
| 1551 | 199.55 | 219.09 |
| 1339 | 190.62 | 211.34 |
| 1426 | 192.06 | 209.99 |
| 1555 | 188.52 | 209.87 |
| 1500 | 169.16 | 184.01 |
| 1600 | 151.34 | 166.81 |
| 1522 | 151.14 | 162.84 |
| 1382 | 137.41 | 147.66 |
| 1185 | 111.91 | 119.22 |
| 1520 | 106.23 | 111.58 |

| | Target Zones | All Zones |
|---|---|---|
| Expected Crash Frequency (Current Baseline): | 750.97 | 5957.25 |
| Predicted Crash Frequency (Future Baseline): | 865.96 | 6409.94 |
| Change in Safety Due to Socio-Demographic Growth (%)*: | 15.31 % | 7.6 % |

* Positive value indicates increase in crash due to Socio-Demographic Growth

# Safety Countermeasure Table




Submitting the safety countermeasure table is not necessary unless users want to use state-specific countermeasure table

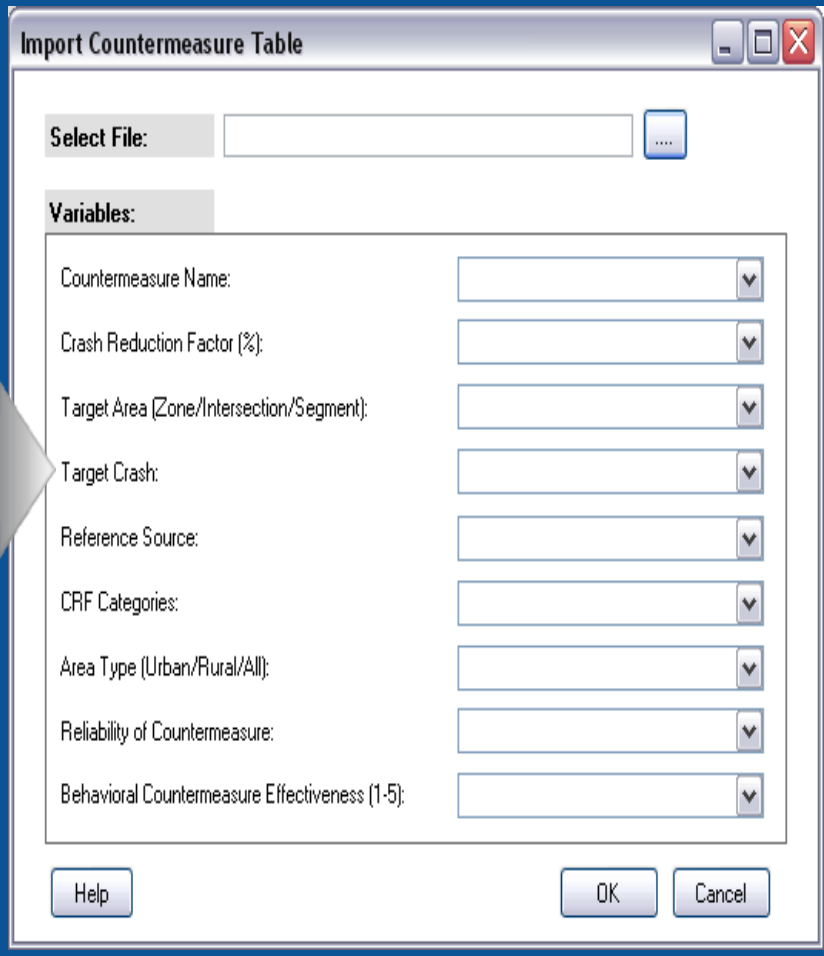
# Safety Countermeasure Table: Import New Countermeasure Table

- Users can import a countermeasure table into PLANSAFE database if they want to apply state specific countermeasures, which generally contain the crash reduction factors estimated from safety evaluations conducted or relevant to users' state

