REGIONAL TRANSPORTATION AUTHORITY

SOUTH CORRIDOR TRANSIT PROJECT

PHASE II

TECHNICAL MEMORANDUM

TASK 4:

DEVELOP PATRONAGE FORECASTS

RIDERSHIP FORECASTING METHODS REPORT

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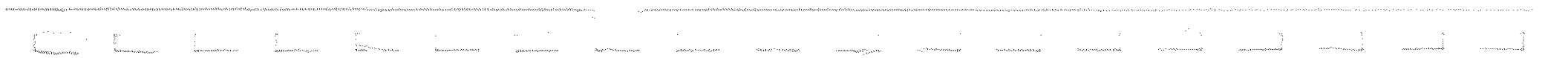

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1. Introduction

This report describes the procedures that will be used for estimating ridership for each of the alternatives considered in Phase II of the South Corridor Study. The ridership forecasting approach described in this report will be used to generate estimates of the expected patronage impacts associated with different transit alternatives in the South corridor of the Chicago Metropolitan area.

As described in Chapter 2 of this report, the modeling methodology is based on a microcomputer version of the EMME/2 Rail Alternatives Planning Study (RAPS) model developed by Metra and implemented on its IBM mainframe computer. In developing a microcomputer version of the model, the consultant staff has:

- Converted data and procedures from the IBM mainframe version of EMME/2 to the microcomputer version of EMME/2.
- Tested the microcomputer version of EMME/2 to determine whether it reliably replicates the mainframe's results.
- Developed a focused area system that concentrates detail in the South corridor and aggregates information elsewhere.
- Prepared and tested a 1990 network to validate the model's ability to replicate recent ridership results on CTA and Metra in the South corridor.

The remainder of this report contains a description of the model in Chapter 2, a summary of the 1985 validation results in Chapter 3, and a summary of the 1990 validation results in Chapter 4.

2. Description of Travel Forecasting Procedures

The approach used to estimate transit ridership in Phase II of the South Corridor Study is based on the EMME/2 Rail Alternatives Planning Study (RAPS) demand models developed by Metra to estimate ridership on commuter rail and other transit services in the Chicago area. The original model was calibrated and estimated using the results of the 1970 Chicago area home interview survey. Metra validated the model by comparing 1985 modeled and observed commuter rail ridership by line to confirm that the model adequately replicates observed commuter rail demand.

The original RAPS model operates on Metra's IBM-mainframe computer. For Phase II of the South Corridor Study, RAPS was converted to the microcomputer (MS-DOS, i386/i486) version of EMME/2 to allow its use by consultant and RTA staff. The success of the conversion was tested by re-running Metra's 1985 validation runs to determine whether the microcomputer version of the model replicates the results of the mainframe model. This test was performed using Metra input data and model procedures (converted to the microcomputer but otherwise not changed). The results of this test are described in Chapter 3.

The model actually used for testing South Corridor transit alternatives has several modifications from the original Metra model designed specifically for application in this project. These include:

- **Focused Area System.** A focused area system has been developed that increases the geographic level of detail in the vicinity of the South Main, Englewood, and Jackson Park rapid transit lines. This focused area system will be used for the mode split and assignment model procedures. Trip generation and distribution will continue to use the RAPS area system to preserve consistency with the data used to develop those models.

- **Revised Transit Travel Time Functions.** During the development of the 1990 networks, it was determined that the original transit travel time procedures overestimated the running speeds of commuter rail, rapid transit and bus services. Revised procedures were developed to more closely represent scheduled transit running speeds.

- **Revised Park-and-Ride Link Coding Procedures.** During the development of the 1990 networks and 1990 validation testing, it was determined that the original park-and-ride links created drive-access service areas that were too large for certain Metra Electric stations and too small for Rapid Transit park-and-ride facilities in the corridor. Revised procedures were developed that adjusted the service areas to yield better ridership results at those stations.

- **Revised Mode Choice Model Coefficients and Constants.** During 1990 model development and testing, a series of small adjustments were made to the mode choice model coefficients and constants that:

  - Corrected for changes in transit travel time functions described above.
  - Treated drive access to rapid transit stations more like the drive-to-commuter rail mode.

The enhanced version of the model was revalidated for 1990 to establish that the model adequately estimates rapid transit, bus, and commuter rail ridership following these changes.

The results of this validation are described in Chapter 4.

The remainder of this chapter describes the RAPS model as implemented for both the 1985 and 1990 validations. The model will be applied in analyzing alternatives using the revised model used for the 1990 validation.

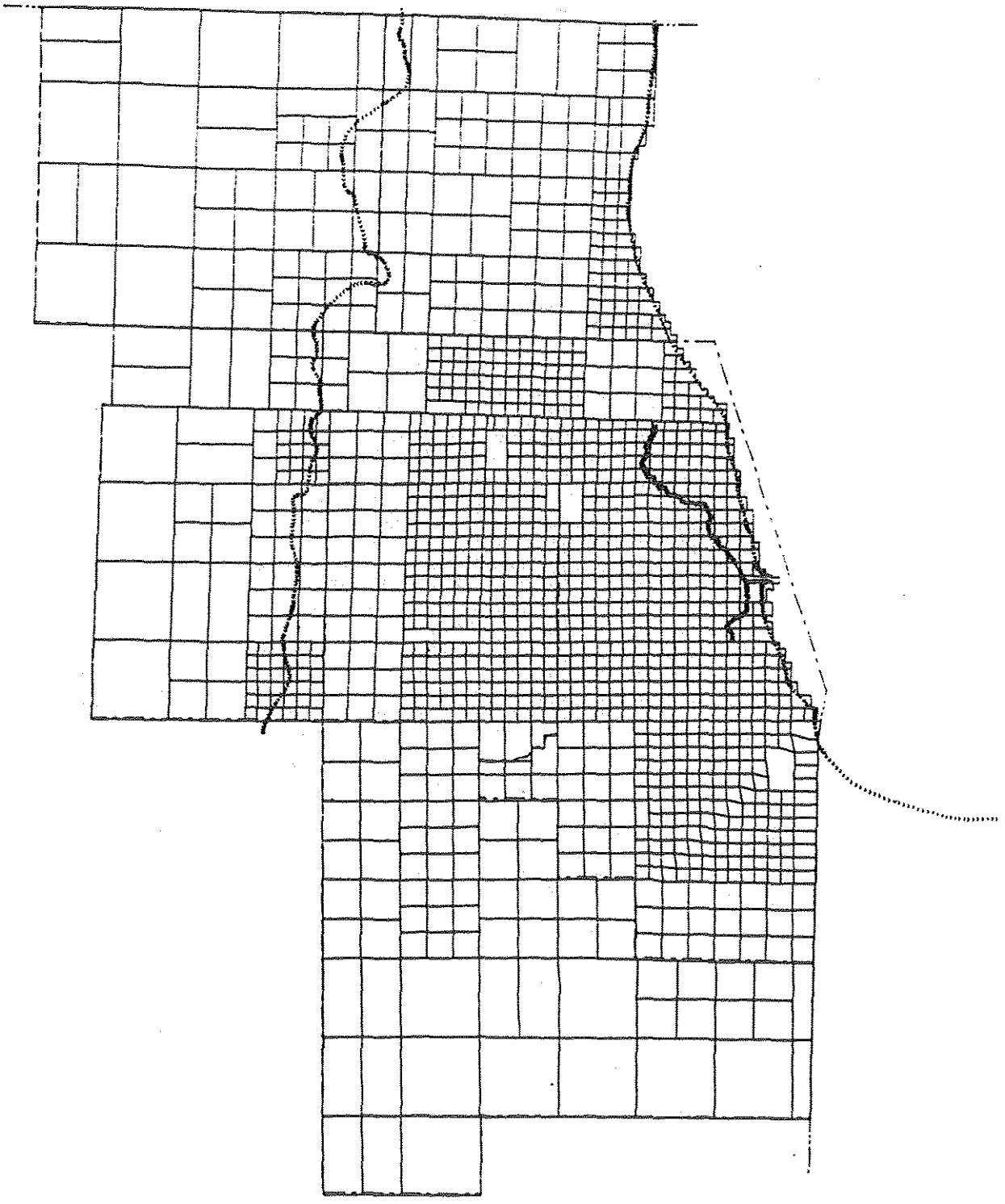
ZONE SYSTEM

The model region includes all of Cook, DuPage, Will, Kane, Lake, and McHenry counties in Northeastern Illinois. Two geographic area systems are used in this project for different phases of the modeling effort. These are:

1. **The Metra RAPS Area System.** This area system is used for all phases of the 1985 validation. It will also be used for the trip generation and distribution phases of the 1990 validation and 1994/2010 South Corridor Alternatives. This area system covers the six-county Northeastern Illinois region and consists of 1,334 internal and 26 external zones. It is composed of quarter-sections in the Chicago CBD; full sections in most of the remaining portion of Cook County, most of DuPage County, Elgin, Aurora, and Waukegan; and aggregated full sections in the remaining areas. A map showing the Metra zone boundaries is shown in Exhibit 2-1.

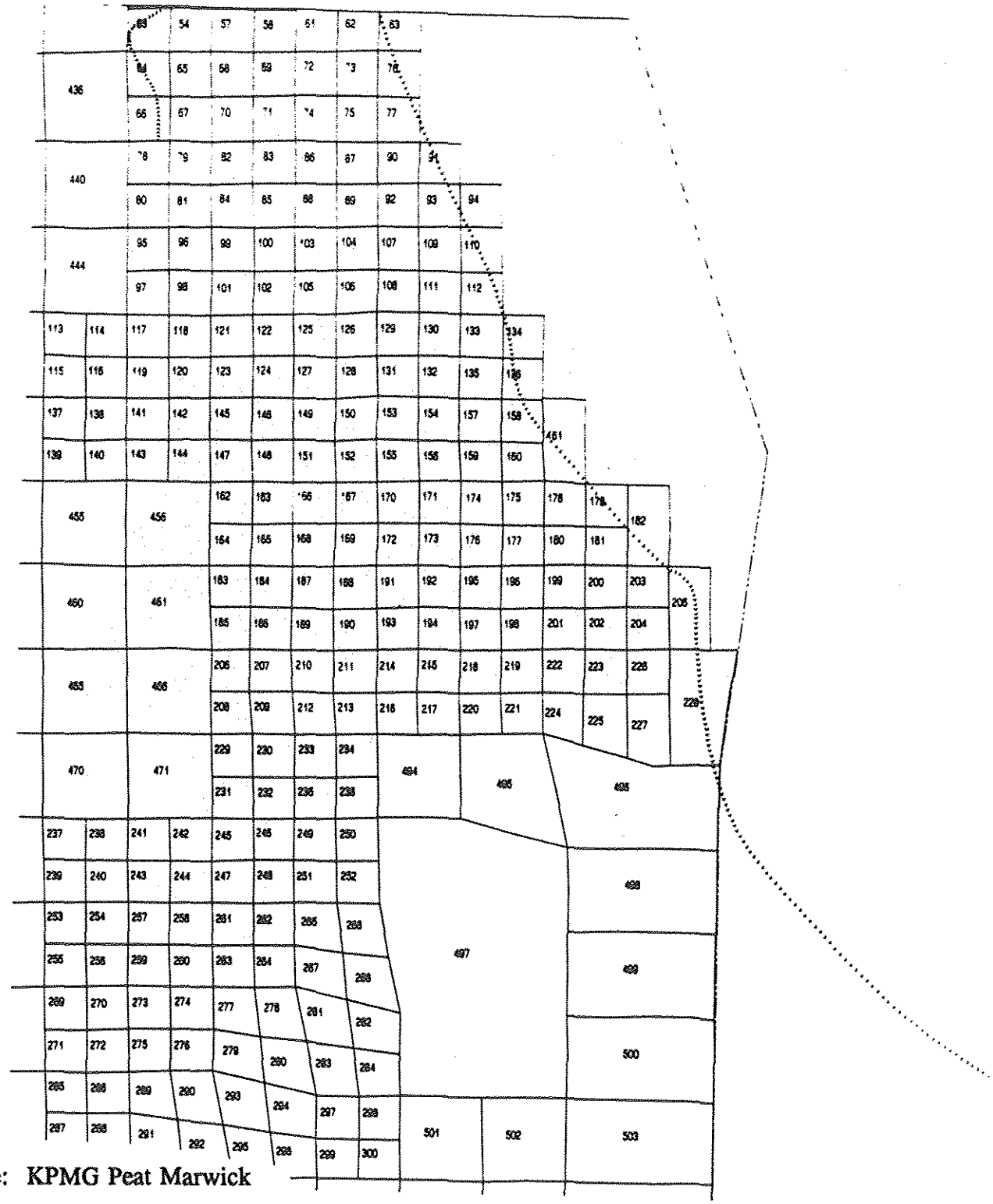
2. **The South Corridor Focused Area System.** This area system is used for mode choice and assignment in the 1990 validation and 1994/2010 South Corridor Alternatives. It consists of 673 internal and 26 external zones and is composed of quarter-sections in the Chicago CBD and areas within walking distance of the South Main, Jackson Park, and Englewood rapid transit lines; full sections within the influence area of those rapid transit lines; and aggregated full sections elsewhere in the region. Exhibit 2-2 presents an overview of the area system.

Exhibit 2-1
Metra Area System



Source: Metra

Exhibit 2-2
Focused Area System Zone Map
South Corridor Zones



Source: KPMG Peat Marwick

Two area systems are used in the 1990 validation run (and the analysis of alternatives) because:

- Trip distribution models are very sensitive to the area system. Since the Metra trip generation and distribution models were calibrated and validated for the RAPS area system, that area system will be used in the model application.

- Mode choice models are less sensitive to changes in the area system and tend to perform better with smaller, more detailed zones that allow the models to better distinguish between travelers who can walk to transit (or rapid transit) and those who must drive (or take a feeder bus). The use of a focused area system in the South corridor allows the model to better predict the impact of transit alternatives in that corridor.

NETWORK LINK FILES

Network link files are maintained for 1985, 1990, and 2010 for the full and focused area systems. The link files contain all modeled transportation links including facilities used by automobiles, buses, and rail transit. They also include transit auxiliary links which are used for accessing and transferring between transit lines.

Each alternative requires three link files for the Metra Area System and three link files for the Focused Area System. These files are:

- **Base Link File:** The base link file is used for work distribution and non-work distribution and mode choice. The key characteristic of this link file is that it has most transit centroid walk connectors coded with a distance of 0.25 miles or less.

- **Fare Calculation Link File:** The fare calculation link file is used for computing commuter rail fares. Commuter rail links are coded (in user field 3) with the number of fare zones crossed by the link. This file also has slightly different centroid walk connector distances (as compared to the base) but most are still 0.25 miles or less.

- **Work Mode Split Link File:** The work mode split link file is used for work mode split calculations. The key difference of this network from the base transit network is that distances on transit walk access and egress links are coded using distances based on zone size rather than using a maximum distance of 0.25 miles.

The remainder of this section describes the coding standards used to create the link files.

Modes

In EMME/2, each link in the network includes a list of the highway, transit, and auxiliary transit modes that are allowed to traverse the link. Auxiliary transit modes are defined as those walk and auto access modes that allow access to, from, and between transit lines as part of the origin-to-destination transit trip.

The following modes are defined in the Metra networks:

- **Automobile**
  a - automobile

- **Transit**
  b - bus
  c - commuter rail
  r - CTA rail
  x - express bus
  l - light rail

- **Auxiliary Transit**
  w - walk
  u - pedestrian ways
  t - transfer links
  d - walk access links
  e - walk egress links
  p - park-and-ride to commuter rail
  o - park-and-ride to rapid transit
  s - park-and-ride to bus

Area Types and Facility Types
Link types on automobile links are coded using a two-digit number representing geographic location and functional classification and are the same for 1985, 1990, and 2010. The link types are defined as follows:

Code	Geographic Location
1	Chicago CBD
2	Chicago Non-CBD
3	Suburban Cook County
4	DuPage County
5	Kane County
6	Lake County
7	McHenry County
8	Will County
9	External

Code	Functional Classification
0	Ramps
1	Freeways
2	Major Arterials
3	Area Service
4	Other Principal Arterials (Urban)
5	Minor Arterials (Urban)
6	Collectors (Urban)
7	Major and Minor Arterials (Rural)
8	Toll Links
9	Centroid Collectors

Other Link Attributes

EMME/2 has a number of required and user-defined link attributes that are used to represent different data items depending on the link type and the network (peak distribution/off peak, fare, and peak mode choice) being used. The definition of link attributes does not change between 1985, 1990, and 2010. The uses of each of the link attributes are summarized in Exhibit 2-7. Transit and auxiliary transit links are described in more detail in the section on transit networks.

HIGHWAY NETWORK

The highway network consists of the automobile links described above and a series of turn penalties the restrict travel between selected pairs of links. The highway travel time inputs to the distribution and mode choice models are calculated using the estimated peak and off peak loaded link speeds. These loaded speeds are obtained using the lookup table shown in Exhibit 2-4 and the vdf attribute of the link. The Volume Delay Function (VDF) attribute is a code similar to the link type except that it is composed of a two-digit code representing area type and functional classification rather than the geographic location and functional classification. The area type code varies between 1 and 5 where 1 represents the most rural areas and 5 represents the most urban areas. The area type is set by a special program described in Appendix A. The functional classification is the same value used in the link's type.

The same estimated loaded speeds for a given area type and facility classification are used in 1985, 1990, and 2010 but are different for the peak and off peak periods. Because the link's area type and facility type may change from year to year, the link speed may change in response to changes in socioeconomic conditions or in response to highway improvement projects.

Travel times for toll links are not based on distance and speed calculations. Instead the highway travel times for these facilities are computed as:

$$\text{Travel Time} = \frac{ul1 + ul2}{(ul1 \times 425) + (ul2 \times 625)} \times 60$$

where:

Travel Time = Highway Travel Time in Minutes
ul1 = Number of Manual Toll Booths
ul2 = Number of Automatic Toll Booths

Exhibit 2-3
Link Attributes

Link Type	Allowable Modes	Link Type(s)	Distance (in miles)	Number of Lanes	Volume-Delay Function	U1	U2	U3
Highway: Highway	abx	10-97 except types ending in 8 or 9	actual length	actual number of lanes	1st digit: area type 2nd digit: functional class	speed	blank	blank
Toll Links	abx	18,28,38,48,58, 68,78,88,98	actual length including approach, booth, & departure links	actual number of lanes	18, 28, 38, 48, 58	No. of manual booths	No. of automatic booths	toll in cents
Metra Dummy Links	abx	19,29,39,49,59, 69,79,89,99	0	9	99	blank	blank	blank
Transit Bus-only	bx	5	actual length	—	—	blank	blank	blank
CTA Rail	r	7	actual length	—	—	see text	see text	see text
Commuter Rail	c	8	actual length	—	—	see text	see text	see text
Light Rail	l		actual length	—	—	—	average speed	—
Auxiliary Transit Centroid Connectors	ade (modes d and c are mutually exclusive)	19,29,39,49,59, 69,79,89,99	see text	9	19,29,39,49,59	link length as a function of zonal area	blank	blank (unless mode p,o,s then parking cost)
Park-and-ride Links	p,o, or s	19,29,39,49,59, 69,79,89,99	airline distance	—	—	blank	blank	station parking cost
Transfer links	t	4	.10	—	—	blank	blank	blank
Walk-only links	w	6	actual length	—	—	blank	blank	blank
Pedway link	u	6	actual length	—	—	blank	blank	blank

Source: Metra

Exhibit 2-4
Estimated Loaded Speeds for Peak and Off Peak Networks
(Miles per Hour)

Functional Class	Peak/ Off Peak	Area Type				
		1	2	3	4	5
0 - Ramps	Peak	31	25	25	25	10
	Off Peak	37	30	30	30	30
1 - Freeways	Peak	48	48	48	43	20
	Off Peak	55	55	55	52	47
2 - Major Arterials	Peak	39	33	30	27	15
	Off Peak	42	38	35	32	34
3 - Area Service	Peak	37	32	30	27	12
	Off Peak	41	37	35	33	29
4 - Other Principal Arterials (Urban)	Peak	37	37	31	27	20
	Off Peak	41	41	33	32	34
5 - Minor Arterials (Urban)	Peak	33	32	31	23	12
	Off Peak	36	34	33	30	28
6 - Collectors (Urban)	Peak	30	27	27	23	9
	Off Peak	32	29	29	27	27
7 - Major and Minor Arterials (Rural)	Peak	37	32	26	23	12
	Off Peak	41	37	31	27	28
8 - Toll Links	Peak	--	--	--	--	--
	Off Peak	--	--	--	--	--
9 - Centroid Connectors	Peak	23	21	21	17	17
	Off Peak	23.6	21.5	21.5	20.1	20.6

Source: Metra

TRANSIT NETWORKS

In EMME/2, the characteristics of the transit network are incorporated into the transportation network by:

- Coding transit and auxiliary transit links in the network link files
- Coding transit routes, headways, and default speeds in the transit itinerary file.
- Creating transit travel time functions
- Executing the transit assignment procedures

Each of these subjects is described in the sections that follow.

Transit Link Characteristics

As indicated earlier, separate link files are maintained for each year/alternative, area system, and network type (base, fare calculation, and work mode split). The key characteristics of each file is presented below.

Transit Link Characteristics

Original/Revised Travel Times and File Type	Walk Access Link Distance	Commuter Rail and Rapid Transit Links		
		UL1	UL2	UL3
ORIGINAL METRA TRAVEL TIME PROCEDURES				
Distribution	0.25	travel time, local	travel time, accelerating	travel time, decelerating
Fare Calculation	0.25			number of fare zones crossed
Mode Split	Actual Length	travel time, local	travel time, accelerating	travel time, decelerating
REVISED TRAVEL TIME PROCEDURES				
Distribution	0.25	peak local travel time	off peak local travel time	
Fare Calculation	0.25			fare zones
Mode Choice	Actual Length	peak local travel time	off peak local travel time	

Transit Access Links

Each zone is connected to the transit network through a series of walk and park-and-ride links. Walk to transit links are coded by connecting each zone centroid to one corner of the zone and by adding an additional centroid connector, if necessary, to attach the centroid to the best transit lines or stations serving the zone. No attempt is made, however, to attach the

centroid to all transit lines serving a given zone. Walk links that cross any portion of another zone are avoided wherever possible.

Walk link distances are coded differently depending on the network:

- **Peak Distribution, Peak Fare, and Off Peak Networks:** Walk links are coded as the actual centroid-to-transit node distance up to a maximum of 0.25 miles. Centroids that are more than 0.25 miles from the nearest transit line are coded as 0.25 miles. To account for fact that not all persons within the zone are able to reach transit within this distance, a walk percent is used to limit the use of transit to just those persons within 0.25 miles of the nearest transit stop.

- **Peak Mode Split Network:** Walk link distances are coded with a value that is related to the size (area) of the zone. The formula used to estimate walk link distance is:

  DIST = 0.6 * SQRT(ZONE AREA in square miles)

Park-and-ride links are separately coded for park-and-ride facilities associated with commuter rail, rapid transit, and express bus services. In the original Metra model, commuter rail park and ride links are coded so that each zone is connected by one (and only one) park-and-ride link to the commuter rail station (with parking) most-used by residents of that zone. The choice of station connected to each zone is based on a license plate survey conducted by Metra in each station's parking lot. Some zones in the remote portions of the modeling region are not connected to any Metra station to prevent overloading of some Metra lines. Zones in downtown Chicago (north of 39th, east of Ashland, and south of North) are also not auto connected to a Metra station, representing the lack of park-and-ride facilities for persons living in that area. As part of the 1990 validation process, these coding procedures were slightly amended to limit the park-and-ride coverage area of stations on the Metra Electric mainline to just those zones that are closer to the Metra Electric mainline than to other commuter rail **or** rapid transit facilities. The revised procedures are used for the 1990 validation and all alternative runs.

In the original Metra model, rapid transit stations with park-and-ride lots are connected to the nearest 9 or 10 Metra zones (full sections) including any zones immediately adjacent to the station. During the 1990 validation, these coding procedures were slightly relaxed so that the rapid transit coverage areas are similar to those used for commuter rail. The revised procedures are used for the 1990 validation and all alternative runs.

Bus park-and-ride connectors are coded for formal park-and-ride lots only. No attempt is made to account for informal bus park-and-ride activity. Bus park-and-ride lots are also connected to the nearest 9 or 10 closest Metra zones and, again, the focused areas are coded to preserve the same geographic coverage of each lot.

Walk/Transfer Links

A downtown walk network is coded allowing persons to walk along downtown streets to transfer between transit lines or to walk to their final destination from their downtown transit stop or station. These walk links parallel the downtown auto links and are traversed at the default walk speed. Transfer links are used to connect rapid transit and commuter rail stations to the nearest highway network node and are coded with a nominal distance of 0.10 miles.

Commuter Rail and Rapid Transit Links

Commuter rail and rapid transit links are coded with either the calculated travel time or with the number of fare zone crossings (commuter rail only) depending on the network. The procedures used to calculate travel times are discussed later in the section on transit travel times.

Transit Itinerary Coding

Transit itineraries are used to represent each transit route. The data representing each route includes route name and identification code, mode, headway, default operating speed, user-specified data, and the sequence of nodes representing the geographic location of the route. Coding procedures are similar to the procedures developed by Metra for coding routes and are described below:

Commuter Rail Itinerary Coding

The following four-step methodology is used for coding commuter rail itineraries:

1. Define the peak hour for each line with the objective of including the greatest variety and number of trains. Generally, this peak hour falls between 7:30 AM and 8:30 AM.

2. Identify the stopping pattern for each train as shown in the sample presented in Exhibit 2-5. Trains are coded as one-way lines. Reverse commuter trains are coded as separate lines.

