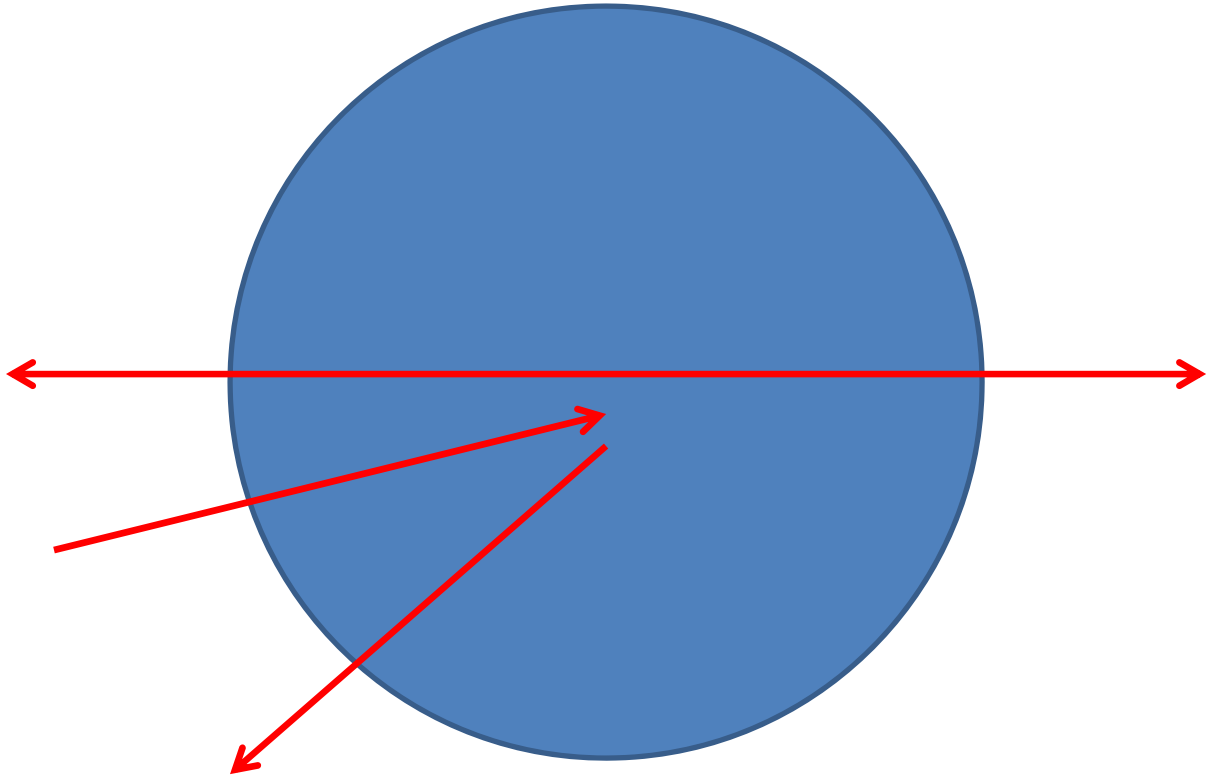
External Travel Analysis

NCHRP 365 vs. iTRAM

E-E, E-I/I-E



NCHRP 365

CHAPTER 5

EXTERNAL TRAVEL ESTIMATION

INTRODUCTION

External trips are trips that have at least one end outside the study area defined by an encircling cordon line. When both the origin and destination of a trip are outside the cor-

The first method provides data only on through travel and does not allow for the estimation of observed external-internal or internal-external travel. The second method, although providing data on all external travel, has the disadvantage of a definite time lag between the time the trip is actually made

Historically, the most popular method for collecting external travel data is to conduct a roadside intercept survey at the regional cordon. Very few roadside surveys have been conducted in recent years, primarily because of the concern that stopping vehicles on the highway would be perceived as an unacceptable intrusion on the motorist. Poorly conducted roadside surveys have resulted in unnecessary delays and extended queues of vehicles. Alternative, nonintrusive sur-

regional cordon. Very few roadside surveys have been conducted in recent years, primarily because of the concern that stopping vehicles on the highway would be perceived as an unacceptable intrusion on the motorist. Poorly conducted roadside surveys have resulted in unnecessary delays and extended queues of vehicles. Alternative, nonintrusive survey methods have been used to collect external survey data. These include the following:

external travel is applicable only to smaller sized urban areas.

BASIS FOR DEVELOPMENT

In most regional or large-area studies, an external cordon survey is a required input to the travel modeling process. An external survey can provide accurate information on trip

NCHRP 365

The procedure presented below produces reasonable results for small urban areas, particularly those with populations of 50,000 or less. For interstates and principal arterials, the rates appear to be reasonable for areas with a population up to about 100,000. For areas with populations greater than 100,000, the method produces through trip percentages that are less than zero, an illogical conclusion. The research conducted in this project yielded very little in the treatment of

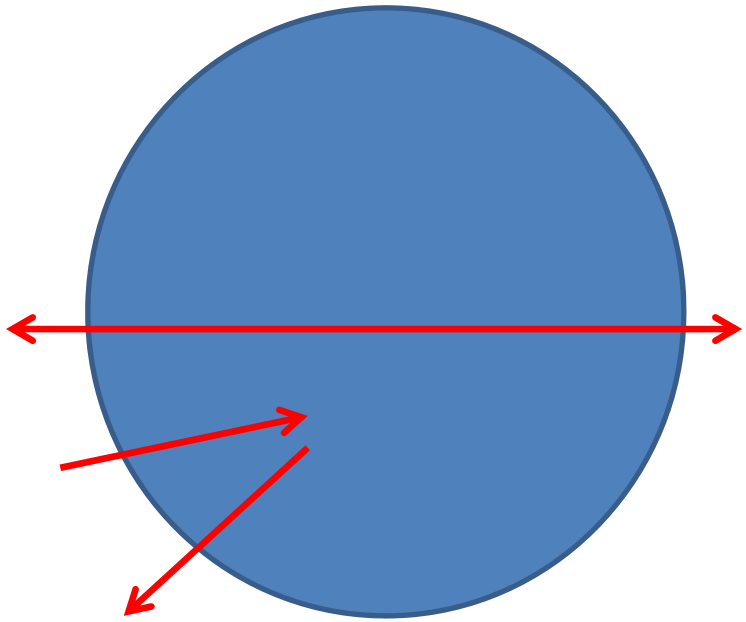
The smaller area- and sketch-planning studies for which this report has been designed may not have the resources to conduct a survey of external travel. An alternative method for estimating external travel is required and presented in this chapter.