# Safety Countermeasure Table: Import New Countermeasure Table (cont'd)

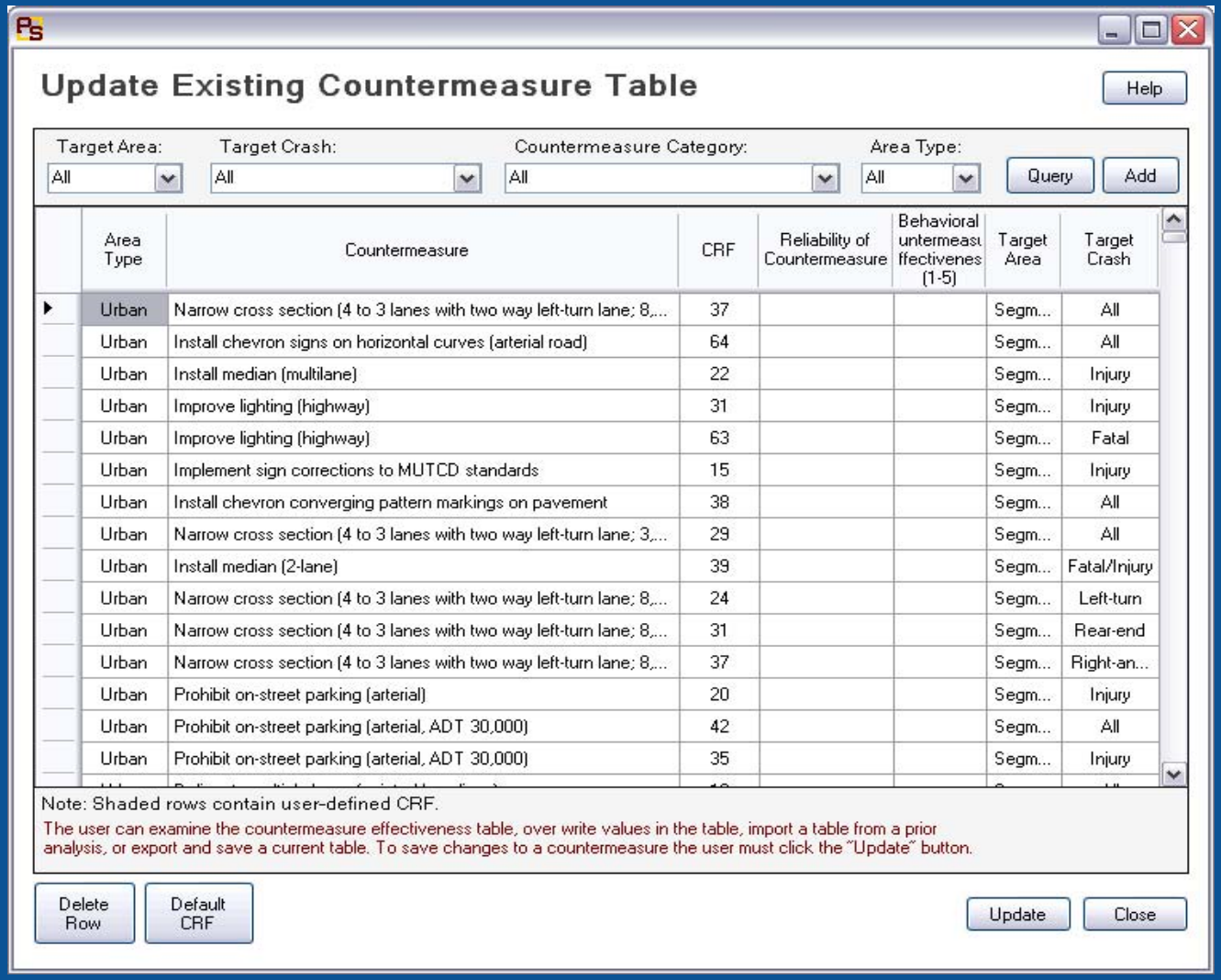
DBF or MS Excel File

| | Variable | Definition* | Type |
|---|---|---|---|
| Required variables | Countermeasure | Countermeasure name | Text |
| | CRF | Crash reduction factor, or the expected percent reduction in crashes | Number |
| | Target Area | Type of area where the countermeasure can be applied (zone, intersection, or segment) | Text (Zone, Intersection, or Segment) |
| | Target Crash | Crash types to be directly affected by the countermeasure | Text |
| | Reference Source | Research reference where countermeasure information is obtained | Text |
| Optional variables | CRF Categories | Categorical classification of countermeasure | Text |
| | Area Type | Area type where countermeasure is relevant | Text (All, Urban, Rural) |
| | Measure of Reliability | Cash reduction factor level of predictive certainty | Text |
| | Measure of Effectiveness | Maximum effect that can be realized with high-quality implementation. | Number (1-5) |



# Safety Countermeasure Table: Update Existing Countermeasure Table

- Users can select this option to view and/or update an existing countermea sure table*