3. Using the stopping pattern as a guide, code the peak hour transit routes. Routes with identical stopping patterns are aggregated into one route with the combined headway representing all of the individual lines. The dwell time is coded for each link using the following rules:

Exhibit 2-5
Sample Commuter Rail Stopping Pattern Worksheet

Chicago Northwestern Northwest Line Itin.
Schedule Effective as of March 13,1988
7:24am -8:24am Inbound Trains

Station ID	Station Name	Metra Node #	Train # 608	Train # 610	Train # 612	Train # 614	Train # 616	Train # 618	Train # 620	Train # 622
13631	Harvard	9794	1					1		
	Hartland	9793								
13516	Woodstock	9792	1					1		
	Richmond									
	Ringwood									
13506	McHenry	9998							1	
13432	Crystal Lake	9791	1		1	1		1		1
13428	C.L. Junction	9837								
13386	Cary	9790			1			1		
13373	Fox River Grove	9789			1			1		
13319	Barrington	9788	1	1	1			1	1	1
13268	Palatine	9787	1	1	1	1		1		1
13244	Arlington Park	9840	1	1	1		1			1
13228	Arlington Hts	9785	1	1	1	1	1			1
13200	Mt. Prospect	9784	1	1	1		1			1
13186	Cumberland	9783	1		1			1		1
13171	Des Plaines	9782	1	1	1	1			1	1
13150	Dee Road	9781		1		1			1	
13135	Park Ridge	9780		1	1	1			1	
13126	Edison Park	9779		1		1				1
13114	Norwood Park	9778		1		1				1
13101	Gladstone Park	9777		1						1
13091	Jefferson Park	9776		1		1				1
13070	Irving Park	9775		1						1
13029	Clybourn	9749	1	1	1	1	1	1	1	1
13000	CNW Station	9748	1	1	1	1	1	1	1	1

Source: Metra

dwell time	if the train stops at the second node
#.00	if the train skips the second node
<.00	if the train stops at the second node but only boardings are permitted
>.00	if the train stops at the second node but only alightings are permitted

The average dwell time was specified as 0.50 minutes in the original Metra travel time procedures and is set to a line-specific estimate of station delay for the revised travel time procedures (between 0.9 and 2.1 minutes).

The travel time function (TTF) is entered for each link as follows:

1= diesel train stopping at both nodes
2= diesel train stopping at the first node but not the second node
3= diesel train not stopping at either node
4= diesel train not stopping at the first node but stopping at the second node

31= electric train stopping at both nodes
32= electric train stopping at the first node but not the second node
33= electric train not stopping at either node
34= electric train not stopping at the first node but stopping at the second node

The dwell times and TTFs need only be coded when their value must be changed from one link to the next. The layover time at the end of each record is set to 1 minute to indicate that trains do not return immediately in the reverse direction.

4. Code header information for each line. Each line is named with an alphanumeric line name and train number. The mode is always set to "c" (commuter rail) and the vehicle type is "1" (diesel) or "2" (electric). The headway is coded with the actual combined headway in minutes representing the number of trains with identical stopping patterns occurring during the peak hour. For example, if only one train in the peak hour has a given stopping pattern, then the headway is coded as 60 minutes; if two trains in the peak hour have the same stopping pattern during the peak hour, then the headway is coded as 30 minutes, and so on. The speed is coded with the maximum allowable cruising speed for the train. In the revised travel time procedures, the dwell time used for a particular line is coded in user field 1 for use by the travel time functions.

Rapid Transit Itinerary Coding

The following four-step methodology is used for coding rapid transit itineraries:

1. Prepare a worksheet (similar to that used for commuter rail) showing the "A" stopping pattern and the "B" stopping pattern for each line.

2. Code rail itineraries from the worksheet. CTA rail lines are coded from one end of the line to the other and back (commuter rail lines are coded one-way only). Dwell times are coded as follows:

dwell time	train stops at the second node
#.00	train skips the second node
<.25	train stops for boardings only at the second node
>.25	train stops for alightings only at the second node

The dwell time is set to 0.25 minutes with the Metra travel time procedures and 0.45 minutes for the revised travel time procedures.

Travel time functions (TTF) are coded for each link as follows:

11	train stops at both the first and second node
12	train stops at the first node but not the second node
13	train does not stop at either node
14	train does not stop at the first node but does stop at the second node

The dwell time and TTF codes need only be coded where their values change from one link to the next. The layover time is set to 1 minute at the end of the line.

3. Code header information including the abbreviated line name, the mode "r" (rapid transit), the vehicle type of "3", the default speed of 55 miles per hour (except on the Evanston Express and the Ravenswood B, where the default speed is set to 25 miles per hour to represent the impact of 90-degree turns. Under the original Metra travel time procedures, line user (UT) field 1 is set to the minimum of the headway or 10 minutes. With the revised travel time procedures, the dwell time (0.45 minutes) is coded in user field 1 for use by the travel time functions.

Bus Service Itinerary Coding

Bus service itineraries are coded using the following 3-step procedure.

1. Assemble base data. CTA bus routes are coded using information from CTA's Description of Routes and quarterly "Operating Facts".

2. Code the itinerary using the highway network nodes and EMME/2. Because EMME/2 can determine intermediate nodes, the analyst need only code those nodes where the line deviates from a straight path or where it changes between local and express service. Dwell times and travel time functions (TTF) are coded as follows:

   - Local Service: Dwell=0.1, TTF=21
   - Express Service: Dwell=#.00, TTF=22

   The layover time is coded as 1 minute at the end of each record.

3. Code header information for each route. The mode and vehicle types are assigned based on the main type of service on the line as follows:

   - Local Routes: Mode=b, Vehicle=4, Speed=20
   - Express Routes: Mode=x, Vehicle=5, Speed=40

   Headways are coded with the actual headways and line user field 1 is coded with the minimum of the headway or 10 minutes. In the 1990 validation and all alternative runs, a headway penalty of 2.0 minutes is added to express buses to account for the 20 cent (in $1990) surcharge for that mode.

4. In the 1990 validation and all alternative runs, a line-specific travel time adjustment factor (described later in the section on transit travel times) is coded in transit user field 1 (UT1).

Itinerary Differences for the Fare Network

The fare itinerary file is based on the peak itinerary file with the following differences:

- Only one commuter rail line is coded for each line. It is coded with all stops and a dwell time of +0.00 and a TTF of 4 (5 using the revised travel time procedures), and a layover of 0.00 minutes.
- Commuter rail headways are coded as 10 minutes.
- No rapid transit lines are included in the network.

Transit Travel Times

The original transit travel time functions developed by Metra were used in the 1985 validation for determining how well the microcomputer model replicates the mainframe model. In conducting the 1990 validation, revised travel time procedures were developed that improve the ability of the model to replicate scheduled transit travel times. The original and revised procedures for each mode are discussed below.

Commuter Rail Travel Times (Original Procedure)

Commuter rail travel times are computed outside of EMME/2 and are stored on the commuter rail links in the three link user data fields:

UL1= local train (accelerates and decelerates on this link)
UL2= accelerating express train
UL3= decelerating express train

The equations used to compute these link times are:

UL1 = 1.30 + ((DIST-0.36)/0.50) if 0.00 < DIST <= 0.53
UL1 = 1.60 + ((DIST-0.53)/0.58) if 0.53 < DIST <= 0.75
UL1 = 2.00 + ((DIST-0.75)/0.67) if 0.75 < DIST <= 1.00
UL1 = 2.40 + ((DIST-1.04)/0.75) if 1.00 < DIST <= 1.40
UL1 = 2.90 + ((DIST-1.42)/0.83) if 1.40 < DIST <= 1.90
UL1 = 3.40 + ((DIST-1.91)/0.92) if 1.90 < DIST <= 2.60
UL1 = 4.10 + ((DIST-2.57)/1.00) if 2.60 < DIST <= 3.50
UL1 = 5.00 + ((DIST-3.51)/1.08) if 3.50 < DIST <= 4.90
UL1 = 6.30 + ((DIST-4.90)/1.17) if 4.90 < DIST

UL2 = 0.83 + ((DIST-0.29)/0.58) if 0.00 < DIST <= 0.44
UL2 = 1.10 + ((DIST-0.44)/0.67) if 0.44 < DIST <= 0.65
UL2 = 1.40 + ((DIST-0.64)/0.75) if 0.65 < DIST <= 0.93
UL2 = 1.70 + ((DIST-0.93)/0.83) if 0.93 < DIST <= 1.32
UL2 = 2.20 + ((DIST-1.32)/0.92) if 1.32 < DIST <= 1.86
UL2 = 2.70 + ((DIST-1.86)/1.00) if 1.86 < DIST <= 2.68
UL2 = 3.50 + ((DIST-2.67)/1.08) if 2.68 < DIST <= 4.00
UL2 = 4.70 + ((DIST-4.00)/1.17) if 4.00 < DIST

UL3 = 1.01 + ((DIST-0.40)/0.75) if 0.00 < DIST <= 0.49
UL3 = 1.13 + ((DIST-0.49)/0.83) if 0.49 < DIST <= 0.60
UL3 = 1.30 + ((DIST-0.60)/0.92) if 0.60 < DIST <= 0.71
UL3 = 1.40 + ((DIST-0.71)/1.00) if 0.71 < DIST <= 0.84
UL3 = 1.50 + ((DIST-0.84)/1.08) if 0.84 < DIST <= 0.97
UL3 = 1.61 + ((DIST-0.97)/1.17) if 0.97 < DIST

Each segment in each transit route has a travel time function code that determines how the link data described above is used to compute the route's travel time. The coded travel time function depends on the type of train (diesel or electric) and the type of operation (local, accelerating, cruising, and decelerating). Local trains stop at both the a-node and the b-node on the link, accelerating trains stop at just the a-node, cruising trains do not stop at either node, and decelerating trains stop at just the b-node. The travel time function for each situation is presented in Exhibit 2-6.

Commuter Rail Travel Times (Revised Procedure)

The revised procedures for estimating commuter rail travel times are based on scheduled travel times contained in published Metra timetables. Schedules for each line (e.g., Burlington Northern, C&NW North, etc.) are used to estimate:

Exhibit 2-6
Travel Time Functions for Commuter Rail
(Original Travel Time Approach)

Train Type		Function	
Diesel	Local	1	Time = UL1
Diesel	Accelerating	2	Time = UL2
Diesel	Cruising	3	Time = LENGTH*60/SPEED
Diesel	Decelerating	4	Time = UL3
Electric	Local	31	Time = UL1
Electric	Accelerating	32	Time = UL2
Electric	Cruising	33	Time = LENGTH*60/SPEED
Electric	Decelerating	34	Time = UL3

Note: In the table above, LENGTH refers to the link length and SPEED refers to the default speed coded for each line.

Source: Metra

- **Local Travel Time:** The local travel time is based on the station-to-station time for trains making all stops. This time is determined by selecting one local train as the model train and calculating station-to-station travel times for that train. In cases where no train is local for the entire length of the line, several trains may be used as the model for different portions of the line. The peak local travel time is coded in link user field (UL) 1 and the off peak travel time is coded in user field 2.

- **Average Dwell Time:** Skip-stop trains are compared to the model train's times to determine the average time saved by skipping a station stop. The total travel time savings (as compared to the model train) is divided by the total number of skipped station stops to estimate the average travel time savings per station stop. All trains along a given line or family of lines (e.g., Metra Electric Blue Island, Main Line, South Chicago, and South Shore) are coded with the same average travel time savings. The average travel time savings is stored in the itinerary file as user field (UT) 1 and in the itineraries as the dwell time for all station stops.

The commuter rail travel time functions compute link travel time as follows:

- **Peak:** travel time = UL1 - UT1
- **Offpeak:** travel time = UL2 - UT1

Where station stops are made, EMME/2 adds the average dwell to compute the total station-to-station travel time.

Rapid Transit Travel Times (Original Procedure)
Link travel times for CTA Rapid Transit services are computed within EMME/2 for local, accelerating, cruising, and decelerating trains using the travel time functions shown in Exhibit 2-7.

Rapid Transit Travel Times (Revised Procedure)
The revised rapid transit travel times are computed using the same approach as for the commuter rail lines except that CTA operator schedules are used instead of public time tables. Because these schedules do not include timepoints at every station, station-to-station travel times are interpolated using the timepoint-to-timepoint travel times and station-to-station distance.

Bus/LRT Travel Times (Original Procedure)
Travel times for bus service are computed for each type of service using the automobile time on the link and a factor to account for stops and vehicle performance. LRT travel time is computed using the average LRT speed on each link and is stored in link user variable UL2. The travel time computations are summarized in Exhibit 2-8.

Exhibit 2-7
Travel Time Functions for Rapid Transit
(Original Travel Time Approach)

Train Type		Function
Local	11	Time = ((SQRT (1.25 * LENGTH)) .MIN. (0.573)) + ((0) .MAX. ((LENGTH-0.263)/0.917))
Accelerating	12	Time = ((SQRT (0.625 * LENGTH)) .MIN. (0.286)) + ((0) .MAX. ((LENGTH-0.131)/0.917))
Cruising	13	Time = LENGTH*60/SPEED
Decelerating	14	Time = ((SQRT (0.625 * LENGTH)) .MIN. (0.286)) + ((0) .MAX. ((LENGTH-0.131)/0.917))

Note: In the table above, SQRT is the square root function, LENGTH refers to the link length and SPEED refers to the default speed coded for each line.

Source: Metra

Exhibit 2-8
Travel Time Functions for Bus and LRT

Original Peak and Off Peak Bus Travel Time Functions

Transit Mode	Function	
Local Bus Inside Cook County	21	Time = TIMEAU * 1.6
Express Bus	22	Time = TIMEAU * 1.1
Local Bus Outside Cook County	23	Time = TIMEAU * 1.4
Light Rail	24	Time = LENGTH/UL2

Revised Peak Bus Travel Time Functions

Transit Mode	Function	
Local Bus Inside Cook County	21	Time = TIMEAU * 1.8 * LINEFACT
Express Bus	22	Time = TIMEAU * 1.1 * LINEFACT * 1.25
Local Bus Outside Cook County	23	Time = TIMEAU * 1.4 * LINEFACT
Light Rail	24	Time = LENGTH/UL2

Revised Off Peak Bus Travel Time Functions

Transit Mode	Function	
Local Bus Inside Cook County	21	Time = TIMEAU * 2.2 * LINEFACT
Express Bus	22	Time = TIMEAU * 1.1 * LINEFACT * 1.25
Local Bus Outside Cook County	23	Time = TIMEAU * 1.4 * LINEFACT
Light Rail	24	Time = LENGTH/UL2

Note: TIMEAU is the link's automobile travel time, LENGTH is the link length, UL2 is the contents of user link variable 2, and LINEFACT is a line-specific adjustment factor.

Source: Metra and KPMG Peat Marwick

Bus/LRT Travel Times (Revised Procedure)

Travel times for bus services are similar to those used in the original procedures with the following differences:

- A different set of travel time factors are applied.

- Because modeled times on individual routes differ significantly from scheduled times, a line-specific adjustment factor (LINEFACT) is used to normalize the modeled round trip running time to the scheduled running time. This factor is computed for each route by running the transit assignment module with LINEFACT set to 1.0 and comparing the resulting model results to the schedules. A new LINEFACT is computed as the ratio of scheduled to modeled time. This computation is performed twice--once for peak and once for offpeak and is stored in transit user fields 1 and 2 (UT1 and UT2), respectively.

- Because initial validation runs indicated that ridership on express buses were significantly over-predicted, the travel times for express-mode travel were factored by 1.25 to account for apparent differences between scheduled and perceived travel times. This adjustment was determined through trial-and-error until the model replicated observed relative ridership shares for express and local bus services.

The resulting travel time functions are shown in Exhibit 2-8.

Transit Path Building

The Metra model requires that a total of forty-two transit paths be built for each transit alternative being studied. The different paths account for the different networks used and the different informational requirements for each model (peak distribution, peak mode choice, off peak distribution/mode choice). The networks used for each model procedure are summarized in Exhibit 2-9. The path building parameters for each transit path are shown in Exhibit 2-10.

OTHER TRANSPORTATION INPUTS

This section describes the other transportation-related input information used in the model including terminal times, parking costs, transit fares, percent walk to transit and a CBD dummy variable.

Terminal Times

Terminal times are used to represent the additional time associated with departing from the origin and arriving at the destination that is not included in the network representation of highway facilities. Terminal times are entered as matrix (vector) data for each production and attraction zone and are based on the area type calculation described in Appendix A. Production-end terminal times are equal to one minute except for area type 5 (the Chicago Loop and the zones immediately west and south of the Loop) where the production-end terminal time is two minutes.

Exhibit 2-9
Transit Networks Used for Each Model Procedure

Model Procedure	Network Link File	Area System *	Transit Itinerary File
Fares	Fare Link File	Metra (work distribution), Focused (work and non-work mode choice)	Fare Transit Itineraries
Work Distribution	Base Link File	Metra	Peak Itineraries
Work Mode Choice	Mode Choice Link File	Focused	Peak Itineraries
Non-Work Distribution	Base Link File	Metra	Off-Peak Itineraries
Non-Work Mode Choice	Base Link File	Focused	Off-Peak Itineraries

* Note: The 1985 validation is performed at the full Metra zone system for all model procedures. The 1990 validation and all alternative runs will be run using the focused area system as shown in this table.

Source: Metra and KPMG Peat Marwick

Exhibit 2-10
Transit Path Building Parameters

Path Type and Affected Procedures	Modes Included	Attributes Saved	Boarding Time (min)	Wait Time Factor	Wait Time Weight	Auxiliary Time Weight	Boarding Time Weight
Walk Access to Commuter Rail - Work Distribution - Work Mode Choice	b - bus c - com. rail w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In-vehicle travel time, walk time, and wait time for all modes	7	0.5	1.0	1.0	1.0
Walk Access to Commuter Rail (Comm. Rail Portion) - Work Distribution - Work Mode Choice	b - bus c - com. rail w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In-vehicle travel time for commuter rail only	7	0.5	1.0	1.0	1.0
Walk Access to Commuter Rail (Bus Portion) - Work Distribution - Work Mode Choice	b - bus c - com. rail w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In-vehicle travel time for bus only	7	0.5	1.0	1.0	1.0
Walk Access to Rapid Transit - Work Distribution - Work Mode Choice	b - bus r - rapid transit w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In-vehicle travel time, walk time, and wait time for all modes	7	0.5	1.0	1.0	1.0
Walk Access to Rapid Transit (Rapid Transit Portion) - Work Distribution - Work Mode Choice	b - bus r - rapid transit w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In-vehicle travel time for rapid transit only	7	0.5	1.0	1.0	1.0
Walk Access to Rapid Transit (Bus Portion) - Work Distribution - Work Mode Choice	b - bus r - rapid transit w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In-vehicle travel time for bus only	7	0.5	1.0	1.0	1.0
Walk Access to Bus - Work Distribution - Work Mode Choice	b - bus x - express bus w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In-vehicle travel time, walk time, wait time, and number of boardings for all modes	7	0.5	1.0	1.0	1.0
Drive Access to Commuter Rail - Work Distribution - Work Mode Choice	b - bus c - com. rail w - walk u - pedway t - transfer e - wlk egrss p - pnr to rail	In-vehicle travel time, walk time, and wait time for all modes except pnr	7	0.5	1.0	1.0	1.0

Exhibit 2-10
Transit Path Building Parameters

Drive Access to Commuter Rail (Rail Portion) - Work Distribution - Work Mode Choice	b - bus c - com. rail w - walk u - pedway t - transfer e - wlk egrss p - pnr to rail	In-vehicle travel time and PNR access time for commuter rail and park-and-ride modes	7	0.5	1.0	1.0	1.0
Drive Access to Commuter Rail (Bus Portion) - Work Distribution - Work Mode Choice	b - bus c - com. rail w - walk u - pedway t - transfer e - wlk egrss p - pnr to rail	In-vehicle travel time for bus	7	0.5	1.0	1.0	1.0
Drive Access to Rapid Transit - Work Distribution - Work Mode Choice	b - bus r - rapid transit w - walk u - pedway t - transfer e - wlk egrss o - pnr to rapid transit	In-vehicle travel time, walk time, and wait time for all modes except pnr	7	0.5	1.0	1.0	1.0
Drive Access to Rapid Transit (Rapid Transit Portion) - Work Distribution - Work Mode Choice	b - bus r - rapid transit w - walk u - pedway t - transfer e - wlk egrss o - pnr to rapid transit	In-vehicle travel time and PNR access time for rapid transit and park-and-ride modes	7	0.5	1.0	1.0	1.0
Drive Access to Rapid Transit (Bus Portion) - Work Distribution - Work Mode Choice	b - bus r - rapid transit w - walk u - pedway t - transfer e - wlk egrss o - pnr to rapid transit	In-vehicle travel time on bus	7	0.5	1.0	1.0	1.0
Drive Access to Bus - Work Distribution - Work Mode Choice	b - bus x - express bus w - walk u - pedway t - transfer e - wlk egrss s - pnr to bus	In-vehicle travel time, walk time, wait time, and nuber of boardings for all modes except pnr	7	0.5	1.0	1.0	1.0
Drive Access to Bus (Park-and-Ride Portion) - Work Distribution - Work Mode Choice	b - bus x - express bus w - walk u - pedway t - transfer e - wlk egrss s - pnr to bus	Park-and-Ride Access Time	7	0.5	1.0	1.0	1.0

Exhibit 2-10
Transit Path Building Parameters

Walk Access to Transit - Non-work Mode Choice	b - bus c - com. rail r - rapid transit x - express bus w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In-vehicle travel time, walk time, wait time, and number of boardings for all modes	7	0.5	1.0	1.0	1.0
Walk Access to Transit (Commuter Rail Portion) - Non-Work Mode Choice	b - bus c - com. rail r - rapid transit x - express bus w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In-vehicle time on commuter rail	7	0.5	1.0	1.0	1.0
Walk Access to Transit (Rapid Transit Portion) - Non-Work Mode Choice	b - bus c - com. rail r - rapid transit x - express bus w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In-vehicle time on rapid transit	7	0.5	1.0	1.0	1.0
Drive Access to Transit - Non-Work Mode Choice	b - bus c - com. rail r - rapid transit x - express bus w - walk u - pedway t - transfer e - wlk egrss p - pnr to rail o - pnr to rapid transit s - pnr to bus	In-vehicle travel time, walk time, wait time, and number of boardings for all modes	7	0.5	1.0	1.0	1.0
Drive Access to Transit (Commuter Rail Portion) - Non-Work Mode Choice	b - bus c - com. rail r - rapid transit x - express bus w - walk u - pedway t - transfer e - wlk egrss p - pnr to rail o - pnr to rapid transit s - pnr to bus	In-vehicle time on commuter rail	7	0.5	1.0	1.0	1.0

Exhibit 2-10
Transit Path Building Parameters

Drive Access to Transit (Rapid Transit Portion) - Non-Work Mode Choice	b - bus c - com. rail r - rapid transit x - express bus w - walk u - pedway t - transfer e - wlk egrss p - pnr to rail o - pnr to rapid transit s - pnr to bus	In-vehicle time on rapid transit	7	0.5	1.0	1.0	1.0
Drive to Commuter Rail Fare Assignment - Non Work Mode Choice Fares	b - bus c - com. rail w - walk u - pedway t - transfer e - wlk egrss p - pnr to rail	In-vehicle travel time for commuter rail	0	0.5	1.0	1.0	1.0
Walk to Commuter Rail Fare Assignment - Work Distribution Fares - Non-Work Mode Choice Fares	b - bus c - com. rail w - walk u - pedway t - transfer e - wlk egrss d - wlk access	In vehicle travel time for commuter rail	0	0.5	1.0	1.0	1.0

Source: Metra

Attraction-end terminal times (in minutes) are set equal to the area type. In other words, zones in area type 1 have a 1-minute terminal time, zones in area type 2 have a 2-minute terminal time, and so on.

Parking Costs

Parking costs are used in the work distribution and the work and non-work mode choice models to represent disincentives associated with driving and parking an automobile. To be consistent with the model calibration, all parking costs are stated in 1970 dollars.

Parking costs are included for just those zones located in the Chicago CBD. Three parking costs are used representing:

- **All-day Parking Cost.** The all-day parking cost is used to represent part of the automobile cost associated with home-based work trips.

- **Two-Hour Parking Cost.** The two-hour parking cost is used to represent part of the automobile cost associated with non-home based trips.

- **Three-Hour Parking Cost.** The three-hour parking cost is used to represent part of the automobile cost associated with home-based non-work trips.

Parking costs for 1985 and 2010 are shown in Exhibit 2-11. The mode choice models use one-half of these costs to represent the cost assigned to each trip.

Transit Fares

Transit fares are computed in 1970 dollars as the sum of three components:

- **Commuter Rail Fare.** The commuter rail fare is a distance-based fare computed by estimating the fare zones crossed while on-board a commuter rail vehicle and using that figure to read the appropriate fare from the look-up table presented in Exhibit 2-12. This table shows the weighted average fare paid by number of zone boundaries crossed. Ther weighted average is based on the number of purchases of the different ticket types.

- **Rapid Transit, Bus, and Light Rail Fare.** The fare for all other transit modes are computed from the modes boarded and the number of transfers using the table shown in Exhibit 2-13. This exhibit also shows that the cost of accessing transit by automobile is calculated using an average cost per mile of auto access and a circuity factor that converts the network auto access distance to the appropriate driving distance.

- **Transit Station Parking Costs.** The transit station parking costs are based on production zone vectors that indicate the average station parking costs by transit mode for each zone in the region. One-half of the parking cost assigned to each trip.

