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16. Abstract

This report represents the comparison of the results from TRANPLAN with the Texas Travel Demand Package (Texas Package) incorporated in a research project entitled "Subarea Analysis Using Microcomputers." One of the study objectives is to develop and incorporate into the Texas Package procedures for downloading a portion of the output from the Texas Package to the selected microcomputer transportation planning package to perform subarea analysis. TRANPLAN was tested and recommended for interface with the Texas Package. A two-phase test procedure was utilized: Phase I -- assignment comparisons using the same trip table and Phase II -- trip table comparisons. The 1985 network in Bryan-College Station was selected as the data base for this test. The results from the TRANPLAN assignments using three different assignment techniques were compared to the Texas Large Network Assignment Models results. The analysis included selected link, screenlines, cutlines, and major travel routes comparisons. Phase II investigated alternative trip distribution techniques (i.e., TRANPLAN, Texas Model, and Atomistic distributions) for the modeling of the trip table. The results of three trip tables were then compared on a cell-by-cell basis. It was found that there were no differences using All-Or-Nothing, and that there were no significant differences between the TRANPLAN Incremental assignment and the new capacity restraint assignment of the Texas Large Network Assignment Models. There are slight differences of trip tables between TRANPLAN and MODEL, but the differences are not practically significant.

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COMPARISON OF THE RESULTS FROM TRANPLAN

WITH THE TEXAS PACKAGE

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Subarea Analysis Using Microcomputers

Research Report Number 1110-2

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Sponsored by

State Department of Highways and Public Transportation

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U.S. Department of Transportation
Federal Highway Administration

Texas Transportation Institute
The Texas A&M University System
College Station, Texas

October 1988

METRIC CONVERSION FACTORS

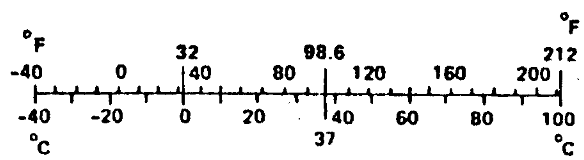
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



ABSTRACT

This report represents the comparison of the results from TRANPLAN with the Texas Travel Demand Package (Texas Package) incorporated in a research project entitled "Subarea Analysis Using Microcomputers." One of the study objectives is to develop and incorporate into the Texas Package procedures for downloading a portion of the output from the Texas Package to the selected microcomputer transportation planning package to perform subarea analysis.

The TRANPLAN package was already tested and recommended for interface with the Texas Package. TRANPLAN should be compared with the Texas Package before subarea analysis is performed. A two-phase test procedure was utilized: Phase I -- assignment comparisons using the same trip table and Phase II -- trip table comparisons. The 1985 network in Bryan-College Station was selected as the data base for this test.

The results from the TRANPLAN assignments using three different assignment techniques (All-Or-Nothing and two different Incremental Assignments) were compared to the Texas Large Network Assignment Models (All-Or-Nothing, Capacity Restraint, and Incremental Assignments) results. The analysis included a selected link-by-link comparison of the posted assignment results, comparisons of screenlines and cutlines, and a comparison of major travel routes. Phase II investigated alternative trip distribution techniques (i.e., TRANPLAN, Texas Model, and Atomistic distributions) for the modeling of the trip table. The results of three trip tables were then compared on a cell-by-cell basis.

It was found that there were no differences between TRANPLAN and the Texas Package using All-Or-Nothing, and that there were no significant differences between the TRANPLAN Incremental assignment and the new capacity restraint assignment of the Texas Large Network Assignment Models. Finally, there are slight differences of trip tables between TRANPLAN and MODEL, but the differences are not practically significant.

DISCLAIMER

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I. INTRODUCTION

One of the study objectives is to develop and incorporate into the Texas Travel Demand Package (Texas Package) procedures for downloading a portion of the output from the Texas Package to the selected microcomputer transportation planning package to perform subarea analysis. The TRANPLAN package was tested and recommended for interface with the Texas Package. TRANPLAN should be compared with the Texas Package before subarea analysis is performed.

It is obvious that no package assignment procedure will exactly replicate the assignment results which would be produced using another package. The TRANPLAN assignment procedure should, however, reasonably replicate the assignment results from the Texas Package modeling process. There are, of course, two primary sources of variation which may affect the assignment results: (1) the assignment procedure itself and (2) the urban travel patterns described by the trip table. In other words, there are basically two issues to be addressed by the preliminary tests. First, given the urban travel pattern (i.e., given the trip table for the urban area), can the TRANPLAN assignment procedure reasonably replicate the assignment results from the Texas Package? Second, given that the TRANPLAN assignment procedure can reasonably replicate the mainframe assignment results, can a trip table from the TRANPLAN Gravity Model be sufficiently accurate to produce reasonable assignment results?

To address these issues, a two-phase test procedure was utilized. The 1985 network in Bryan-College Station was selected as the data base for this test. This well-detailed and coded network consists of 269 internal zones, 16 external stations, 688 nodes, and 2967 links. The following briefly outlines the two-phase preliminary test procedure being performed:

Phase I -- Assignment Comparisons Using the Same Trip Table

A trip table from the Texas Trip Distribution Models will be assigned to TRANPLAN using three different assignment techniques (i.e., All-Or-Nothing, Capacity Restraint using five iterations, and Incremental Assignments). The results will then be compared to the assignment results from Texas Large Network Assignment Models. The analysis includes a selected link-by-link comparison of the posted assignment results, comparisons of screenlines and cutlines, and a comparison of major travel routes.

Phase II -- Trip Table Comparisons

Phase II would be initiated only if the results from Phase I have no differences between the Texas Large Network Assignment Models and the TRANPLAN package. Phase II would investigate alternative trip distribution techniques (i.e., TRANPLAN, Texas Model, and Atomistic Model distributions) for the modeling of the trip table. The results of three trip tables will then be compared on a cell-by-cell basis. These comparisons include TRANPLAN vs. Texas Model, TRANPLAN vs. Atomistic Model, and Texas Model vs. Atomistic Model. The purpose of this report is to present the findings of both Phase I and Phase II of this study.

II. ASSIGNMENT COMPARISONS

As specified in the introduction (Phase I), a trip matrix (285x285) from the 1985 network in Bryan-College Station was prepared by the Texas Trip Distribution Models, and a traffic assignment was performed using three different assignment techniques. To evaluate the TRANPLAN assignment techniques, the assigned volumes from selected links, screenlines and cutlines, and major travel routes were compared with those from the Texas Large Network Assignment Models results. The following measures of assignment accuracy were utilized in evaluating the results of the various assignments.

Selected Links

To illustrate the magnitude of the assignment differences, 54 selected links were cross-classified by volume group (based on the TRANPLAN assignment) and the magnitude of the link volume and percent volume differences observed between the two assignments (see Table II-1). Figure II-1 shows the selected links in the study area.

Selected Major Routes

An evaluation of the major route differences provides an indication of the location and the relative position of the individual link disparities with respect to the network structure. Six major travel routes are shown in Figure II-2. The summary of six major routes within the study area indicates the number of links of each route, total traffic volumes, and differences (see Table II-2).

Selected Screenlines and Cutlines

Eleven cutlines were determined within the study area. Six intercepted the northbound/southbound thoroughfares, and the remaining five intercepted eastbound/westbound thoroughfares. Figure II-3 shows the locations of the 11 cutlines. Four screenlines defined within the network are shown in Figure II-4.

Figure II-1. SELECTED LINKS.

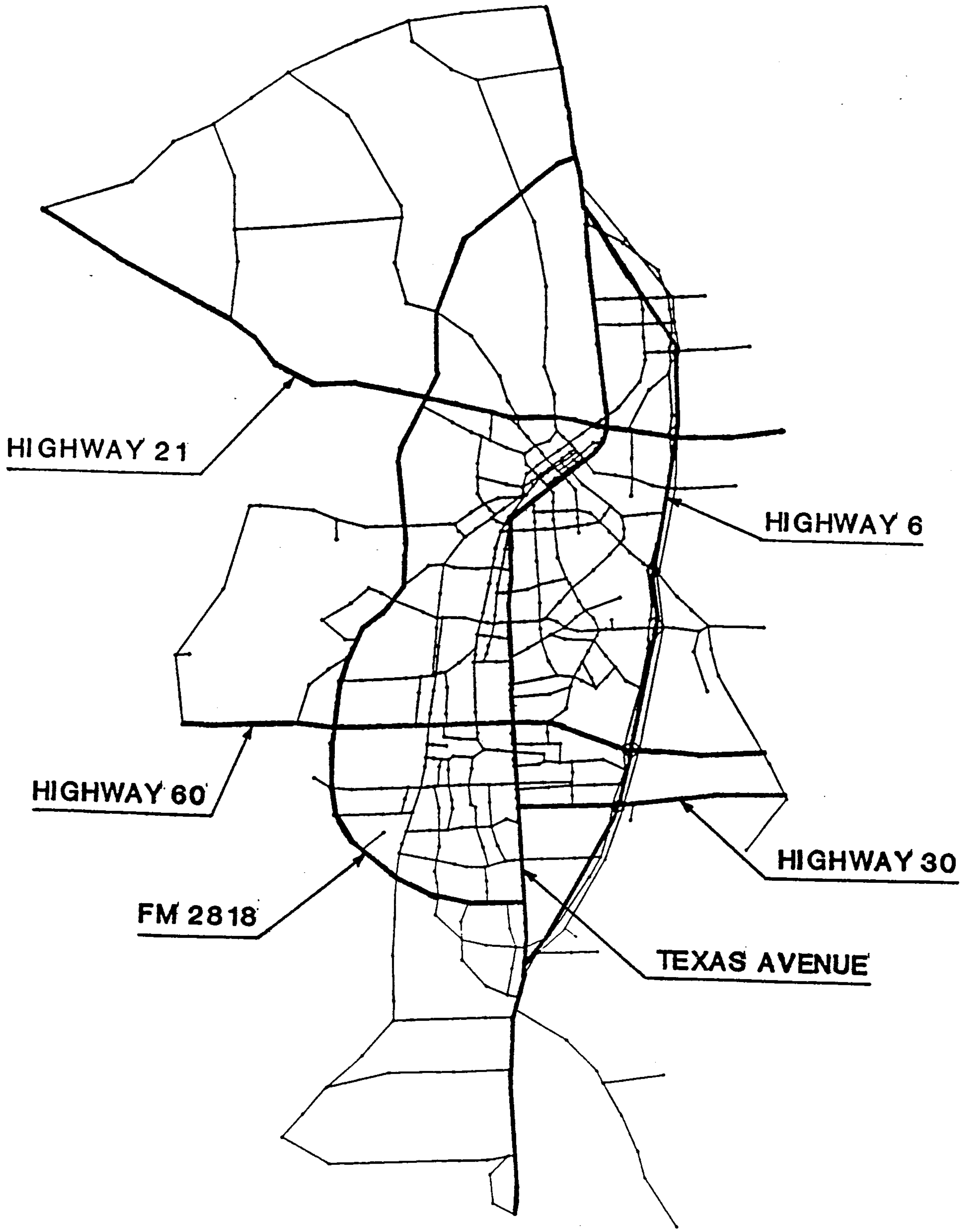

Figure II-2. SIX MAJOR TRAVEL ROUTES.

Figure II-3. SELECTED CUTLINES.