Use of Statewide Models

- 13 of 19 states that had an operational statewide model in a 2006 survey used it for MPO-level external station analysis
  - NCHRP 358
- MPO External Trip Forecast Methods Survey, 2006
  - Survey high-growth MPOs

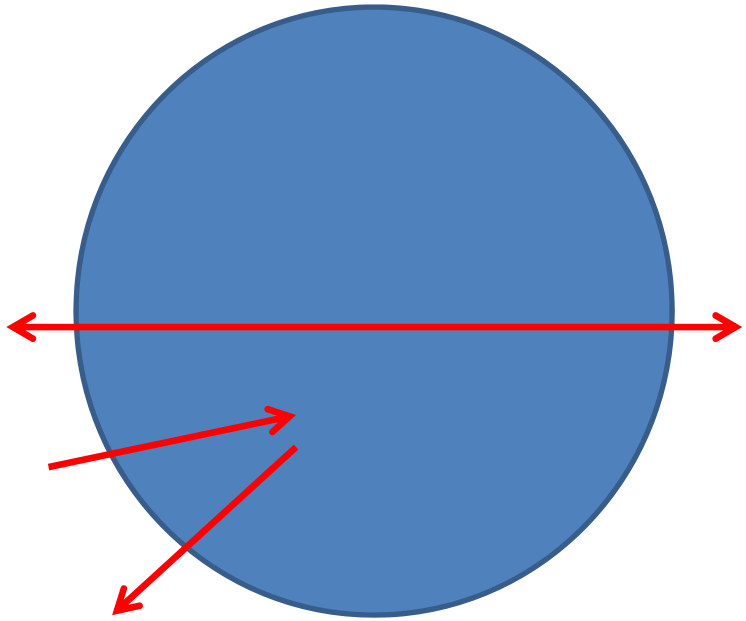
E-E Goals

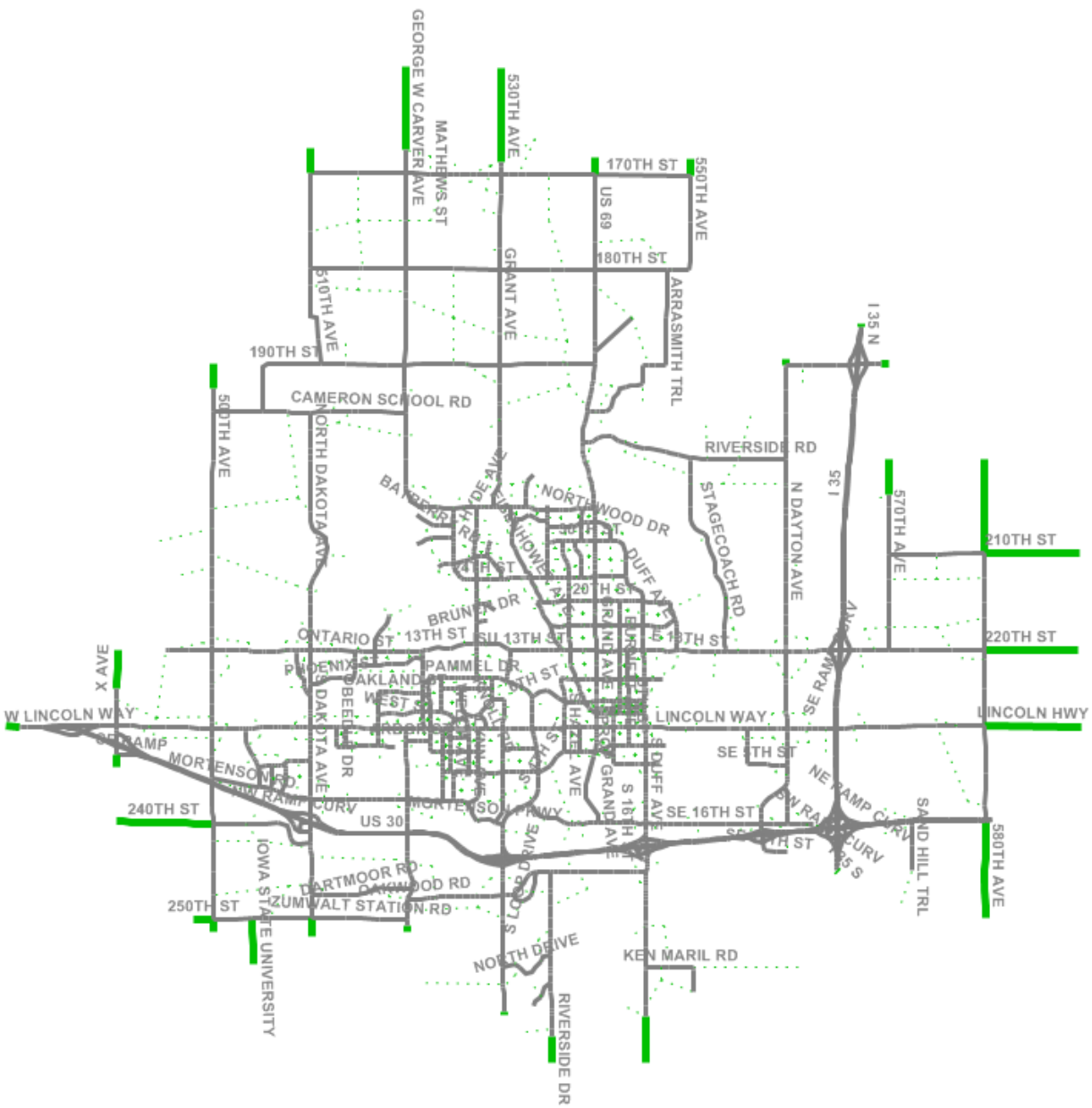
- Decide which external stations will have through trips
- Figure out percentage of E-E trips
- Figure out distribution of E-E trips