Exhibit 2-11
Parking Costs in 1970 Cents

Metra Zone	1985			2010		
	All-Day	2-Hour	3-Hour	All-Day	2-Hour	3-Hour
1316	164	247	371	168	251	376
1317	155	238	357	155	238	357
1318	235	318	477	259	342	513
1319	164	247	370	173	256	383
1320	154	237	356	175	258	387
1321	200	283	424	199	282	423
1322	152	235	352	152	235	353
1323	218	300	450	247	330	495
1324	148	230	346	148	230	346
1325	149	232	347	149	231	347
1326	148	230	346	148	230	346
1327	148	231	346	148	231	346
1328	193	276	414	201	284	426
1329	148	231	346	148	231	347
1330	157	240	360	159	242	363
1331	295	378	567	349	431	647
1332	182	265	398	185	267	401
1333	149	232	348	151	233	350
1334	153	236	353	154	237	355

Source: Metra

Exhibit 2-12
Peak and Off Peak Rail Fare Lookup Table
(Fares Specified in 1970 Dollars)

1985 Validation Fare

Fare Zone Crossings	Fare	Fare Zone Crossings	Fare	Fare Zone Crossings	Fare
<1	$0.51	9	$1.35	18	$2.81
1	$0.46	10	$1.48	19	$2.91
2	$0.64	11	$1.60	20	$2.98
3	$0.75	12	$1.74	21	$3.09
4	$0.84	13	$2.20	22	$3.22
5	$0.94	14	$2.38	23	$3.34
6	$1.07	15	$2.49	24	$3.48
7	$1.17	16	$2.58		
8	$1.24	17	$2.68		

Source: Metra

Exhibit 2-13
Non-Commuter Rail Fare Parameters Used for the 1985 Validation
(in 1970 Dollars)

Fare Category	Fare
Bus Boarding Fare	$0.33
Rapid Transit Boarding Fare	$0.33
Transfer Charge (a maximum of one transfer is charged in the work model)	$0.036
Auto Access Cost per Mile	$0.048
Assumed Circuity Factor for Auto Access Cost	1.414

Source: Metra

Percent Walk to Transit

The percent walk to transit on the production and attraction end is used in the non-work model to determine the fraction of travelers on each interchange who are able to use transit to make the trip. The percent walk to transit variables represent the percentage of each zone's productions and attractions that are within 0.25 miles of transit. This information is used to stratify the travel market into three categories:

- **Able to Walk to Transit.** This market is within walking distance of transit on both the origin and production end and is computed as:

  Walk-to-Transit = Total Trips * %Walk(production end) * %Walk(attraction end)

- **Must Drive to Transit.** This market is beyond walking distance on the production end of the trips but can walk to transit on the attraction end. The size of this market is computed as:

  Drive-to-Transit = Total Trips * (1-%Walk(production end)) * %Walk(attraction end)

- **Cannot Use Transit.** This market represents trip makers who cannot use transit because they are beyond walking distance on the attraction end of the trip. This size of this market is computed as:

  Cannot-Use-Transit = Total Trips * (1-%Walk(attraction end))

The percent walk information is only used for non-work travel. The work models use the centroid connector length and the mode choice model to compute the fraction of travelers who choose to walk or drive to transit.

CBD Dummy Variable

The CBD dummy variable is an attraction-end variable that indicates whether the zone is within the Chicago CBD. It is set to one if the zone is located in the Chicago CBD (Metra zones 1316-1334) and is zero otherwise.

SOCIOECONOMIC INPUTS

Socioeconomic inputs are used as input to the Metra trip generation model and are maintained at the full Metra zone level (1334 zones). The socioeconomic dataset input to the trip generation model requires the following information for each zone:

- Number of Households
- Population
- Income Ratio (the ratio of the average household income in the zone to the region's average household income)

- Manufacturing Employment
- Retail Employment
- Services Employment
- Government Employment
- Other Employment (including Transportation, Communications, Utility, and Other Employment)
- Assembly Floor Space in the CBD

Three socioeconomic data sets were used:

- **1985 Metra Socioeconomic Inputs.** The 1985 dataset was obtained directly from Metra and is used for testing the conversion of the models from Metra's mainframe version of EMME/2 to the microcomputer version of EMME/2. The 1985 dataset is also used for creating an adjusted version of the 2010 forecasts. This dataset is based on NIPC estimates of population and employment.

- **1990 RTA Socioeconomic Inputs.** The 1990 dataset was prepared by RTA at the Metra zone level and is based on the sources of information shown in Exhibit 2-14. Information on the zonal income ratio and assembly floor space were not available for 1990 so 1985 estimates of these measures were used in the 1990 dataset.

- **2010 Socioeconomic Inputs.** The 2010 dataset is based on the 2010 Metra socioeconomic dataset currently used by Metra, adjusted to represent more recent information concerning population and households in the City of Chicago. Because the forecasts of 2010 population and households contained in the Metra database are based on pre-1990 Census estimates of 1985 population in the City of Chicago, the 2010 forecasts of population and households are different (and higher) than what would currently be expected. Since NIPC has not prepared revised projections of population and households, a procedure was developed to adjust these forecasts by adding the annually-adjusted expected growth implied by the earlier forecasts to the 1990 RTA dataset. The actual adjustment was performed by calculating the growth (or decline) in population and households between 1985 and 2010 as given in the Metra datasets for those years. This increment was factored by 0.8 (the ratio of 20 to 25 years) and added to the 1990 RTA forecasts. This adjustment was only applied to zones located in the City of Chicago and only applied to population and households. All other fields of the dataset are identical to the original Metra 2010 dataset.

Key characteristics of the 1985, 1990, and 2010 socioeconomic forecasts are displayed in Exhibit 2-15.

Exhibit 2-14
Sources and Control Totals for 1990 RTA Socioeconomic Inputs

Variable	Data Sources	Six-County Total
Population	1990 Census PL94-17	7,261,119
Households	1990 Census STF1B	2,619,847
Population in Group Quarters	1990 Census STF1B	131,340
Mean Household Size	Computed from the above three fields	2.72
Employment by Categories		
Government & Institutional Employment	NIPC estimates received on October 6, 1992	443,840
Manufacturing Employment		659,998
Retail Employment		591,536
Service (FIRE) Employment		1,277,703
TCUM Employment		497,259
Other Employment (includes self-emp)		364,462
Total Employment		3,834,898

Source: RTA

Exhibit 2-15
Summary of Socioeconomic Inputs

1985 METRA FORECAST

Area	House-holds	Popu-lation	Income Ratio	Manuf. Employ.	Retail Employ.	Service Employ.	Govt. Employ.	Other Employ.	Total Employ.	Assembly Space
McHenry	52,257	154,118	1.06	19,269	8,740	10,349	6,315	10,716	55,389	0
Lake	148,667	456,947	1.29	42,091	32,291	40,664	28,357	30,822	174,225	0
Kane	96,436	281,665	1.04	33,790	23,375	31,331	15,903	21,270	125,669	0
DuPage	241,196	704,821	1.31	77,820	68,758	149,843	22,922	74,553	393,896	0
Will	106,973	329,982	1.04	16,891	16,290	20,383	14,549	18,450	86,563	0
Other Cook	1,891,601	5,254,712	0.93	456,760	312,015	542,838	238,766	477,502	2,027,881	0
Chicago CBD	10,742	17,271	0.95	41,722	69,441	298,735	63,047	108,891	581,836	100,031
Externals	0	0	0.00	0	0	0	0	0	0	0
TOTAL:	2,547,872	7,199,516	1.00	688,343	530,910	1,094,143	389,859	742,204	3,445,459	100,031

1990 RTA FORECAST

Area	House-holds	Popu-lation	Income Ratio	Manuf. Employ.	Retail Employ.	Service Employ.	Govt. Employ.	Other Employ.	Total Employ.	Assembly Space
McHenry	62,940	183,241	1.07	21,954	10,034	13,508	7,337	13,261	66,094	0
Lake	173,966	516,416	1.30	47,739	41,079	59,869	33,395	44,294	226,376	0
Kane	107,176	317,471	1.06	33,779	28,434	40,360	15,676	27,054	145,303	0
DuPage	279,338	781,654	1.32	72,282	86,204	155,766	58,772	148,074	521,098	0
Will	116,933	357,313	1.07	16,885	18,161	25,485	15,960	23,044	99,535	0
Other Cook	1,862,893	5,078,648	0.96	423,301	363,328	593,450	203,996	500,044	2,084,119	0
Chicago CBD	16,601	26,374	0.87	44,058	44,296	389,265	108,704	106,050	692,373	100,031
Externals	0	0	0.00	0	0	0	0	0	0	0
TOTAL:	2,619,847	7,261,119	1.03	659,998	591,536	1,277,703	443,840	861,821	3,834,898	100,031

2010 METRA FORECAST

Area	House-holds	Popu-lation	Income Ratio	Manuf. Employ.	Retail Employ.	Service Employ.	Govt. Employ.	Other Employ.	Total Employ.	Assembly Space
McHenry	87,850	235,781	1.10	19,077	15,472	16,731	7,477	14,464	73,223	0
Lake	240,162	640,693	1.30	56,110	58,687	107,490	32,001	50,446	306,734	0
Kane	160,085	414,443	1.15	31,322	42,806	53,075	17,790	29,397	174,389	0
DuPage	361,023	972,848	1.32	130,245	96,833	224,541	31,209	78,836	561,664	0
Will	170,942	472,360	1.11	18,198	25,371	44,806	16,796	28,977	134,145	0
Other Cook	2,191,733	5,523,769	0.92	348,639	370,549	942,555	270,583	560,062	2,492,601	0
Chicago CBD	40,676	54,259	0.76	23,444	74,978	460,879	73,159	123,943	756,403	94,815
Externals	0	0	0.00	0	0	0	0	0	0	0
TOTAL:	3,252,473	8,314,173	1.02	629,235	684,696	1,850,077	449,015	886,125	4,499,159	94,815

2010 RTA/PEAT MARWICK FORECAST

Area	House-holds	Popu-lation	Income Ratio	Manuf. Employ.	Retail Employ.	Service Employ.	Govt. Employ.	Other Employ.	Total Employ.	Assembly Space
McHenry	87,850	235,781	1.10	19,077	15,472	16,731	7,477	14,464	73,223	0
Lake	240,162	640,693	1.30	56,110	58,687	107,490	32,001	50,446	306,734	0
Kane	160,085	414,443	1.15	31,322	42,806	53,075	17,790	29,397	174,389	0
DuPage	361,023	972,848	1.32	130,245	96,833	224,541	31,209	78,836	561,664	0
Will	170,942	472,360	1.11	18,198	25,371	44,806	16,796	28,977	134,145	0
Other Cook	2,089,939	5,278,558	0.92	348,639	370,549	942,555	270,583	560,062	2,492,601	0
Chicago CBD	40,591	55,957	0.76	23,444	74,978	460,879	73,159	123,943	756,403	94,815
Externals	0	0	0.00	0	0	0	0	0	0	0
TOTAL:	3,150,592	8,070,640	1.02	629,235	684,696	1,850,077	449,015	886,125	4,499,159	94,815

Source: KPMG Peat Marwick

TRIP GENERATION MODEL

The trip generation model is documented in "Development of Trip Generation Models" (Metra: September 1989). Key characteristics of the resulting model are presented in this section.

The trip generation model estimates person trip productions and attractions by zone and purpose. The results of trip generation are input to trip distribution and used to create the person trip tables. The trip generation model consists of four components:

1. A model to estimate the number of households in an income group and household size category given the total households, average income and average persons per household.

2. A set of models to estimate trip productions on the basis of number of households, income group, and household size.

3. A set of models to estimate trip attractions on the basis of employment, households, and population in each zone.

4. A production-attraction balancing process that adjusts the results of the prior models so that total regional trip productions match regional trip attractions for each purpose.

The trip generation models are based on a 1970 home interview survey (HIS) conducted by the Chicago Area Transportation Study (CATS) and the Northwestern Indiana Regional Planning Committee (NIRPC). A sample, stratified by income, household size, and location was used consisting of 2,386 Illinois households and 390 Indiana households. The HIS included records representing all vehicle trips made by members of the household over a 24-hour period by purpose and mode of travel.

The model separately estimates trips for the following purposes:

- Home-Based Work (HBW)
- Home-Based Shopping (HBS)
- Home-Based School (HBSC)
- Home-Based Other (HBO)
- Non-Home Based (NHB)

The HIS includes data for two other purposes (change-mode and serve-passenger) that represent travel related to other trip making. Trips were linked according to the table shown in Exhibit 2-16.

The following subsections describe each of the four trip generation submodels.

Exhibit 2-16
Trip Linking Criteria

Trip Type	Before Linking	After Linking	Action
Trip 1	Home->Serve Passenger Serve Passenger->Home	Home->Home	Drop Trip
Trip 2	Home->Serve Passenger Serve Passenger->Work	Home->Work	Keep Trip

Source: Metra

Household Income and Household Size Submodels

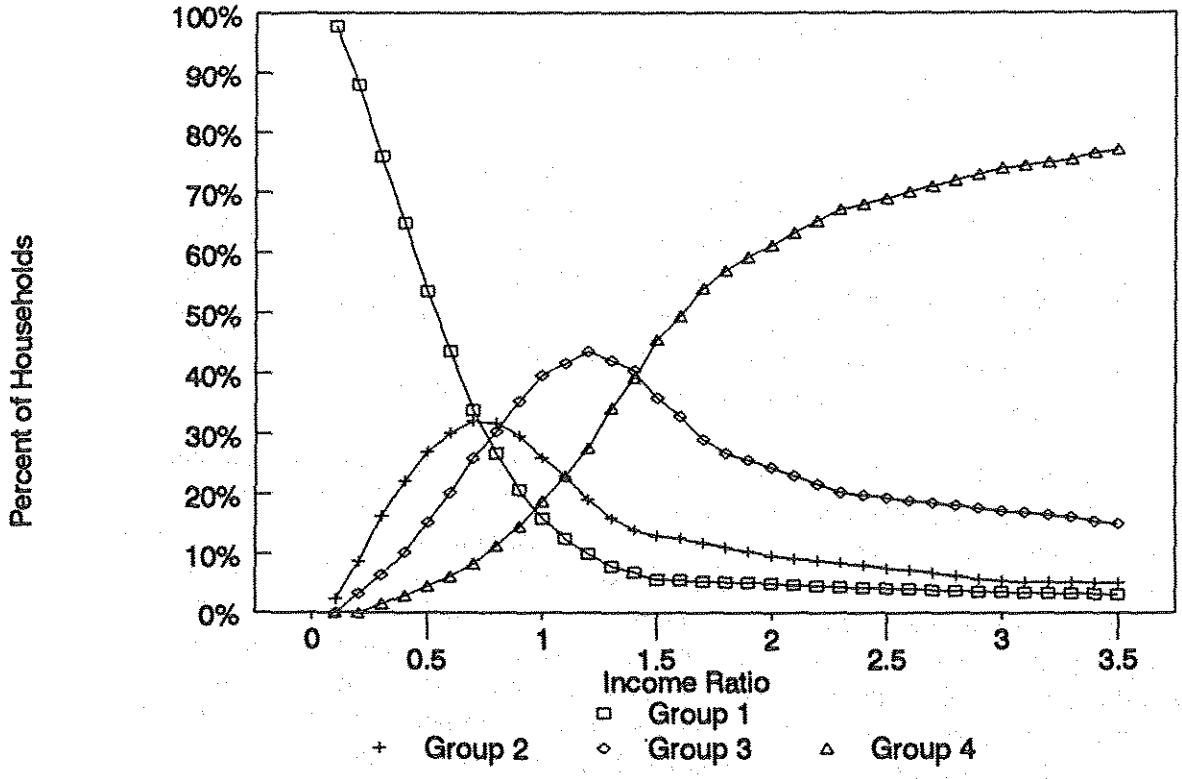
This submodel estimates the number of households by income group and household size for each zone given input information on the total population, the number of households, and average income. This process is necessary because most sources of forecast information include these average values but do not estimate the stratified values required by the trip production model. The model is based on data obtained from the 1980 Urban Transportation Planning Package and has three steps:

1. **Estimate Households by Income Group.** This model estimates the number of households in four income quartiles. The relationship between income ratio and income group is based on the 1980 UTPP and shown graphically in Exhibit 2-17. The model is applied by using the average household income divided by the regional income to compute the income ratio for each zone. This ratio is used to look-up the appropriate percentages by income group from the table shown in Exhibit 2-18. These percentages are used to distribute total households to each income group.

2. **Estimate Households by Household Size.** The household size model is also based on 1980 UTPP data and estimates the number of households in six household size groups: 1) 1-person, 2) 2-person, 3) 3-person, 4) 4-person, 5) 5-person, and 6) 6 or more persons based on the average household size in the zone. The relationship between average household size and the number of households by household size is shown graphically in Exhibit 2-19. The model is applied by computing the average household size in each zone using the projected population and households in each zone. The average size is used to look-up the appropriate percentages of households in each household size group using the table shown in Exhibit 2-20. These percentages are used to distribute total households to each household size group.

3. **Estimate Households by Income Group and Household Size.** This step combines the results of the household income and household size submodels. This is done by using the table in Exhibit 2-21 to spread the results of Step 2 (households by household size group to households by household size and income group. The total households by income group are then compared to the results of Step 1 (households by income group). A balancing algorithm is used to maintain the estimates from steps 1 and 2 while modifying the matrix as little as possible.

Exhibit 2-17
Income Group Distribution by Income Ratio



Income Groups:

1. $0 – $9,999
2. $10,000 – $19,999
3. $20,000 – $34,999
4. $35,000+

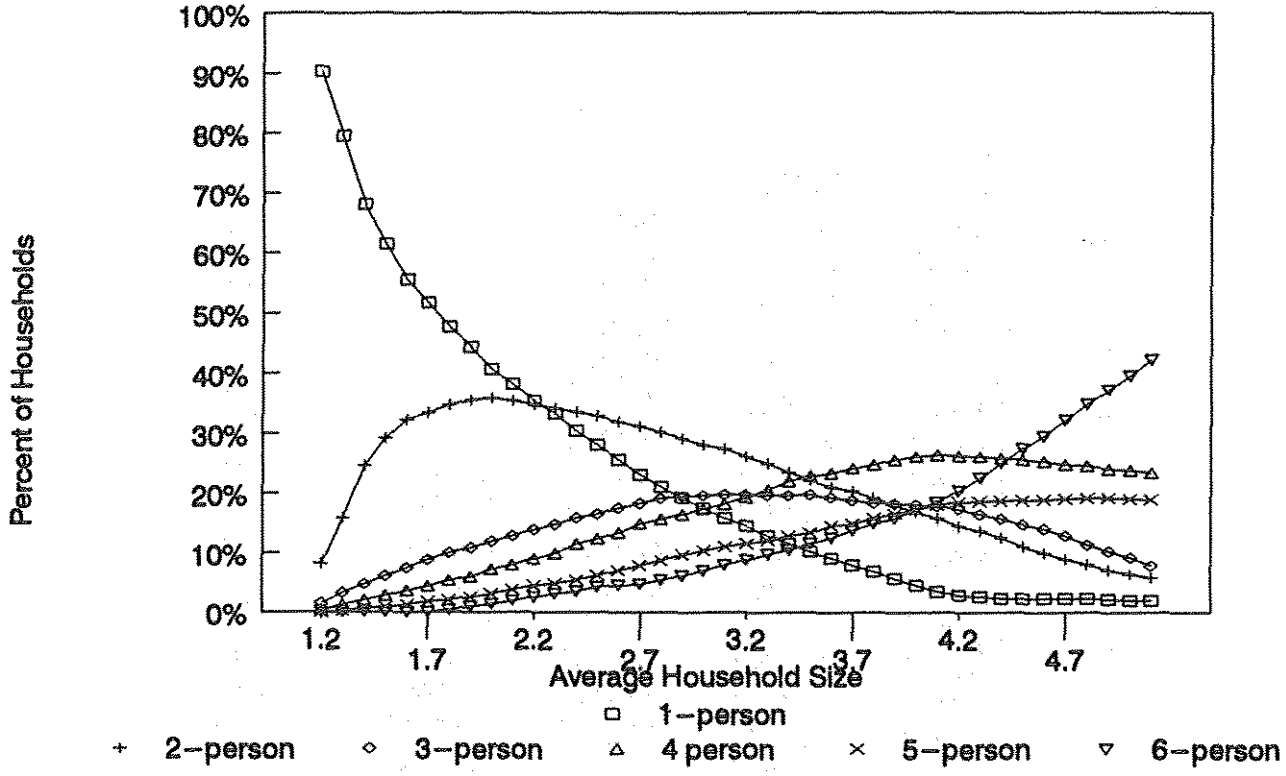
Source: Metra

Exhibit 2-18
Income Group Distribution Lookup Table

Income Index	Income Group 1	2	3	4	Total
0					
0.1	97.7%	2.3%	0.0%	0.0%	100.0%
0.2	88.0%	8.7%	3.3%	0.0%	100.0%
0.3	76.0%	16.2%	6.4%	1.4%	100.0%
0.4	64.9%	22.1%	10.2%	2.8%	100.0%
0.5	53.5%	26.9%	15.2%	4.4%	100.0%
0.6	43.6%	30.1%	20.2%	6.1%	100.0%
0.7	33.8%	32.0%	25.9%	8.3%	100.0%
0.8	26.7%	31.7%	30.3%	11.3%	100.0%
0.9	20.6%	29.6%	35.3%	14.5%	100.0%
1	15.8%	26.0%	39.6%	18.7%	100.1%
1.1	12.5%	22.9%	41.6%	23.0%	100.0%
1.2	10.0%	19.0%	43.5%	27.5%	100.0%
1.3	7.8%	15.9%	42.0%	34.2%	99.9%
1.4	6.7%	13.9%	40.3%	39.1%	100.0%
1.5	5.6%	13.0%	35.9%	45.5%	100.0%
1.6	5.5%	12.5%	32.7%	49.3%	100.0%
1.7	5.3%	11.8%	28.9%	54.0%	100.0%
1.8	5.2%	11.1%	26.7%	57.0%	100.0%
1.9	5.0%	10.3%	25.5%	59.2%	100.0%
2	4.9%	9.6%	24.3%	61.2%	100.0%
2.1	4.7%	9.1%	23.0%	63.2%	100.0%
2.2	4.5%	8.8%	21.5%	65.2%	100.0%
2.3	4.3%	8.4%	20.2%	67.1%	100.0%
2.4	4.2%	8.0%	19.8%	68.0%	100.0%
2.5	4.1%	7.5%	19.4%	69.0%	100.0%
2.6	4.0%	7.2%	18.8%	70.0%	100.0%
2.7	3.8%	6.7%	18.5%	71.0%	100.0%
2.8	3.7%	6.2%	18.1%	72.0%	100.0%
2.9	3.6%	5.7%	17.7%	73.0%	100.0%
3	3.5%	5.4%	17.1%	74.0%	100.0%
3.1	3.4%	5.2%	16.9%	74.5%	100.0%
3.2	3.3%	5.2%	16.5%	75.0%	100.0%
3.3	3.2%	5.2%	16.1%	75.5%	100.0%
3.4	3.1%	5.0%	15.4%	76.5%	100.0%
3.5	3.0%	5.0%	15.0%	77.0%	100.0%

Source: Metra

Exhibit 2-19
Household Size Distribution by Average Household Size



Source: Metra

Exhibit 2-20
Household Size Distribution Lookup Table

Average HH Size	Number in Household						Total	Computed Avg HH
	1	2	3	4	5	6+		
1.2	90.2%	8.2%	1.4%	0.2%	0.0%	0.0%	100.0%	1.12
1.3	79.6%	15.8%	3.3%	1.2%	0.1%	0.0%	100.0%	1.26
1.4	68.1%	24.6%	4.7%	2.0%	0.6%	0.0%	100.0%	1.42
1.5	61.4%	29.1%	6.0%	2.7%	0.8%	0.0%	100.0%	1.52
1.6	55.6%	32.2%	7.4%	3.6%	1.2%	0.0%	100.0%	1.63
1.7	51.7%	33.4%	8.8%	4.3%	1.8%	0.0%	100.0%	1.71
1.8	47.7%	34.7%	10.0%	5.3%	2.0%	0.3%	100.0%	1.80
1.9	44.4%	35.5%	10.8%	5.9%	2.5%	0.9%	100.0%	1.90
2	40.7%	35.9%	11.9%	7.2%	3.0%	1.3%	100.0%	2.01
2.1	38.2%	35.4%	12.8%	7.9%	3.8%	1.9%	100.0%	2.11
2.2	35.4%	34.8%	13.9%	9.0%	4.4%	2.5%	100.0%	2.22
2.3	33.3%	34.2%	14.8%	9.9%	4.8%	3.0%	100.0%	2.30
2.4	30.4%	33.5%	15.8%	11.4%	5.4%	3.5%	100.0%	2.41
2.5	28.1%	32.8%	16.5%	12.3%	6.1%	4.2%	100.0%	2.52
2.6	25.6%	31.9%	17.5%	13.4%	7.0%	4.6%	100.0%	2.62
2.7	23.1%	31.2%	18.3%	14.9%	7.8%	4.7%	100.0%	2.71
2.8	21.0%	30.2%	19.1%	15.6%	8.7%	5.4%	100.0%	2.82
2.9	19.2%	29.1%	19.5%	16.5%	9.6%	6.1%	100.0%	2.92
3	17.5%	28.1%	19.6%	17.4%	10.4%	7.0%	100.0%	3.02
3.1	15.8%	27.4%	19.7%	18.2%	11.0%	7.9%	100.0%	3.12
3.2	14.5%	26.1%	19.7%	19.3%	11.6%	8.8%	100.0%	3.21
3.3	12.9%	25.0%	19.6%	20.6%	12.1%	9.8%	100.0%	3.32
3.4	11.6%	23.5%	19.6%	22.0%	12.8%	10.5%	100.0%	3.41
3.5	10.2%	22.2%	19.8%	22.8%	13.4%	11.6%	100.0%	3.52
3.6	9.1%	21.1%	19.4%	23.4%	14.5%	12.5%	100.0%	3.61
3.7	7.9%	20.4%	18.8%	24.2%	14.9%	13.8%	100.0%	3.71
3.8	6.9%	19.2%	18.4%	24.8%	15.8%	14.9%	100.0%	3.81
3.9	5.7%	18.0%	18.3%	25.6%	16.6%	15.8%	100.0%	3.90
4	4.6%	16.9%	18.0%	26.1%	17.2%	17.2%	100.0%	4.01
4.1	3.5%	15.8%	17.8%	26.3%	18.1%	18.5%	100.0%	4.11
4.2	2.9%	14.6%	17.4%	26.2%	18.5%	20.4%	100.0%	4.21
4.3	2.6%	13.7%	16.5%	26.1%	18.6%	22.5%	100.0%	4.31
4.4	2.3%	12.5%	15.7%	25.8%	18.7%	25.0%	100.0%	4.42
4.5	2.3%	11.1%	14.8%	25.6%	18.8%	27.4%	100.0%	4.53
4.6	2.3%	10.0%	14.0%	25.3%	18.9%	29.5%	100.0%	4.62
4.7	2.3%	8.9%	12.9%	24.8%	19.0%	32.1%	100.0%	4.73
4.8	2.3%	8.0%	11.3%	24.5%	19.1%	34.8%	100.0%	4.84
4.9	2.2%	7.1%	10.3%	24.0%	19.2%	37.2%	100.0%	4.94
5	2.0%	6.5%	9.2%	23.8%	19.0%	39.5%	100.0%	5.03
5.1	2.0%	5.8%	7.8%	23.4%	18.9%	42.1%	100.0%	5.13

Note: The average value for 6+ is 6.85
Source: Metra

Exhibit 2-21
Income Group Lookup Table by Average Household Size

Persons Per Household	Income Quartile				Total
	1	2	3	4	
1	11.77%	8.22%	3.58%	0.82%	24.39%
2	5.23%	7.80%	10.02%	5.36%	28.41%
3	2.38%	3.63%	6.40%	4.32%	16.72%
4	1.63%	2.68%	6.25%	4.49%	15.05%
5	0.98%	1.33%	3.31%	2.75%	8.38%
6+	1.02%	1.29%	2.38%	2.36%	7.05%
Total	23.01%	24.95%	31.94%	20.10%	100.00%

Note: All Percentages are precents of total households (2,487,690)

Source: Metra, from 1980 U.S. Census Urban Transportation Planning Package

Trip Production Model

The Metra trip production model is a cross-classification model that predicts the number of person trips given the number of households in each household size and income group. The non-work models are also stratified by whether the production zone is inside or outside the City of Chicago. This stratification was used for all purposes that showed a statistically significant (95% confidence level) difference between CBD and Non-CBD production rates. The trip rates for each purpose are shown in Exhibits 2-22 through 2-26.