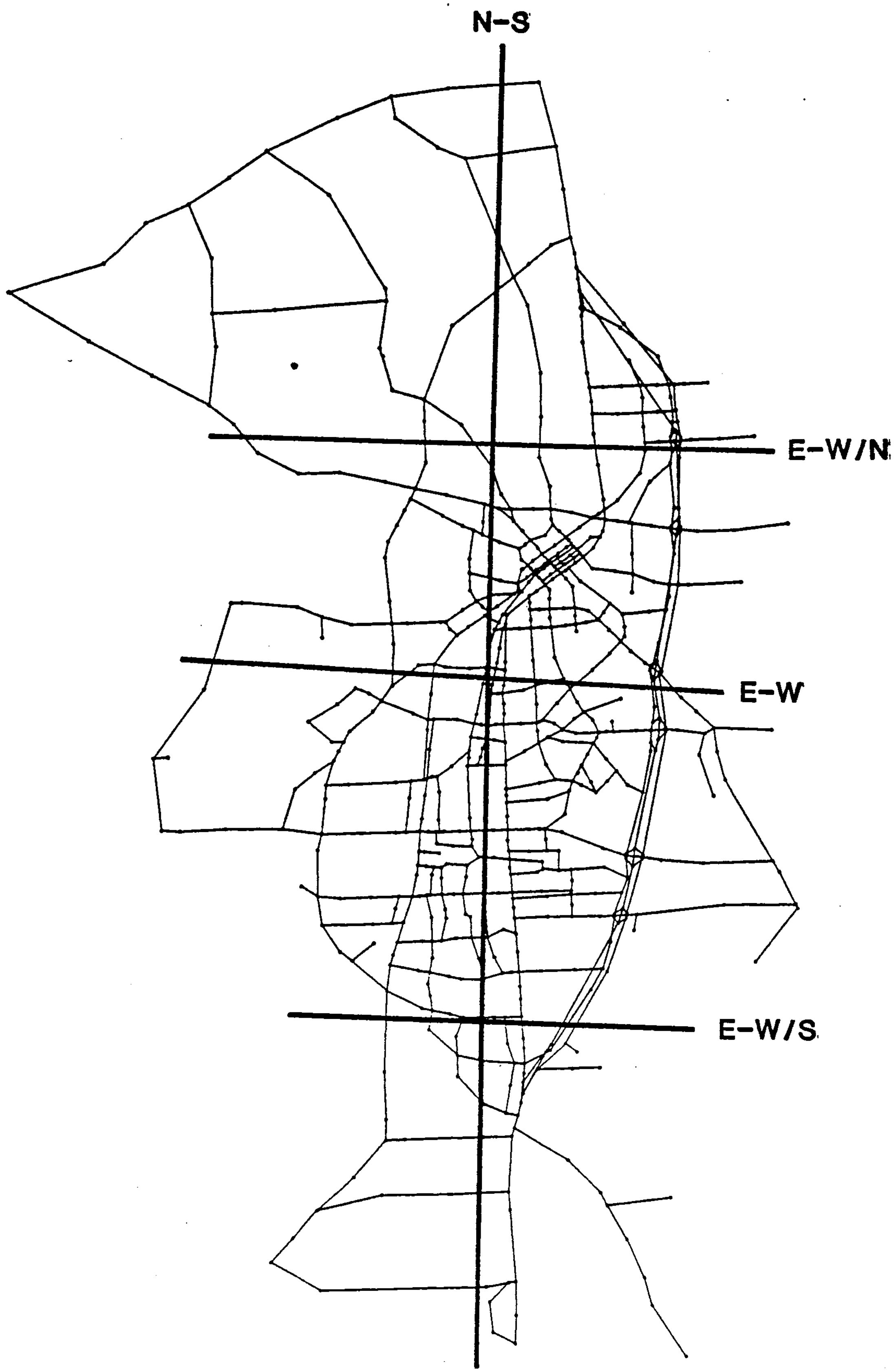

Figure II-4. SELECTED SCREENLINES.

II.1. ALL-OR-NOTHING ASSIGNMENT

Link Volume Differences

As may be observed in Table II-1, 83 percent of the 54 links were within the 25 volume difference range, and all links were within the 100 volume difference range. Approximately 76 percent of the links had a percent difference of less than 0.1 percent, and all links had a difference of less than 1.0 percent. These data illustrate that there are no link volume differences between the two packages using the All-Or-Nothing assignment.

Table II-1. Distribution of Selected Links Volume Differences by Volume Group Using All-Or-Nothing.

Volume Group (vpd)	Absolute Volume Difference (vpd) 0 to 10	11 to 25	26 to 50	51 to 100	Totals
0 - 999					0
1,000 - 4,999	6				6
5,000 - 9,999	10	2		2	14
10,000 - 14,999	5	1		2	8
15,000 - 19,999	3	3			6
20,000 - 29,000	3	2		1	6
30,000 - 39,999	1	6		2	9
40,000 and above		3		2	5
Totals	28	17	0	9	54
Percent	51.9	31.4	0	16.7	100.0
Accum. %	51.9	83.3	83.3	100.0	100.0

Volume Group (vpd)	Absolute Percent Difference (percent) 0.0 to 0.1	0.1 to 0.3	0.3 to 0.6	0.6 to 1.0	Totals
0 - 999					0
1,000 - 4,999	6				6
5,000 - 9,999	10	2		2	14
10,000 - 14,999	5	1	1	1	8
15,000 - 19,999	5	1			6
20,000 - 29,000	5			1	6
30,000 - 39,999	7	2			9
40,000 and above	3	2			5
Totals	41	8	2	3	54
Percent	75.9	14.8	3.7	5.6	100.0
Accum. %	75.9	90.7	94.4	100.0	100.0

Major Routes Differences

The summary of six major routes within the study area is provided in Table II-2. The table indicates that the mean volume differences of all routes are well within 50 traffic volumes. Using a peak hour factor of 0.1, this suggests an average peak hour nondirectional difference of substantially less than five vehicles per hour. In addition, all average percent differences are within 0.1 percent, and the vehicle miles total for each route shows negligible differences between the two assignments (i.e., all are within 0.1 percent).

Table II-2. Summary of Major Travel Routes Using All-Or-Nothing.

Travel Routes	Number of Links	TRANPLAN Volume	Total Differences Volume	Total Differences Percent	Average Volume Differences
Highway 21	27	422,923	-130	-0.03	-5
Highway 60	26	457,633	-394	-0.09	-15
Texas Avenue	60	1,942,922	2126	0.01	35
FM 2818	40	405,234	127	0.03	3
Highway 30	8	92,106	0	0.0	0
Highway 6	31	526,151	-222	-0.04	-7

Screenlines and Cutlines Differences

A review of Table II-3 indicates the degree of "fit" between two assignments relative to 11 cutlines and four screenlines. The four selected screenlines show that the TRANPLAN package has an excellent comparableness to the Texas Package assignment volume totals. All screenlines and cutlines were well within 1.0 percent; therefore, there is considered to be an insignificant difference between the two packages.

Table II-3. Summary of Screenlines and Cutlines Differences Using All-Or-Nothing Assignment.

Cutlines	Number of Links	TRANPLAN Volumes	Texas Package Volumes	Absolute Differences Volume	Absolute Differences Percent
A	5	11946	11946	0	0.0
B	4	75534	75526	8	0.01
C	3	38263	38178	85	0.22
D	3	29955	29947	8	0.03
E	4	41333	41308	25	0.06
F	3	12184	12184	0	0.0
G	3	29101	29123	-22	-0.08
H	3	24907	24906	1	0.0
I	4	38206	38206	0	0.0
J	3	13412	13490	-78	-0.58
K	4	20808	20822	-14	-0.07

Table II-3. (Continued)

Screenlines	Number of Links	TRANPLAN Volumes	Texas Package Volumes	Absolute Differences Volume	Percent
N-S	28	173862	173822	40	0.02
E-W/S	8	45852	45852	0	0.0
E-W	15	147912	147916	-4	-0.0
E-W/N	10	32851	32851	0	0.0

Conclusion

It was felt that the TRANPLAN All-Or-Nothing assignment yielded excellent results. However, it further appears that there should be slightly different procedures for building a minimum path or for calculating travel time between TRANPLAN and the Texas Package. In short, the results of the All-Or-Nothing assignment comparisons in Phase I tests were felt to demonstrate the applicability of trip distribution modeling at this level of detail and its impact on All-Or-Nothing assignment results.

II.2. CAPACITY RESTRAINT ASSIGNMENT

A new impedance adjustment function for capacity restraint was used for the Texas Large Network Assignment Models in running Assign Self-Balancing. The most significant difference between the new impedance adjustment function and the old Texas Procedure is that, with the new function, the link impedances are adjusted after each iteration for every link having a specified capacity whether or not the assigned link volume is over or under capacity. The old procedure adjusted link impedances only for those links where the assigned volume exceeded capacity. When the use of Capacity Restraint Traffic Assignment in the Texas Package is indicated, the analyst must consider two options: Iteration Weighting and Access/Egress Penalties (turn penalties).

In defining the iteration weights, it was recommended that later assignments (iteration) should be weighted more heavily than earlier ones. Additionally, in an effort to dampen oscillations in the assignments to parallel facilities on consecutive iterations, successive pairs of all-or-nothing assignments should receive equal weights. As a result of these considerations, iteration weights of 15%, 15%, 20%, 20%, and 30% were used in this comparison. The access/egress penalties option was not used.

The formulation of the new Texas function should directly use the impedance computed from the input speed and distance rather than an estimate of the zero volume impedance based on an estimate of the zero volume (free flow) speed. Since the input speeds in Texas studies generally reflect an estimated speed at a V/C ratio of roughly 0.85, the impedance remains unchanged at this ratio. The impedance should increase at ratios above 0.85; the impedance decreases at the ratios below 0.85. A bounding condition was placed on the impedance adjustment function because there is a potential for severe oscillation in both link impedances and assigned link volumes. The final formulation of the impedance adjustment function was:

$$I_{(n+1)} = (0.92 + 0.15\ (V_{(n)}/C)^4) \times I_{(1)}$$

subject to the constraint that $I_{(n+1)} \leq (n+1)I_1$

and where $V_{(n)}$ = a weighted average of the volumes assigned on all preceding iterations
C = level of service link capacity
$I_{(1)}$ = level of service link impedance
$I_{(n+1)}$ = adjusted link impedance

Level of service link capacity is the maximum number of vehicles a link can serve and still maintain a steady flow without being unstable. Level of service link travel time is the time required to traverse the link under these conditions. It is important to note that every link impedance having a specified capacity is subject to adjustment between successive iterations in this procedure.

It was found that there are significant different procedures and options in iterative capacity restraint assignment in TRANPLAN compared with the new capacity restraint assignment procedure used for the Texas Package because all selected interzonal highway trips are loaded on the minimum paths of the input highway network in Restraint Loading of TRANPLAN. However, it was suggested that the incremental assignment in TRANPLAN might give very similar results if the proper options and parameters were used. There are various options and parameters for the TRANPLAN incremental assignment procedures. In order to obtain the compatible results with Capacity Restraint Traffic Assignment in the Texas Package, the following options and parameters were used in this report:

1. No DAMPING option used in this assignment specifies that the network time is directly adjusted by the time difference.
2. BASE NETWORK option used in this assignment specifies that the adjusted network for any iteration is based on an accumulated loaded volume which is applied to the original network to produce the adjusted network (unless, applied to the previous network).
3. ADJUST 100 option used in this assignment specifies that volumes loaded are hypothetically expanded to 100 percent before the volume/capacity ratio is calculated for link impedance adjustment.
4. LOAD PERCENTAGES parameter of 15, 15, 20, 20, and 30 percents used in this procedure specifies the number of iterations as well as the percent of the total volume to be applied during each iteration.