Update Existing Countermeasure Table

Help

Target Area: All | Target Crash: All | Countermeasure Category: All | Area Type: All | Query | Add

| Area Type | Countermeasure | CRF | Reliability of Countermeasure | Behavioral untermeasu ffectivenes (1-5) | Target Area | Target Crash |
|---|---|---|---|---|---|---|
| Urban | Narrow cross section (4 to 3 lanes with two way left-turn lane; 8,... | 37 | | | Segm... | All |
| Urban | Install chevron signs on horizontal curves (arterial road) | 64 | | | Segm... | All |
| Urban | Install median (multilane) | 22 | | | Segm... | Injury |
| Urban | Improve lighting (highway) | 31 | | | Segm... | Injury |
| Urban | Improve lighting (highway) | 63 | | | Segm... | Fatal |
| Urban | Implement sign corrections to MUTCD standards | 15 | | | Segm... | Injury |
| Urban | Install chevron converging pattern markings on pavement | 38 | | | Segm... | All |
| Urban | Narrow cross section (4 to 3 lanes with two way left-turn lane; 3,... | 29 | | | Segm... | All |
| Urban | Install median (2-lane) | 39 | | | Segm... | Fatal/Injury |
| Urban | Narrow cross section (4 to 3 lanes with two way left-turn lane; 8,... | 24 | | | Segm... | Left-turn |
| Urban | Narrow cross section (4 to 3 lanes with two way left-turn lane; 8,... | 31 | | | Segm... | Rear-end |
| Urban | Narrow cross section (4 to 3 lanes with two way left-turn lane; 8,... | 37 | | | Segm... | Right-an... |
| Urban | Prohibit on-street parking (arterial) | 20 | | | Segm... | Injury |
| Urban | Prohibit on-street parking (arterial, ADT 30,000) | 42 | | | Segm... | All |
| Urban | Prohibit on-street parking (arterial, ADT 30,000) | 35 | | | Segm... | Injury |

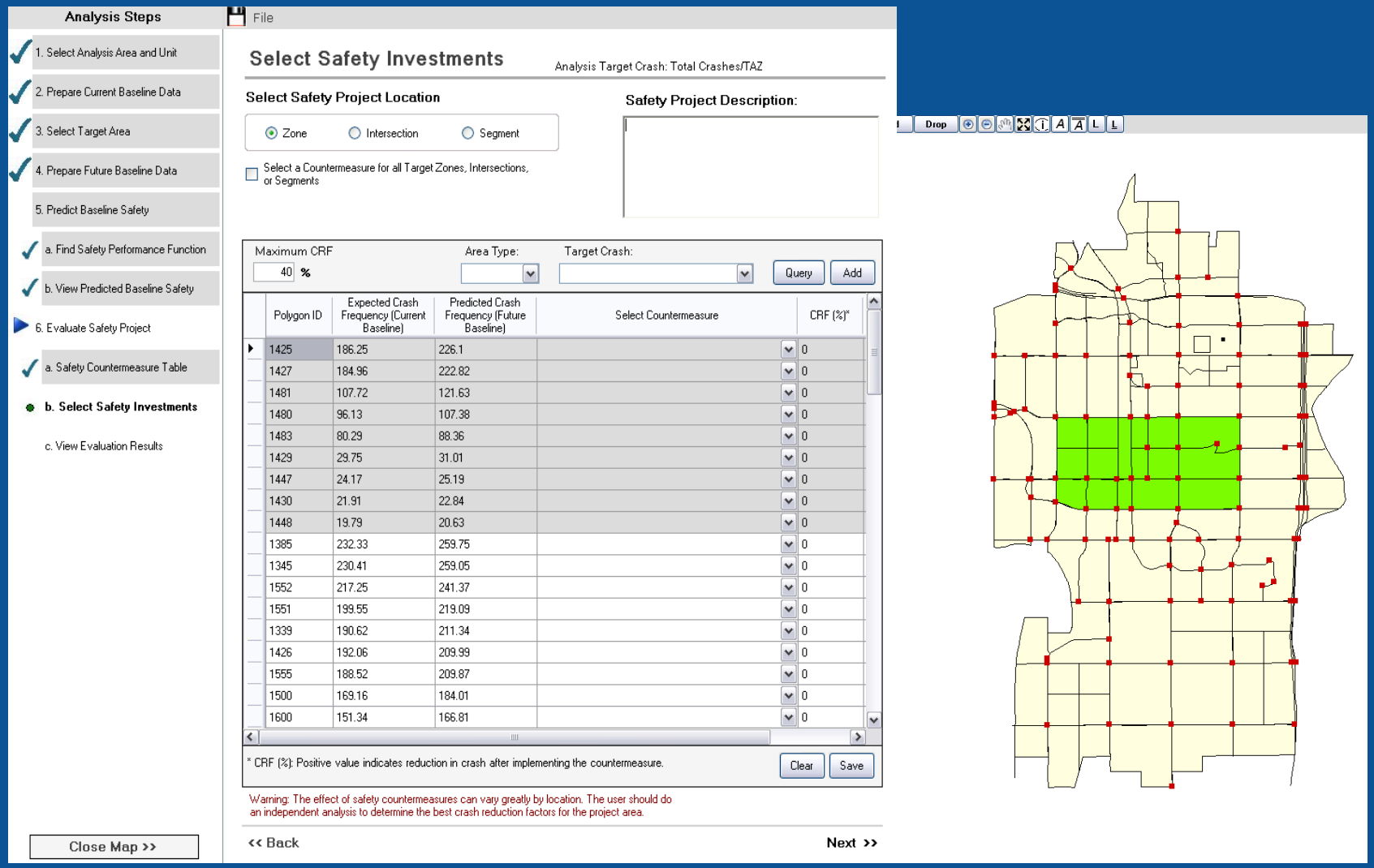
Note: Shaded rows contain user-defined CRF.