Trip Attraction Model

The trip attraction model was calibrated by Metra using an aggregate linear-regression model at the district level. The model is stratified by whether the attraction zone is or is not inside the Chicago CBD. The trip attraction equations are applied at the zonal level with the exception of Home-Based Shopping Trips which are applied at both the district and zonal levels as follows:

1. The district model, with retail employment, service employment, and population as independent variables, is used to estimate shopping attractions at the district level.

2. The zone model, with retail and service employment as independent variables, is used to estimate shopping attractions at the zone level.

3. Zone-level attractions, from step 2, are summed by district and used to establish a proportion of shopping attractions for each zone within a district.

4. The proportions, from step 3, are used to distribute district attractions to the zone level.

This process was developed because Metra found that at the district level, proximity to population is an important indicator of the number of person trips that each retail and service employee can attract. At the zone level, however, retail attractions are concentrated in zones with a large number of retail establishments and therefore many retail and service employees. This approach allows the model to be sensitive to the impact that population has on shopping attractions without actually assigning those trip to zones with large population and little retail activity.

The final trip attraction equations are shown in Exhibit 2-27.

Trip Production/Attraction Balancing Model

The trip production and attraction equations presented above will not necessarily produce the same number of productions as attractions for each purpose. In order to balance productions and attractions, the trip generation model normalizes HBW productions to meet regional attractions. For all other purposes, trip attractions are balanced to regional productions.

Application

The trip generation procedures are applied using the Metra Fortran model, converted to run under MS-DOS on a microcomputer. The model will be run at the full Metra zone system using the socioeconomic inputs described earlier.

Exhibit 2-22
Trip Productions Per Household
Home-Based Work Trips

Household Size	Income Group			
	1	2	3	4
1	0.3430	1.4770	1.4770	1.4770
2	0.7490	1.4770	2.6070	2.6070
3	1.1730	1.9510	2.6070	2.6070
4	1.1730	2.6070	2.6070	2.6070
5+	1.1730	2.6070	2.6070	2.6070

Source: Metra

Exhibit 2-23
Trip Productions Per Household
Home-Based Shopping Trips

Chicago Rates

Household Size	Income Group			
	1	2	3	4
1	0.1016	0.1016	0.1016	0.1016
2	0.2900	0.2900	0.4522	0.4522
3	0.2900	0.4522	0.4522	0.4522
4	0.2900	0.4522	0.9558	2.2977
5+	0.2900	0.4522	0.9558	2.2977

Non-Chicago Rates

Household Size	Income Group			
	1	2	3	4
1	0.2976	0.2976	0.2976	0.2976
2	0.8188	0.8188	1.2040	1.2040
3	0.8188	1.2040	1.2040	1.2040
4	0.8188	1.2040	1.8280	2.2977
5+	0.8188	1.2040	1.8280	2.2977

Source: Metra

Exhibit 2-24
Trip Productions Per Household
Home-Based School Trips

Chicago Rates

Household Size	Income Group			
	1	2	3	4
1	0.0425	0.0425	0.0425	0.0000
2	0.2898	0.2898	0.2898	0.2898
3	0.3389	0.3389	0.3389	1.0000
4	0.3389	0.3389	0.6961	1.9231
5+	0.3389	0.3389	0.6961	1.9231

Non-Chicago Rates

Household Size	Income Group			
	1	2	3	4
1	0.0425	0.0425	0.0425	0.0000
2	0.2898	0.2898	0.2898	0.2898
3	0.8844	0.8844	0.8844	1.0000
4	0.8844	0.8844	1.4893	1.9231
5+	0.8844	0.8844	1.4893	1.9231

Source: Metra

Exhibit 2-25
Trip Productions Per Household
Home-Based Other Trips

Chicago Rates

Household Size	Income Group			
	1	2	3	4
1	0.3390	0.4500	0.4500	0.4500
2	0.7230	0.7230	0.7230	1.6420
3	0.7230	0.7230	0.8840	1.6420
4	0.7230	0.7230	0.8840	1.6420
5+	0.7230	0.7230	1.6420	1.6420

Non-Chicago Rates

Household Size	Income Group			
	1	2	3	4
1	0.3390	0.8530	0.8530	0.8530
2	1.3710	1.3710	1.3710	2.8060
3	1.3710	1.3710	1.9410	2.8060
4	1.3710	1.3710	1.9410	2.8060
5+	1.3710	1.3710	2.8060	2.8060

Source: Metra

Exhibit 2-26
Trip Productions Per Household
Non-Home Based Trips

Chicago Rates

Household Size	Income Group			
	1	2	3	4
1	0.0914	0.2685	0.2685	1.1917
2	0.2685	0.2685	0.4635	1.1917
3	0.2685	0.4635	0.4635	1.1917
4	0.2685	0.4635	1.3495	1.1539
5+	0.2685	0.4635	1.3495	1.1539

Non-Chicago Rates

Household Size	Income Group			
	1	2	3	4
1	0.2500	0.7156	0.7156	1.1917
2	0.7156	0.7156	1.0452	1.1917
3	0.7156	1.0452	1.0452	1.1917
4	0.7156	1.0452	1.3495	2.7238
5+	0.7156	1.0452	1.3495	2.7238

Source: Metra

Exhibit 2-27
Final Trip Attraction Equations

Non-CBD Zones:

$$T_{HBW} = 1.389 \times TE$$

$$T_{HBS}(Zone) = 6.626 \times RE - 1.531 \times SE$$

$$T_{HBS}(District) = 4.505 \times RE - 0.925 \times SE + 0.154 \times POP$$

$$T_{HBS}(Final) = \left[\frac{T_{HBS}(District)}{\sum_{i=1}^{NZoneD} T_{HBS}(Zone)} \right] \times T_{HBS}(Zone)$$

$$T_{HBSC} = 0.325 \times POP - 0.656 \times HH$$

$$T_{HBO} = 6.822 \times RE + 0.134 \times POP$$

$$T_{NHB} = 4.589 \times RE + 0.077 \times POP$$

CBD Zones:

$$T_{HBW} = 1.389 \times TE$$

$$T_{HBS}(Zone) = 6.626 \times RE - 1.531 \times SE$$

$$T_{HBS}(District) = 4.505 \times RE - 0.925 \times SE + 0.154 \times POP$$

$$T_{HBS}(Final) = 0.320 \times \left[\frac{T_{HBS}(District)}{\sum_{i=1}^{NZoneD} T_{HBS}(Zone)} \right] \times T_{HBS}(Zone)$$

$$T_{HBSC} = 0.7690 \times (0.1661 \times AFS)$$

$$T_{HBO} = 0.212 \times (6.822 \times RE + 0.134 \times POP)$$

$$T_{NHB} = 0.203 \times (4.589 \times RE + 0.077 \times POP)$$

where:

T_{HBW} = Home-Based Work Trips
T_{HBS} = Home-Based Shopping Trips
T_{HBSC} = Home-Based School Trips
T_{HBO} = Home-Based Other Trips
T_{NHB} = Non-Home-Based Trips
TE = Total Employment
RE = Retail Employment
SE = Service Employment
POP = Population
HH = Households
AFS = Assembly Floor Space in CBD
NZoneD = Number of Zones in District

Source: Metra

TRIP DISTRIBUTION MODEL

The trip distribution model uses the output of the trip generation model (i.e., trips produced and attracted in each zone by purpose) to create trip tables containing the number of trips by purpose traveling between each pair of zones in the region. The trip distribution models use the microcomputer version of EMME/2, converted versions of the Metra procedures, and the full Metra area system to perform the distribution step. Two different procedures are used to distribute work and non-work trips as described in the following subsections.

Work Distribution

Home-Based work trips are distributed using a standard formulation of the gravity model and combined impedances representing the travel time associated with both the highway and transit modes of travel. The formulation of the work distribution model is as follows:

$$T_{ij} = P_i \times \frac{A_j \times F_{ij} \times D_{ij} \times K_{ij}}{\sum_{j=1}^{J} A_j \times F_{ij} \times D_{ij} \times K_{ij}}$$

where:

T_{ij} = the number of trips between zone i and zone j
P_i = the trip productions for zone i
A_j = the trip attractions for zone j
F_{ij} = the friction factor associated with the travel impedance from zone i to zone j
D_{ij} = the distance impedance factor between zone i and zone j
K_{ij} = the socioeconomic or physical factor for all movements between zone i and zone j

Input Impedance Data

Input impedances to the work distribution model represent the total time and cost impedances of the highway and transit network. Highway impedances are obtained from EMME/2's highway assignment program run against the peak highway network and the peak highway speeds described earlier. Intrazonal times and distances are estimated as equal to one-half of the smallest interzonal time and distance found for each production zone. Terminal times (as described earlier) for all production and attraction zones are added to estimate the total zone-to-zone travel time by automobile.

A separate toll assignment is performed to record the total toll paid (from ul3 in the network) on all interchanges. Total highway operating costs are calculated assuming 4.8 cents per mile and 0.36 times the skimmed toll (to convert to 1970 dollars) and one-half of the daily parking rate.

Fifteen peak period transit assignments are performed in EMME/2 (as described earlier) to develop the input transit travel time impedances used in the distribution model. Intrazonal transit times and distances are estimated as equal to one-half of the smallest interzonal time and distance found for each production zone. Transit skims for disconnected zones are set to 999 minutes. Likewise, commuter rail paths where no time is spent on commuter rail time and rapid transit paths where no time is spent on rapid transit are set to 999 minutes.

Fares are computed using two special commuter rail assignments and the fare calculation procedures described earlier.

Computation of F-, D- and K-Factors

The F-Factors for the distribution model are based on the combined impedance from the highway and transit networks. The impedance is calculated from the logsum of the utilities for each mode. Modal utilities are computed separately for two income categories:

- **Low Income:** comprised of income quartiles 1 and 2.
- **High Income:** comprised of income quartiles 3 and 4.

The low and high income impedances are combined using the proportion of production zone trip ends in each income group. The impedance calculation for each interchange is shown in Exhibit 2-28.

Exhibit 2-28
Work Distribution Impedance Calculation

$IMPED = ((\ln((1/(MIN(EXPU))/EXPU_{low\ income})) * P_{low\ income} + ((\ln((1/(MIN(EXPU))/EXPU_{high\ income})) * P_{high\ income} + 2.0)*25$

$MIN(EXPU)$ = Minimum value of EXPU over all interchanges and both high and low income groups

$P_{low\ income}$ = Percent of HBW trips in quartiles 1 and 2.
$P_{high\ income}$ = Percent of HBW trips in quartiles 3 and 4.

The following are computed separately for high and low income groups and for each interchange:

$EXPU = \exp(U_{AUTO}) + \exp(U_{TRN})$

$U_{AUTO} = 0.70640*0.88430*U_{AUTO}$

$U_{TRN} = 0.70640*\ln(\exp(U_{W\_TRN} + \exp(U_{A\_TRN}))$

$U_{W\_TRN} = 0.88430*\ln(\exp(U_{W\_CR}) + \exp(U_{W\_RT}) + \exp(U_{WBUS}))$

$U_{A\_TRN} = 0.88430*\ln(\exp(U_{A\_CR}) + \exp(U_{A\_RT}) + \exp(U_{ABUS}))$

U_{AUTO} = -0.05611*(AUTO_TIME+2*(P_TERM_TIME+A_TERM_TIME)) + -0.01837*AUTO_COST+AUTO_CONST

U_{W_CR} = -0.05611*(W_CR_INVEH*TTADJ+2*(W_CR_WALK+W_CR_WAIT)) + -0.01837*W_CR_FARE + -0.0001147*RES_DENS + W_CR_CONST + 1.37599*CBD_DUMMY

U_{A_CR} = -0.05611*(A_CR_INVEH*TTADJ+2*(A_CR_WALK+A_CR_WAIT+ A_CR_AUTO)) + -0.01837*A_CR_FARE + A_CR_CONST + 1.37599*CBD_DUMMY

U_{W_RT} = -0.05611*(W_RT_INVEH*TTADJ+2*(W_RT_WALK+W_RT_WAIT)) + -0.01837*W_RT_FARE + -0.0001147*RES_DENS + W_RT_CONST + 0.84200*CBD_DUMMY

(continued)

Exhibit 2-28
Work Distribution Impedance Calculation
(Continued)

U_{A_RT} = -0.05611*(A_RT_INVEH*TTADJ+2*(A_RT_WALK+A_RT_WAIT+ A_RT_AUTO)) +
-0.01837*A_RT_FARE+ A_RT_CONST + 0.84200*CBD_DUMMY

U_{WBUS} = -0.05611*(WBUS_INVEH*TTADJ+2*(WBUS_WALK+WBUS_WAIT)) +
-0.01837*WBUS_FARE + -0.0001147*RES_DENS

U_{ABUS} = -0.05611*(ABUS_INVEH*TTADJ+2*(ABUS_WALK+ABUS_WAIT+ABUS _AUTO)) +
-0.01837*ABUS_FARE+ABUS_CONST

Home-Based Work Distribution Model Modal Constants

	Low Income	High Income
AUTO_CONST	-0.32200	0.82310
TTADJ - original model - revised model	 1.0 0.85	 1.0 0.85
W_CR_CONST	-1.39399	-0.44540
A_CR_CONST	1.19599	2.44850
W_RT_CONST	-0.76010	-0.41280
A_RT_CONST	0	0
ABUS_CONST	0.7601	0.4128

(continued)

Exhibit 2-28
Work Distribution Impedance Calculation
(continued)

Definitions

Modes:

AUTO = Automobile
TRN = Transit
W_TRN = Walk-to-Transit
A_TRN = Auto-to-Transit
W_CR = Walk-to Commuter Rail
A_CR = Auto-to-Commuter Rail
W_RT = Walk-to-Rapid Transit
A_RT = Auto-to-Rapid Transit
WBUS = Walk-to-Bus
ABUS = Auto-to-Bus

Input Variables:

AUTO_TIME = Automobile travel time
P_TERM_TIME = Production-end terminal time
A_TERM_TIME = Attraction-end terminal time
AUTOCOST = Auto operating cost, toll, and one-half daily parking cost
X_INVEH = Mode x invehicle time
X_WALK = Mode x walk time
X_WAIT = Mode x wait time
X_FARE = Mode x fare and one-half of daily station parking cost (if applicable)
X_CONST = Mode x Constant
TTADJ = Travel time adjustment factor
RES_DENS = Residential Density
CBD_DUMMY = 1 if attraction zone in CBD, 0 otherwise

The F-factors are calculated from the combined impedances using the following formula:

$$F_{HBW} = \exp(26.82) \times IMPED^{-3.0} \times \exp(-0.068 * IMPED)$$

where:
F_{HBW} = The F-Factor for HBW Trips
IMPED = The combined highway/transit impedance

D-factors are highway distance-based factors and are computed as follows:

$$D_{long} = \exp(0.100 \times (DIST - 19))$$
$$D_{short} = \exp(0.125 \times (5 - DIST))$$

where:
D_{long} = D-Factor for long trips (19 miles or longer)
D_{short} = D-Factor for short trips (5 miles or shorter and not intrazonal)

A K-factor of 1.416 was used for all interchanges between North Cook County and the Chicago CBD. All other K-factors are set to 1.0.

Modifications to the Work Distribution Model

Results from early runs of the 1990 validation network indicated that the model tended to significantly overpredict total transit trips (and express bus trips in particular) from the South Corridor to the Chicago CBD and northern portions of the region. To correct this problem, the Home-Based Work Distribution procedures were modified as follows:

- Express bus services were excluded from the combined impedances used to create the Home-Based Work trip tables.
- Input transit in-vehicle travel times were adjusted to account for changes in the transit travel time functions.
- The output person trip table was post-factored as follows:
  - From/to South Chicago to/from the Chicago CBD, North Chicago, and West Chicago: Factor=0.766.

- From/to the southern suburbs to/from South Chicago, the Chicago CBD, North Chicago, and West Chicago: Factor=0.752.

Non-Work Distribution

The non-work trip distribution model uses the results of the trip generation model to create four non-work trip tables:

- Home-Based Shop (HBS)
- Home-Based School (HBSCH)
- Home-Based Other (HBO)
- Non-Home Based (NHB)

The distribution model is based on Metra's non-work distribution model as documented in a Technical Memorandum dated November 14, 1988 and applied in its EMME/2 macros received in September 1992. This distribution model is formulated as a traditional gravity model as follows:

$$T_{ij} = P_i \times \frac{A_j \times F_{ij} \times K_{ij}}{\sum_{j=1}^{J} A_j \times F_{ij} \times K_{ij}}$$

where:

T_{ij} = the number of trips between zone i and zone j
P_i = the trip productions for zone i
A_j = the trip attractions for zone j
F_{ij} = the friction factor associated with the travel impedance from zone i to zone j
K_{ij} = the socioeconomic or physical factor for all movements between zone i and zone j

Input Impedance Data

Input impedances to the non-work model are based on output from EMME/2's highway assignment program run against the off-peak highway network and off-peak highway travel speeds as described earlier. Intrazonal times and distances are estimated as equal to one-half of the smallest interzonal time or distance found for each production zone. Terminal times for all production and attraction zones are as stated earlier.

The non-work distribution model does not incorporate transit impedance in the F-factor computation.

Computation of F-Factors

F-factors are computed from the off-peak highway travel time using the following equations:

$$F_{HBO} = 2.24271580 \times (HWY\_TIME^{-2.02274015}) \times \exp(-0.13036451 \times HWY\_TIME)$$
$$F_{HBSCH} = 2.82885192 \times (HWY\_TIME^{0.37602610}) \times \exp(-0.41028118 \times HWY\_TIME)$$
$$F_{HBS} = 2.77761318 \times (HWY\_TIME^{-1.10903145}) \times \exp(-0.27345560 \times HWY\_TIME)$$
$$F_{NHB} = 2.67196374 \times (HWY\_TIME^{-1.00816285}) \times \exp(-0.16948255 \times HWY\_TIME)$$

where:

F_{HBO} = the friction factor for Home-Based Other Trips
F_{HBSCH} = the friction factor for Home-Based School Trips
F_{HBS} = the friction factor for Home-Based Shop Trips
F_{NHB} = the friction factor for Non-Home Based Trips
HWY_TIME = the total highway time (including terminal time)

No K-factors are used in this model.

The output of the school trip distribution model is adjusted to remove trips that are expected to use school buses. The output HBSCH trip table is multiplied by a series of factors (stratified by county) representing the fraction of school trips not on school buses. These factors are based on home interview survey data collected in 1970 and are shown below:

Trip Type	Factor
Chicago CBD-Remaining Cook County	0.53605
Internal to Remaining Cook County	0.66370
Remaining Cook to Lake County	0.58407
Internal to DuPage County	0.26796
Internal to Kane County	0.75738
Lake to Remaining Cook County	0.53833
Internal to Lake County	0.40213
Internal to McHenry County	0.31047
Internal to Will County	0.42680
Kane to Lake County	0.00000
Remaining Cook to Will County	0.00000

MODE AND PATH CHOICE MODEL

The mode and path choice models are applied using the Metra area system for the 1985 validation and the focused area system for the 1990 validation and all subsequent alternatives. Two separate procedures are used for the work and non-work purposes as described below.

Work Mode Split

The work mode split model estimates Home-Based Work trips by mode for four income groups. The model is formulated as a nested logit model that estimates automobile vs. transit trips at the highest nest level. Transit trips are further separated into walk access and drive access trips and each access type is split into Metra, CTA rail, and bus trips. The nesting structure for this model is presented in Exhibit 2-29.

Input Impedance Information

Input impedances to the work mode choice model are developed using the same highway and transit assignment procedures described in the Home-Based Work Distribution Model. One important difference, however, is that the mode choice procedures are run against the peak "mode choice" transit network rather than the peak "distribution" network. Unlike the distribution process, intrazonal transit times are not estimated; instead, transit skims for these zones are set to 999 minutes.

To prevent Independence of Irrelevant Alternatives (IIA) problems in the mode choice computations, commuter rail paths where no time is spent on commuter rail and rapid transit paths where no time is spent on rapid transit are flagged as disconnected by setting the travel time to 999 minutes. Interchanges on the commuter rail path that are improbable are also flagged as being disconnected. The rules for flagging a commuter rail path as disconnected are:

- Walk Access

  Commuter Rail-only time < =11 and Attraction Zone < > CBD

  - or -

  Bus Time > =25 minutes

- Drive Access

  Commuter Rail-only time < =11 and Attraction Zone

  - or -

  Bus Time > =25 minutes

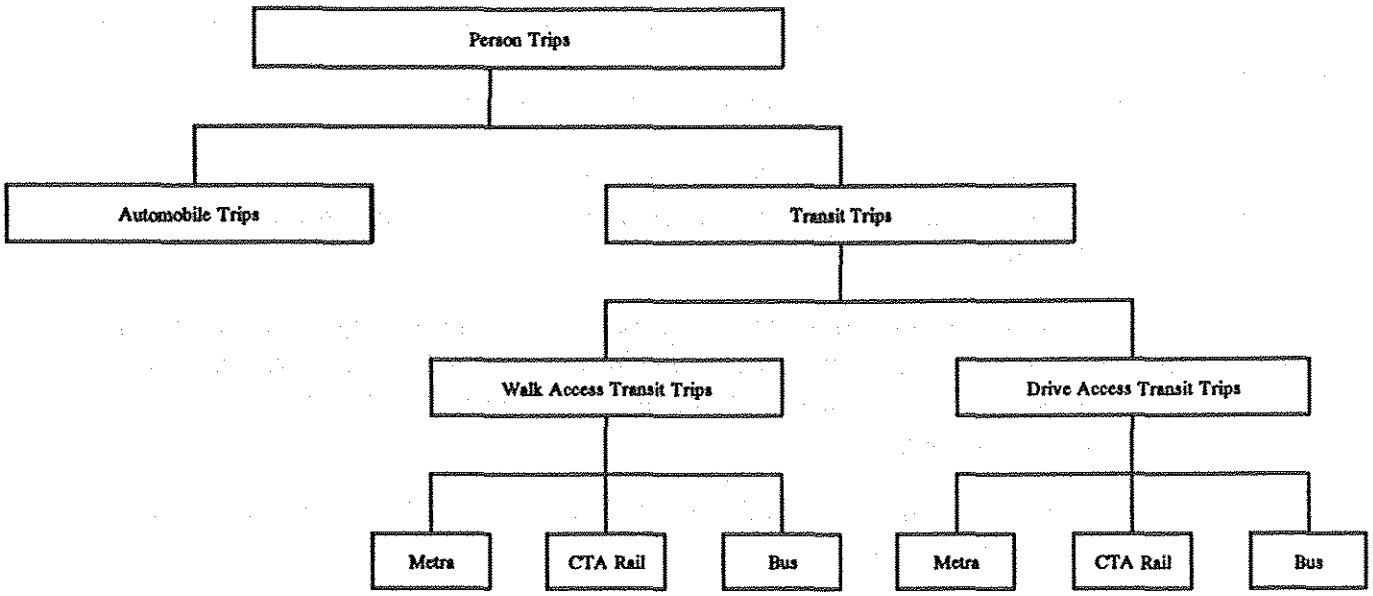
Fares are computed using the same procedures as for distribution.