For each iteration, a given percentage of selected interzonal highway trips was loaded on the minimum paths determined during path building. The network parameter, time, may be adjusted link by link according to user-specified volume/capacity time adjustment curve data or the following capacity restraint formula in TRANPLAN:

$$T_n = T_{n-1} \times [\ 1.0 + 0.15\ (V/C)^4\ ] \times 0.87$$

where, n = current restraint iteration
T_n = travel time on loaded link
T_{n-1} = travel time of the previous iteration
V = assigned volume
C = capacity specified in link data (practical capacity)

A capacity-restraint assignment is constrained not only to the travel impedance but also to each link capacity. Since the two capacity restraint formulas were different, it was decided to use the user-specified V/C time adjustment curve data which is essentially from the final formulation of the impedance adjustment function in the Texas Package.

The bounding condition, Max $(I_{(n+1)}) \leq (n+1)I_1$, was placed on the impedance adjustment function in the Texas Package. However, this limit cannot be simulated in TRANPLAN of each iteration. Instead of the bounding condition, the minimum limit of 0.167 (for base time/adjusted time) was used in the V/C ratio of 2.4 or higher. Finally, the following curve data were specified using the data specifications in a TRANPLAN control file:

```
$DATA
  ASSIGNMENT GROUP = 0-9, XYDATA = (0.0,1.087) (0.5,1.076) (1.0, .935)
                          (1.5,0.595) (2.0,0.301) (2.4,0.167) (4.0,0.167)
$END TP FUNCTION
```

<u>Link Volume Differences</u>

About 40 percent of the 54 links were within the 200 volume difference range, and 80 percent were within the 800 volume difference range shown in Table II-4. It is interesting to note for perspective that volume differences of 800 vpd or less suggest peak-hour differences of 80 vph or less (assuming a 0.1 peak hour factor). In short, the magnitude of the link volume differences observed were not considered of sufficient magnitude to significantly affect any long-range planning decisions.

Table II-4. Distribution of Selected Links Volume Differences by Volume Group Using Capacity Restraint Assignment.

Volume Group (vpd)	Absolute Volume Difference (vpd) 0-200	201-400	401-600	601-800	801-1000	1001-above	Totals
0 - 999							0
1,000 - 4,999	6						6
5,000 - 9,999	3	3	3				9
10,000 - 14,999	7	3		1		3	14
15,000 - 19,999	4		1	1	1	1	8
20,000 - 29,000	2	2	1	1		2	8
30,000 - 39,999		1	2	2		3	8
40,000 and above						1	1
Totals	22	9	7	5	1	10	54
Percent	40.7	16.7	13.0	9.3	1.8	18.5	100.0
Accum. %	40.7	57.4	70.4	79.7	81.5	100.0	100.0

Table II-4. (Continued)

Volume Group (vpd)	Absolute Percent Difference (percent) 0.0 to 3.0	3.0 to 6.0	6.0 to 9.0	9.0 to 10.0	Totals
0 - 999					0
1,000 - 4,999	4	1	1		6
5,000 - 9,999	3	3	3		9
10,000 - 14,999	8	2	2	2	14
15,000 - 19,999	4	3	1		8
20,000 - 29,000	5	2	1		8
30,000 - 39,999	5	2	1		8
40,000 and above	1				1
Totals	30	13	9	2	54
Percent	55.6	24.0	16.7	3.7	100.0
Accum. %	55.6	79.6	96.3	100.0	100.0

As may be observed in Table II-4, over 55 percent of the links had a percent difference of less than 3.0 percent, and over 96 percent had a difference of less than 9.0 percent. Only two link had 10.1 percent difference. It should be further noted that 23 of the 25 links with an assigned volume greater than 15,000 vpd (i.e., 92.0 percent of the higher volume links) had link volume differences of 6.0 percent or less and that all 25 links had differences of less than 9.0 percent. These data again illustrate that there are no significant link volume differences between the Texas Package, using the new capacity restraint assignment, and TRANPLAN, using the incremental assignment.

Major Routes Differences

The summary of six major routes within the study area is provided in Table II-5. The table indicates that the mean volume differences of all routes are well within 700 traffic volumes. Using a peak hour factor of 0.1, this suggests an average peak hour nondirectional difference of substantially less than 70 vehicles per hour. In addition, all average percent differences are within 5.1 percent, and the vehicle miles total for each route shows negligible differences between the two assignments (i.e., all are within 5.1 percent).

Screenlines and Cutlines Differences

A review of Table II-6 indicates the degree of "fit" between two assignments relative to 11 cutlines and four screenlines. The four screenlines selected show an excellent comparison with the comparable Texas Package assignment volume totals. The difference for all screenlines was well within 0.8 percent and is thereby considered insignificant. However, 11 cutlines indicated that the absolute percent difference was less than 4.1 percent, and therefore the difference between the two packages was not considered to be significant.

Table II-5. Summary of Major Travel Routes Using Capacity Restraint Assignment.

Travel Routes	Number of Links	TRANPLAN Volume	Total Differences Volume	Total Differences Percent	Average Volume Differences
Highway 21	27	392,947	4933	1.26	183
Highway 60	26	340,933	17215	5.05	662
Texas Avenue	60	1,399,317	15240	1.09	254
FM 2818	40	426,854	19785	4.64	495
Highway 30	8	90,543	-621	-0.69	-78
Highway 6	31	556,326	-11348	-2.04	-336

Table II-6. Summary of Screenlines and Cutlines Differences Using Capacity Restraint Assignment.

Cutlines	Number of Links	TRANPLAN Volumes	Texas Package Volumes	Absolute Differences Volume	Absolute Differences Percent
A	5	12041	12049	-8	-0.07
B	4	50360	51854	-1494	-2.94
C	3	30567	30410	157	0.51
D	3	28819	27903	916	3.18
E	4	40051	39368	683	1.71
F	3	22062	21156	906	4.10
G	3	28762	28398	364	1.27
H	3	19184	19476	-291	-1.52
I	4	37345	37377	-32	0.09
J	3	16337	16562	-225	1.38
K	4	23043	23396	-353	1.53

Screenlines	Number of Links	TRANPLAN Volumes	Texas Package Volumes	Absolute Differences Volume	Absolute Differences Percent
N-S	28	177676	177945	-269	-0.15
E-W/S	8	46698	46798	-100	-0.21
E-W	15	149962	148863	1099	-0.73
E-W/N	10	33947	33789	158	0.47

Conclusion

It was felt that there is no significant difference between the TRANPLAN incremental assignment and the new capacity restraint assignment of the Texas Large Network Assignment Models. Therefore, the results of the capacity restraint assignment comparisons in these Phase I tests were felt to demonstrate the applicability of trip distribution modeling at this level of detail and its impact on the assignment results.

II.3. INCREMENTAL ASSIGNMENT

There are totally different incremental assignment procedures and options between TRANPLAN and the Texas Large Network Assignment Models. An incremental technique in Texas Package adjusts link impedances from a look-up table by level of service (LOS) to obtain the desired balance. The program runs four increments, each of 25 percent. The program produces several cross classification tables and comparison tables to indicate how well the objective is being achieved.

The following options and parameters were used in the Texas Large Network Assignment Models in running Incremental Assignment:

1. The initial speeds for each link are determined by using level of service A speeds from the input level of service speed table.
2. After each increment the assigned volume is adjusted to 100 percent and the volume to capacity ratio is calculated for links non-directionally. This ratio is used to extract a new speed from the level of service speed table for the next increment.
3. Each iteration receives approximately 25 percent of the trips. The first increment will receive the 25 percent of the trip interchanges plus the remainder of the integer division by four of each trip interchange.
4. Paths are allowed through links with Volume/Capacity (V/C) ratios over 1.0.

The following options and parameters were used in the TRANPLAN Incremental Assignment:

1. BASE NETWORK option used in this assignment specifies that the adjusted network for any iteration is based on an accumulated loaded volume which is applied to the original (or base) network to produce the adjusted network.
2. ADJUST 100 option used in this assignment specifies that volumes loaded are hypothetically expanded to 100 percent before the volume/capacity ratio is calculated for link impedance adjustment.
3. LOAD PERCENTAGES parameter of 25, 25, 25, 25 percents used in this procedure specifies the number of iterations as well as the percent of the total volume to be applied during each iteration.

For each iteration, a given percentage of selected interzonal highway trips was loaded on the minimum paths determined during path building. The network parameter, time, was adjusted link by link according to the following capacity restraint formula in TRANPLAN:

$$T_n = T_{n-1} \times [\ 1.0 + 0.15\ (V/C)^4\ ] \times 0.87$$

where, n = current restraint iteration
T_n = travel time on loaded link
T_{n-1} = travel time of the previous iteration
V = assigned volume
C = capacity specified in link data (practical capacity)

Link Volume Differences

As may be observed in Table II-7, only 59 percent of the 54 links were within the 1,000 volume difference range, and 98 percent were within the 3,000 volume difference range shown in Table II-7. Even one link had a volume difference greater than 3,000 vpd. This link is located at the north end of Texas Avenue and had a volume difference of -3,283 vpd representing a percent error of -15.9 percent. In short, the link volume differences observed were considered of sufficient magnitude to significantly affect any long-range planning decisions.

As may be observed, over 35 percent of the links had a percent difference of higher than 10.0 percent. It should be further noted that 17 of the 19 links with an assigned volume greater than 20,000 vpd (i.e., 89.5 percent of the higher volume links) had link volume differences of 10.0 percent or less and that all 19 links had differences of less than 25.0 percent. These data again illustrate that there are significant link volume differences between the two packages using the Incremental Assignment, but the differences are of no practical significance.

Major Routes Differences

The summary of six major routes within the study area is provided in Table II-8. The table indicates that the mean volume differences of all routes are well within 600 traffic volumes. Using a peak hour factor of 0.1, this suggests an average peak hour nondirectional difference of substantially less than 60 vehicles per hour. In addition, all average percent differences are within 3.3 percent, and the vehicle miles total for each route shows negligible differences between the two assignments (i.e., all are within 3.3 percent).

Table II-7. Distribution of Selected Links Volume Differences by Volume Group Using Incremental Assignment.

Volume Group (vpd)	Absolute Volume Difference (vpd) 0-250	251-500	501-1000	1001-2000	2001-3000	3001-above	Totals
0 - 999							0
1,000 - 4,999	2	3	1				6
5,000 - 9,999	2	1	5	1			9
10,000 - 14,999	4	1		3	5		14
15,000 - 19,999			1	3	1		5
20,000 - 29,000	4		1	3	2	1	11
30,000 - 39,999	4		2	2			8
40,000 and above					1		1
Totals	16	5	10	13	9	1	54
Percent	29.6	9.3	18.5	24.1	16.6	1.9	100.0
Accum. %	29.6	38.9	57.4	81.5	98.1	100.0	100.0

Table II-7. (Continued)

Volume Group (vpd)	Absolute Percent Volume Difference 0.0 to 2.0	2.0 to 5.0	5.0 to 10	10 to 25	25 to above	Totals
0 - 999						0
1,000 - 4,999	1	1		3	1	6
5,000 - 9,999	2	1	2	4		9
10,000 - 14,999	4	1	2	7		14
15,000 - 19,999		1	3	2		6
20,000 - 29,000	5	2	1	2		10
30,000 - 39,999	6	2				8
40,000 and above			1			1
Totals	18	8	9	18	1	54
Percent	33.3	14.8	16.7	33.3	1.9	100.0
Accum. %	33.3	48.1	64.8	98.2	100.0	100.0

Table II-8. Summary of Major Travel Routes Using Incremental Assignment.