E-I/I-E Goals

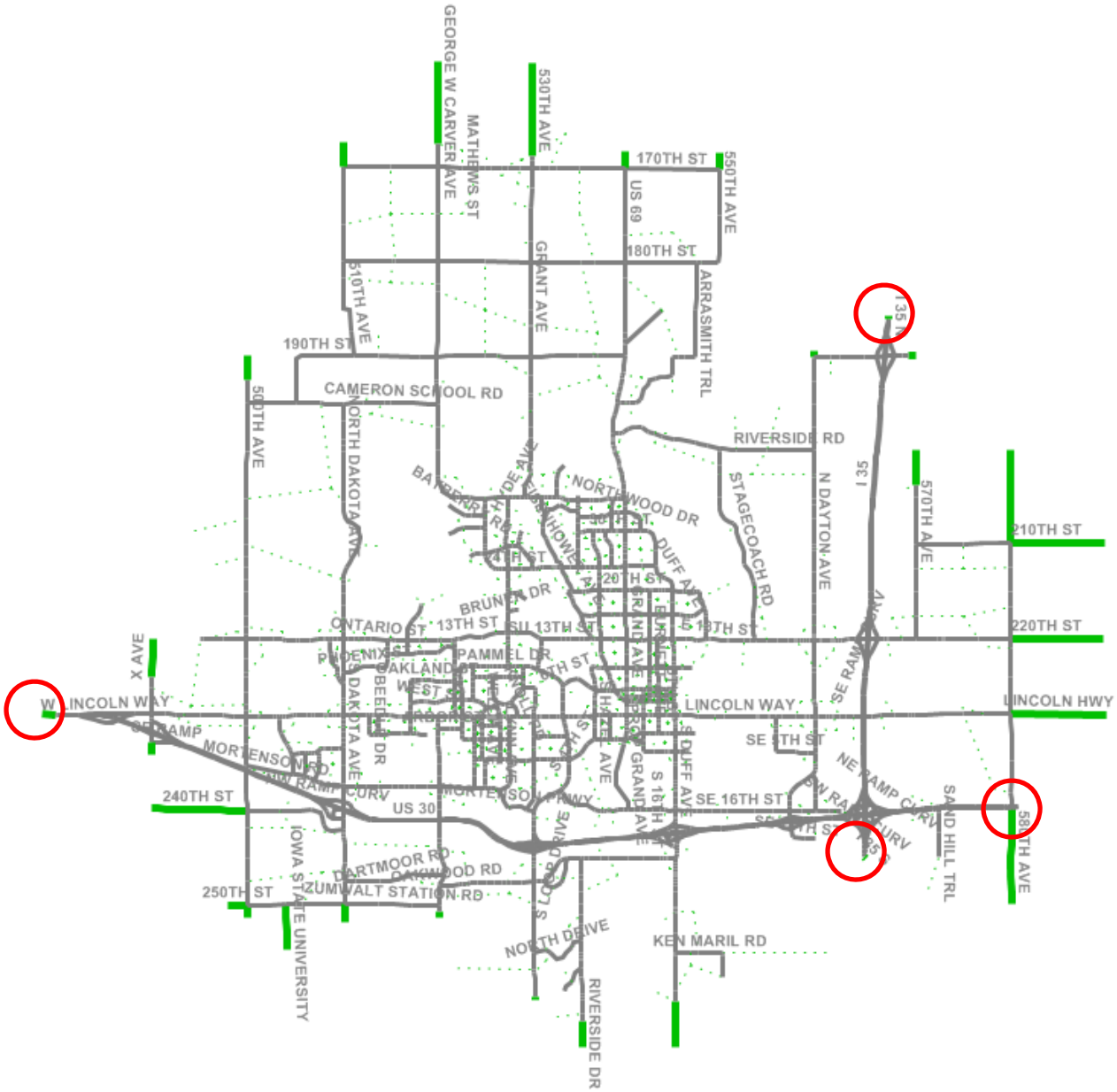
- Figure out number of E-I/I-E trips
- Split into trip purposes (HBW, HBO, NHB)




GEORGE W CARVER AVE
MATHEWS ST
530TH AVE
170TH ST
550TH AVE
US 69
180TH ST
GRANT AVE
ARRASMITH TRL
510TH AVE
190TH ST
I 35 N
CAMERON SCHOOL RD
500TH AVE
NORTH DAKOTA AVE
RIVERSIDE RD
STAGECOACH RD
N DAYTON AVE
I 35
570TH AVE
210TH ST
NORTHWOOD DR
DUFF AVE
20TH ST
BRUNETTE DR
ONTARIO ST
13TH ST
S 13TH ST
220TH ST
PHOENIX
PAMMEL DR
OAKLAND
9TH ST
GRAND AVE
X AVE
W LINCOLN WAY
LINCOLN WAY
LINCOLN HWY
SE RAMP
SE 5TH ST
NE RAMP CURV
MORTENSON RD
240TH ST
SE 16TH ST
US 30
SAND HILL TRL
580TH AVE
DARTMOOR RD
OAKWOOD RD
250TH ST
ZUMWALT STATION RD
IOWA STATE UNIVERSITY
NORTH DRIVE
KEN MARIL RD
RIVERSIDE DR

E-E Goals – NCHRP 365 Method

- Decide which external stations will have through trips
- Figure out percentage of E-E trips
- Figure out distribution of E-E trips