The user can examine the countermeasure effectiveness table, over write values in the table, import a table from a prior analysis, or export and save a current table. To save changes to a countermeasure the user must click the "Update" button.

Delete Row | Default CRF | Update | Close

•NHTSA, 2009, "Countermeasures that work: A highway safety countermeasure guide for state highway safety offices"
NCHRP, 2008, "Accident Modification Factors for Traffic Engineering and ITS Improvements"
FHWA, 2007, "Desktop Reference for Crash Reduction Factors"

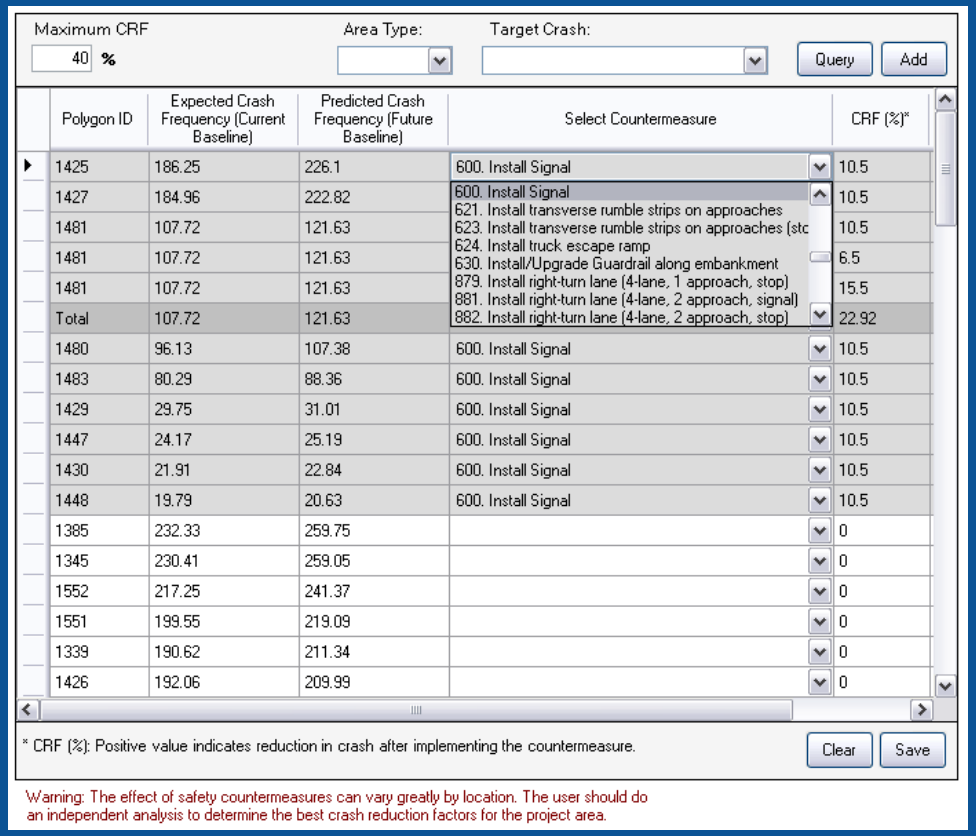
# Evaluate Safety: Select Safety



# Evaluate Safety: Select Safety Project (cont'd

- Select Safety Project Location
  - Before entering the safety countermeasure, users must choose the safety project location