Travel Routes	Number of Links	TRANPLAN Volume	Total Differences Volume	Percent	Average Volume Differences
Highway 21	27	383,530	-11134	-2.90	-412
Highway 60	26	342,767	-4718	-1.38	-315
Texas Avenue	60	1,394,180	14056	1.01	234
FM 2818	40	411,438	5013	1.22	126
Highway 30	8	95,614	-451	-0.47	56
Highway 6	31	561,568	18108	3.23	584

Screenlines and Cutlines Differences

A review of Table II-9 indicates the degree of "fit" between two assignments relative to 11 cutlines and four screenlines. The four screenlines selected show an excellent comparison of the Texas Package assignment volume totals. The percent difference between the two packages for all screenlines is well within 3.0 percent and is thereby considered no significant difference. Only one of 11 cutlines indicated the absolute percent difference of 15.8 percent.

Conclusion

It was felt that there is a significant difference between the TRANPLAN Incremental Assignment and the Texas Large Network Assignment Models. Therefore, the results of the incremental assignment comparisons in these Phase I tests do not indicate the need for further investigation of this assignment technique in Phase II of this study.

Table II-9. Summary of Screenlines and Cutlines Differences Using Incremental Assignment.

Cutlines	Number of Links	TRANPLAN Volumes	Texas Package Volumes	Absolute Differences Volume	Percent
A	5	12180	12104	76	0.62
B	4	50872	53215	-2343	-4.61
C	3	31551	32535	-984	-3.12
D	3	27912	29270	-1358	-4.87
E	4	39523	39262	261	0.66
F	3	22942	22312	630	2.75
G	3	28419	26655	1764	6.21
H	3	20232	23424	-3192	-15.77
I	4	38510	38050	460	1.19
J	3	16526	15370	1156	7.00
K	4	23833	25151	-1318	-5.53

Screenlines	Number of Links	TRANPLAN Volumes	Texas Package Volumes	Absolute Differences Volume	Percent
N-S	28	180524	179029	1495	0.83
E-W/S	8	47182	46325	857	1.82
E-W	15	152151	150390	1761	1.16
E-W/N	10	34721	33749	972	2.80

III. TRIP TABLE COMPARISONS

Since the Phase I study results demonstrated the feasibility of two assignments (All-Or-Nothing and Incremental Assignments) of the TRANPLAN package, Phase II of the study was initiated. The basic objectives of Phase II were to investigate trip distribution techniques for the modeling of the trip table and to compare the results of three trip tables (TRANPLAN, Texas Model, and Atomistic Model distributions) on a cell-by-cell basis.

Trip distribution is the process by which the trip interchange volumes between zones are estimated. Thus, the expected urban travel pattern is described. The Texas Trip Distribution Models provide the analyst with the option to select either of two synthetic, mathematical, distribution techniques. The alternatives are MODEL (Texas Model) and ATOM (Atomistic Model). MODEL and ATOM perform the same task, trip distribution, but in fundamentally differing ways. Nevertheless, the inputs are similar, and the outputs are similar.

III.1. INPUTS

The same input data base was used for the Phase II analysis. In order to simplify the analyses and minimize the study costs, the trip distributions were performed for a single trip purpose: total internal travel (home-based work + home-based nonwork + nonhome-based + truck & taxi).

Preliminary evaluation of the results found that some differences existed in searching a minimum path between the Texas Package and TRANPLAN. The problems were associated with the handling of a decimal number. The impedance (e.g., travel time) of the Texas Package is calculated by truncation in a third decimal point while the impedance of TRANPLAN is rounded to a second decimal point. Two separation matrices from the Texas Package and TRANPLAN were compared after the truncation problem of the Texas Package was altered. It was found that there is no difference between the two separation matrices (see Appendix A). The modified Friction-Factors from desired trip length frequency were used for the TRANPLAN trip distribution. Again, the same trip length frequency distributions results from the TRANPLAN trip distribution were used for MODEL and ATOM.

RADIUS cards that are not required as input into TRANPLAN or MODEL are used to define the centroid area in ATOM. This card simply presents the dimension (in minutes) of each zone radius as input into ATOM. Where zones or sectors are not performing correctly during the validation process, the adjustment of the radius value can increase or decrease intrazonal trips as needed to establish proper interchange volumes.

III.2. TRIP END COMPARISON

As indicated in Table III-1, there is no significant difference in production and attraction of the trip ends; however, the Atomistic Model has generated less intrazonal trips than TRANPLAN and/or the Texas Model. Again, by considering the activities within a zone to be spatially distributed (rather than concentrated at a single theoretical point, i.e., the zone centroid), the Atomistic Model can be expected to yield travel pattern estimates more consistent with basic travel theory than the Texas Model when dealing with very large zones such as the sectors.

Table III-1. Summary of Trip End Comparison.

	PRODUCTION	ATTRACTION	TOTAL	INTRAZONAL	TOTAL
TRANPLAN	394729	394729	789458	13344	802802
MODEL	394733	394733	789466	13317	802783
ATOM	394717	394717	789434	9240	798674

III.3. TRIP TABLE COMPARISON RESULTS

TRANPLAN vs. MODEL

As indicated in Appendix B, 31246 interchanges in the trip table of TRANPLAN and 31148 interchanges in the Texas Model of the total 66564 interchanges (47 percent) have zero volume in both trip tables. Table III-2A shows that 52410 interchanges (78.7 percent) have less than or equal to five traffic volumes in the trip table of TRANPLAN, and a total of 40723 cells (61.18 percent) are indicated as less than or equal to 1.0 percent difference.

Table III-2A. Summary of Trip Table Percent Difference between TRANPLAN (V1) and MODEL (V2).

Volume	Percent Difference [(V1 - V2) / (V1 + V2)]				
Group (V1)	0 - 1	1 - 2	2 - 5	5 -100	Total
0 - 5	35106	0	0	17304	52410
6 - 10	2026	0	174	3513	5713
11 - 50	2513	953	2957	791	7214
51 - 2000	1078	132	17	0	1227
Total	40723	1085	3148	21608	66564
Percent	61.18	1.63	4.72	32.47	100.0
Accum. %	61.18	62.81	67.53	100.00	100.0

Table III-2B indicates the absolute differences between TRANPLAN and MODEL trip tables. 40068 cells (60.20 percent) show no trip difference at all. The number of trip differences between cells of the two trip tables are all within ± 5 trips. In addition, about 99.0 percent of the interchanges are within only ± 2 trips difference.

Table III-2B. Summary of Trip Table Absolute Difference between TRANPLAN (V1) and MODEL (V2).

Volume Group (V1)	Absolute Difference (V1 - V2) 0	1	2	3 - 5	6 - 50	Total
0 - 5	35106	13725	3168	411	0	52410
6 - 10	2026	2686	860	141	0	5713
11 - 50	2507	3400	1120	187	0	7214
51 - 2000	429	578	178	42	0	1227
Total	40068	20389	5326	781	0	66564
Percent	60.20	30.63	8.00	1.17	0	100.0
Accum. %	60.20	90.83	98.83	100.00	100.0	100.0

<u>TRANPLAN vs. ATOM</u>

As indicated in Appendix C, 31354 interchanges of the total 66564 interchanges (46.9 percent) have zero volume in the trip table of the Atomistic Model. Total 39799 cells (59.79 percent) are indicated as less than or equal to 1.0 percent difference in Table III-3A.

Table III-3A. Summary of Trip Table Percent Difference between TRANPLAN (V1) and ATOM (V2).

Volume Group (V1)	Percent Difference [(V1 - V2) / (V1 + V2)] 0 - 1	1 - 2	2 - 5	5 -100	Total
0 - 5	35298	0	0	17112	52410
6 - 10	1979	0	169	3565	5713
11 - 50	2052	799	2938	1425	7214
51 - 2000	470	288	336	133	1227
Total	39799	1087	3443	22235	66564
Percent	59.79	1.63	5.18	33.40	100.0
Accum. %	59.79	61.42	66.60	100.00	100.0

Table III-3B indicates the absolute differences between TRANPLAN and ATOM trip tables. While about 97.1 percent of the interchanges are within $\pm$ 2 trips difference, 412 interchanges (0.62 percent) have six or more trips differences between cells of the two trip tables.

Table III-3B. Summary of Trip Table Absolute Difference between TRANPLAN (V1) and ATOM (V2).

Volume Group (V1)	Absolute Difference (V1 - V2) 0	1	2	3 - 5	6 - 50	Total
0 - 5	35298	13561	3124	427	0	52410
6 - 10	1979	2611	908	214	1	5713
11 - 50	2041	3082	1444	581	66	7214
51 - 2000	143	270	189	280	345	1227
Total	39461	19524	5665	1502	412	66564
Percent	59.28	29.33	8.51	2.26	0.62	100.0
Accum. %	59.28	88.61	97.12	99.38	100.0	100.0

MODEL vs. ATOM

As indicated in Appendix D and Table III-4A, 52423 interchanges (78.8 percent) have less than or equal to five traffic volumes in the trip table of the Texas Model. A total of 39968 cells (60.04 percent) are indicated as less than or equal to 1.0 percent difference.

Table III-4A. Summary of Trip Table Percent Difference between MODEL (V1) and ATOM (V2).

Volume Group (V1)	Percent Difference [(V1 - V2) / (V1 + V2)] 0 - 1	1 - 2	2 - 5	5 -100	Total
0 - 5	35436	0	0	16987	52423
6 - 10	1968	0	138	3579	5685
11 - 50	2098	748	3082	1305	7233
51 - 2000	466	316	309	132	1223
Total	39968	1064	3529	22003	66564
Percent	60.04	1.60	5.30	33.06	100.0
Accum. %	60.04	61.64	66.94	100.00	100.0

Table III-4B indicates the absolute differences between MODEL and ATOM trip tables. While about 97.1 percent of the interchanges are within ± 2 trips difference, 393 interchanges (0.59 percent) have six or more trips differences between cells of the two trip tables which indicate significant difference.

Table III-4B. Summary of Trip Table Absolute Difference between MODEL (V1) and ATOM (V2).

Volume Group (V1)	Absolute Difference (V1 - V2) 0	1	2	3 - 5	6 - 50	Total
0 - 5	35436	13586	2965	436	0	52423
6 - 10	1968	2587	950	179	1	5685
11 - 50	2087	3044	1418	625	59	7233
51 - 2000	131	270	213	276	333	1223
Total	39622	19487	5546	1516	393	66564
Percent	59.52	29.28	8.33	2.28	0.59	100.0
Accum. %	59.52	88.80	97.13	99.41	100.0	100.0

Overall Statistical Comparisons

Each of the three trip tables has the same total traffic volume of approximately 394700 which yields an overall average interchange volume of 5.9 trips for all three tables. Four common statistical measures (standard deviation of the differences [SD], root-mean-square error [RMS], percent RMS error [PRMS], and sum of square difference [SUMSQ]) were employed in the evaluation of trip table differences on a cell-by-cell basis. The following relationships were used for calculation:

- o SD $= \sqrt{(\Sigma(V1_i - V2_i)^2 / N) - (\Sigma(V1_i - V2_i) / N)^2}$
- o RMS $= \sqrt{(\Sigma(V1_i - V2_i)^2 / N)}$
- o PRMS $= 100 \times (RMS / (\Sigma V1_i / N))$
- o SUMSQ $= \Sigma(V1_i - V2_i)^2$

where, $V1_i$ = base traffic volume of interchange i
$V2_i$ = compared traffic volume of interchange i
N = total number of interchanges of trip table

While a mean difference tending toward zero would indicate that the traffic volumes were evenly divided into the trip tables, it does not necessarily follow that it is a "good" of the results. The standard deviation is a measure of the dispersion of data about the mean, and it gives some indication of the "goodness" of the results. The smaller the value of the standard deviation, the closer the grouping of data about the mean.

Root-mean-square (RMS) error is very similar to the standard deviation, in that it is also a measure of dispersion of the data. However, it is a measure of dispersion of the differences relative to a zero difference; whereas, the standard deviation is relative to the mean difference.