GEORGE W CARVER AVE
MATHEWS ST
530TH AVE
170TH ST
550TH AVE
US 69
180TH ST
ARRASMITH TRL
510TH AVE
GRANT AVE
190TH ST
CAMERON SCHOOL RD
500TH AVE
NORTH DAKOTA AVE
RIVERSIDE RD
STAGECOACH RD
N DAYTON AVE
I 35
570TH AVE
210TH ST
220TH ST
LINCOLN HWY
W LINCOLN WAY
SE LINCOLN WAY
SE 5TH ST
SE 16TH ST
240TH ST
US 30
MORTENSON RD
SAND HILL TRL
580TH AVE
DARTMOOR RD
PAXWOOD RD
250TH ST
ZUMWALT STATION RD
IOWA STATE UNIVERSITY
NORTH DRIVE
KEN MARIL RD
RIVERSIDE DR
ONTARIO ST
13TH ST
PHOENIX ST
OAKLAND ST
PAMMEL DR
BEECH DR
WEST ST
9TH ST
DUFF AVE
GRAND AVE
S 16TH ST
BRUNS DR
20TH ST

E-E Goals – NCHRP 365 Method

- ~~Decide which external stations will have through trips~~
- Figure out percentage of E-E trips
- Figure out distribution of E-E trips

$$Y_i = 76.76 + 11.22 \times I - 25.74 \times PA - 042.18 \times MA + 0.00012 \times ADT_i + 0.59 \times PTKS_i - 0.48 \times PPS_i - 0.000417 \times POP \quad (5\text{-}1)$$

where

Y_i = percentage of the ADT at external station i, that are through trips,
I = interstate (0 or 1),
PA = principal arterial (0 or 1),
MA = minor arterial (0 or 1),
ADT_i = average daily traffic at external station i,
$PTKS_i$ = percentage of trucks excluding vans and pickups at external station i,
PPS_i = percentage of vans and pickups at external station i, and
POP = population inside the cordon area.

E-E Goals – NCHRP 365 Method

- ~~Decide which external stations will have through trips~~
- ~~Figure out percentage of E-E trips~~
- Figure out distribution of E-E trips

Interstate:

$$Y_{ij} = -2.70 + 0.21 \times PTTDES_j + 67.86 \times RTECON_{ij} \quad (5\text{-}2)$$

where

Y_{ij} = percentage distribution of through-trip ends from origin station i to destination station j,

$PTTDES_j$ = percentage through-trip ends at destination station j,

$RTECON_{ij}$ = route continuity between stations i and j: 1 = Yes, 0 = No, and

E-E Goals – NCHRP 365 Method

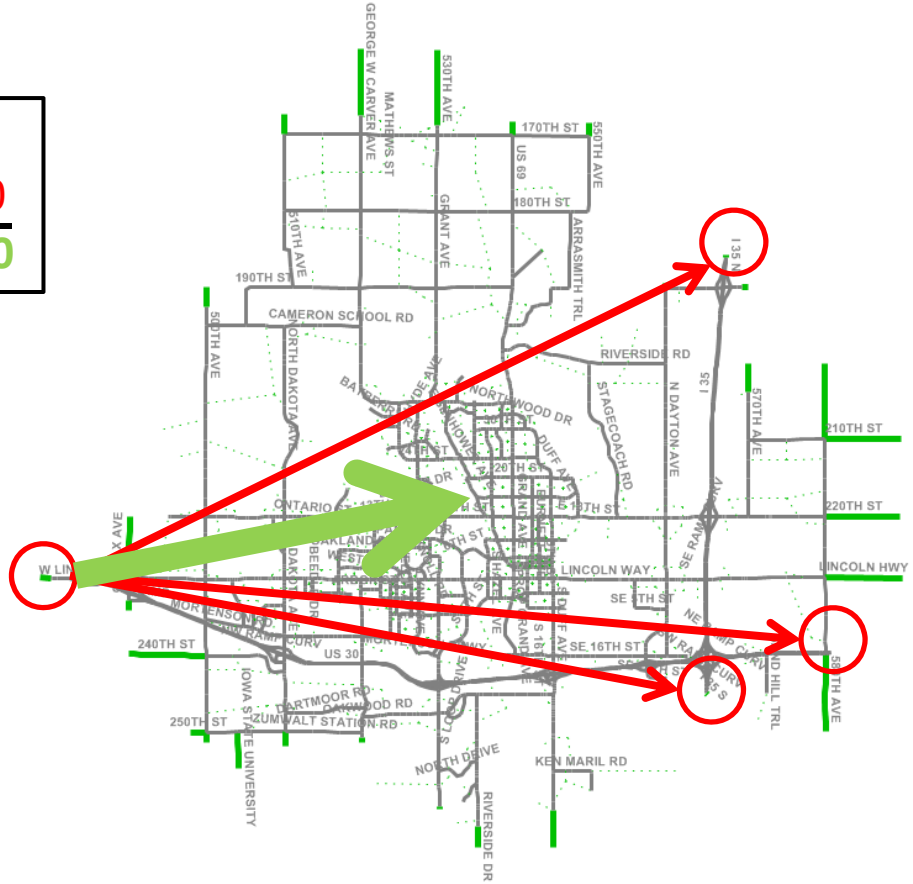
- ~~Decide which external stations will have through trips~~
- ~~Figure out percentage of E-E trips~~
- ~~Figure out distribution of E-E trips~~

E-I/I-E Goals – NCHRP 365 Method

- Figure out number of E-I/I-E trips
- Split into trip purposes (HBW, HBO, NHB)

- Subtract E-E Trips from count ← E-I/I-E Trips

Count:	20,000
E-E Total:	- 3,000
E-I/I-E Total:	**17,000**



E-I/I-E Goals – NCHRP 365 Method

- ~~Figure out number of E-I/I-E trips~~
- Split into trip purposes (HBW, HBO, NHB)

TABLE 26 External trip purpose/residency factors for centralized areas[1]

Trip Purpose	Resident	Non-Resident	Total
Home-Based Work	12%	34%	46%
Home-Based Other	9	23	32
Non-Home-Based	11	11	22
Total	32	68	100

[1] San Juan, Puerto Rico 1990 External Cordon Survey.