- Safety Project Table
  - Once users select the safety project location, the safety project table will show the safety countermeasures for the selected project location
  - The record unit of the safety project table will change according to the selected safety project location




| Polygon ID | Expected Crash Frequency (Current Baseline) | Predicted Crash Frequency (Future Baseline) | Select Countermeasure | CRF (%)* |
|---|---|---|---|---|
| 1425 | 186.25 | 226.1 | 600. Install Signal | 10.5 |
| 1427 | 184.96 | 222.82 | 600. Install Signal | 10.5 |
| 1481 | 107.72 | 121.63 | 621. Install transverse rumble strips on approaches | 10.5 |
| 1481 | 107.72 | 121.63 | 623. Install transverse rumble strips on approaches (stc | 6.5 |
| 1481 | 107.72 | 121.63 | 624. Install truck escape ramp | 15.5 |
| Total | 107.72 | 121.63 | 630. Install/Upgrade Guardrail along embankment | 22.92 |
| 1480 | 96.13 | 107.38 | 879. Install right-turn lane (4-lane, 1 approach, stop) | 10.5 |
| 1483 | 80.29 | 88.36 | 881. Install right-turn lane (4-lane, 2 approach, signal) | 10.5 |
| 1429 | 29.75 | 31.01 | 882. Install right-turn lane (4-lane, 2 approach, stop) | 10.5 |
| 1447 | 24.17 | 25.19 | 600. Install Signal | 10.5 |
| 1430 | 21.91 | 22.84 | 600. Install Signal | 10.5 |
| 1448 | 19.79 | 20.63 | 600. Install Signal | 10.5 |
| 1385 | 232.33 | 259.75 | 600. Install Signal | 10.5 |
| 1345 | 230.41 | 259.05 | | 0 |
| 1552 | 217.25 | 241.37 | | 0 |
| 1551 | 199.55 | 219.09 | | 0 |
| 1339 | 190.62 | 211.34 | | 0 |
| 1426 | 192.06 | 209.99 | | 0 |

- Users also can select multiple safety countermeasure for different locations
  - E.g. users can select an intersection-related safety countermeasure and a segment-related countermeasure at the same time

# Evaluate Safety: View Evaluation Results

**Analysis Steps**

- ✓ 1. Select Analysis Area and Unit
- ✓ 2. Prepare Current Baseline Data
- ✓ 3. Select Target Area
- ✓ 4. Prepare Future Baseline Data
- 5. Predict Baseline Safety
  - ✓ a. Find Safety Performance Function
  - ✓ b. View Predicted Baseline Safety
- ▶ 6. Evaluate Safety Project
  - ✓ a. Safety Countermeasure Table
  - ✓ b. Select Safety Investments
  - ● **c. View Evaluation Results**

File

## View Safety Project Evaluation Results

Print

**Analysis Area and Unit**

| | | | |
|---|---|---|---|
| State | Arizona | County | Maricopa |
| Jurisdiction | Tempe | Analysis Unit | Traffic Analysis Zone |

**Analysis Target Crash:** Total Crashes/TAZ

**Target Area Description**

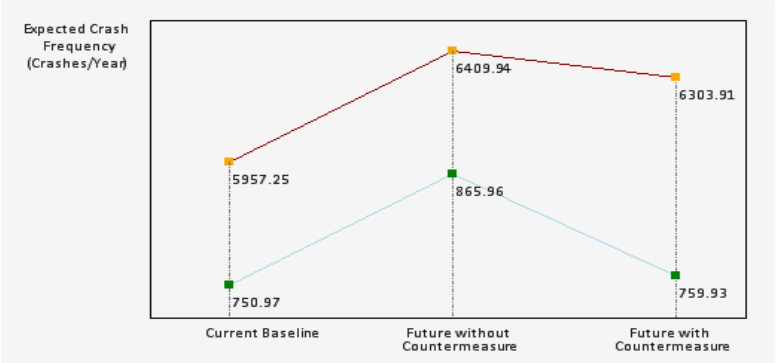
**Safety Project Description**

**Safety Impacts of Socio-Demographic Changes and Safety Countermeasure Investments**

| The assumed maximum effectiveness is 40% | Target Zones | All Zones |
|---|---|---|
| A. Expected Crash Frequency (Current Baseline): | 750.97 | 5957.25 |
| B. Predicted Crash Frequency (Without Countermeasure): | 865.96 | 6409.94 |
| C. Predicted Crash Frequency (With Countermeasure): | 759.93 | 6303.91 |
| D. Change in Safety Due to Socio-Demographic Growth (%)*: | -15.31 % | -7.6 % |
| E. Project Effectiveness (%)**: | 12.24 % | 1.65 % |

* Negative value indicates increase in crash due to Socio-Demographic Growth.
** Positive value indicates reduction in crash after implementing the selected countermeasure in the future.