Calculation of the standard deviation involves a bias which is the mean; as the mean approaches zero, the standard deviation approaches the RMS error.

Percent RMS error (PRMS) measures the relationship between RMS error and the average traffic volume. It is valuable in comparing results of different trip tables, and it is a relative measure among trip tables. Sum of square difference (SUMSQ) is the most direct measure of interchange differences between the two tables.

As indicated in Table III-5, there are no different results between SD and RMS because of no differences in mean traffic volume among the trip tables. The comparison of TRANPLAN vs. MODEL has smaller values of SD and RMS than the other two comparisons. Also, it is 90 times smaller than the other two comparisons in the SUMSQ difference. Finally, in comparison to values of the four statistical measures from the TRANPLAN trip table, the Texas Model appears to be within acceptable limits.

Table III-5. Summary of Statistical Comparisons.

	SD	RMS	PRMS	SUMSQ
TRANPLAN vs. MODEL	0.86	0.9	14.49	49130
TRANPLAN vs. ATOM	8.14	8.1	137.23	4408464
MODEL vs. ATOM	8.14	8.1	137.19	4405842

III.4. CONCLUSION

The trip table evaluations demonstrate the feasibility of using the Texas Model interfacing with TRANPLAN in further applications. Both the Texas Model and TRANPLAN are considering the activities within a zone to be concentrated at a single theoretical point (i.e., the zone centroid) instead of considering the activities to be spatially distributed in the Atomistic Model.

The results from the Tables III-3A&B are very similar to the results from the Tables III-4A&B; that is, TRANPLAN vs. ATOM has almost the same significant difference as MODEL vs. ATOM. The difference of trip tables from TRANPLAN vs. MODEL is less significant than the one either from TRANPLAN vs. ATOM or from MODEL vs. ATOM. Finally, there are slight differences of trip tables between TRANPLAN and MODEL, but the differences are of no practical significance.

Appendix A

Comparison Results of Separation Matrices - TRANPLAN vs. Texas Package

REPORT MATRIX COMPARISON
B/CS TEST NETWORK COMPARISON OF 285x285 SEPARATION MATRICES
BETWEEN TEXAS PACKAGE AND TRANPLAN

SEPARATION COMPARISON REPORT ---- FREQUENCY DISTRIBUTION (V1-V2).
MAXIMUM CENTROID NUMBER = 285 NUMBER OF PURPOSES = 4
INTERCHANGES WITH ZERO SEPARATION TAPE 1 = 285 TAPE 2 = 285

PURPOSE 4

SEPARATION GRP	NEGATIVE										POSITIVE									
V1	-50 TO -31	-30 TO -21	-20 TO -11	-10 TO -8	-7 TO -6	-5 TO -4	-3 TO -3	-2 TO -2	-1 TO -1	-0 TO +0	+1 TO +1	+2 TO +2	+3 TO +3	+4 TO +5	+6 TO +7	+8 TO +10	+11 TO +20	+21 TO +30	+31 TO +50	TOT
0- 1	0	0	0	0	0	0	0	0	0	285	0	0	0	0	0	0	0	0	0	285
21- 25	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	4
31- 35	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
36- 40	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	6
41- 45	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
46- 50	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
51- 60	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	10
61- 70	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	12
71- 80	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	12
81- 90	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	20
91- 100	0	0	0	0	0	0	0	0	0	44	0	0	0	0	0	0	0	0	0	44
101- 150	0	0	0	0	0	0	0	0	0	254	0	0	0	0	0	0	0	0	0	254
151- 200	0	0	0	0	0	0	0	0	0	493	0	0	0	0	0	0	0	0	0	493
201- 250	0	0	0	0	0	0	0	0	0	663	0	0	0	0	0	0	0	0	0	663
251- 300	0	0	0	0	0	0	0	0	0	1032	0	0	0	0	0	0	0	0	0	1032
301- 350	0	0	0	0	0	0	0	0	0	1334	0	0	0	0	0	0	0	0	0	1334
351- 400	0	0	0	0	0	0	0	0	0	1609	0	0	0	0	0	0	0	0	0	1609
401- 450	0	0	0	0	0	0	0	0	0	1931	0	0	0	0	0	0	0	0	0	1931
451- 500	0	0	0	0	0	0	0	0	0	2372	0	0	0	0	0	0	0	0	0	2372
501- 1000	0	0	0	0	0	0	0	0	0	29790	0	0	0	0	0	0	0	0	0	29790
1001- 2000	0	0	0	0	0	0	0	0	0	36837	0	0	0	0	0	0	0	0	0	36837
2001- 3000	0	0	0	0	0	0	0	0	0	4405	0	0	0	0	0	0	0	0	0	4405
3001 AND OVER	0	0	0	0	0	0	0	0	0	106	0	0	0	0	0	0	0	0	0	106
TOTAL	0	0	0	0	0	0	0	0	0	81225	0	0	0	0	0	0	0	0	0	81225

Appendix B

Trip Table Difference between TRANPLAN and Texas Model

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT MATRIX COMPARISON
B/CS TEST NETWORK COMPARISON OF 258x258 TRIP MATRICES
TRANPLAN AND TEXAS MODEL

DATE 09OCT87
TIME 15:18:01

VOLUME COMPARISON REPORT ---- FREQUENCY DISTRIBUTION (V1-V2 / V1+V2).
MAXIMUM CENTROID NUMBER = 258 NUMBER OF PURPOSES = 1
INTERCHANGES WITH ZERO VOLUME TAPE 1 = 31246 TAPE 2 = 31148

PURPOSE 1

VOLUME GRP V1		NEGATIVE 1.00 TO .75	.75 TO .50	.50 TO .40	.40 TO .30	.30 TO .20	.20 TO .10	.10 TO .05	.05 TO .02	.02 TO .01	-.01 TO +.01	POSITIVE .01 TO .02	.02 TO .05	.05 TO .10	.10 TO .20	.20 TO .30	.30 TO .40	.40 TO .50	.50 TO .75	.75 TO 1.00	TOT
0-	1	3772	60	367	1492	0	0	0	0	0	30462	0	0	0	0	0	0	0	0	2988	39141
2-	2	0	0	39	279	0	920	0	0	0	1686	0	0	0	0	0	1494	0	0	619	5037
3-	3	0	0	0	27	205	670	0	0	0	1315	0	0	0	0	900	0	0	404	64	3585
4-	4	0	0	0	1	22	695	0	0	0	937	0	0	0	660	0	248	0	56	3	2622
5-	5	0	0	0	0	17	117	399	0	0	706	0	0	0	570	174	0	37	5	0	2025
6-	6	0	0	0	0	0	114	343	0	0	551	0	0	404	0	146	29	0	1	0	1588
7-	7	0	0	0	0	0	72	296	0	0	501	0	0	340	124	19	0	4	0	0	1356
8-	8	0	0	0	0	0	60	231	0	0	388	0	0	275	119	15	1	0	0	0	1089
9-	9	0	0	0	0	0	11	273	0	0	312	0	0	211	69	14	0	0	0	0	890
10-	10	0	0	0	0	0	5	49	174	0	274	0	0	207	81	0	0	0	0	0	790
11-	15	0	0	0	0	0	23	173	581	0	1025	0	662	186	106	3	0	0	0	0	2759
16-	20	0	0	0	0	0	0	91	362	0	520	0	428	143	6	0	0	0	0	0	1550
21-	25	0	0	0	0	0	0	13	241	41	325	0	345	26	2	0	0	0	0	0	993
26-	30	0	0	0	0	0	0	3	43	153	205	159	66	9	0	0	0	0	0	0	638
31-	35	0	0	0	0	0	0	0	42	95	163	106	43	5	0	0	0	0	0	0	454
36-	40	0	0	0	0	0	0	1	22	87	110	82	31	0	0	0	0	0	0	0	333
41-	45	0	0	0	0	0	0	0	34	65	86	73	24	0	0	0	0	0	0	0	282
46-	50	0	0	0	0	0	0	0	11	42	79	50	22	1	0	0	0	0	0	0	205
51-	60	0	0	0	0	0	0	0	4	21	222	13	6	0	0	0	0	0	0	0	266
61-	70	0	0	0	0	0	0	0	1	4	163	14	1	0	0	0	0	0	0	0	183
71-	80	0	0	0	0	0	0	0	2	15	121	17	3	0	0	0	0	0	0	0	158
81-	90	0	0	0	0	0	0	0	0	12	78	10	0	0	0	0	0	0	0	0	100
91-	100	0	0	0	0	0	0	0	0	8	69	9	0	0	0	0	0	0	0	0	86
101-	150	0	0	0	0	0	0	0	0	4	209	3	0	0	0	0	0	0	0	0	216
151-	200	0	0	0	0	0	0	0	0	0	83	2	0	0	0	0	0	0	0	0	85
201-	250	0	0	0	0	0	0	0	0	0	31	0	0	0	0	0	0	0	0	0	31
251-	300	0	0	0	0	0	0	0	0	0	31	0	0	0	0	0	0	0	0	0	31
301-	350	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	20
351-	400	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	14
401-	450	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	9
451-	500	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	4
501-	1000	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	20
1001-	2000	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	4

DCCO / UAG	REPORT MATRIX COMPARISON	PAGE NO. 1
TRANPLAN SYSTEM	B/CS TEST NETWORK COMPARISON OF 258x258 TRIP MATRICES	DATE 28SEP87
VERSION 5.0	TRANPLAN AND TEXAS MODEL	TIME 12:45:34

VOLUME COMPARISON REPORT ---- FREQUENCY DISTRIBUTION (V1-V2).