TABLE 27 External trip purpose/residency factors for evenly distributed areas[1]

Trip Purpose	Resident	Non-Resident	Total
Home-Based Work	15%	10%	25%
Home-Based Other	27	23	50
Non-Home-Based	8	17	25
Total	50	50	100

[1] San Diego Region.

E-I/I-E Goals – NCHRP 365 Method

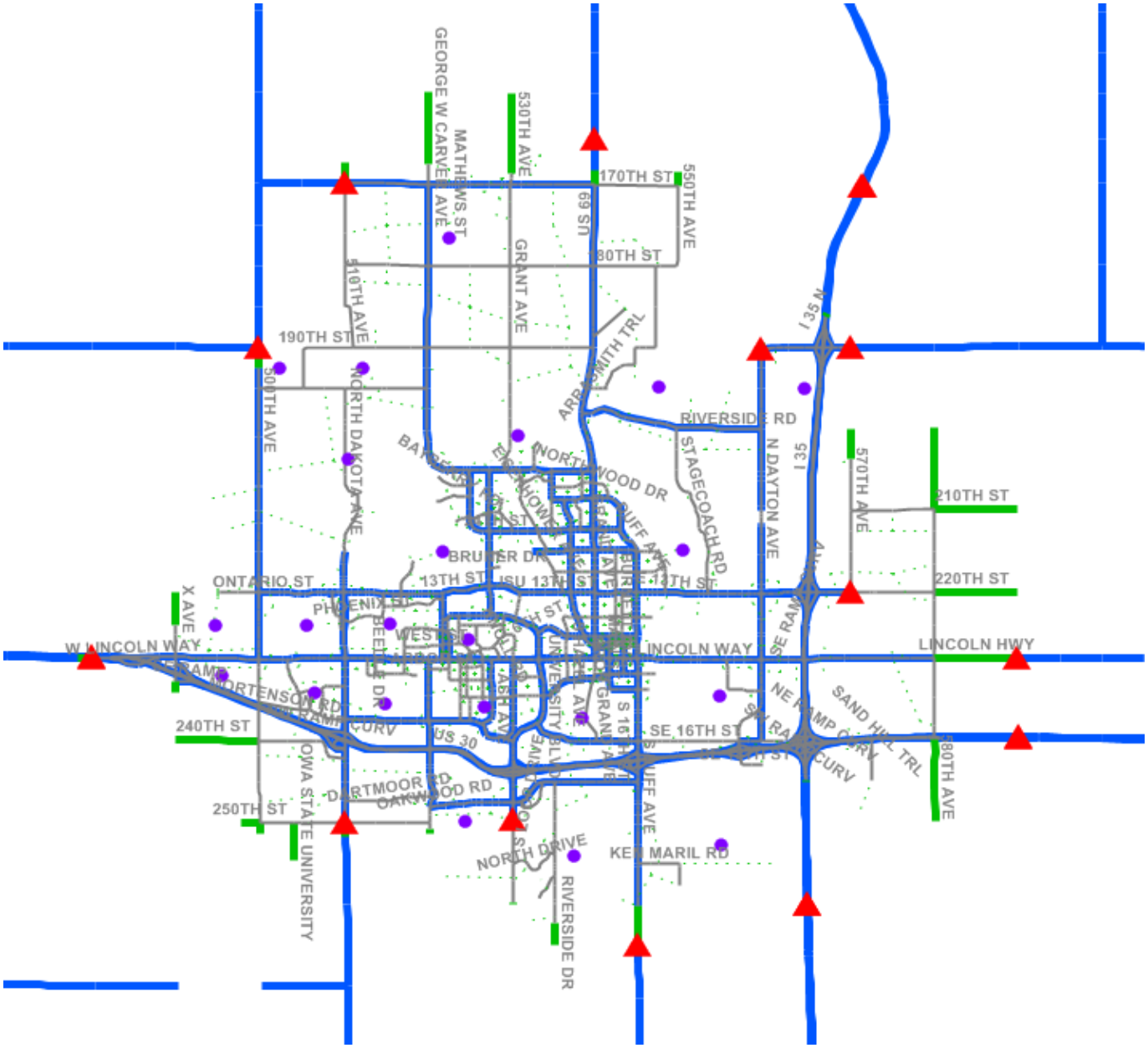
- ~~Figure out number of E-I/I-E trips~~
- ~~Split into trip purposes (HBW, HBO, NHB)~~

→ Then, forecast each station…

E-E Goals – iTRAM Method

- Decide which external stations will have through trips
- Figure out percentage of E-E trips
- Figure out distribution of E-E trips

Blue = iTRAM network
Red = Sub-externals
Purple = Sub-centroids



iTRAM ID		48672	48742	48745	48824	48975	48993	49403	49805	49831	49839	49846	49855	49857	49873	49991	49993	49998	118245
	TAZ	1003	1000	1000	1027	1023	1025	1033	1009	1017	1017	1016	1020	1020	1015	1010	1011	1010	1036
48672	1003			101	35	134				209		23		175					
48742	1000					232			4	726		79		107			24		
48745	1000																		
48824	1027	11		95															0
48975	1023	27		600					6	352		52				106	27		129
48993	1025																		
49403	1033								15										70
49805	1009			10		6		7		38		3		104		514	723		6
49831	1017																		
49839	1017	33		930		333			52					1155		501			2
49846	1016	4		123	2	52													58
49855	1020	34		589					103	1180						11127	253		4
49857	1020																		
49873	1015																		
49991	1010																		
49993	1011			80		46			693					263		327			
49998	1010			90		122			531	330		34		11266			430		
118245	1036				0	124		70	7	1		71		5					