Mode Choice Stratifications

The HBW Mode Choice model is stratified by income group. This is done by multiplying the HBW person trips output from the distribution model by the percentage of zonal productions occurring in each income quartile. The percentage of zonal productions in each quartile is created by the trip generation model and is described above. No stratification is

maintained for the portions of the production and attraction zones that are within walking distance of transit. Instead, the full centroid connector length is used as an input to the walk-to-transit disutility and the airline centroid-to-node distance is used for the drive-to-transit disutility. The nested model is used to compute the walk/drive split.

Exhibit 2-29
Work Mode Split Structure



Modal Share Calculations

The modal shares for interzonal trips are computed separately for each income quartile and for each interchange using the equations shown in Exhibit 2-30 and the constants shown in Exhibit 2-31. As this exhibit shows a commuter rail-to-CBD adjustment constant is used to account for differences in the relative attractiveness of the commuter rail mode in different portions of the region. This adjustment constant ranges from 1.09 to 3.70 depending on the location of the production zone.

All of the intrazonal trips are assumed top use the auto mode.

Differences Between the Original and the Revised Mode Choice Model

As part of the 1990 validation effort, two modifications to the original Metra mode split model were developed:

1. **Transit Travel Time Adjustments.** Because the travel time functions used in the revised model are different than the functions used to validate and calibrate the original model, the mode choice model must be adjusted accordingly. Two adjustments were implemented:

   - The travel time is multiplied by 0.85 to represent the average adjustment made to commuter rail travel times

   - A constant of -0.268 is added to the walk-to-bus and drive-to-bus modes to account for the fact that average bus times were less affected by the revised travel time procedures than were average rapid transit times.

2. **Revised Auto-to-Rapid Transit Constants.** Early results from the 1990 validation indicated that the model tended to underpredict transit boardings at the Ashland station on the Englewood Branch and the 95th station on the Dan Ryan. Because both of these stations were coded with extensive drive-access links, it seemed likely that the model was underpredicting drive-to-rapid transit trips. The solution was to treat drive-to-rapid transit similarly to drive-to-commuter rail trips. This was accomplished by changing the network coding to provide drive access link coverage areas for rapid transit that are similar to those for commuter rail (previously described) and applying the drive-to-commuter rail constants to the drive-to-rapid transit mode.

Non-Work Mode Split

The non-work mode split model separately estimates trips by mode for two trip purposes:

- Home-Based Non-Work (HBNW, a combination of HBS, HBSCH, and HBO trip tables created by the non-work distribution model).

- Non-Home Based

Exhibit 2-30
Computation of HBW Modal Shares

$T_{TRN} = \exp(U_{TRN})/(\exp(U_{AUTO}) + \exp(U_{TRN})) * T_{TOTAL\ PERSON\ TRIPS}$

$T_{AUTO} = T_{TOTAL} - T_{TRN}$

$T_{W\_TRN} = \exp(U_{W\_TRN})/(\exp(U_{W\_TRN}) + \exp(U_{A\_TRN})) * T_{TRN}$

$T_{A\_TRN} = \exp(U_{A\_TRN})/(\exp(U_{W\_TRN}) + \exp(U_{A\_TRN})) * T_{TRN}$

$T_{W\_CR} = \exp(U_{W\_CR})/(\exp(_{W\_CR}) + \exp(_{W\_RT}) + \exp(_{WBUS})) * T_{W\_TRN}$

$T_{W\_RT} = \exp(U_{W\_RT})/(\exp(_{W\_CR}) + \exp(_{W\_RT}) + \exp(_{WBUS})) * T_{W\_TRN}$

$T_{WBUS} = \exp(U_{WBUS})/(\exp(_{W\_CR}) + \exp(_{W\_RT}) + \exp(_{WBUS})) * T_{W\_TRN}$

$T_{A\_CR} = \exp(U_{A\_CR})/(\exp(_{A\_CR}) + \exp(_{A\_RT}) + \exp(_{ABUS})) * T_{A\_TRN}$

$T_{A\_RT} = \exp(U_{A\_RT})/(\exp(_{A\_CR}) + \exp(_{A\_RT}) + \exp(_{ABUS})) * T_{A\_TRN}$

$T_{ABUS} = \exp(U_{ABUS})/(\exp(_{A\_CR}) + \exp(_{A\_RT}) + \exp(_{ABUS})) * T_{A\_TRN}$

$U_{AUTO} = 0.70640*0.88430*U_{AUTO}$

$U_{TRN} = 0.70640*\ln(\exp(U_{W\_TRN}) + \exp(U_{A\_TRN}))$

$U_{W\_TRN} = 0.88430*\ln(\exp(U_{W\_CR}) + \exp(U_{W\_RT}) + \exp(U_{WBUS}))$

$U_{A\_TRN} = 0.88430*\ln(\exp(U_{A\_CR}) + \exp(U_{A\_RT}) + \exp(U_{ABUS})) + D\_CONST$

U_{AUTO} = -0.05611*(AUTO_TIME+2*(P_TERM_TIME+A_TERM_TIME)) + -0.01837*AUTO_COST+AUTO_CONST

U_{W_CR} = -0.05611*((W_CR_INVEH*TTADJ)+2*(W_CR_WALK+W_CR_WAIT)) + -0.01837*W_CR_FARE + -0.0001147*RES_DENS + W_CR_CONST + CRCBD*CBD_DUMMY

U_{A_CR} = -0.05611*((A_CR_INVEH*TTADJ)+2*(A_CR_WALK+A_CR_WAIT+ A_CR_AUTO)) + -0.01837*A_CR_FARE + A_CR_CONST + CRCBD*CBD_DUMMY

U_{W_RT} = -0.05611*((W_RT_INVEH*TTADJ)+2*(W_RT_WALK+W_RT_WAIT)) + -0.01837*W_RT_FARE + -0.0001147*RES_DENS + W_RT_CONST + 0.354*CBD_DUMMY

U_{A_RT} = -0.05611*((A_RT_INVEH*TTADJ)+2*(A_RT_WALK+A_RT_WAIT+ A_RT_AUTO)) + -0.01837*A_RT_FARE + A_RT_CONST + 0.354*CBD_DUMMY

(continued)

Exhibit 2-30
Computation of HBW Modal Shares
(continued)

U_{WBUS} = -0.05611*((WBUS_INVEH*TTADJ)+2*(WBUS_WALK+WBUS_WAIT)) + -0.01837*WBUS_FARE + -0.0001147*RES_DENS + TTCONST

U_{ABUS} = -0.05611*((ABUS_INVEH*TTADJ)+2*(ABUS_WALK+ABUS_WAIT+ ABUS_AUTO)) + -0.01837*ABUS_FARE+ABUS_CONST + TTCONST

Home-Based Work Mode Split Model Modal Constants

	Income Quartile 1	Income Quartile 2	Income Quartile 3	Income Quartile 4
TTADJ - original model - revised model	 1.0 0.85	 1.0 0.85	 1.0 0.85	 1.0 0.85
AUTO_CONST	-2.48490	-0.88970	0.02790	-0.38830
W_CR_CONST	-2.72119	-2.65000	-2.05170	-0.78180
A_CR_CONST	-0.75070	0.08590	0.91410	2.85560
W_RT_CONST	-0.27390	-0.23020	0.46960	0.02180
A_RT_CONST - original model - revised model	 0.0 -0.75070	 0.0 0.08590	 0.0 0.91410	 0.0 2.85560
ABUS_CONST	3.47189	2.56410	1.1376	-2.07380
D_CONST	-4.10000	-4.09409	-3.42119	-3.87130
CRCBD	See Exhibit 2.35 for values of CRCBD			
TTCONST - original model - revised model	 0.0 -0.268	 0.0 -0.268	 0.0 -0.268	 0.0 -0.268

(continued)

Exhibit 2-30
Computation of HBW Modal Shares
(continued)

Definitions

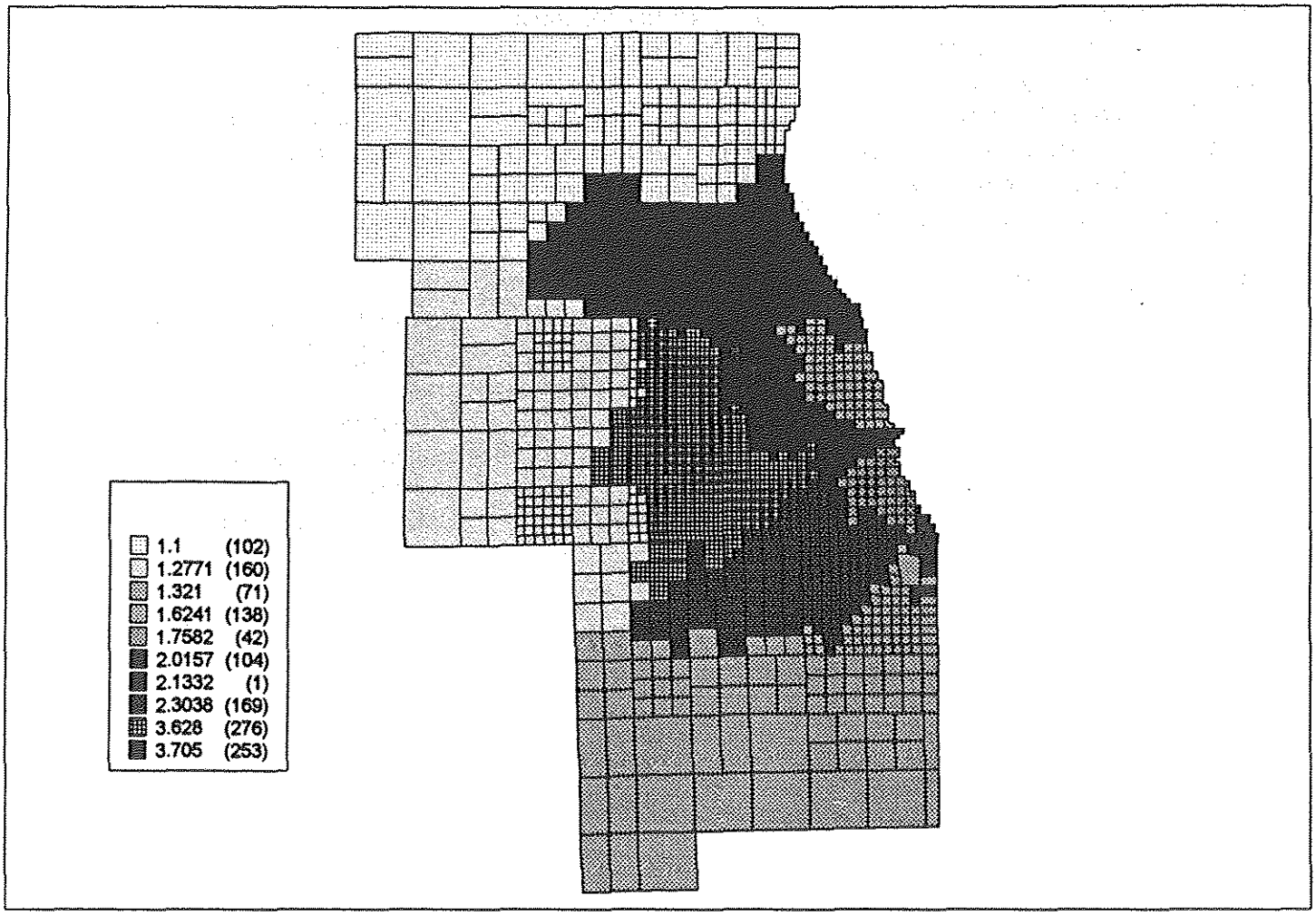
Modes:

AUTO = Automobile
TRN = Transit
W_TRN = Walk-to-Transit
A_TRN = Auto-to-Transit
W_CR = Walk-to Commuter Rail
A_CR = Auto-to-Commuter Rail
W_RT = Walk-to-Rapid Transit
A_RT = Auto-to-Rapid Transit
WBUS = Walk-to-Bus
ABUS = Auto-to-Bus

Input Variables:

T_x = Trips on mode x
U_x = Utility for mode x
AUTO_TIME = Automobile travel time
P_TERM_TIME = Production-end terminal time
A_TERM_TIME = Attraction-end terminal time
AUTOCOST = Auto operating cost, tolls, and one-half of the daily parking cost
X_INVEH = Mode x invehicle time
X_WALK = Mode x walk time
X_WAIT = Mode x wait time
X_FARE = Mode x fare and one-half of daily station parking charge (for drive access trips)
X_CONST = Mode x Constant
TTADJ = Travel time adjustment factor
TTCONST = Travel time adjustment constant
RES_DENS = Residential Density
CBD_DUMMY = 1 if attraction zone in CBD, 0 otherwise

Exhibit 2-31
Commuter Rail to CBD Constants by Production Zone



The model is formulated as a multinomial logit model that estimates automobile (drive alone), automobile (shared ride), and transit trips as shown in Exhibit 2-32.

Input Impedance Information

Input highway impedances are the same as described for the non-work distribution model, above, except that a separate toll assignment is also performed to store the zone-to-zone tolls in a matrix. Highway operating costs are calculated as follows:

- **Home-Based, Non-Work:** 4.8 cents per mile and 0.36 times the toll parameters stored in link user field 3 (to convert to 1970 dollars). Note: the three-hour parking cost is directly input into the utility equation for this purpose.

- **Non-Home Based:** 4.8 cents per mile plus 0.36 times the tolls stored in link user field 3 (to convert to 1970 dollars) plus half of the 2-hour parking cost stored.

The off peak transit impedance inputs are developed from EMME/2's transit assignment module. Six transit assignments are performed to provide skim values for each of the transit options as described in the section on transit path building. Disconnected zones are flagged by setting the wait and walk times to 999 if the value of the matrix is either greater than or equal to 999 or less than or equal to zero.

Model Stratifications

The model is stratified by walk access and egress categories as follows:

- **Walk Access/Walk Egress.** The portion of the zone within the walk to transit area (within 0.25 miles of a transit line or station) on the production and attraction end of the trip. Modes available are drive alone, shared ride and walk to transit.

- **Auto Access/Walk Egress.** The portion of the zone outside the walk to transit area on the production end of the trip and inside the walk to transit area on the attraction end of the trip. Modes available are drive alone, shared ride, and drive to transit.

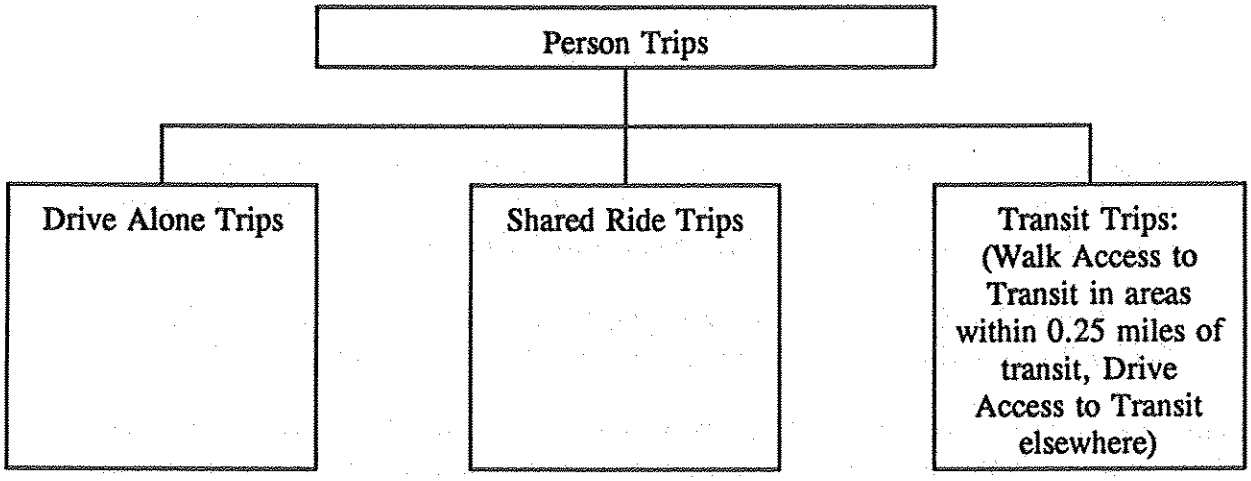
- **No Transit.** The portion of the zone outside of the walk to transit area on the attraction end of the trip. Modes available are drive alone and shared ride.

The Home-Based Non-Work model is also stratified by income quartile.

Disutility Equations

The Home-Based Non-Work disutility equations are shown in Exhibit 2-33 and the Non-Home Based disutility equations are shown in Exhibit 2-34.

Exhibit 2-32
Non-Work Mode Split Structure



Note: The home-based non-work and non-home based models are stratified by 3 transit access categories (walk to transit, drive to transit, and transit not available). The home-based non-work model is further stratified by four income stratifications.

Exhibit 2-33
Home-Based Non-Work Disutility Equations

$U_{HBNW\text{-}DA}$ = -0.00328*(AUTO_TIME+3*(P_TERM_TIME+A_TERM_TIME) + 0.45*(3HR_PARK_COST/2) + 0.35*HBNW_DA_COST) + (-0.16692*HH_SIZE)+HBNW_DA_CONST

$U_{HBNW\text{-}SR}$ = -0.00328*((AUTO_TIME+0.321)+ 3*(P_TERM_TIME+A_TERM_TIME) + (0.45*(3HR-PARK_COST/2)/2.606) + 0.35*(HBNW_DA_COST/2.606)) + HBNW_SR_CONST

$U_{HBNW\text{-}WTRN}$ = -0.00328*(W_TRN_TIME*TTADJ + 3*W_TRN_WALK + 6*W_TRN_WAIT +0.45*W_TRN_FARE) + 2.707443*CBD_DUMMY

$U_{HBNW\text{-}ATRN}$ = -0.00328*(A_TRN_TIME*TTADJ + 3*A_TRN_WALK + 6*W_TRN_WAIT +0.45*W_TRN_FARE) + 2.707443*CBD_DUMMY

	HBNW_DA_ CONST	HBNW_SR_ CONST
Income 1	0.008128	0.385392
Income 2	1.415909	1.474159
Income 3	1.943901	2.116195
Income 4	2.463859	2.377501

Definitions

Modes:
DA = Drive Alone
SR = Shared Ride
WTRN = Walk-to-Transit
ATRN = Auto-to-Transit

Input Variables:
AUTO_TIME = Automobile travel time
P_TERM_TIME = Production-end terminal time
A_TERM_TIME = Attraction-end terminal time
3HR_PARK_COST = 3-hour parking cost
X_COST = Automobile operating cost and tolls
X_TRN_TIME = Mode x invehicle time
X_TRN_WALK = Mode x walk time
X_TRN_WAIT = Mode x wait time
X_TRN_FARE = Mode x fare
CBD_DUMMY = 1 if attraction zone in CBD, 0 otherwise
HHSIZE = Average Household Size
TTADJ=1 (original model) or 0.85 (revised model)

Exhibit 2-34
Non-Home Based Disutility Equations

$U_{NHB\text{-}DA}$ = -0.01780*(AUTO_TIME+2*(P_TERM_TIME+A_TERM_TIME)) +
-0.01019*(NHB_DA_COST) +
-0.02084*EMP_DENS/1000 + 1.81445

$U_{NHB\text{-}SR}$ = -0.01780*((AUTO_TIME+0.323) +
2*(P_TERM_TIME+A_TERM_TIME)) +
-0.01019*(NHB_DA_COST/2.614) +
-0.02864*EMP_DENS/1000 + 1.8579

$U_{NHB\text{-}WTRN}$ = -0.01780*(W_TRN_TIME*TTADJ + 2*W_TRN_WALK +
4*W_TRN_WAIT)) + -0.01019*W_TRN_FARE

$U_{NHB\text{-}ATRN}$ = -0.01780*(A_TRN_TIME*TTADJ + 2*A_TRN_WALK
+4*A_TRN_WAIT)) + -0.01019*A_TRN_FARE

Definitions

Modes:
DA = Drive Alone
SR = Shared Ride
WTRN = Walk-to-Transit
ATRN = Auto-to-Transit

Input Variables:
AUTO_TIME = Automobile travel time
P_TERM_TIME = Production-end terminal time
A_TERM_TIME = Attraction-end terminal time
DA_COST = Automobile drive alone operating cost, tolls and one-half of the 2-hour parking cost
X_TRN_TIME = Mode x invehicle time
X_TRN_WALK = Mode x walk time
X_TRN_WAIT = Mode x wait time
X_TRN_FARE = Mode x fare
CBD_DUMMY = 1 if attraction zone in CBD, 0 otherwise
EMP_DENS = Employment Density
TTADJ = 1 (original model) or 0.85 (revised model)

ASSIGNMENT PROCEDURES

The assignment procedures described in this section are designed to determine the highway link volumes and the boarding and alighting patterns for each modeled transit line. Separate procedures are employed for the work and non-work assignments as described below.

Work Assignment

The work assignment procedures are relatively simple. A single auto assignment is performed using the peak highway network and the automobile trip table representing the sum of auto person trips for each income quartile. Note that the work auto assignment indicates the total number of persons traveling on each highway link rather than the total number of vehicles.

Transit trips output by the mode choice model are summed across income quartile to create six transit person trip tables:

- Walk to commuter rail
- Walk to rapid transit
- Walk to bus
- Drive to commuter rail
- Drive to rapid transit
- Drive to bus

Each trip table is separately assigned to the transit network. The resulting transit volumes are reported and displayed using EMME/2's standard link reporting and plotting procedures.

Non-Work Assignment

The assignment procedures consist of four procedures:

1. Post-processing of the mode split output tables to convert automobile person trips into vehicle trips.

2. Post-processing of the output transit trip tables to combine similar trip types and eliminate unreasonable trips

3. Assignment of the vehicle trip tables

4. Assignment of transit trip tables.

The non-work assignment procedures begin by converting the trip tables output from mode split into a form that is ready for assignment. Highway-related trips are converted to automobile trips using the average auto occupancies shown in Exhibit 2-35. Note that, unlike the work model, the non-work model total auto trip table represents vehicle trips rather that auto mode person trips.

Exhibit 2-35
Non-Work Auto Occupancy by Mode and Purpose

	Drive Alone	Shared Ride
Home-Based Non-Work	1.0	2.606
Non-Home Based	1.0	2.614

The transit trip tables are processed to reduce the number of very short commuter rail trips. This is done by preventing transit trips of less than 11 minutes from using commuter rail unless they are walk access trips attracted to the CBD. Transit trips that are less than 11 minutes are reassigned to a non-commuter rail transit path or, if none is available, to one of the automobile modes. This is done by dividing both the walk- and drive-access transit trip tables into three (each) matrices:

- Walk access transit trips greater than 11 minutes, or attracted to the CBD.
- Other transit trips for paths that can be built without commuter rail
- Other transit trips for paths that cannot be built without commuter rail and must, therefore, use an automobile mode.

A shortest path all-or-nothing highway assignment is performed using the offpeak highway network and a trip table representing the auto vehicle trips (calculated from the drive alone and shared ride modes) and the short (under 11 minutes) transit trips that cannot be assigned to a non-commuter rail path.

The transit trip tables as described above are used as input to four transit assignments:

- **Walk access transit trips greater than 11 minutes, or attracted to the CBD, or riding on rail, bus, rapid transit, or express bus for at least part of the trip.** This transit assignment is similar to the assignments used to create the walk access to transit impedance values used in the mode split model. This assignment includes all transit modes.
- **Other walk access transit trips.** This assignment is performed using similar parameters to the previous assignment except that commuter rail is not included as a valid mode.
- **Drive access transit trips greater than 11 minutes, or attracted to the CBD, or riding on rail, bus, rapid transit, or express bus for at least part of the trip.** This transit assignment is similar to the assignments used to create the drive access to transit impedance values used in the mode split model. This assignment includes all transit modes.
- **Other drive access transit trips.** This assignment is performed using similar parameters to the previous assignment except that commuter rail is not included as a valid mode.

The resulting transit volumes are reported and displayed using EMME/2's standard link reporting and plotting procedures.

POST PROCESSING ACTIVITIES

Following the conclusion of each model run, a series of post-processing steps are performed to prepare information used for reporting the results of the run. Three steps are performed:

1. Compute "new" riders

2. Compute incremental revenue

3. Compute travel time savings

Each step is described below.

Compute "New" Riders

Incremental ("New") riders are computed by subtracting the total linked transit trips for the base alternative from the total linked transit trips for each alternative. Total linked transit trips is a result included in the Metra mode choice macros and the computation of incremental riders is done manually, outside of EMME/2.

Compute Incremental Revenue

Metra's EMME/2 macros have been modified to store the transit cost inputs to the mode choice model for calculation of total revenue. This calculation is performed in a special-purpose macro that multiplies the number of trips by submode by the transit cost by submode and stores the result in a series of EMME/2 scalars. Since transit cost is expressed in 1970 dollars and does not represent CTA pass utilization, the revenue numbers are manually adjusted to account for inflation (based on the relative values of the Chicago Consumer Price Index) for 1970 and the model-year. Rapid transit and bus revenues are further adjusted to account for average pass utilization and discounts.