**Expected Crash Frequency Plot**

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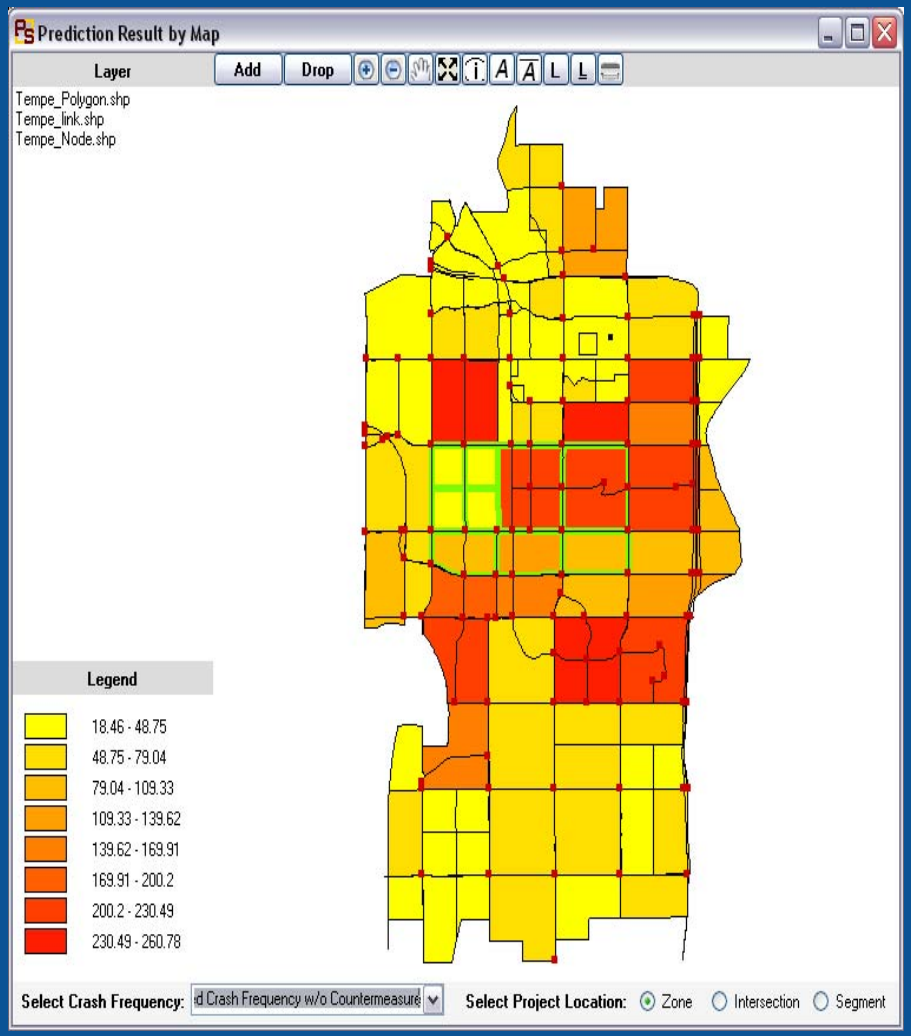
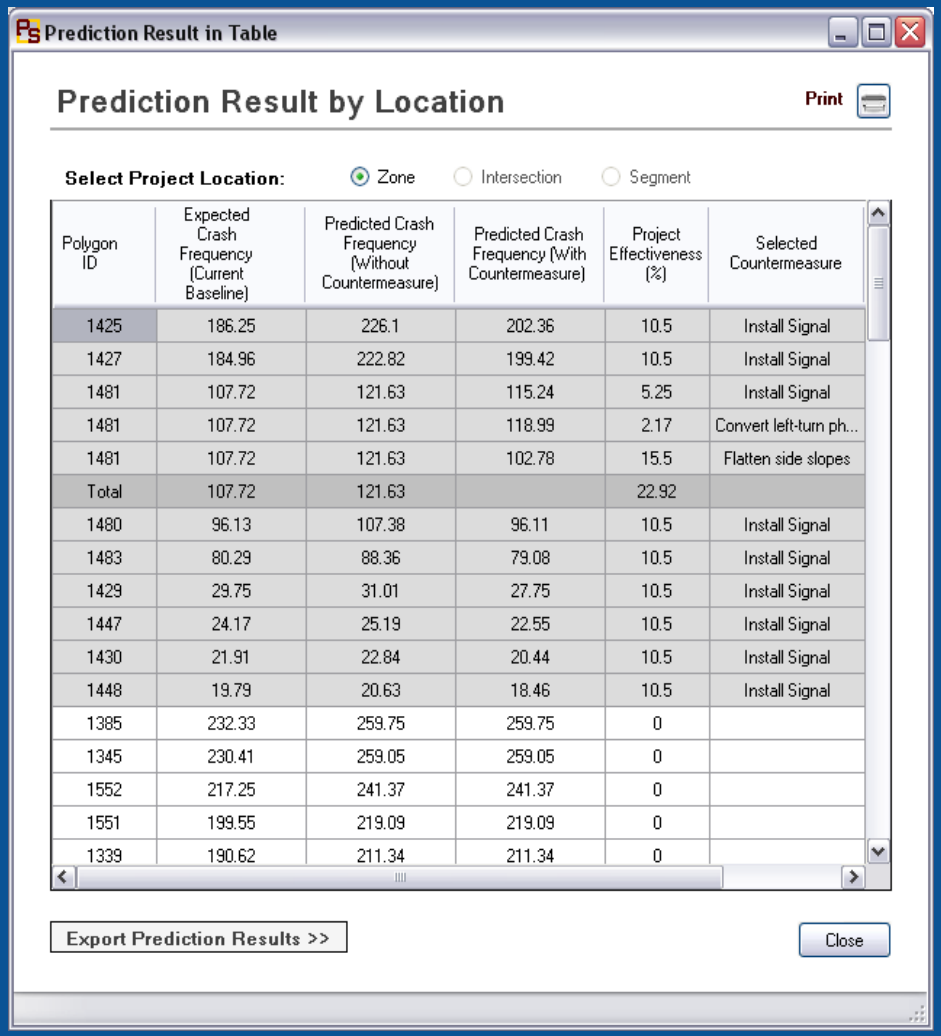
Show Prediction Result: Map Table