E-E Goals – iTRAM Method

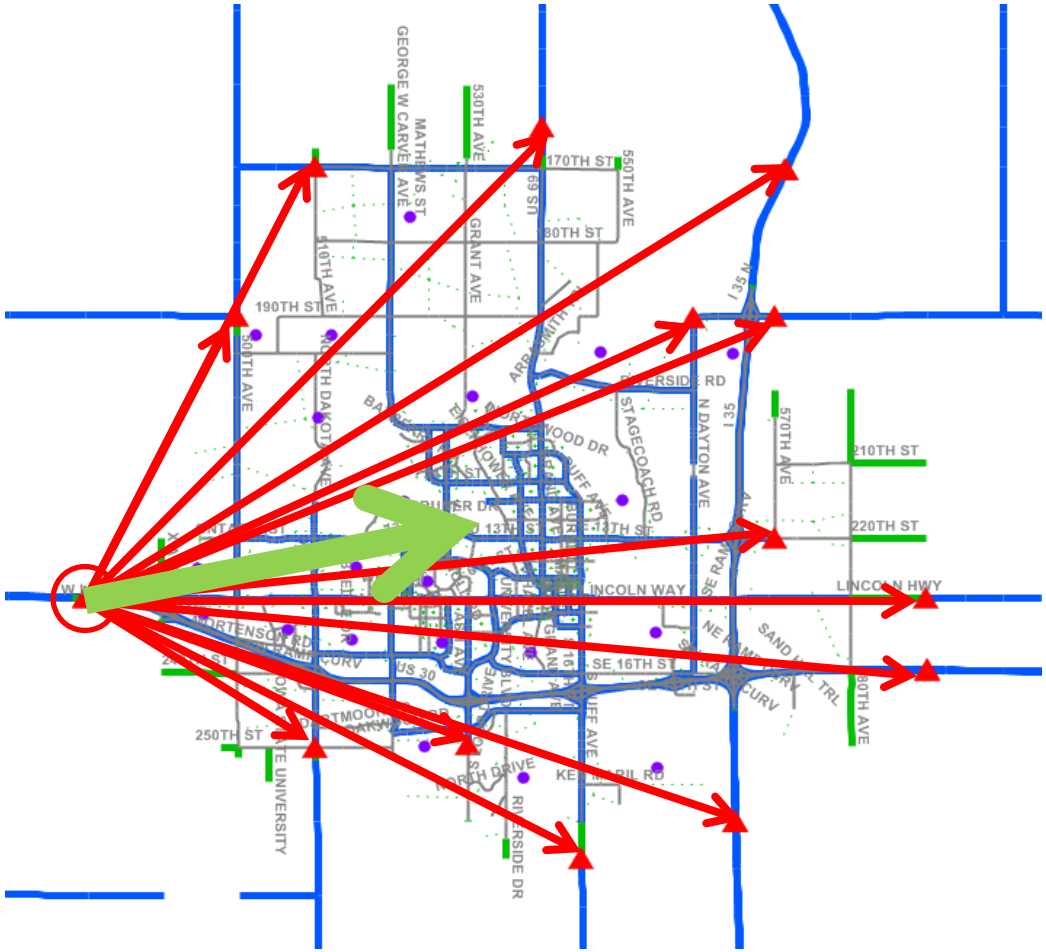
- ~~Decide which external stations will have through trips~~
- ~~Figure out percentage of E-E trips~~
- ~~Figure out distribution of E-E trips~~

E-I/I-E Goals – iTRAM Method

- Figure out number of E-I/I-E trips
- Split into trip purposes (HBW, HBO, NHB)

- Subtract E-E Trips from count ← E-I/I-E Trips

Count:	20,000
E-E Total:	- 3,000
E-I/I-E Total:	17,000



E-I/I-E Goals – iTRAM Method

- ~~Figure out number of E-I/I-E trips~~
- Split into trip purposes (HBW, HBO, NHB)

- Run iTRAM Subarea for each trip purpose separately (HBW, HBO, NHB) to get percentage of each ← E-I/I-E Flow by iTRAM Trip Purpose
- Apply percentages of each trip purpose to calculated number of E-I/I-E trips