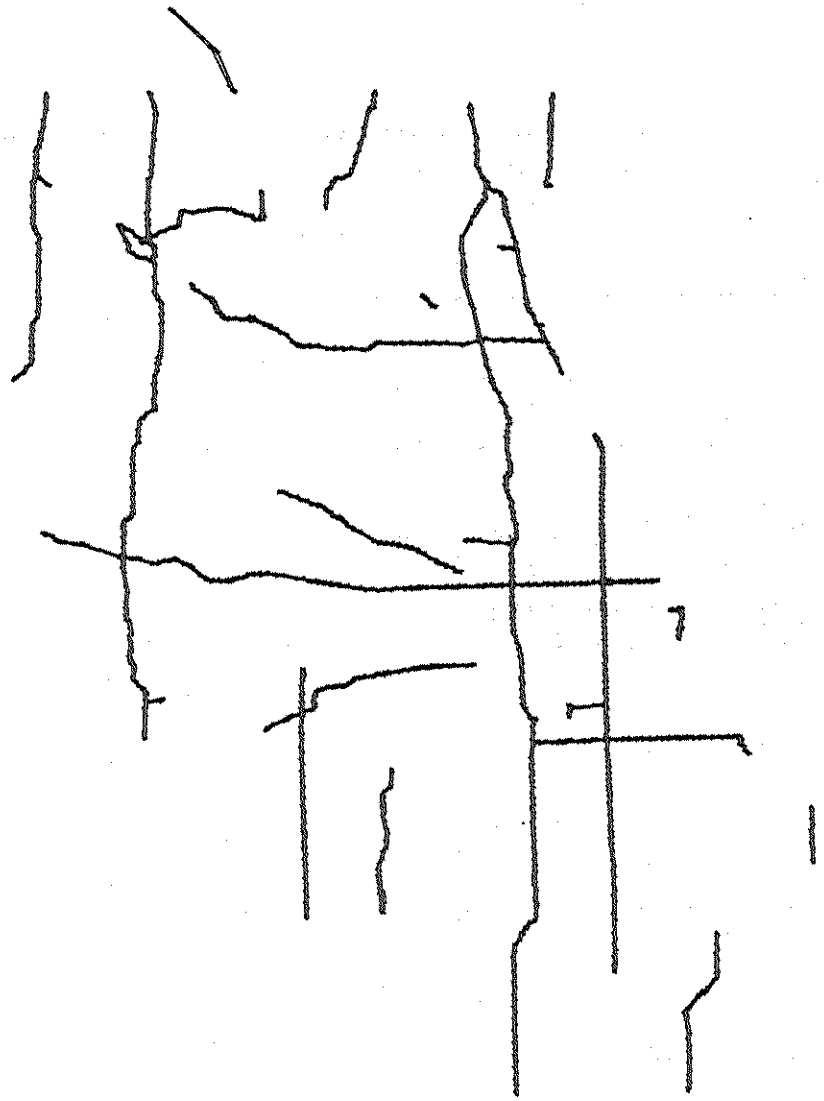
Compute Travel Time Savings

Metra's EMME/2 macros have been modified to store the total transit travel time inputs to the mode choice model for calculation of total travel time savings. This calculation is performed in a special-purpose macro that computes the total person-minutes of travel for all persons in the base transit trip table. This is done by multiplying base transit trips (stratified by submode) by the travel time (stratified by submode). Travel time savings are computed as the difference between the alternative person-minutes (computed using the base transit trip table) and base person-minutes.

Exhibit 3-2
1985 Major Arterial Network

emme/2

LINKS:
typ=12.92.10



WINDOW:
2405.9/ 16668
9217.1/ 21776

EMME/2 PROJECT: Chicago (Metra) Model
SCENARIO 100: Chicago Work Distribution Network

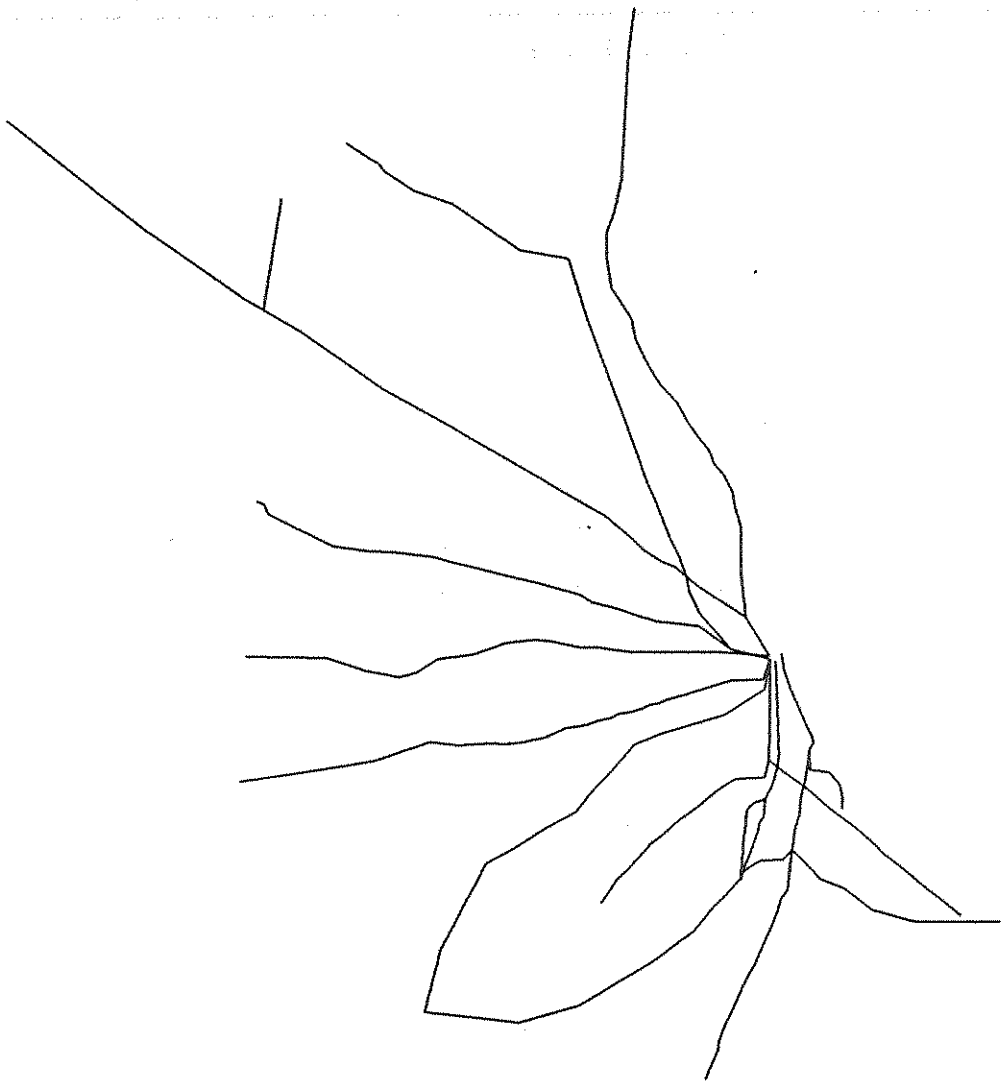
DATE: 92 11 21
MODULE: 2.13
KPMG.....wau

Exhibit 3-3
Year 1985 Toll Links

A-Node	B-Node	1985 Toll	A-Node	B-Node	1985 Toll
3076	3075	40	5950	6644	40
3312	3311	40	5961	5962	40
3632	3643	30	5963	5964	40
3638	3632	30	6542	4272	30
3695	3714	30	6602	4065	30
3869	3866	40	6645	5949	40
3870	3871	40	6648	5960	30
3925	3924	40	7502	7503	40
3926	3927	40	7504	7505	40
3953	8217	40	7918	8485	40
3955	3954	40	7922	7921	175
3956	3957	40	7924	7925	175
3958	3959	40	8382	8383	40
3960	3961	40	8384	8381	40
3962	3963	40	8486	7343	40
3982	5782	40	8869	9245	15
3996	3997	40	8869	9402	15
4004	4001	40	9014	9015	40
4005	4001	40	9016	9017	40
4029	4031	15	9034	8243	30
4031	4028	15	9037	9040	30
4047	4046	40	9083	4157	15
4072	4073	15	9217	9512	30
4095	4634	15	9221	9512	30
4105	6586	30	9223	4230	30
4155	4156	15	9232	9234	25
4171	9090	15	9232	9247	25
4231	9222	30	9234	9232	30
4271	6542	30	9245	8869	25
4507	4055	15	9247	9232	30
4645	4094	15	9402	8869	25
5466	4270	40	9439	9537	30
5780	3981	40	9512	9217	25
5862	5870	30	9512	9221	25
5871	5862	30	9537	9440	25
5876	3796	15			

Exhibit 3-4
1985 Commuter Rail Lines

emme/2



LINKS:
all
TRANSIT LINES:
84 LINES

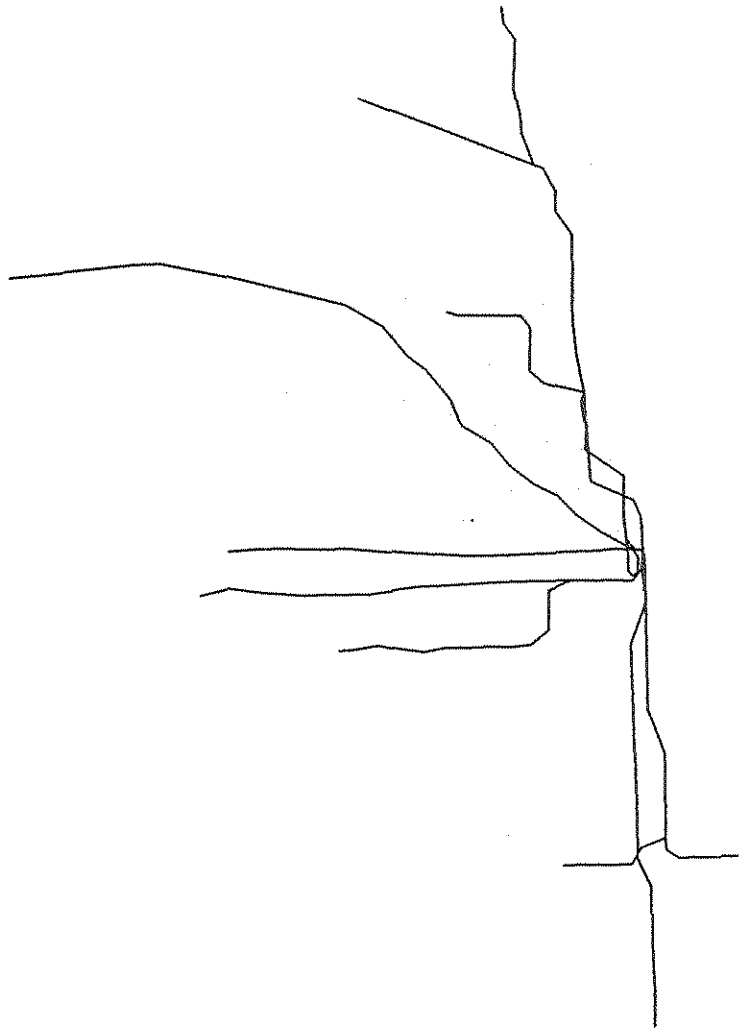
WINDOW:
3042/ 17304
8756/ 21589

EMME/2 PROJECT: Chicago (Metra) Model
SCENARIO 100: Chicago Work Distribution Network

DATE: 92 11 21
MODULE: 2.23
KPMG.....wow

Exhibit 3-5
1985 Rapid Transit Lines

emme/2



LINKS:
all

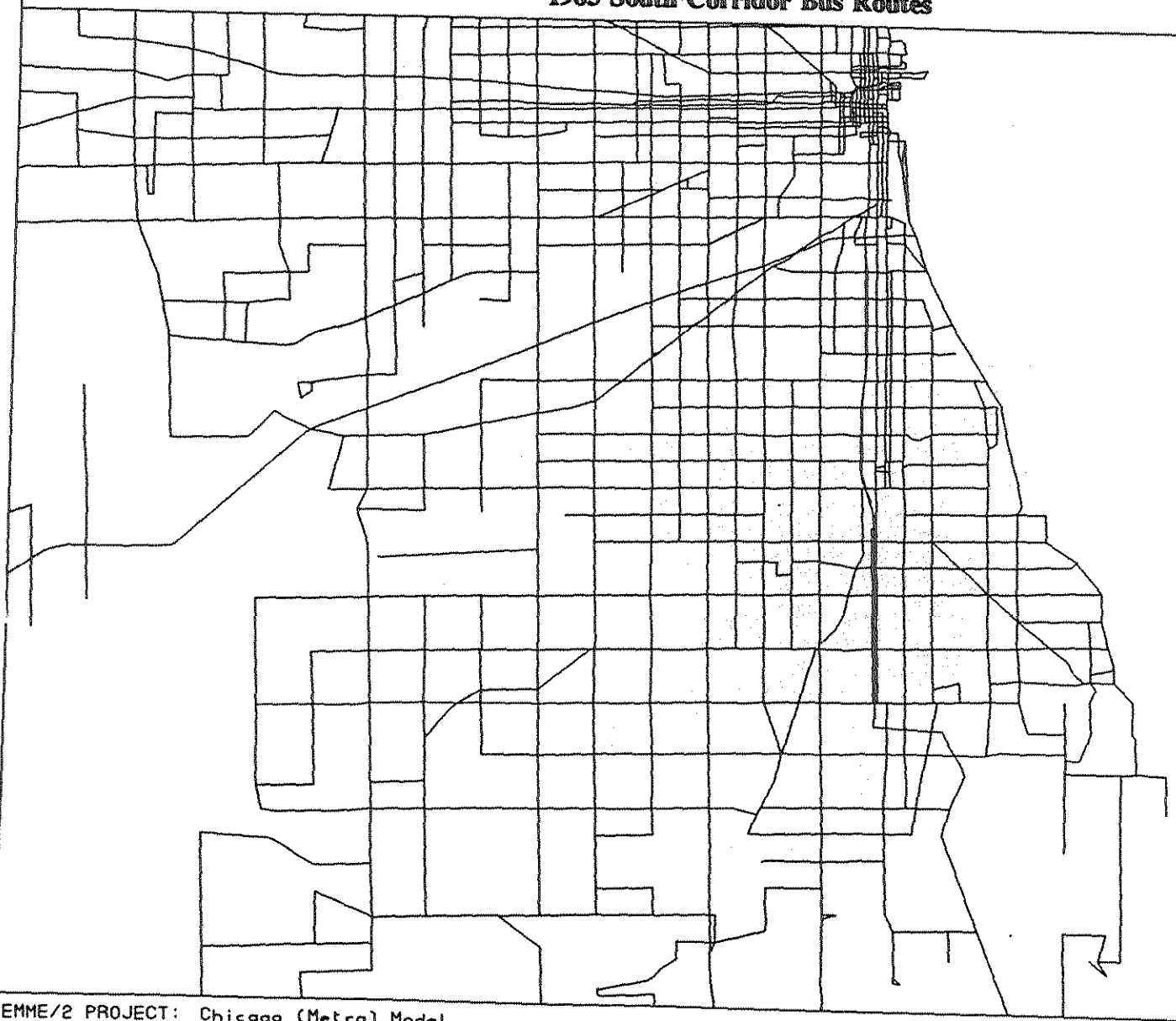
TRANSIT LINES:
evanst hourda
hourdb lakea
lakeb oharea
ohareb raven
ravenb skokie

WINDOW:
5636.2/ 18305
7564.1/ 19751

EMME/2 PROJECT: Chicago (Metra) Model
SCENARIO 100: Chicago Work Distribution Network

DATE: 92 11 21
MODULE: 2.23
KPMC.....waw

Exhibit 3-6
1985 South Corridor Bus Routes



emme/2

LINKS:
all

TRANSIT LINES:
360 LINES

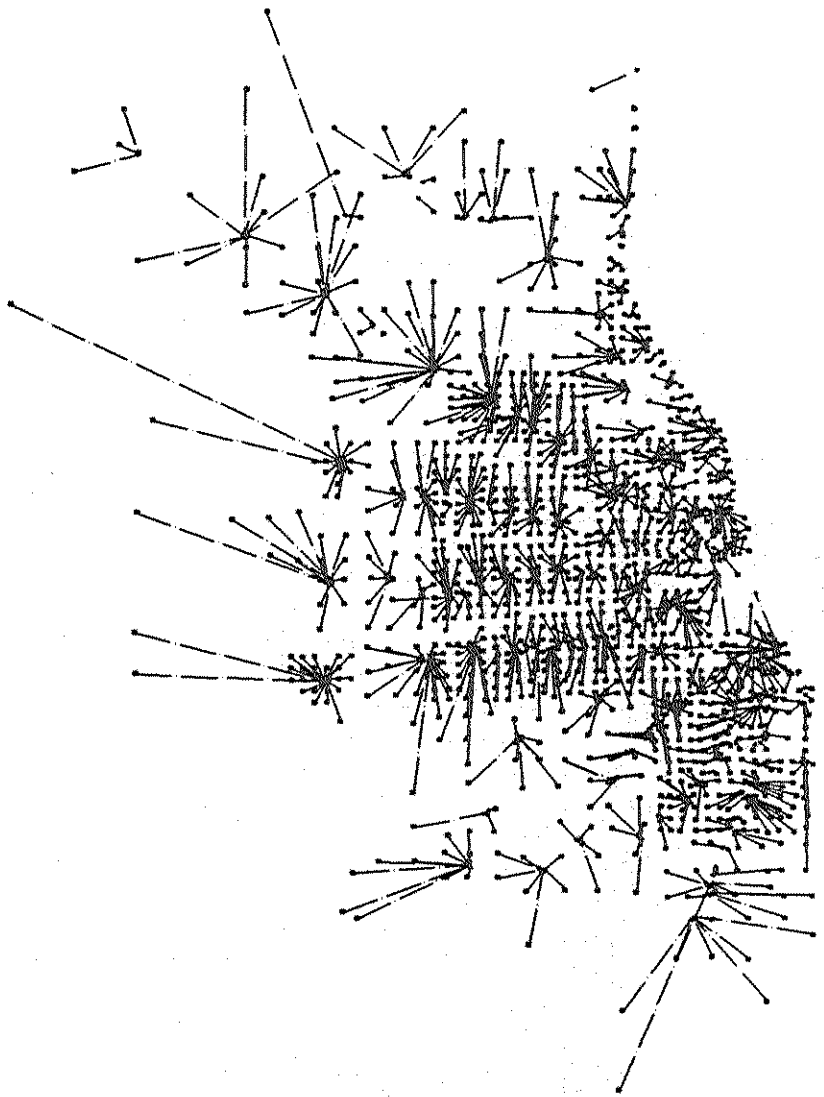
WINDOW:
6117.3/ 18111
7412.2/ 19083

EMME/2 PROJECT: Chicago (Metra) Model
SCENARIO 100: Chicago Work Distribution Network

DATE: 92 11 21
MODULE: 2.23
KPMG.....waw

Exhibit 3-7
1985 Park-and-Ride Links

emme/2



MODES:
s o p s

LINKS:
mod=m
mod=o
mod=p
mod=e

WINDOW:
1856.9/ 16457
9002.2/ 21815

EMME/2 PROJECT: Chicago (Metra) Model
SCENARIO 100: Chicago Work Distribution Network

DATE: 92 11 21
MODULE: 2.13
KPMG.....wau

Exhibit 3-8
Peak and Off-Peak Rail Fare Lookup Table
(Fares Specified in 1970 Dollars)

1985 Validation Fare

Fare Zone Boundaries Crossed	Fare	Fare Zone Boundaries Crossed	Fare	Fare Zone Boundaries Crossed	Fare
<1	$0.51	9	$1.35	18	$2.81
1	$0.46	10	$1.48	19	$2.91
2	$0.64	11	$1.60	20	$2.98
3	$0.75	12	$1.74	21	$3.09
4	$0.84	13	$2.20	22	$3.22
5	$0.94	14	$2.38	23	$3.34
6	$1.07	15	$2.49	24	$3.48
7	$1.17	16	$2.58		
8	$1.24	17	$2.68		

Exhibit 3-9
Non-Commuter Rail Fare Parameters Used for the 1985 Validation
(in 1970 Dollars)

Fare Category	Fare
Bus Boarding Fare	$0.33
Rapid Transit Boarding Fare	$0.33
Light Rail Boarding Fare	—
Transfer Charge (a maximum of one transfer is charged in the work model)	$0.033
Auto Access Cost per Mile	$0.048
Assumed Circuity Factor for Auto Access Cost	1.414

3. 1985 Validation

The 1985 validation is conducted to determine whether the microcomputer-version of the Metra model adequately replicates the original mainframe version of the model. It is run using 1985 data inputs supplied by Metra including demographic data, highway networks, transit networks, and model procedures. All model procedures are run against the full Metra area system.

1985 VALIDATION INPUT DATA

This section describes the input data used in the 1985 validation including the highway network, the toll structure, the transit network, and the transit fares.

Highway Network

The highway network was supplied by Metra and is similar to the network used for the 1985 validation of its mainframe model. Exhibit 3-1 shows the freeway, expressway, and toll road facilities included in the network. Exhibit 3-2 shows the major arterials included in the network.

Tolls

A table of tolls is presented in Exhibit 3-3.

Transit Network

The 1985 Metra transit network is used to represent transit services in the Chicago region. Exhibits 3-4 and 3-5 show the regional network of coded commuter rail and rapid transit lines included in the 1985 transit network. The coded stopping patterns and headways for each commuter rail and rapid transit route are presented in Appendix B. Exhibit 3-6 shows the express and local bus service patterns in the South Corridor. The network includes all relevant CTA bus services in the these corridors. Exhibit 3-7 shows the park-and-ride connector links used in the 1985 transit network.

Transit Fares

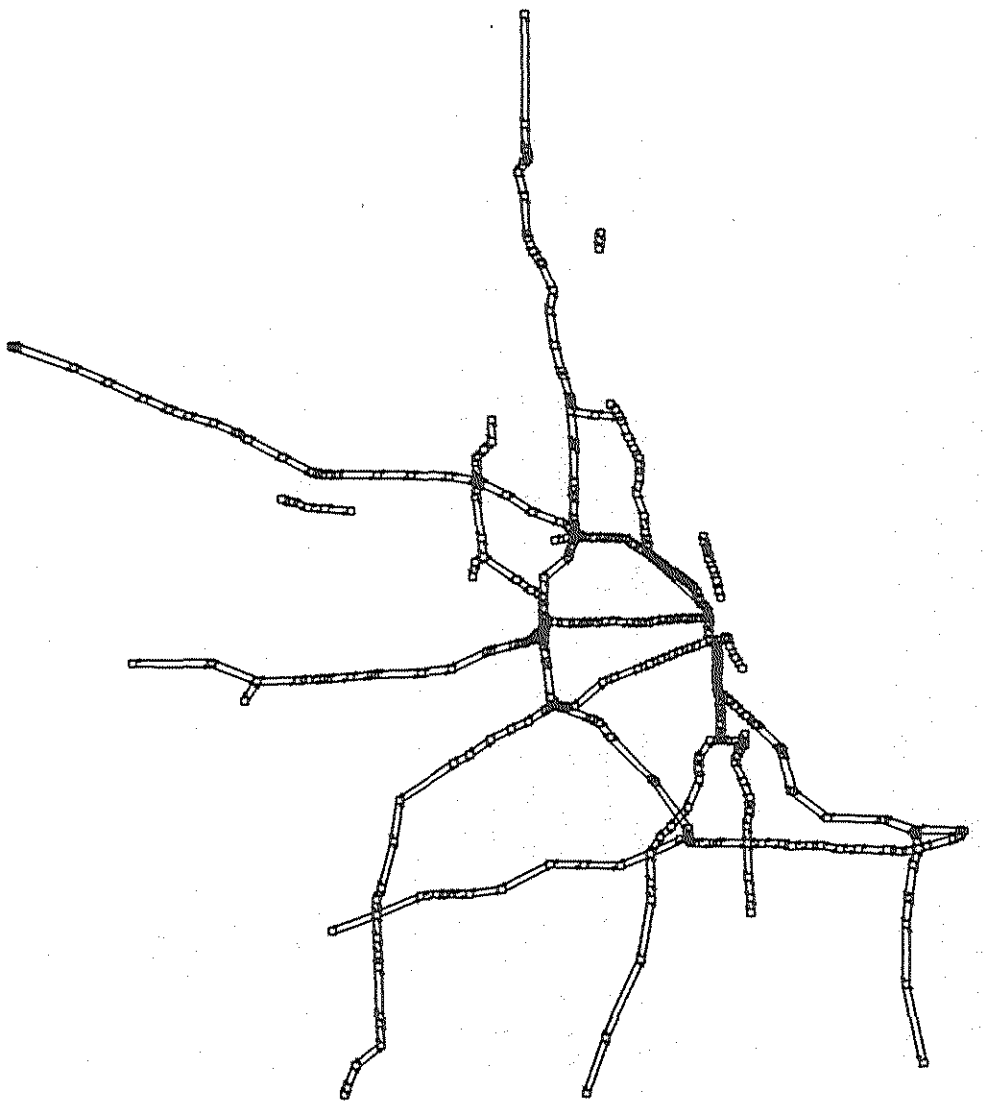
As described in the section on methodology, the transit fares used for the 1985 validation consist of a distance-based commuter rail fare and a fixed rapid transit/bus fare. The commuter rail fare is computed based on the number of zone boundaries crossed and the table shown in Exhibit 3-8. The rapid transit and bus fares are computed using the information shown in Exhibit 3-9.

1985 VALIDATION RESULTS

The following sections describe the results of the 1985 validation of the trip generation, distribution, and mode choice modeling procedures.

Exhibit 3-1
1985 Freeway/Expressway/Toll Road Network

emme/2



LINKS:
typ=11.91.10

WINDOW:
2147.8/ 16486
9591.2/ 22069

EMME/2 PROJECT: Chicago (Metra) Model
SCENARIO 100: Chicago Work Distribution Network

DATE: 92 11 21
MODULE: 2.13
KPMG.....waw

Trip Generation

Exhibit 3-10 summarizes the results of the trip generation validation. This table shows that total households by household size, unnormalized trip productions and attractions, and normalized trip productions and attractions agree to within 0.10 percent for each measure. It is interesting to note that the normalized trip productions and attractions agree to within two trips for the microcomputer version but are different by 81 trips in the mainframe version of the model. This difference is trivial but illustrates the impact that different levels of mathematical precision have on these models. The microcomputer version of the program, with its more precise floating point numbers, is better able to balance productions and attractions than the corresponding mainframe version.