MAXIMUM CENTROID NUMBER = 258 NUMBER OF PURPOSES = 1

INTERCHANGES WITH ZERO VOLUME TAPE 1 = 31246 TAPE 2 = 31148

PURPOSE 1

VOLUME GRP V1		NEGATIVE -50 TO -31	-30 TO -21	-20 TO -11	-10 TO -8	-7 TO -6	-5 TO -4	-3 TO -3	-2 TO -2	-1 TO -1	-0 TO +0	+1 TO +1	+2 TO +2	+3 TO +3	POSITIVE +4 TO +5	+6 TO +7	+8 TO +10	+11 TO +20	+21 TO +30	+31 TO +50	TOT
0-	1	0	0	0	0	0	14	126	977	4574	30462	2988	0	0	0	0	0	0	0	0	39141
2-	2	0	0	0	0	0	2	37	279	920	1686	1494	619	0	0	0	0	0	0	0	5037
3-	3	0	0	0	0	0	2	25	205	670	1315	900	404	64	0	0	0	0	0	0	3585
4-	4	0	0	0	0	0	1	22	145	550	937	660	248	56	3	0	0	0	0	0	2622
5-	5	0	0	0	0	0	0	17	117	399	706	570	174	37	5	0	0	0	0	0	2025
6-	6	0	0	0	0	0	0	14	100	343	551	404	146	29	1	0	0	0	0	0	1588
7-	7	0	0	0	0	0	0	8	64	296	501	340	124	19	4	0	0	0	0	0	1356
8-	8	0	0	0	0	0	0	7	53	231	388	275	119	15	1	0	0	0	0	0	1089
9-	9	0	0	0	0	0	1	10	68	205	312	211	69	14	0	0	0	0	0	0	890
10-	10	0	0	0	0	0	0	5	49	174	274	207	68	13	0	0	0	0	0	0	790
11-	15	0	0	0	0	0	2	30	164	581	1025	662	256	35	4	0	0	0	0	0	2759
16-	20	0	0	0	0	0	1	16	110	326	520	428	130	17	2	0	0	0	0	0	1550
21-	25	0	0	0	0	0	0	13	71	211	325	280	81	9	3	0	0	0	0	0	993
26-	30	0	0	0	0	0	0	4	42	153	205	159	66	6	3	0	0	0	0	0	638
31-	35	0	0	0	0	0	0	6	36	95	163	106	37	11	0	0	0	0	0	0	454
36-	40	0	0	0	0	0	1	6	16	87	110	82	26	5	0	0	0	0	0	0	333
41-	45	0	0	0	0	0	0	2	32	65	86	73	21	3	0	0	0	0	0	0	282
46-	50	0	0	0	0	0	0	2	15	42	73	50	17	4	2	0	0	0	0	0	205
51-	60	0	0	0	0	0	0	4	21	65	101	56	16	2	1	0	0	0	0	0	266
61-	70	0	0	0	0	0	0	1	4	54	61	48	14	1	0	0	0	0	0	0	183
71-	80	0	0	0	0	0	1	2	14	31	59	31	17	3	0	0	0	0	0	0	158
81-	90	0	0	0	0	0	0	1	11	27	26	25	9	1	0	0	0	0	0	0	100
91-	100	0	0	0	0	0	0	2	6	21	28	20	8	1	0	0	0	0	0	0	86
101-	150	0	0	0	0	0	0	4	15	54	79	48	14	2	0	0	0	0	0	0	216
151-	200	0	0	0	0	0	0	5	6	21	34	12	5	0	2	0	0	0	0	0	85
201-	250	0	0	0	0	0	0	1	2	7	11	7	2	1	0	0	0	0	0	0	31
251-	300	0	0	0	0	0	0	2	3	7	15	4	0	0	0	0	0	0	0	0	31
301-	350	0	0	0	0	0	0	0	2	6	4	7	1	0	0	0	0	0	0	0	20
351-	400	0	0	0	0	0	0	0	1	8	3	1	0	0	1	0	0	0	0	0	14
401-	450	0	0	0	0	0	0	1	0	1	4	3	0	0	0	0	0	0	0	0	9
451-	500	0	0	0	0	0	0	0	2	0	0	1	1	0	0	0	0	0	0	0	4
501-	1000	0	0	0	0	0	0	2	2	8	4	3	1	0	0	0	0	0	0	0	20
1001-	2000	0	0	0	0	0	0	0	1	0	0	2	0	1	0	0	0	0	0	0	4
TOTAL		0	0	0	0	0	25	375	2633	10232	40068	10157	2693	349	32	0	0	0	0	0	66564

Appendix C

Trip Table Difference between TRANPLAN and Atomistic Model

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT MATRIX COMPARISON
B/CS TEST NETWORK COMPARISON OF 258x258 TRIP MATRICES
TRANPLAN AND ATOMISTIC

PAGE NO. 1
DATE 09OCT87
TIME 15:19:35

VOLUME COMPARISON REPORT ---- FREQUENCY DISTRIBUTION (V1-V2 / V1+V2).
MAXIMUM CENTROID NUMBER = 258 NUMBER OF PURPOSES = 1
INTERCHANGES WITH ZERO VOLUME TAPE 1 = 31246 TAPE 2 = 31543

PURPOSE 1

VOLUME GRP V1	NEGATIVE 1.00 TO .75	.75 TO .50	.50 TO .40	.40 TO .30	.30 TO .20	.20 TO .10	.10 TO .05	.05 TO .02	.02 TO .01	-.01 TO +.01	POSITIVE .01 TO .02	.02 TO .05	.05 TO .10	.10 TO .20	.20 TO .30	.30 TO .40	.40 TO .50	.50 TO .75	.75 TO 1.00	TOT
0- 1	3469	53	344	1462	0	0	0	0	0	30773	0	0	0	0	0	0	0	0	3040	39141
2- 2	0	0	34	251	0	813	0	0	0	1720	0	0	0	0	0	1587	0	0	632	5037
3- 3	0	0	0	27	173	664	0	0	0	1198	0	0	0	0	1013	0	0	430	80	3585
4- 4	0	0	0	0	29	629	0	0	0	909	0	0	0	727	0	258	0	64	6	2622
5- 5	0	0	0	0	19	122	399	0	0	698	0	0	0	535	207	0	37	7	1	2025
6- 6	0	0	0	0	3	113	293	0	0	560	0	0	422	0	158	37	0	2	0	1588
7- 7	0	0	0	0	2	82	269	0	0	478	0	0	360	132	30	0	3	0	0	1356
8- 8	0	0	0	0	0	80	213	0	0	374	0	0	273	125	21	3	0	0	0	1089
9- 9	0	0	0	0	0	15	264	0	0	292	0	0	233	67	18	0	0	0	1	890
10- 10	0	0	0	0	0	19	46	169	0	275	0	0	181	99	1	0	0	0	0	790
11- 15	0	0	0	0	0	42	226	541	0	862	0	675	248	156	9	0	0	0	0	2759
16- 20	0	0	0	0	0	11	127	353	0	455	0	378	205	18	2	0	0	0	1	1550
21- 25	0	0	0	0	0	4	51	272	43	277	0	274	64	6	2	0	0	0	0	993
26- 30	0	0	0	0	0	2	29	89	133	160	125	63	32	5	0	0	0	0	0	638
31- 35	0	0	0	0	0	2	11	79	101	105	82	57	15	1	1	0	0	0	0	454
36- 40	0	0	0	0	0	2	9	47	69	92	62	43	6	3	0	0	0	0	0	333
41- 45	0	0	0	0	0	2	11	65	60	46	54	39	4	1	0	0	0	0	0	282
46- 50	0	0	0	0	0	1	4	37	40	55	30	26	8	4	0	0	0	0	0	205
51- 60	0	0	0	0	0	2	19	38	32	131	20	14	6	4	0	0	0	0	0	266
61- 70	0	0	0	0	0	1	6	46	28	75	8	14	4	1	0	0	0	0	0	183
71- 80	0	0	0	0	0	1	8	26	29	68	10	8	8	0	0	0	0	0	0	158
81- 90	0	0	0	0	0	1	4	18	21	36	10	5	2	2	0	0	0	0	1	100
91- 100	0	0	0	0	0	1	5	14	17	31	8	5	5	0	0	0	0	0	0	86
101- 150	0	0	0	0	0	0	12	57	39	79	15	8	6	0	0	0	0	0	0	216
151- 200	0	0	0	0	0	0	8	31	9	24	7	3	0	0	2	0	0	0	1	85
201- 250	0	0	0	0	0	0	0	9	7	12	0	1	1	1	0	0	0	0	0	31
251- 300	0	0	0	0	0	0	1	13	7	5	1	3	0	1	0	0	0	0	0	31
301- 350	0	0	0	0	0	1	3	6	3	4	0	1	1	1	0	0	0	0	0	20
351- 400	0	0	0	0	0	0	2	4	4	1	0	2	0	0	0	0	0	0	1	14
401- 450	0	0	0	0	0	1	0	2	6	0	0	0	0	0	0	0	0	0	0	9
451- 500	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	1	4
501- 1000	0	0	0	0	0	2	2	6	6	3	0	1	0	0	0	0	0	0	0	20
1001- 2000	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1	4

REPORT MATRIX COMPARISON
B/CS TEST NETWORK COMPARISON OF 258x258 TRIP MATRICES
TRANPLAN AND ATOMISTIC

VOLUME COMPARISON REPORT ---- FREQUENCY DISTRIBUTION (V1-V2).
MAXIMUM CENTROID NUMBER = 258 NUMBER OF PURPOSES = 1
INTERCHANGES WITH ZERO VOLUME TAPE 1 = 31246 TAPE 2 = 31543

PURPOSE 1

VOLUME GRP V1		NEGATIVE -50 TO -31	-30 TO -21	-20 TO -11	-10 TO -8	-7 TO -6	-5 TO -4	-3 TO -3	-2 TO -2	-1 TO -1	-0 TO +0	POSITIVE +1 TO +1	+2 TO +2	+3 TO +3	+4 TO +5	+6 TO +7	+8 TO +10	+11 TO +20	+21 TO +30	+31 TO +50	TOT
0-	1	0	0	0	0	0	3	120	893	4312	30773	3040	0	0	0	0	0	0	0	0	39141
2-	2	0	0	0	0	0	2	32	251	813	1720	1587	632	0	0	0	0	0	0	0	5037
3-	3	0	0	0	0	0	1	26	173	664	1198	1013	430	80	0	0	0	0	0	0	3585
4-	4	0	0	0	0	0	0	29	158	471	909	727	258	64	6	0	0	0	0	0	2622
5-	5	0	0	0	0	0	0	19	122	399	698	535	207	37	8	0	0	0	0	0	2025
6-	6	0	0	0	0	0	3	16	97	293	560	422	158	37	2	0	0	0	0	0	1588
7-	7	0	0	0	0	0	2	12	70	269	478	360	132	30	3	0	0	0	0	0	1356
8-	8	0	0	0	0	0	0	13	67	213	374	273	125	21	3	0	0	0	0	0	1089
9-	9	0	0	0	0	0	3	12	66	198	292	233	67	16	2	0	1	0	0	0	890
10-	10	0	0	0	0	0	1	18	46	169	275	181	80	19	1	0	0	0	0	0	790
11-	15	0	0	0	0	0	8	50	210	541	862	675	331	68	13	1	0	0	0	0	2759
16-	20	0	0	0	0	2	14	35	131	309	455	378	167	48	8	1	1	1	0	0	1550
21-	25	0	0	0	0	1	17	37	89	226	277	194	106	32	9	3	2	0	0	0	993
26-	30	0	0	0	2	0	13	27	78	133	160	125	63	27	7	3	0	0	0	0	638
31-	35	0	0	0	2	5	6	18	61	101	105	82	44	18	10	0	1	1	0	0	454
36-	40	0	0	0	3	7	5	11	32	69	92	62	35	8	5	3	1	0	0	0	333
41-	45	0	0	2	4	4	14	23	31	60	46	54	28	9	4	2	1	0	0	0	282
46-	50	0	0	1	2	2	7	14	24	43	44	30	14	9	7	4	1	3	0	0	205
51-	60	0	0	5	7	10	16	21	32	44	47	40	21	10	3	6	0	4	0	0	266
61-	70	0	0	5	1	6	13	28	28	32	23	20	8	4	8	3	2	2	0	0	183
71-	80	0	0	7	2	5	15	14	21	29	24	15	9	2	6	1	6	2	0	0	158
81-	90	0	1	4	0	9	9	11	10	13	13	10	6	4	3	1	2	2	1	1	100
91-	100	0	2	4	4	4	6	7	10	13	11	7	5	3	3	0	2	5	0	0	86
101-	150	1	7	9	13	30	31	17	15	22	18	13	12	4	13	2	2	7	0	0	216
151-	200	4	3	10	21	4	6	3	7	5	4	2	2	1	6	2	1	1	0	3	85
201-	250	0	0	6	6	2	3	3	3	2	2	1	0	0	0	0	0	1	1	1	31
251-	300	1	5	8	5	2	1	0	0	0	1	0	0	2	1	1	0	3	0	1	31
301-	350	1	1	8	0	1	0	0	0	1	0	0	0	0	2	0	0	0	1	5	20
351-	400	0	2	4	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	4	14
401-	450	1	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9
451-	500	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	4
501-	1000	4	4	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	6	20
1001-	2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
TOTAL		12	25	84	75	95	200	616	2725	9445	39461	10079	2940	553	133	33	23	32	5	28	66564

Appendix D

Trip Table Difference between Texas Model and Atomistic Model

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT MATRIX COMPARISON
B/CS TEST NETWORK COMPARISON OF 258x258 TRIP MATRICES
TEXAS MODEL AND ATOMISTIC