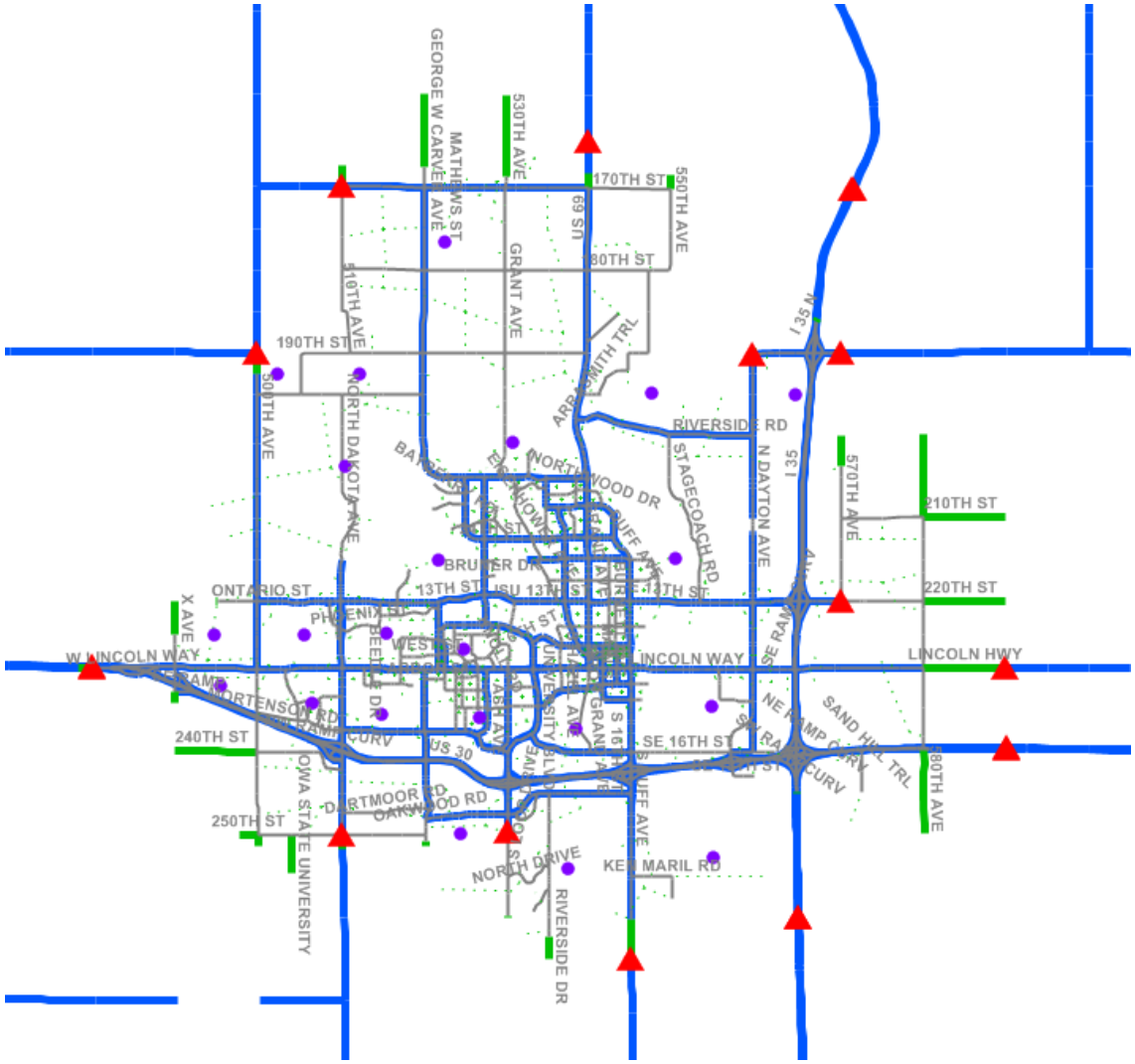
E-I/I-E Goals – iTRAM Method

- ~~Figure out number of E-I/I-E trips~~
- ~~Split into trip purposes (HBW, HBO, NHB)~~

→ Then, use iTRAM for forecast year to forecast each station…

External Stations that are not available in iTRAM

- For smaller external stations, use count and split by percent of each Trip Purpose ← E-I/I-E Flow by Trip Purpose



E-I/I-E Comparison of Results

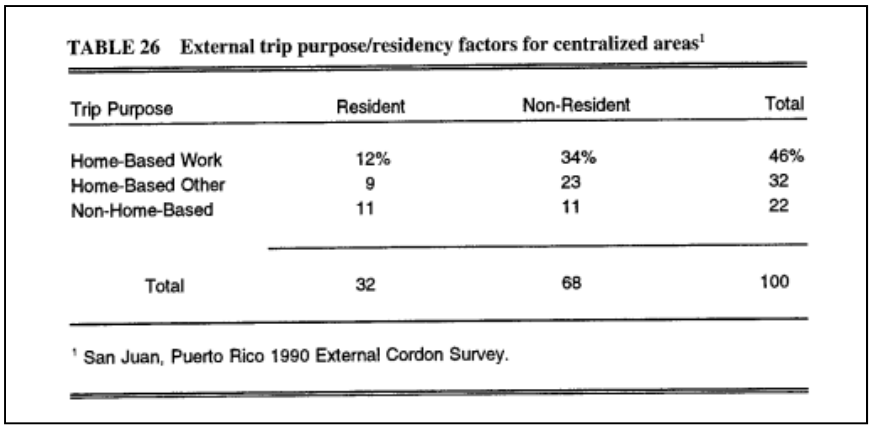


TABLE 26 External trip purpose/residency factors for centralized areas[1]

Trip Purpose	Resident	Non-Resident	Total
Home-Based Work	12%	34%	46%
Home-Based Other	9	23	32
Non-Home-Based	11	11	22
Total	32	68	100

[1] San Juan, Puerto Rico 1990 External Cordon Survey.