Distribution

The results of the home-based work, home-based non-work, and non-home based distribution validation are presented in Exhibits 3-11, 3-12, and 3-13, respectively. These tables compare county-to-county (with some additional stratification in Cook County for the HBW model) by purpose output by the mainframe and microcomputer versions of the model. The districts used in the work and non-work models are shown in Exhibits 3-14 and 3-15, respectively. The comparison shows that the two models generate similar trip patterns (the R-squared at the district level is 0.99956, 0.99992, and 0.99996 for HBW, HBNW, and NHB, trips respectively) but that some differences also exist between the two trip tables. First, and most importantly, the total number of reported trips output from distribution model are different between the mainframe and microcomputer versions. For example, the HBW distribution output is 4,777,903 trips (mainframe) and 4,785,725 trips (microcomputer). Since mainframe and microcomputer versions of the trip generation models create very nearly the same number of trips and since the mainframe version of the mode split model reports a total number of trips within several hundred of the micro version, it is evident that the mainframe version of the model is "losing" up to 100,000 trips during distribution reporting (using the program to output a matrix).

This difference is probably caused by the relatively small precision of the mainframe single precision floating point number used in that program. Although the trips are not actually lost in the distribution model (they are available for subsequent calculations), the single precision variables used in the matrix output program are unable to sum a series of small numbers when the total exceeds one or two million trips. The microcomputer version of EMME/2 does not suffer from this problem because its single precision number is more precise than the equivalent mainframe number.

At the individual county (or sub-county) level, the error is larger. In general terms, cells with more than 100,000 trips are within 5 percent of the target, and cells with fewer than 1,000 trips have a much larger percentage error but (relative to the larger cells) but have a reasonably small error in absolute terms. Some of this difference may be caused by differences in the maximum number of iterations used in the distribution model. Metra

currently allows the distribution model to proceed for up to 20 iterations while the microcomputer model is allowed to proceed for up to 10 iterations.

Exhibit 3-10
1985 Trip Generation Validation Results

	Mainframe Results	Microcomputer Results	Percentage Difference
Households by Household Size			
1 person			
2 person	575,422	575,432	0.002%
3 person	742,296	742,346	0.007%
4 person	447,663	447,696	0.007%
5 person	396,077	396,108	0.008%
6+ person	223,532	223,555	0.010%
	162,717	162,735	0.011%
Unnormalized Productions			
Work	4,826,346	4,826,803	0.009%
Shop	3,200,150	3,200,545	0.012%
Other	4,988,372	4,988,867	0.010%
Non-Home Based	3,190,103	3,190,491	0.012%
School	1,060,733	1,090,786	0.005%
Unnormalized Attractions			
Work	4,785,344	4,785,740	0.008%
Shop	2,564,997	2,265,214	0.008%
Other	4,211,045	4,211,479	0.010%
Non-Home Based	2,735,339	2,735,672	0.012%
School	694,843	694,879	0.005%
Normalized Productions			
Work			
Shop	4,785,363	4,785,738	0.008%
Other	3,200,150	3,200,545	0.012%
Non-Home Based	4,988,372	4,988,867	0.010%
School	3,190,143	3,190,492	0.011%
TOTAL	1,060,733	1,060,786	0.005%
	17,224,761	17,226,428	0.010%
Normalized Attractions			
Work			
Shop	4,785,344	4,785,740	0.008%
Other	3,200,179	3,200,545	0.011%
Non-Home Based	4,988,428	4,988,868	0.009%
School	3,190,143	3,190,492	0.011%
TOTAL	1,060,748	1,060,785	0.003%
	17,224,842	17,226,430	0.009%

Source: Metra and KPMG Peat Marwick

Exhibit 3-11
Comparison of 1985 Metra Mainframe and Microcomputer Work Trip Distribution Results

Origin Groups	Destination Groups										Total
	1 CBD	2 N Chicago	3 S Chicago	4 N Cook	5 S Cook	6 DuPage	7 Kane	8 Lake	9 McHenry	10 Will	
1 Metra	3987	6010	3637	911	401	246	15	52	3	11	15273
Micro	4008	5954	3682	911	396	244	22	56	4	11	15288
Difference	0.53%	-0.93%	1.24%	0.00%	-1.25%	-0.81%	46.67%	7.69%	33.33%	0.00%	0.10%
2 Metra	239854	439640	80819	158030	25105	24735	1274	5082	309	327	975175
Micro	242704	433669	81950	158217	24962	26268	1891	5867	404	389	976321
Difference	1.19%	-1.36%	1.40%	0.12%	-0.57%	6.20%	48.43%	15.45%	30.74%	18.96%	0.12%
3 Metra	276778	102084	419614	33498	90069	19286	921	1677	110	1732	945769
Micro	275188	99679	422763	32944	90528	20352	1357	1813	141	1762	946527
Difference	-0.57%	-2.36%	0.75%	-1.65%	0.51%	5.53%	47.34%	8.11%	28.18%	1.73%	0.08%
4 Metra	84675	104724	14766	456728	15923	62578	13439	25741	2253	260	781087
Micro	88368	108175	15740	446932	16915	63181	14414	26920	2410	407	783462
Difference	4.36%	3.30%	6.60%	-2.14%	6.23%	0.96%	7.26%	4.58%	6.97%	56.54%	0.30%
5 Metra	111826	50877	127806	43977	336599	58837	2056	1313	187	12445	745923
Micro	105911	50567	122747	49780	333792	65803	3278	2416	291	12563	747148
Difference	-5.29%	-0.61%	-3.96%	13.20%	-0.83%	11.84%	59.44%	84.01%	55.61%	0.95%	0.16%
6 Metra	43968	23868	9155	67535	24913	308091	18557	2088	556	4237	502968
Micro	45305	25750	9987	69539	27045	298937	19993	2746	632	4395	504329
Difference	3.04%	7.89%	9.09%	2.97%	8.56%	-2.97%	7.74%	31.51%	13.67%	3.73%	0.27%
7 Metra	12201	2717	1068	15642	1181	26312	123677	2005	4340	522	189665
Micro	12254	3687	1391	17079	1718	27494	119236	2109	4233	580	189781
Difference	0.43%	35.70%	30.24%	9.19%	45.47%	4.49%	-3.59%	5.19%	-2.47%	11.11%	0.06%
8 Metra	15664	9702	2178	65973	973	5549	1978	193350	6759	39	302165
Micro	16014	11843	2461	66637	1451	6441	2228	189605	6628	82	303390
Difference	2.23%	22.07%	12.99%	1.01%	49.13%	16.07%	12.64%	-1.94%	-1.94%	110.26%	0.41%
9 Metra	8416	2407	577	11974	325	2581	6435	9944	62316	22	104997
Micro	8561	2851	651	11854	407	2668	6386	9722	62083	29	105212
Difference	1.72%	18.45%	12.82%	-1.00%	25.23%	3.37%	-0.76%	-2.23%	-0.37%	31.82%	0.20%
10 Metra	10714	5588	10482	7154	36562	37392	5987	355	93	100554	214881
Micro	9856	6063	9806	9723	36455	35734	5746	738	108	100018	214267
Difference	-8.01%	8.86%	-6.45%	35.91%	-0.29%	-4.43%	-4.03%	107.89%	16.13%	-0.53%	-0.29%
Tot Metra	808083	747617	670102	861422	532051	545607	174339	241607	76926	120149	4777903
Micro	808169	748258	671178	863616	533669	547122	174551	241992	76934	120236	4785725
Difference	0.01%	0.09%	0.16%	0.25%	0.30%	0.28%	0.12%	0.16%	0.01%	0.07%	0.16%

Source: Metra and KPMG Peat Marwick

Exhibit 3-12
Comparison of 1985 Metra Mainframe and Microcomputer Home-Based Non-Work Trip Distribution Results

Origin Groups	Destination Groups							Total
	1 CBD	2 Cook	4 DuPage	5 Kane	6 Lake	7 McHenry	8 Will	
1 Metra	5594	9328	19	0	0	0	0	14941
Micro	5933	9509	21	0	2	0	0	15466
Difference	6.06%	1.94%	10.69%	NA	NA	NA	NA	3.51%
2 Metra	158517	5554456	132969	18949	36382	424	9235	5910932
Micro	158892	5711952	141697	20763	42037	541	10263	6086145
Difference	0.24%	2.84%	6.56%	9.58%	15.54%	27.65%	11.13%	2.96%
4 Metra	1687	179019	876983	14547	352	16	8100	1080704
Micro	1406	156857	880178	16209	401	23	8220	1063293
Difference	−16.68%	−12.38%	0.36%	11.42%	14.00%	42.63%	1.48%	−1.61%
5 Metra	49	15952	31213	361402	784	1060	192	410652
Micro	36	14027	26391	361488	817	1201	194	404154
Difference	−26.76%	−12.07%	−15.45%	0.02%	4.23%	13.33%	0.93%	−1.58%
6 Metra	313	100861	1694	1439	533008	3475	1	640791
Micro	233	82261	1389	1413	530138	3769	1	619204
Difference	−25.63%	−18.44%	−18.01%	−1.84%	−0.54%	8.47%	42.56%	−3.37%
7 Metra	14	6167	535	20203	22538	161862	0	211339
Micro	8	4148	354	16819	19861	161253	0	202443
Difference	−41.89%	−32.74%	−33.91%	−16.75%	−11.88%	−0.39%	NA	−4.21%
8 Metra	687	94745	38927	1156	19	0	323423	458957
Micro	488	79266	34603	1189	17	0	322317	437880
Difference	−28.95%	−16.34%	−11.11%	2.84%	−10.19%	NA	−0.34%	−4.59%
Tot Metra	166861	5960528	1082340	417696	593083	166857	340951	8728316
Micro	166996	6058020	1084631	417681	593273	166768	340995	8828585
Difference	0.08%	1.64%	0.21%	0.04%	0.03%	−0.04%	0.01%	1.15%

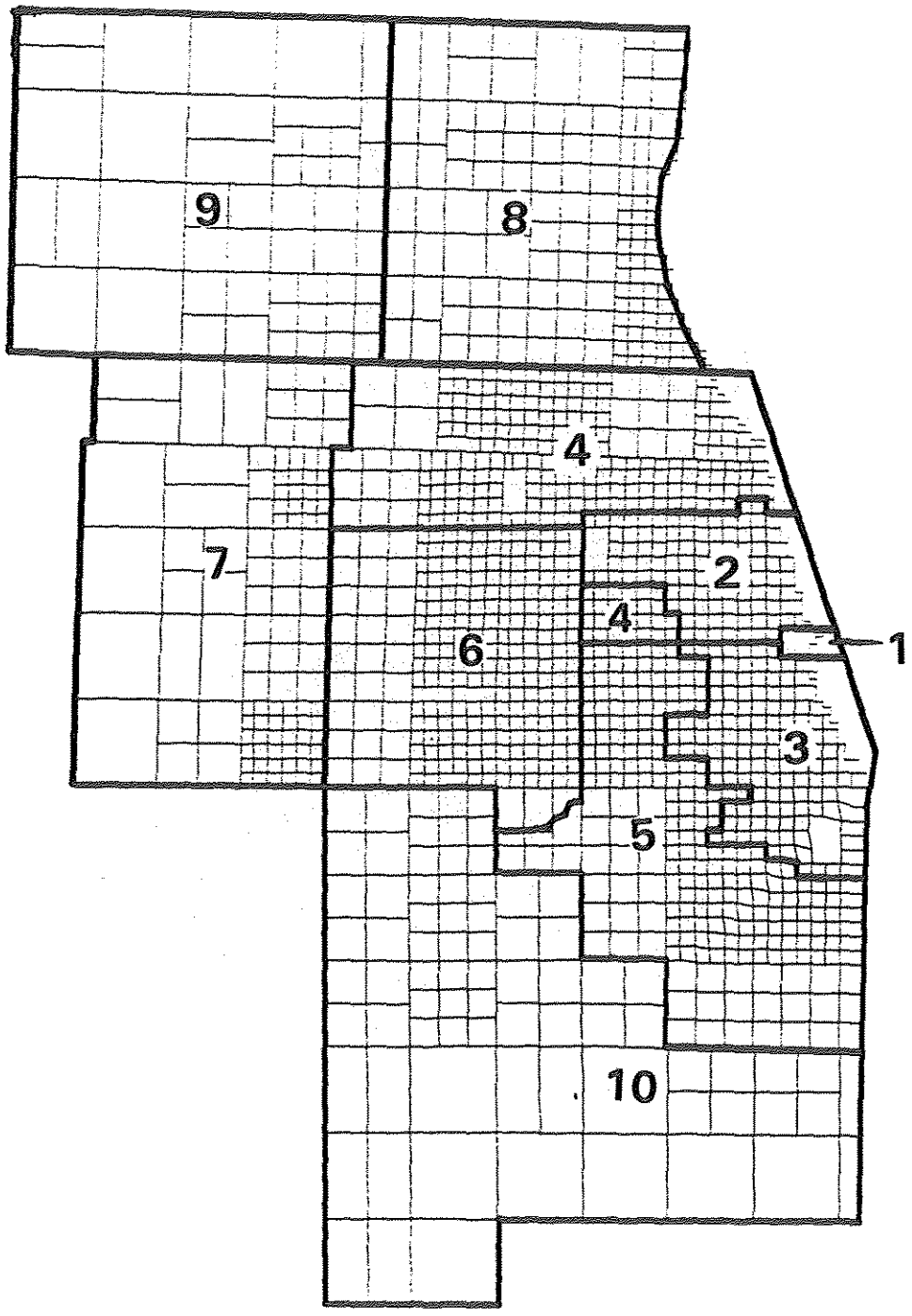
Source: Metra and KPMG Peat Marwick

Exhibit 3-13
Comparison of 1985 Metra Mainframe and Microcomputer Non-Home Based Trip Distribution Results

Origin Groups	Destination Groups							Total
	1 CBD	2 Cook	4 DuPage	5 Kane	6 Lake	7 McHenry	8 Will	
1 Metra	22657	52631	388	4	37	0	16	75733
Micro	22687	52781	404	4	37	0	16	75929
Difference	0.13%	0.29%	4.12%	0.00%	0.00%	NA	0.00%	0.26%
2 Metra	52665	1925006	67313	6677	24710	548	10216	2087135
Micro	52657	1979383	69020	6653	24466	503	10055	2142737
Difference	−0.02%	2.82%	2.54%	−0.36%	−0.99%	−8.21%	−1.58%	2.66%
4 Metra	368	66638	346732	9776	384	92	4953	428883
Micro	352	65591	346541	9806	369	28	4726	427413
Difference	−4.35%	−1.57%	−0.06%	0.31%	−3.91%	−12.50%	−4.58%	−0.34%
5 Metra	4	6699	9531	131102	671	1565	189	149761
Micro	4	6815	9487	131129	660	1459	170	149724
Difference	0.00%	1.73%	−0.46%	0.02%	−1.64%	−6.77%	−10.05%	−0.02%
6 Metra	39	25393	391	671	184488	2895	1	213878
Micro	39	25757	408	685	184976	2750	1	214616
Difference	0.00%	1.43%	4.35%	2.09%	0.26%	−5.01%	0.00%	0.35%
7 Metra	0	623	34	1697	3159	55573	0	61086
Micro	0	684	38	1837	3347	55877	0	61783
Difference	NA	9.79%	11.76%	8.25%	5.95%	0.55%	NA	1.14%
8 Metra	17	10500	5124	250	2	0	101357	117250
Micro	17	10755	5382	279	2	0	101847	118282
Difference	0.00%	2.43%	5.04%	11.60%	0.00%	NA	0.48%	0.88%
Tot Metra	75750	2087490	429513	150177	213451	60613	116732	3133726
Micro	75756	2141766	431260	150393	213857	60617	116815	3190484
Difference	0.01%	2.60%	0.41%	0.14%	0.19%	0.01%	0.07%	1.81%

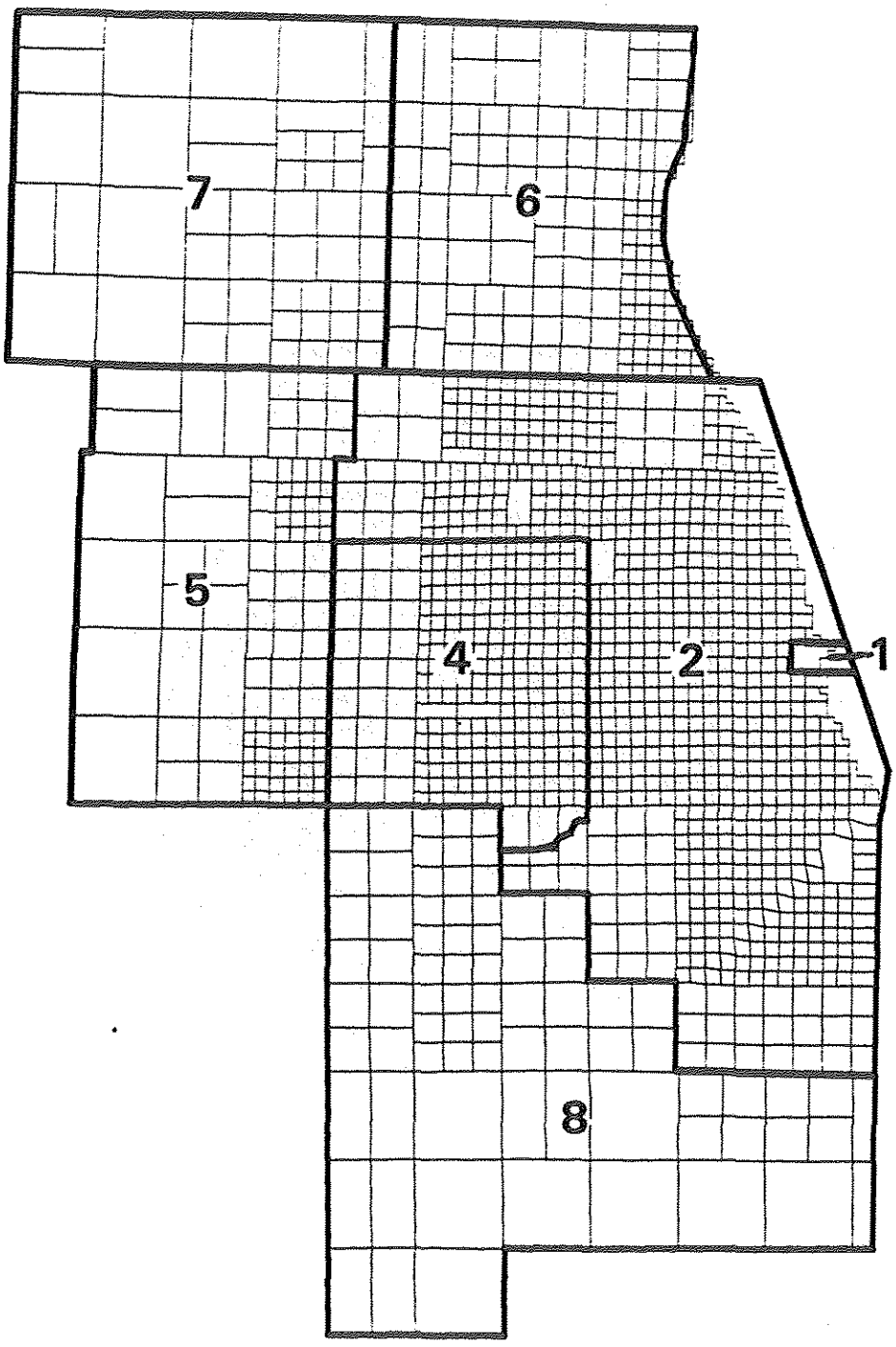
Source: KPMG Peat Marwick and Metra

Exhibit 3-14
Home-Based Work Distribution Model Sub-County Definitions



Source: Metra and KPMG Peat Marwick

Exhibit 3-15
Home-Based Non-Work Distribution Model County Definitions



Source: Metra and KPMG Peat Marwick

Exhibit 3-17
1985 Home-Based Work Mode Split Results
Microcomputer Model

HBW	1985	AUTO TRIPS	TOTAL TRANSIT TRIPS	WALK ACCESS TRIPS Comm. Rail	Rapid Transit	Public Bus	Total WALK	DRIVE ACCESS TRIPS Comm. Rail	Rapid Transit	Public Bus	Total DRIVE	ALL TRANSIT TRIPS Comm. Rail	Rapid Transit	Public Bus	Total ALL	TOTAL TRIPS (A + T)
INCOME	Trips	636754	471072	16340	183873	251728	451941	11496	6870	765	19131	27836	190743	252493	471072	1107826
QUARTILE	% of Total	57.5%	42.5%	1.5%	16.6%	22.7%	40.8%	1.0%	0.6%	0.1%	1.7%	2.5%	17.2%	22.8%	42.5%	100.0%
1	% of Transit	NA	100.0%	3.5%	39.0%	53.4%	95.9%	2.4%	1.5%	0.2%	4.1%	5.9%	40.5%	53.6%	100.0%	NA
	% of Wk/Dr	NA	NA	3.6%	40.7%	55.7%	100.0%	60.1%	35.9%	4.0%	100.0%	NA	NA	NA	NA	23.1%
%Diff. vs. Mainframe		0.26%	−0.35%	2.28%	1.56%	−1.74%	−0.28%	−3.51%	9.43%	−41.15%	−1.85%	−0.19%	1.82%	−1.94%	−0.35%	−0.00%
INCOME	Trips	886172	282658	15441	109967	134131	259539	18598	4227	294	23119	34039	114194	134425	282658	1168830
QUARTILE	% of Total	75.8%	24.2%	1.3%	9.4%	11.5%	22.2%	1.6%	0.4%	0.0%	2.0%	2.9%	9.8%	11.5%	24.2%	100.0%
2	% of Transit	NA	100.0%	5.5%	38.9%	47.5%	91.8%	6.6%	1.5%	0.1%	8.2%	12.0%	40.4%	47.6%	100.0%	NA
	% of Wk/Dr	NA	NA	5.9%	42.4%	51.7%	100.0%	80.4%	18.3%	1.3%	100.0%	NA	NA	NA	NA	24.4%
%Diff. vs. Mainframe		0.02%	−0.06%	4.39%	1.73%	−1.94%	−0.06%	−0.94%	10.37%	−46.06%	−0.13%	1.41%	2.02%	−2.12%	−0.06%	−0.00%
INCOME	Trips	1015233	210172	13567	87993	68243	169803	36731	3514	124	40369	50298	91507	68367	210172	1225405
QUARTILE	% of Total	82.8%	17.2%	1.1%	7.2%	5.6%	13.9%	3.0%	0.3%	0.0%	3.3%	4.1%	7.5%	5.6%	17.2%	100.0%
3	% of Transit	NA	100.0%	6.5%	41.9%	32.5%	80.8%	17.5%	1.7%	0.1%	19.2%	23.9%	43.5%	32.5%	100.0%	NA
	% of Wk/Dr	NA	NA	8.0%	51.8%	40.2%	100.0%	91.0%	8.7%	0.3%	100.0%	NA	NA	NA	NA	25.6%
%Diff. vs. Mainframe		−0.09%	0.45%	3.57%	1.61%	−2.20%	0.20%	1.13%	9.78%	−49.59%	1.52%	1.78%	1.91%	−2.36%	0.45%	−0.00%
INCOME	Trips	1068315	215332	24003	48931	69159	142093	71434	1800	5	73239	95437	50731	69164	215332	1283647
QUARTILE	% of Total	83.2%	16.8%	1.9%	3.8%	5.4%	11.1%	5.6%	0.1%	0.0%	5.7%	7.4%	4.0%	5.4%	16.8%	100.0%
4	% of Transit	NA	100.0%	11.1%	22.7%	32.1%	66.0%	33.2%	0.8%	0.0%	34.0%	44.3%	23.6%	32.1%	100.0%	NA
	% of Wk/Dr	NA	NA	16.9%	34.4%	48.7%	100.0%	97.5%	2.5%	0.0%	100.0%	NA	NA	NA	NA	26.8%
%Diff. vs. Mainframe		−0.13%	0.72%	1.09%	2.84%	−1.61%	0.34%	1.28%	9.76%	−54.55%	1.47%	1.24%	3.07%	−1.61%	0.72%	0.01%
TOTAL	Trips	3606474	1179234	69351	430764	523261	1023376	138259	16411	1188	155858	207610	447175	524449	1179234	4785708
FOR ALL	% of Total	75.4%	24.6%	1.4%	9.0%	10.9%	21.4%	2.9%	0.3%	0.0%	3.3%	4.3%	9.3%	11.0%	24.6%	100.0%
QUARTILES	% of Transit	NA	100.0%	5.9%	36.5%	44.4%	86.8%	11.7%	1.4%	0.1%	13.2%	17.6%	37.9%	44.5%	100.0%	NA
	% of Wk/Dr	NA	NA	6.8%	42.1%	51.1%	100.0%	88.7%	10.5%	0.8%	100.0%	NA	NA	NA	NA	100.0%
%Diff. vs. Mainframe		−0.02%	0.06%	2.58%	1.76%	−1.83%	−0.06%	0.53%	9.78%	−43.48%	0.82%	1.20%	2.03%	−2.00%	0.06%	0.00%
TRIPS TO	Trips	183475	624685	66310	286627	129674	482611	131243	10625	206	142074	197553	297252	129880	624685	808160
CBD:	% of Total	22.7%	77.3%	8.2%	35.5%	16.0%	59.7%	16.2%	1.3%	0.0%	17.6%	24.4%	36.8%	16.1%	77.3%	100.0%
FROM ALL	% of Transit	NA	100.0%	10.6%	45.9%	20.8%	77.3%	21.0%	1.7%	0.0%	22.7%	31.6%	47.6%	20.8%	100.0%	NA
QUARTILES	% of Wk/Dr	NA	NA	13.7%	59.4%	26.9%	100.0%	92.4%	7.5%	0.1%	100.0%	NA	NA	NA	NA	16.9%
%Diff. vs. Mainframe		−1.45%	0.45%	1.54%	1.84%	−3.40%	0.34%	0.24%	10.64%	−46.35%	0.82%	0.67%	2.13%	−3.52%	0.45%	0.01%
PERCENT TO CBD		5.1%	53.0%	95.6%	66.5%	24.8%	47.2%	94.9%	64.7%	17.3%	91.2%	95.2%	66.5%	24.8%	53.0%	16.9%

Exhibit 3-18
Comparison of 1985 Metra Mainframe and Microcomputer Non-Work Mode Split Results

Home-Based Non-Work Mode Split

Income quartile		Drive Alone	Shared Ride	Transit	Total
1	Metra	426846	1023840	380257	1830943
	Micro	430252	1030937	381639	1842827
	Difference	0.80%	0.69%	0.36%	0.65%
2	Metra	703650	1225494	147365	2076509
	Micro	705125	1226570	146415	2078109
	Difference	0.21%	0.09%	-0.64%	0.08%
3	Metra	755309	1494393	80254	2329956
	Micro	753968	1489845	78911	2322724
	Difference	-0.18%	-0.30%	-1.67%	-0.31%
4	Metra	1004760	1537359	53964	2596083
	Micro	1001635	1530711	52523	2584869
	Difference	-0.31%	-0.43%	-2.67%	-0.43%
Total	Metra	2890565	5281086	661840	8833491
	Micro	2890979	5278063	659488	8828531
	Difference	0.01%	-0.06%	-0.36%	-0.06%

Non-Home Based Mode Split

	Drive Alone	Shared Ride	Transit	Total
Metra	1427437	1679952	82741	3190130
Micro	1429246	1681775	79464	3190485
Difference	0.13%	0.11%	-3.96%	0.01%

Source: Metra and KPMG Peat Marwick

Given the precision limitations of the reporting module and differences in the number of allowable iterations, the mainframe and microcomputer models compare well.