DATE 09OCT87
TIME 15:21:10

VOLUME COMPARISON REPORT ---- FREQUENCY DISTRIBUTION (V1-V2 / V1+V2).
MAXIMUM CENTROID NUMBER = 258 NUMBER OF PURPOSES = 1
INTERCHANGES WITH ZERO VOLUME TAPE 1 = 31148 TAPE 2 = 31543

PURPOSE 1

VOLUME GRP						NEGATIVE										POSITIVE				
V1		1.00 TO .75	.75 TO .50	.50 TO .40	.40 TO .30	.30 TO .20	.20 TO .10	.10 TO .05	.05 TO .02	.02 TO .01	-.01 TO +.01	.01 TO .02	.02 TO .05	.05 TO .10	.10 TO .20	.20 TO .30	.30 TO .40	.40 TO .50	.50 TO .75	.75 TO 1.00	TOT
0-	1	3414	56	306	1463	0	0	0	0	0	30813	0	0	0	0	0	0	0	0	3125	39177
2-	2	0	0	38	241	0	829	0	0	0	1773	0	0	0	0	0	1506	0	0	587	4974
3-	3	0	0	0	34	164	644	0	0	0	1226	0	0	0	0	968	0	0	433	73	3542
4-	4	0	0	0	2	23	624	0	0	0	927	0	0	0	747	0	281	0	62	16	2682
5-	5	0	0	0	0	22	91	423	0	0	697	0	0	0	558	205	0	41	10	1	2048
6-	6	0	0	0	0	4	112	312	0	0	571	0	0	409	0	160	24	0	3	0	1595
7-	7	0	0	0	0	2	93	273	0	0	470	0	0	345	139	19	0	3	0	0	1344
8-	8	0	0	0	0	1	87	225	0	0	363	0	0	272	112	26	3	0	0	0	1089
9-	9	0	0	0	0	0	11	269	0	0	274	0	0	244	94	13	0	0	0	1	906
10-	10	0	0	0	0	0	11	37	138	0	290	0	0	185	88	2	0	0	0	0	751
11-	15	0	0	0	0	0	46	222	586	0	876	0	680	211	147	7	0	0	0	0	2775
16-	20	0	0	0	0	0	6	150	358	0	456	0	354	214	26	1	0	0	0	1	1566
21-	25	0	0	0	0	0	4	50	275	32	296	0	256	59	8	1	0	0	0	0	981
26-	30	0	0	0	0	0	3	38	86	128	153	131	66	22	4	0	0	0	0	0	631
31-	35	0	0	0	0	0	2	10	87	87	119	80	51	15	2	1	0	0	0	0	454
36-	40	0	0	0	0	0	1	11	56	55	91	57	59	5	2	0	0	0	0	0	337
41-	45	0	0	0	0	0	3	13	58	59	49	47	45	5	2	0	0	0	0	0	281
46-	50	0	0	0	0	0	0	6	36	44	58	28	29	3	4	0	0	0	0	0	208
51-	60	0	0	0	0	0	3	15	31	36	131	26	10	7	3	1	0	0	0	0	263
61-	70	0	0	0	0	0	2	7	37	36	66	8	17	6	0	0	0	0	0	0	179
71-	80	0	0	0	0	0	0	8	26	36	64	12	9	4	2	0	0	0	0	0	161
81-	90	0	0	0	0	0	2	3	22	17	39	10	4	2	2	0	0	0	0	1	102
91-	100	0	0	0	0	0	2	4	14	16	28	9	4	5	0	0	0	0	0	0	82
101-	150	0	0	0	0	0	0	12	54	38	86	15	6	7	0	0	0	0	0	0	218
151-	200	0	0	0	0	0	0	8	26	15	23	9	1	0	0	2	0	0	0	1	85
201-	250	0	0	0	0	0	0	0	10	5	13	0	1	1	1	0	0	0	0	0	31
251-	300	0	0	0	0	0	0	1	13	6	5	2	3	0	1	0	0	0	0	0	31
301-	350	0	0	0	0	0	1	3	6	3	3	0	1	1	1	0	0	0	0	0	19
351-	400	0	0	0	0	0	0	2	4	3	3	0	2	0	0	0	0	0	0	1	15
401-	450	0	0	0	0	0	1	0	1	7	0	0	0	0	0	0	0	0	0	0	9
451-	500	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	1	4
501-	1000	0	0	0	0	0	2	2	6	5	4	1	0	0	0	0	0	0	0	0	20
1001-	2000	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1	4

DCCO / UAG TRANPLAN SYSTEM VERSION 5.0	REPORT MATRIX COMPARISON B/CS TEST NETWORK COMPARISON OF 258x258 TRIP MATRICES TEXAS MODEL AND ATOMISTIC	PAGE NO. 1 DATE 28SEP87 TIME 12:51:17

VOLUME COMPARISON REPORT ---- FREQUENCY DISTRIBUTION (V1-V2).

MAXIMUM CENTROID NUMBER = 258 NUMBER OF PURPOSES = 1

INTERCHANGES WITH ZERO VOLUME TAPE 1 = 31148 TAPE 2 = 31543

PURPOSE 1

VOLUME GRP V1		NEGATIVE -50 TO -31	-30 TO -21	-20 TO -11	-10 TO -8	-7 TO -6	-5 TO -4	-3 TO -3	-2 TO -2	-1 TO -1	-0 TO +0	POSITIVE +1 TO +1	+2 TO +2	+3 TO +3	+4 TO +5	+6 TO +7	+8 TO +10	+11 TO +20	+21 TO +30	+31 TO +50	TOT
0-	1	0	0	0	0	0	6	108	818	4307	30813	3125	0	0	0	0	0	0	0	0	39177
2-	2	0	0	0	0	0	6	32	241	829	1773	1506	587	0	0	0	0	0	0	0	4974
3-	3	0	0	0	0	0	3	31	164	644	1226	968	433	73	0	0	0	0	0	0	3542
4-	4	0	0	0	0	0	2	23	145	479	927	747	281	62	16	0	0	0	0	0	2682
5-	5	0	0	0	0	0	1	21	91	423	697	558	205	41	11	0	0	0	0	0	2048
6-	6	0	0	0	0	0	4	13	99	312	571	409	160	24	3	0	0	0	0	0	1595
7-	7	0	0	0	0	0	2	12	81	273	470	345	139	19	3	0	0	0	0	0	1344
8-	8	0	0	0	0	0	2	12	74	225	363	272	112	26	3	0	0	0	0	0	1089
9-	9	0	0	0	0	0	0	11	85	184	274	244	94	12	1	0	1	0	0	0	906
10-	10	0	0	0	0	0	5	6	37	138	290	185	69	19	2	0	0	0	0	0	751
11-	15	0	0	0	0	2	12	49	205	586	876	680	283	69	13	0	0	0	0	0	2775
16-	20	0	0	0	0	1	13	44	137	319	456	354	170	54	16	1	0	1	0	0	1566
21-	25	0	0	0	0	1	21	32	110	197	296	188	85	34	14	2	1	0	0	0	981
26-	30	0	0	0	2	1	14	37	73	128	153	131	66	15	8	3	0	0	0	0	631
31-	35	0	0	0	2	2	8	28	59	87	119	80	33	24	8	3	0	1	0	0	454
36-	40	0	0	0	3	7	6	11	41	55	91	57	44	15	5	1	1	0	0	0	337
41-	45	0	0	3	3	4	13	14	37	59	49	47	33	10	7	0	2	0	0	0	281
46-	50	0	0	0	4	1	10	9	25	48	47	28	17	8	4	2	3	2	0	0	208
51-	60	0	0	5	7	6	20	11	36	52	43	36	26	5	6	6	0	4	0	0	263
61-	70	0	0	5	4	4	11	22	36	26	26	14	8	8	6	5	4	0	0	0	179
71-	80	0	0	7	1	5	12	18	27	33	14	17	11	4	4	2	3	3	0	0	161
81-	90	0	1	4	1	7	14	9	8	11	14	14	5	5	2	2	1	2	1	1	102
91-	100	0	2	4	2	5	8	6	9	16	6	6	3	6	2	0	2	5	0	0	82
101-	150	1	7	10	14	22	36	14	21	19	21	15	10	7	8	3	3	7	0	0	218
151-	200	3	4	12	13	8	9	4	4	5	4	1	4	1	6	3	0	1	0	3	85
201-	250	0	0	7	3	4	3	1	5	3	1	1	0	0	0	0	0	1	1	1	31
251-	300	1	4	9	2	4	2	0	0	0	1	0	0	1	1	1	1	2	1	1	31
301-	350	1	1	8	0	0	1	0	0	0	0	0	0	0	1	1	0	0	1	5	19
351-	400	0	3	2	2	1	1	0	0	0	1	0	0	0	0	0	0	0	1	4	15
401-	450	0	1	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9
451-	500	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	4
501-	1000	4	4	4	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	6	20
1001-	2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
TOTAL		10	27	87	64	85	246	578	2668	9458	39622	10029	2878	542	150	35	22	30	5	28	66564

Appendix E

Statistical Calculations

of

TRANPLAN vs. Texas Model,

TRANPLAN vs. Atomistic Model, and

Texas Model vs. Atomistic Model

DCCO / UAG TRANPLAN SYSTEM VERSION 5.0	REPORT MATRIX COMPARISON B/CS TEST NETWORK COMPARISON OF 258x258 TRIP MATRICES TRANPLAN AND TEXAS MODEL	PAGE NO. 2 DATE 28SEP87 TIME 12:45:34

VOLUME COMPARISON REPORT ---- STATISTICAL CALCULATIONS.

MAXIMUM CENTROID NUMBER = 258 NUMBER OF PURPOSES = 1

PURPOSE 1

VOLUME GRP V1	VOL. TAPE1	AVG. VOL.	VOL. TAPE2	AVG. VOL.	AVG. DIFF.	STD. DEV.	PRCNT S.D.	PRCNT TOTAL	WGHTD AVG.	ROOT MN SQ.	PRCNT RMS	SUM OF SQ DIFF
0- 1	7895	.2	11869	.3	-.10	.56	2.79	2.00	5.59	.6	283.82	12828
2- 2	10074	2.0	8939	1.8	.23	1.10	.55	2.55	1.41	1.1	56.23	6371
3- 3	10755	3.0	10018	2.8	.21	1.14	.38	2.72	1.04	1.2	38.73	4839
4- 4	10488	4.0	10062	3.8	.16	1.15	.29	2.66	.77	1.2	29.08	3548
5- 5	10125	5.0	9760	4.8	.18	1.14	.23	2.57	.59	1.2	23.09	2699
6- 6	9528	6.0	9326	5.9	.13	1.15	.19	2.41	.46	1.2	19.32	2134
7- 7	9492	7.0	9279	6.8	.16	1.11	.16	2.40	.38	1.1	15.97	1695
8- 8	8712	8.0	8508	7.8	.19	1.12	.14	2.21	.31	1.1	14.21	1408
9- 9	8010	9.0	7994	9.0	.02	1.16	.13	2.03	.26	1.2	12.88	1196
10- 10	7900	10.0	7805	9.9	.12	1.12	.11	2.00	.23	1.1	11.31	1011
11- 15	35322	12.8	35034	12.7	.10	1.14	.09	8.95	.80	1.1	8.93	3604
16- 20	27584	17.8	27435	17.7	.10	1.15	.06	6.99	.45	1.2	6.48	2059
21- 25	22651	22.8	22562	22.7	.09	1.16	.05	5.74	.29	1.2	5.10	1345
26- 30	17808	27.9	17736	27.8	.11	1.17	.04	4.51	.19	1.2	4.21	882
31- 35	14906	32.8	14878	32.8	.06	1.19	.04	3.78	.14	1.2	3.63	646
36- 40	12614	37.9	12606	37.9	.02	1.16	.03	3.20	.10	1.2	3.08	452
41- 45	12110	42.9	12121	43.0	-.04	1.18	.03	3.07	.08	1.2	2.76	395
46- 50	9811	47.9	9784	47.7	.13	1.23	.03	2.49	.06	1.2	2.59	315
51- 60	14649	55.1	14670	55.2	-.08	1.13	.02	3.71	.08	1.1	2.05	339
61- 70	11980	65.5	11966	65.4	.08	1.02	.02	3.03	.05	1.0	1.56	192
71- 80	11880	75.2	11875	75.2	.03	1.25	.02	3.01	.05	1.3	1.66	247
81- 90	8575	85.8	8581	85.8	-.06	1.22	.01	2.17	.03	1.2	1.43	150
91- 100	8232	95.7	8232	95.7	.00	1.20	.01	2.09	.03	1.2	1.25	124
101- 150	26231	121.4	26245	121.5	-.06	1.12	.01	6.65	.06	1.1	.92	272
151- 200	14564	171.3	14582	171.6	-.21	1.33	.01	3.69	.03	1.3	.79	154
201- 250	7061	227.8	7061	227.8	.00	1.24	.01	1.79	.01	1.2	.55	48
251- 300	8389	270.6	8404	271.1	-.48	1.04	.00	2.13	.01	1.2	.42	41
301- 350	6488	324.4	6489	324.5	-.05	1.12	.00	1.64	.01	1.1	.34	25
351- 400	5173	369.5	5178	369.9	-.36	1.39	.00	1.31	.00	1.4	.39	29
401- 450	3743	415.9	3744	416.0	-.11	1.20	.00	.95	.00	1.2	.29	13
451- 500	1836	459.0	1837	459.3	-.25	1.79	.00	.47	.00	1.8	.39	13
501- 1000	14097	704.8	14110	705.5	-.65	1.28	.00	3.57	.01	1.4	.20	41
1001- 2000	6046	1511.5	6043	1510.8	.75	1.79	.00	1.53	.00	1.9	.13	15
TOTAL	394729	5.9	394733	5.9	.00	.86	.14	100.00	14.49	.9	14.49	49130