# Evaluate Safety: View Evaluation Results (cont'd)




| Polygon ID | Expected Crash Frequency (Current Baseline) | Predicted Crash Frequency (Without Countermeasure) | Predicted Crash Frequency (With Countermeasure) | Project Effectiveness (%) | Selected Countermeasure |
|---|---|---|---|---|---|
| 1425 | 186.25 | 226.1 | 202.36 | 10.5 | Install Signal |
| 1427 | 184.96 | 222.82 | 199.42 | 10.5 | Install Signal |
| 1481 | 107.72 | 121.63 | 115.24 | 5.25 | Install Signal |
| 1481 | 107.72 | 121.63 | 118.99 | 2.17 | Convert left-turn ph... |
| 1481 | 107.72 | 121.63 | 102.78 | 15.5 | Flatten side slopes |
| Total | 107.72 | 121.63 | | 22.92 | |
| 1480 | 96.13 | 107.38 | 96.11 | 10.5 | Install Signal |
| 1483 | 80.29 | 88.36 | 79.08 | 10.5 | Install Signal |
| 1429 | 29.75 | 31.01 | 27.75 | 10.5 | Install Signal |
| 1447 | 24.17 | 25.19 | 22.55 | 10.5 | Install Signal |
| 1430 | 21.91 | 22.84 | 20.44 | 10.5 | Install Signal |
| 1448 | 19.79 | 20.63 | 18.46 | 10.5 | Install Signal |
| 1385 | 232.33 | 259.75 | 259.75 | 0 | |
| 1345 | 230.41 | 259.05 | 259.05 | 0 | |
| 1552 | 217.25 | 241.37 | 241.37 | 0 | |
| 1551 | 199.55 | 219.09 | 219.09 | 0 | |
| 1339 | 190.62 | 211.34 | 211.34 | 0 | |

# Evaluate Safety: View Evaluation Results (cont'd)

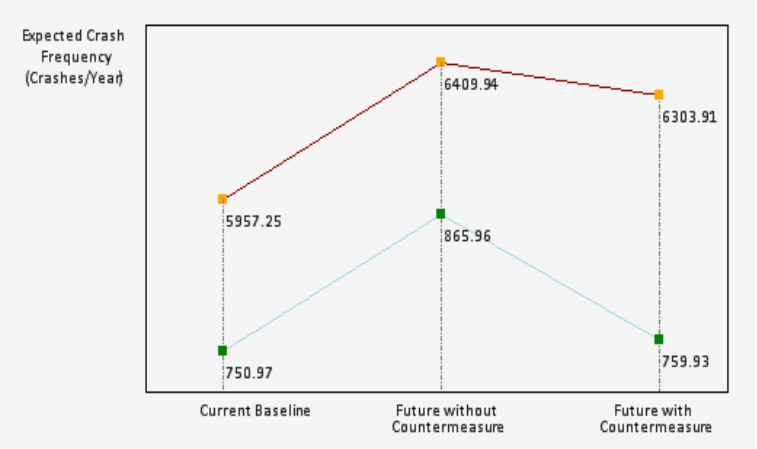
**Safety Impacts of Socio-Demographic Changes and Safety Countermeasure Investments**

| The assumed maximum effectiveness is 40% | Target Zones | All Zones |
|---|---|---|
| A. Expected Crash Frequency (Current Baseline): | 750.97 | 5957.25 |
| B. Predicted Crash Frequency (Without Countermeasure): | 865.96 | 6409.94 |
| C. Predicted Crash Frequency (With Countermeasure): | 759.93 | 6303.91 |
| D. Change in Safety Due to Socio-Demographic Growth (%)*: | -15.31 % | -7.6 % |
| E. Project Effectiveness (%)**: | 12.24 % | 1.65 % |

* Negative value indicates increase in crash due to Socio-Demographic Growth.