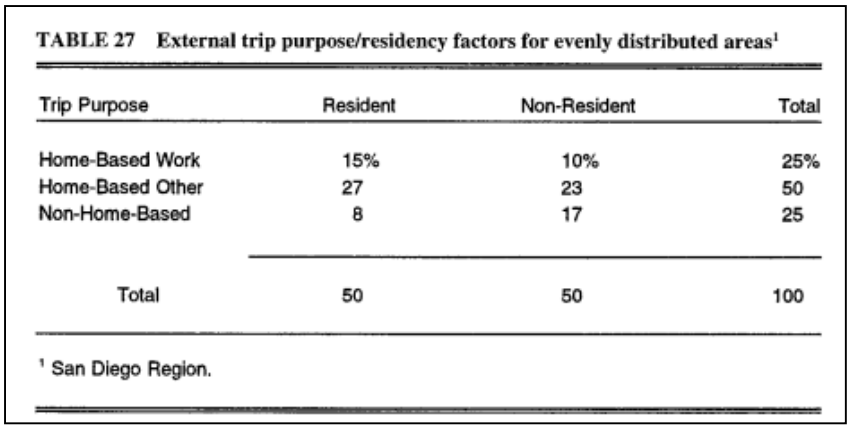


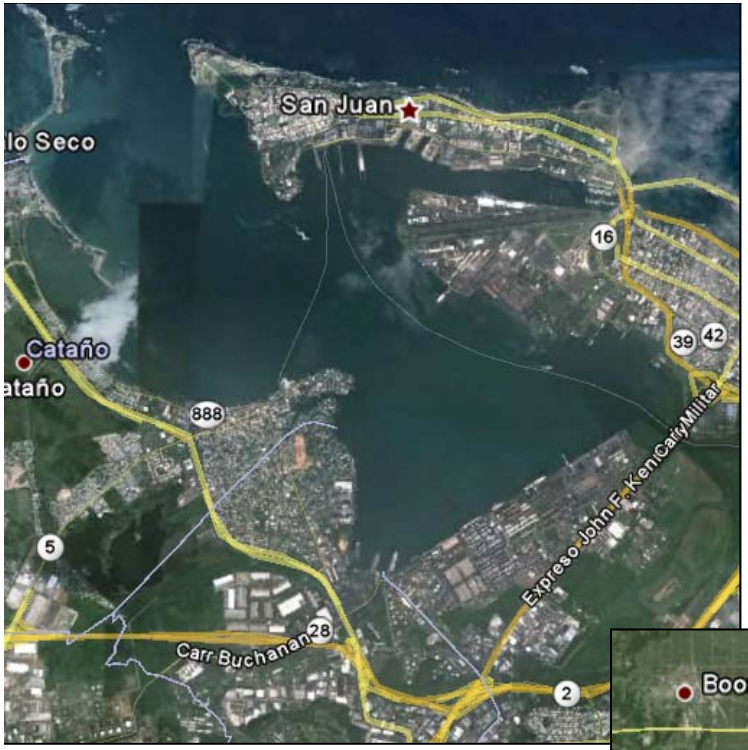
TABLE 27 External trip purpose/residency factors for evenly distributed areas[1]

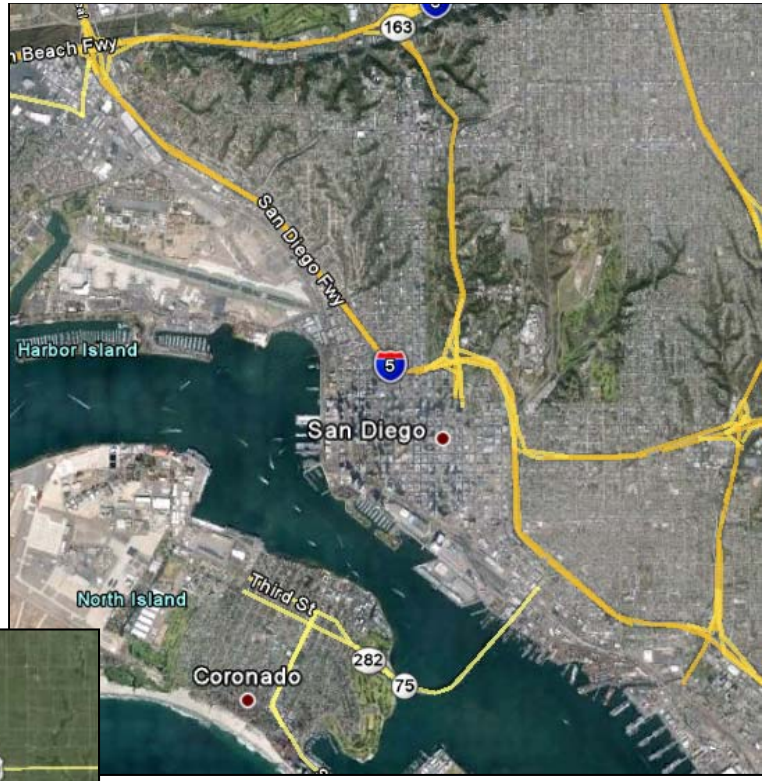
Trip Purpose	Resident	Non-Resident	Total
Home-Based Work	15%	10%	25%
Home-Based Other	27	23	50
Non-Home-Based	8	17	25
Total	50	50	100

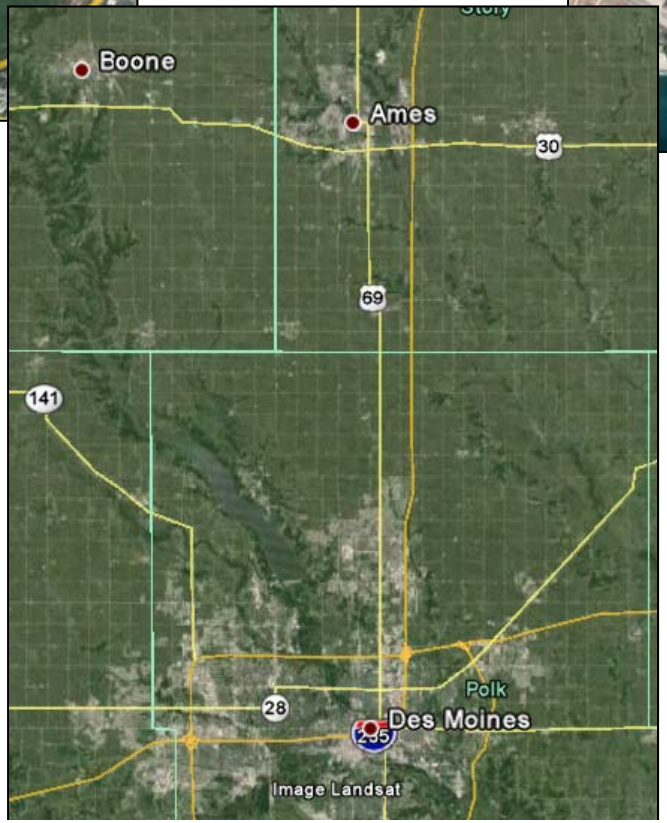
[1] San Diego Region.

NCHRP 365 Method			
	Attractions	Productions	Total
HBW	12%	34%	
HBO	9%	23%	
NHB	11%	11%	
Total			61168

iTRAM Method			
	Attractions	Productions	Total
HBW	13%	13%	
HBO	25%	28%	
NHB	10%	11%	
Total			62137


San Juan
Cataño
888
16
39
42
5
28
Carr Buchanan
2


Beach Fwy
163
San Diego Fwy
Harbor Island
5
San Diego
North Island
Third St
Coronado
282
75


Boone
Ames
30
69
141
Polk
28
Des Moines
235
Image Landsat

Pros & Cons

NCHRP 365

- Pro: Established method
  Pro: Spreadsheet ready to use
- Pro: Less time-consuming

- Con: Older equations
- Con: Non-local equations
- Con: Limited to smaller MPOs
- Con: More subjective decisions

iTRAM

- Pro: Local data used
- Pro: Objective forecast data

- Con: More time-consuming
- Con: Results less tested by us

Questions?
Comments?
Other methods to share?