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT MATRIX COMPARISON
B/CS TEST NETWORK COMPARISON OF 258x258 TRIP MATRICES
TRANPLAN AND ATOMISTIC

DATE 28SEP87
TIME 12:48:26

VOLUME COMPARISON REPORT ---- STATISTICAL CALCULATIONS.

MAXIMUM CENTROID NUMBER = 258 NUMBER OF PURPOSES = 1

PURPOSE 1

VOLUME GRP V1	VOL. TAPE1	AVG. VOL.	VOL. TAPE2	AVG. VOL.	AVG. DIFF.	STD. DEV.	PRCNT S.D.	PRCNT TOTAL	WGHTD AVG.	ROOT MN SQ.	PRCNT RMS	SUM OF SQ DIFF
0- 1	7895	.2	11325	.3	-.09	.55	2.72	2.00	5.43	.6	275.10	12052
2- 2	10074	2.0	8642	1.7	.28	1.08	.54	2.55	1.37	1.1	55.70	6252
3- 3	10755	3.0	9734	2.7	.28	1.15	.38	2.72	1.05	1.2	39.60	5059
4- 4	10488	4.0	9903	3.8	.22	1.18	.30	2.66	.79	1.2	30.08	3795
5- 5	10125	5.0	9732	4.8	.19	1.18	.24	2.57	.60	1.2	23.90	2891
6- 6	9528	6.0	9218	5.8	.20	1.19	.20	2.41	.48	1.2	20.02	2292
7- 7	9492	7.0	9219	6.8	.20	1.16	.17	2.40	.40	1.2	16.89	1895
8- 8	8712	8.0	8500	7.8	.19	1.20	.15	2.21	.33	1.2	15.19	1608
9- 9	8010	9.0	7956	8.9	.06	1.24	.14	2.03	.28	1.2	13.82	1376
10- 10	7900	10.0	7817	9.9	.11	1.24	.12	2.00	.25	1.2	12.42	1219
11- 15	35322	12.8	34865	12.6	.17	1.31	.10	8.95	.92	1.3	10.35	4841
16- 20	27584	17.8	27416	17.7	.11	1.49	.08	6.99	.59	1.5	8.42	3478
21- 25	22651	22.8	22672	22.8	-.02	1.62	.07	5.74	.41	1.6	7.12	2621
26- 30	17808	27.9	17869	28.0	-.10	1.76	.06	4.51	.28	1.8	6.31	1979
31- 35	14906	32.8	14970	33.0	-.14	1.99	.06	3.78	.23	2.0	6.08	1812
36- 40	12614	37.9	12666	38.0	-.16	2.12	.06	3.20	.18	2.1	5.60	1498
41- 45	12110	42.9	12264	43.5	-.55	2.50	.06	3.07	.18	2.6	5.95	1842
46- 50	9811	47.9	9829	47.9	-.09	2.97	.06	2.49	.15	3.0	6.22	1814
51- 60	14649	55.1	14848	55.8	-.75	3.66	.07	3.71	.25	3.7	6.79	3717
61- 70	11980	65.5	12174	66.5	-1.06	3.66	.06	3.03	.17	3.8	5.82	2656
71- 80	11880	75.2	12057	76.3	-1.12	4.39	.06	3.01	.18	4.5	6.03	3249
81- 90	8575	85.8	8622	86.2	-.47	10.56	.12	2.17	.27	10.6	12.33	11177
91- 100	8232	95.7	8361	97.2	-1.50	6.45	.07	2.09	.14	6.6	6.92	3771
101- 150	26231	121.4	26894	124.5	-3.07	6.98	.06	6.65	.38	7.6	6.28	12567
151- 200	14564	171.3	14822	174.4	-3.04	22.86	.13	3.69	.49	23.1	13.46	45190
201- 250	7061	227.8	7140	230.3	-2.55	15.56	.07	1.79	.12	15.8	6.92	7709
251- 300	8389	270.6	8589	277.1	-6.45	15.59	.06	2.13	.12	16.9	6.23	8820
301- 350	6488	324.4	6752	337.6	-13.20	32.34	.10	1.64	.16	34.9	10.77	24404
351- 400	5173	369.5	5040	360.0	9.50	104.54	.28	1.31	.37	105.0	28.41	154261
401- 450	3743	415.9	3982	442.4	-26.56	32.59	.08	.95	.07	42.0	10.11	15907
451- 500	1836	459.0	1516	379.0	80.00	220.84	.48	.47	.22	234.9	51.17	220686
501- 1000	14097	704.8	15189	759.5	-54.60	65.61	.09	3.57	.33	85.4	12.11	145716
1001- 2000	6046	1511.5	4134	1033.5	478.00	833.12	.55	1.53	.84	960.5	63.55	3690310
TOTAL	394729	5.9	394717	5.9	.00	8.14	1.37	100.00	137.23	8.1	137.23	4408464

DCCO / UAG
TRANPLAN SYSTEM
VERSION 5.0

REPORT MATRIX COMPARISON
B/CS TEST NETWORK COMPARISON OF 258x258 TRIP MATRICES
TEXAS MODEL AND ATOMISTIC

DATE 28SEP87
TIME 12:51:17

VOLUME COMPARISON REPORT ---- STATISTICAL CALCULATIONS.

MAXIMUM CENTROID NUMBER = 258   NUMBER OF PURPOSES = 1

PURPOSE 1

VOLUME GRP V1	VOL. TAPE1	AVG. VOL.	VOL. TAPE2	AVG. VOL.	AVG. DIFF.	STD. DEV.	PRCNT S.D.	PRCNT TOTAL	WGHTD AVG.	ROOT MN SQ.	PRCNT RMS	SUM OF SQ DIFF
0- 1	8029	.2	11195	.3	-.08	.54	2.65	2.03	5.38	.5	267.47	11772
2- 2	9948	2.0	8699	1.7	.25	1.07	.54	2.52	1.35	1.1	55.06	6031
3- 3	10626	3.0	9650	2.7	.28	1.15	.38	2.69	1.04	1.2	39.54	4984
4- 4	10728	4.0	10016	3.7	.27	1.19	.30	2.72	.81	1.2	30.50	3992
5- 5	10240	5.0	9776	4.8	.23	1.17	.23	2.59	.61	1.2	23.90	2924
6- 6	9570	6.0	9323	5.8	.15	1.17	.19	2.42	.47	1.2	19.62	2211
7- 7	9408	7.0	9195	6.8	.16	1.16	.17	2.38	.40	1.2	16.79	1857
8- 8	8712	8.0	8544	7.8	.15	1.23	.15	2.21	.34	1.2	15.49	1672
9- 9	8154	9.0	8060	8.9	.10	1.26	.14	2.07	.29	1.3	14.05	1448
10- 10	7510	10.0	7374	9.8	.18	1.20	.12	1.90	.23	1.2	12.11	1102
11- 15	35434	12.8	35132	12.7	.11	1.31	.10	8.98	.92	1.3	10.31	4810
16- 20	27852	17.8	27689	17.7	.10	1.53	.09	7.06	.61	1.5	8.61	3669
21- 25	22401	22.8	22470	22.9	-.07	1.62	.07	5.67	.40	1.6	7.11	2585
26- 30	17591	27.9	17694	28.0	-.16	1.77	.06	4.46	.28	1.8	6.38	1995
31- 35	14883	32.8	14955	32.9	-.16	2.05	.06	3.77	.24	2.1	6.27	1918
36- 40	12767	37.9	12810	38.0	-.13	2.13	.06	3.23	.18	2.1	5.62	1529
41- 45	12075	43.0	12202	43.4	-.45	2.64	.06	3.06	.19	2.7	6.23	2015
46- 50	9969	47.9	10013	48.1	-.21	2.79	.06	2.53	.15	2.8	5.83	1626
51- 60	14538	55.3	14714	55.9	-.67	3.72	.07	3.68	.25	3.8	6.84	3764
61- 70	11697	65.3	11886	66.4	-1.06	3.75	.06	2.96	.17	3.9	5.96	2719
71- 80	12086	75.1	12266	76.2	-1.12	4.37	.06	3.06	.18	4.5	6.01	3274
81- 90	8769	86.0	8819	86.5	-.49	10.46	.12	2.22	.27	10.5	12.18	11192
91- 100	7846	95.7	7977	97.3	-1.60	6.81	.07	1.99	.14	7.0	7.31	4009
101- 150	26449	121.3	27096	124.3	-2.97	6.98	.06	6.70	.39	7.6	6.25	12551
151- 200	14585	171.6	14820	174.4	-2.76	23.09	.13	3.69	.50	23.3	13.55	45971
201- 250	7061	227.8	7140	230.3	-2.55	15.49	.07	1.79	.12	15.7	6.89	7637
251- 300	8404	271.1	8589	277.1	-5.97	15.56	.06	2.13	.12	16.7	6.15	8607
301- 350	6138	323.1	6401	336.9	-13.84	33.13	.10	1.55	.16	35.9	11.11	24493
351- 400	5529	368.6	5391	359.4	9.20	100.91	.27	1.40	.38	101.3	27.49	154018
401- 450	3744	416.0	3982	442.4	-26.44	32.88	.08	.95	.07	42.2	10.14	16022
451- 500	1837	459.3	1516	379.0	80.25	220.49	.48	.47	.22	234.6	51.09	220215
501- 1000	14110	705.5	15189	759.5	-53.95	65.91	.09	3.57	.33	85.2	12.07	145107
1001- 2000	6043	1510.8	4134	1033.5	477.25	833.22	.55	1.53	.84	960.2	63.56	3688123
TOTAL	394733	5.9	394717	5.9	.00	8.14	1.37	100.00	137.19	8.1	137.19	4405842