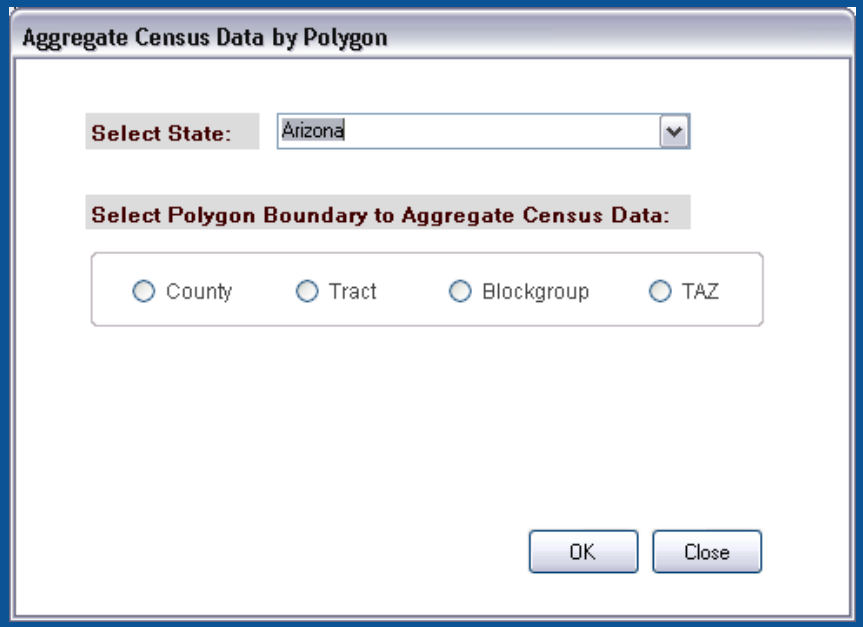
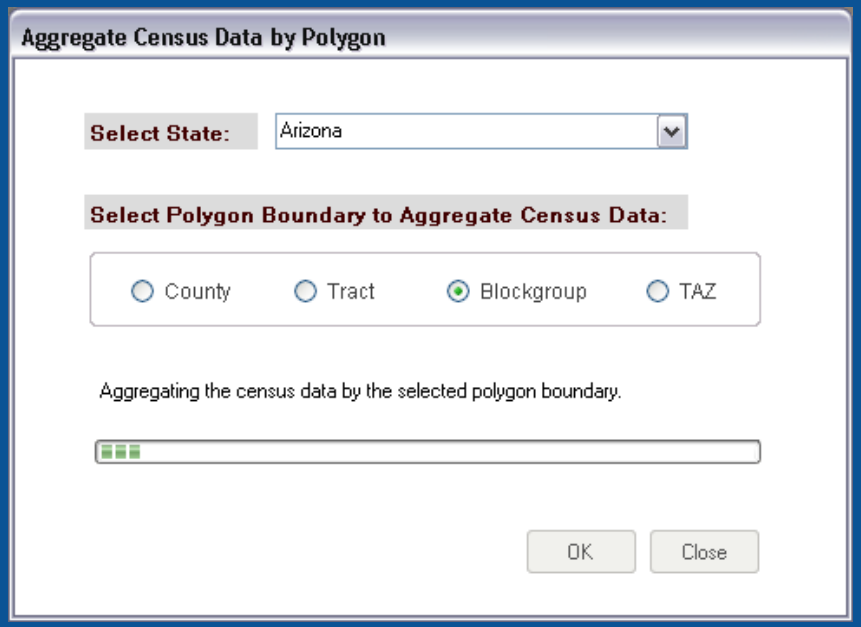
** Positive value indicates reduction in crash after implementing the selected countermeasure in the future.

**Expected Crash Frequency Plot**




- The baseline safety in the target area increases by 15.31% due to the socio-demographic growth from the current baseline to the future baseline
- However, after implementing the selected countermeasures, the total crashes in the target area in the future is expected to be reduced by 12.24%

# Software Demonstration and Discussion

# Aggregate Census Data by Polygon

- When users want to aggregate the census information by the polygon units used in the census study (i.e. County, Tract, or Blockgroup), the census data can be easily summarized without any geographical manipulation.
- Note that the census data structure has the following hierarchical sequence: "County >> Tract >> Blockgroup (BG).