Mode Choice

The results of the mode choice process are presented in Exhibits 3-16, 3-17, and 3-18. Exhibit 3-16 shows the results of the mainframe HBW mode choice model and Exhibit 3-17 shows the results of the microcomputer HBW mode choice model. As these exhibits show, the total number of transit trips agree to within 0.06 percent. Transit trips by submode (commuter rail, rapid transit, and public bus) agree to within plus or minus 2 percent. Walk transit trips by submode agree to within plus or minus 3 percent. Drive access trips to rapid transit and public bus show a very large error in relative terms but the absolute difference is only 1,500 drive to rapid transit trips and 1,000 drive to public bus trips. This difference may be caused by small differences in the distribution results or by slight differences in the network data used for the mainframe and microcomputer validation.

Exhibit 3-18 compares mainframe and microcomputer results for the home-based non-work and non-home based models. As these tables show, the microcomputer version of the home-based non-work model estimates transit trips to within 0.36 percent of the mainframe model. The difference for non-home based trips is approximately 4 percent. Once again, the difference may be attributable to differences in the trip distribution model and to possible differences in input data.

1985 VALIDATION CONCLUSIONS

Although the mainframe and microcomputer versions of the Metra model do not generate identical results, in the aggregate, they generate the same number of total transit trips to within 0.06 to 4 percent, depending on purpose. Key reasons for the differences may include:

- Different maximum number of iterations in trip distribution may slightly alter trip distribution results.
- Differences in mainframe and microcomputer floating point precision change the results, particularly in trip distribution.
- The input data provided by Metra is close to that used in their validation runs but may not be identical.
- The microcomputer version of EMME/2 is a later version of the software than the mainframe version. Differences in any module may slightly change the results.

Because the differences between the mainframe and microcomputer versions of the model are relatively small, the microcomputer model was judged to adequately replicate the mainframe model. The remainder of the validation effort concentrated on the 1990 validation as discussed in Chapter 4.

Exhibit 3-16
1985 Home-Based Work Mode Split Results
Mainframe Model

HBW	1985	AUTO TRIPS	TOTAL TRANSIT TRIPS	WALK ACCESS TRIPS Comm. Rail	Rapid Transit	Public Bus	Total WALK	DRIVE ACCESS TRIPS Comm. Rail	Rapid Transit	Public Bus	Total DRIVE	ALL TRANSIT TRIPS Comm. Rail	Rapid Transit	Public Bus	Total ALL	TOTAL TRIPS (A + T)
INCOME	Trips	635134	472703	15975	181052	256184	453211	11914	6278	1300	19492	27889	187330	257484	472703	1107837
QUARTILE	% of Total	57.3%	42.7%	1.4%	16.3%	23.1%	40.9%	1.1%	0.6%	0.1%	1.8%	2.5%	16.9%	23.2%	42.7%	100.0%
1	% of Transit	NA	100.0%	3.4%	38.3%	54.2%	95.9%	2.5%	1.3%	0.3%	4.1%	5.9%	39.6%	54.5%	100.0%	NA
	% of Wk/Dr	NA	NA	3.5%	39.9%	56.5%	100.0%	61.1%	32.2%	6.7%	100.0%	NA	NA	NA	NA	23.1%
INCOME	Trips	886023	282833	14792	108101	136791	259684	18774	3830	545	23149	33566	111931	137336	282833	1168856
QUARTILE	% of Total	75.8%	24.2%	1.3%	9.2%	11.7%	22.2%	1.6%	0.3%	0.0%	2.0%	2.9%	9.6%	11.7%	24.2%	100.0%
2	% of Transit	NA	100.0%	5.2%	38.2%	48.4%	91.8%	6.6%	1.4%	0.2%	8.2%	11.9%	39.6%	48.6%	100.0%	NA
	% of Wk/Dr	NA	NA	5.7%	41.6%	52.7%	100.0%	81.1%	16.5%	2.4%	100.0%	NA	NA	NA	NA	24.4%
INCOME	Trips	1016184	209235	13099	86595	69775	169469	36319	3201	246	39766	49418	89796	70021	209235	1225419
QUARTILE	% of Total	82.9%	17.1%	1.1%	7.1%	5.7%	13.8%	3.0%	0.3%	0.0%	3.2%	4.0%	7.3%	5.7%	17.1%	100.0%
3	% of Transit	NA	100.0%	6.3%	41.4%	33.3%	81.0%	17.4%	1.5%	0.1%	19.0%	23.6%	42.9%	33.5%	100.0%	NA
	% of Wk/Dr	NA	NA	7.7%	51.1%	41.2%	100.0%	91.3%	8.0%	0.6%	100.0%	NA	NA	NA	NA	25.6%
INCOME	Trips	1069715	213792	23744	47581	70288	141613	70528	1640	11	72179	94272	49221	70299	213792	1283507
QUARTILE	% of Total	83.3%	16.7%	1.8%	3.7%	5.5%	11.0%	5.5%	0.1%	0.0%	5.6%	7.3%	3.8%	5.5%	16.7%	100.0%
4	% of Transit	NA	100.0%	11.1%	22.3%	32.9%	66.2%	33.0%	0.8%	0.0%	33.8%	44.1%	23.0%	32.9%	100.0%	NA
	% of Wk/Dr	NA	NA	16.8%	33.6%	49.6%	100.0%	97.7%	2.3%	0.0%	100.0%	NA	NA	NA	NA	26.8%
TOTAL	Trips	3607056	1178563	67610	423329	533038	1023977	137535	14949	2102	154586	205145	438278	535140	1178563	4785619
FOR ALL	% of Total	75.4%	24.6%	1.4%	8.8%	11.1%	21.4%	2.9%	0.3%	0.0%	3.2%	4.3%	9.2%	11.2%	24.6%	100.0%
QUARTILES	% of Transit	NA	100.0%	5.7%	35.9%	45.2%	86.9%	11.7%	1.3%	0.2%	13.1%	17.4%	37.2%	45.4%	100.0%	NA
	% of Wk/Dr	NA	NA	6.6%	41.3%	52.1%	100.0%	89.0%	9.7%	1.4%	100.0%	NA	NA	NA	NA	100.0%
TRIPS TO	Trips	186174	621911	65302	281448	134240	480990	130934	9603	384	140921	196236	291051	134624	621911	808085
CBD:	% of Total	23.0%	77.0%	8.1%	34.8%	16.6%	59.5%	16.2%	1.2%	0.0%	17.4%	24.3%	36.0%	16.7%	77.0%	100.0%
FROM ALL	% of Transit	NA	100.0%	10.5%	45.3%	21.6%	77.3%	21.1%	1.5%	0.1%	22.7%	31.6%	46.8%	21.6%	100.0%	NA
QUARTILES	% of Wk/Dr	NA	NA	13.6%	58.5%	27.9%	100.0%	92.9%	6.8%	0.3%	100.0%	NA	NA	NA	NA	16.9%
PERCENT TO CBD		5.2%	52.8%	96.6%	66.5%	25.2%	47.0%	95.2%	64.2%	18.3%	91.2%	95.7%	66.4%	25.2%	52.8%	16.9%

4. 1990 Validation

The 1990 validation is based on 1990 socioeconomic and transportation network characteristics, the focused area system and the microcomputer version of the EMME/2 macros. The results of the 1990 validation runs are compared to passenger count data in the South Corridor to test the model's ability to replicate observed passenger volumes. This validation is designed to be a comprehensive test of the models actually used in evaluating alternatives and includes:

- Tests of the focused version of the mode split model
- Creation of a new (i.e., the 1990 base) transit network
- More realistic socioeconomic inputs (based on 1990 Census and other updated sources of information)
- Review of modeled passenger boardings to determine how well the model estimates rapid transit, commuter rail and bus patronage.

The 1990 validation runs are conducted using the same procedures that will be used in estimating ridership for each alternative. In these procedures, the distribution model is run against the full Metra zone system. The resulting person trip tables are converted to the focused area system and the mode split models are applied at the focused area system.

1990 VALIDATION INPUT DATA

This section describes the input data used in the 1990 validation including the highway network, the toll structure, the transit network, and transit fares.

Highway Network

The highway network is based on the 1985 Metra network with additional links coded to represent facilities constructed or improved between 1985 and 1990. Facilities that have been added include:

- Skokie Highway limited access section between Rockland Road and Buckley Road near Knollwood
- Anshutz Highway in Waukegan
- Limited access highway (Route 137) between Buckley Road and 22nd Street in Waukegan
- Extension of I-290 north from Route 68 to County Line Road
- Extension of South Tollway between Army Trail Road and I-55.

The network coding for each of these improvements was obtained from the Metra 2010 network.

Tolls

Toll links for the Year 1990 are identical to the 1985 network except where a new toll facility (e.g., South Tollway extension) is coded. In these cases, toll links are obtained from Metra's 2010 network.

Transit Network

A new 1990 transit network was coded for this project based on the following:

- **Bus Itineraries.** Bus itineraries were used from the Metra 1985 network and modified to account for 1990 headways (as documented in CTA's operating facts), and changes in the route structure that occurred between 1985 and 1990. Pace bus services were used as coded in the 1985 network and were not modified. Exhibit 4-1 presents the coded bus headways used in the 1990 network as compared to the 1985 headways.

- **Rapid Transit.** Rapid transit itineraries were coded from scratch based on CTA's 1990 Operating Facts. Rapid transit itineraries and headways are presented in Appendix C.

- **Commuter Rail.** Commuter rail itineraries were coded from scratch using the procedures described in Chapter 2 and 1990-91 Metra schedules. Commuter rail itineraries and headways are presented in Appendix C.

As part of the 1990 validation, the highway and transit networks were loaded into EMME/2 and end-to-end running times for each route were computed using Metra's original travel time procedures. These times are compared to scheduled running times to determine how well these travel time functions replicate actual operating characteristics. Commuter rail and rapid transit times are compared in Exhibit 4-2, peak bus travel times are compared in Exhibit 4-3, and off peak bus travel times are compared in Exhibit 4-4. These exhibits show that:

- Commuter rail travel times are generally underpredicted and the average error is approximately 15 percent.

- Rapid transit travel times are always underpredicted and the average error is approximately 40 percent.

- The procedures to estimate peak period bus travel times are not highly correlated with the scheduled travel time (this is common to most models) but the model is more likely to underpredict travel time rather than overpredict travel time.

- Off peak bus travel times are generally underpredicted and the average error is approximately 25 percent.

Exhibit 4-1
Comparison of 1990 and 1985 Headways

Bus Route	1985 Headway (Metra Network)		1990 Headway (CTA)	
	Peak	Offpeak	Peak	Offpeak
1 Indiana/Hyde Park	7.8	12	8.6	12
2 Hyde Park Express	7.7		8.6	
3 King Drive	3.4	6	4	6
4 Cottage Grove	3.2	7	4	7
6 Jeffery (exp &local)	4.8	7	4.4	6
7 Harrison	12	15	12.4	15
8 Halsted	5.8	6.5	6.5	9
8A South Halsted	12	15	12	15
9 Ashland	4.2	8	5	7.5
11 Lincoln	6.8	12	7.5	12
12 Roosevelt	8.4	10	10	12
14 S. Lake Shore Express	1.5		1.5	
16 Lake	10.7	15	12	15
17 Westchester	20	30	20	30
18 16th/18th	12	15	15	20
20 Madison	6	7.5	7	7.5
21 Cermak	12	15	15	15
22 Clark	2.2	7.5	2.5	9
24 Wentworth	7.9	12	9	12
25 West Cermak	13.4	30	12	10
27 South Deering	7.3	15	8	15
28 Stony Island	4	10	4	10
29 State	6.8	10	7.5	7.5
30 South Chicago	8.4	15	8.6	15
31 31st	30	30	30	30
33 Magnificent Mile Express			10	
34 S Michigan	5.2	12		
34/119 S Michigan/119th			2.4	6
35 35th	7.4	12	8.5	15
36 Broadway	3	7.5	4.3	9
37 Sedgwick/Ogden	8.3	15	10	15
38 Indiana	20	20		
39 Pershing	12	15	15	20
41 Elston/Clybourn	15	12	15	20
42 Halsted/Archer	10		10.2	
43 43rd	12	15	15	15
44 Wallace/Racine	7.3	12	7.3	12
45 Ashland/Archer	8		8	
47 47th	8.3	10	7.3	10
48 South Damen	8.6	15	8.1	15
49 Western	5.6	10	5.6	10
49A South Western	24	10	12	15
49B North Western	8.6	12	6.7	12
50 Damen	12	15	12	15
51 51st	15	15	12	15
52 Kedzie/California	7.1	10	10	12
52A South Kedzie	15	15	7.5	15
53 Pulaski	4.4	9	4.5	9
53A South Pulaski	6	10	6	10
54 Cicero	7.5	10	7.5	10
54A North Cicero/Skokie Blvd	20	30	20	30
54B South Cicero	12	12	12	15

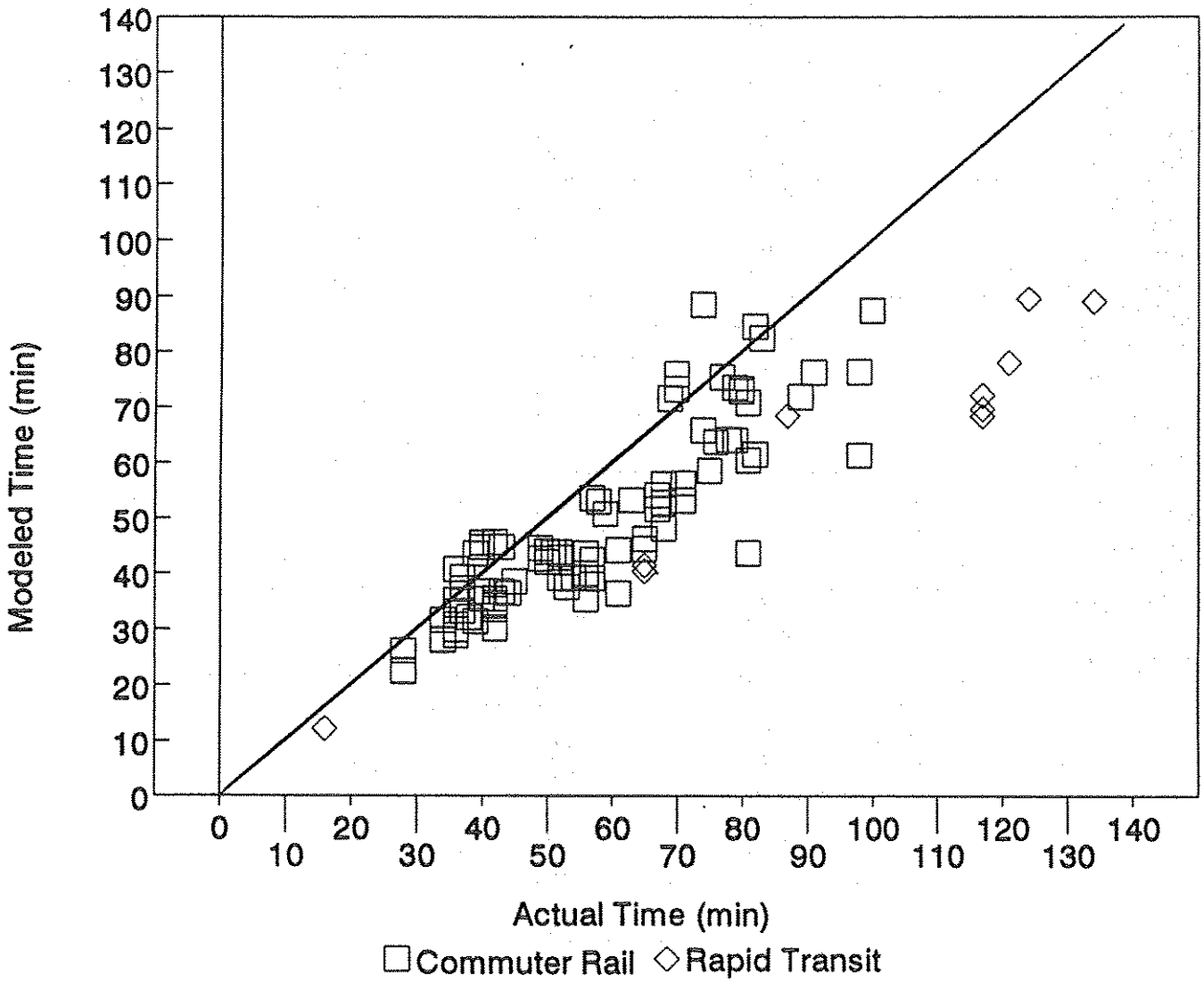
Exhibit 4-1
Comparison of 1990 and 1985 Headways

Bus Route	1985 Headway (Metra Network)		1990 Headway (CTA)	
	Peak	Offpeak	Peak	Offpeak
55 Garfield	4.3	10	5.2	7.5
56 Milwaukee	4.8	10	9	10
56A North Milwaukee	10	20	12	10
57 Laramie	10	15	12	15
59 59th/61st	15	20	15	20
60 Blue Island/26th	6.4	10	6.3	10
61 Archer/Franklin Express	3.9		3.5	
62 Archer Local	4.9	8	5.6	8
62A Archer Express	2.8	10	3.2	10
63 63rd	3.5	7	3.5	7
64 Foster/Canfield			15	20
65 Grand	7.6	15	7.6	15
66 Chicago	5.2	8	5.3	8
67 67th/69th/71st	3.4	7.5	4.1	7.5
68 Northwest Highway	8.9	15	8	15
69 Cumberland/Foster	18	35		
69 Cumberland/East River			20	20
70 Division	7.4	10	7.8	10
71 71st	8	10	8	10
72 North	6.2	10	5.6	10
73 Armitage	10	15	10	15
74 Fullerton	8	12	7.5	12
75 74th/75th	12	12	10	12
76 Diversey	4.3	10	5.3	10
77 Belmont	4.1	8	4.9	8
78 Montrose	12	12	10	12
79 79th	2.9	7.5	3.1	6
80 Irving Park	7.9	10	8.2	10
80W West Irving Park	14	15		
81 Lawrence	6.8	10	6.9	10
81W West Lawrence	12	20	12	20
82 Kimball/Homan	4.3	10	4.2	10
84 Peterson	8.8	15	8.9	15
85 Central	4.9	12	4.6	12
85A North Central	11.4	20	15	30
86 Narragansett	8	15	15	20
87 87th	2.2	7.5	2.9	7.5
88 Higgins	8.9	20	15	20
89 North Kedzie	20	30	30	30
90 Harlem	10	15	10	15
90N North Harlem	15	15	15	20
91 Austin	5.8	10	4.4	10
92 Foster	12	12	12	12
92W West Foster	20	40		
93 North California	7.5	20	12	20
94 South California	6.2	12	5.6	15
95E 93rd/95th	5.7	10	7.5	10
95W 95th	5	7.5	8.3	10
96 Lunt	12	20	12	20
97 Skokie	10	15	10	15
99 Stevenson Express	4.5	15	6.9	30
99M Midway Express	7.4		9.5	

Exhibit 4-1
Comparison of 1990 and 1985 Headways

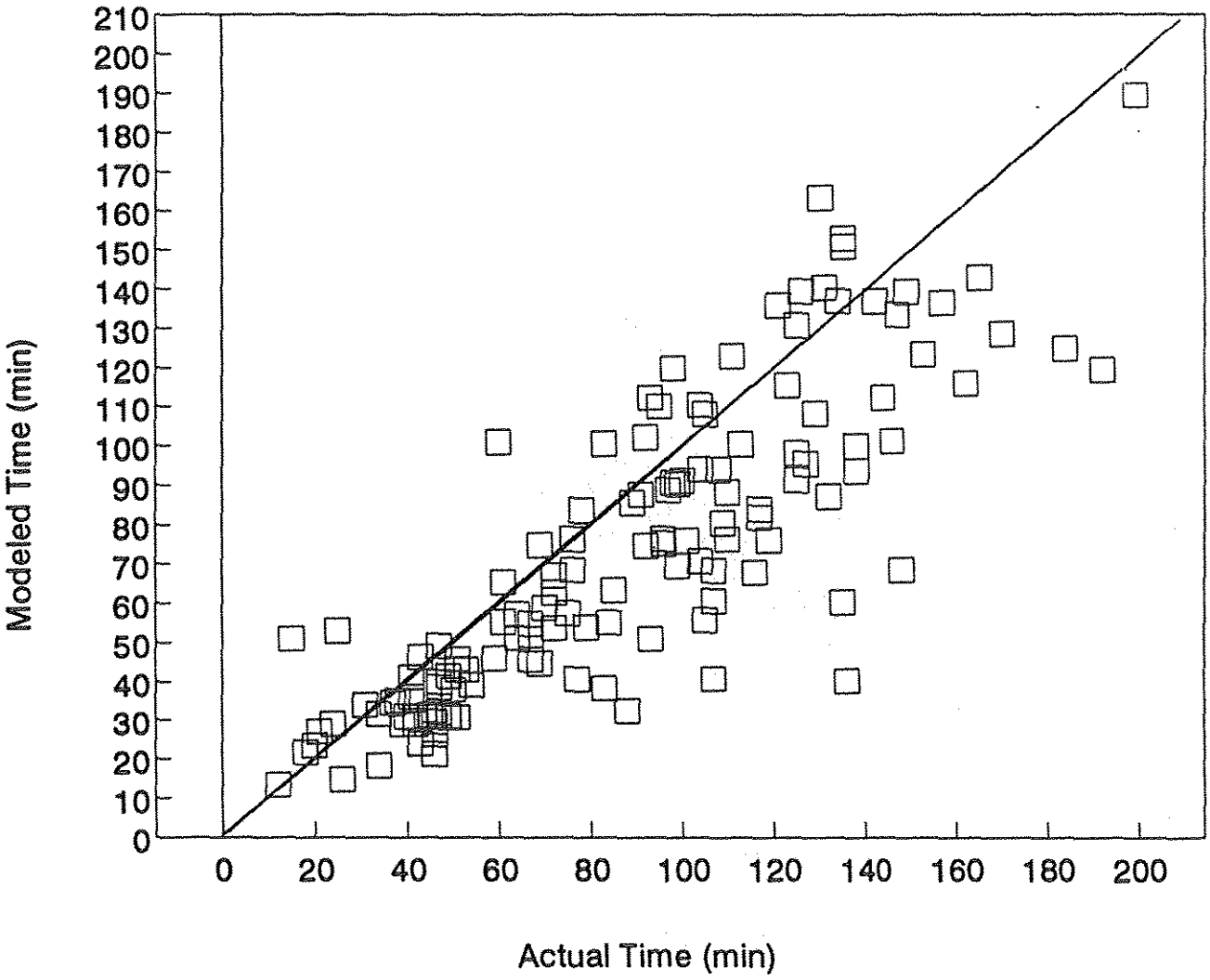
Bus Route	1985 Headway (Metra Network)		1990 Headway (CTA)	
	Peak	Offpeak	Peak	Offpeak
100 Jeffery Manor Express	12		12	30
103 West 103rd	4.2	10	5.5	15
104 Pullman	5.5	20		
104 Pullman/Altgeid			11.3	
106 103rd/106th	3.6	10	3.5	15
108 Halsted	4.2	10		
108 Halsted/95th			5.5	10
110 Marquette	12		15	
111 111th/115th/Pullman			11.4	15
111A 111th/115th Outer	10.7	15		
111B 111th/115th Inner	10.7	15		
112 Vincennes/111th	4.9	10	7.4	15
119 Michigan/119th		12		
120 NW/Wacker Express	3		3	
121 Union/Wacker Express	3.2		3.2	
122 Illinois Center/NW Exp	7		8.1	
123 Illinois Center/Union Exp	8.3		5.8	
125 Water Tower Express	2.6	10	2.5	10
126 Jackson	4	8	4.3	10
127 NW/Madison	5.8			
127 NW/McCormick Place			6	
128 Orleans	15			
129 NW/Franklin	4.4		4	
130 Grant Park Treasures	--	--	--	--
131 Washington	15	30	15	30
135 Wilson/LaSalle Exp	3		3.8	
136 Sheridan/LaSalle Exp	4.9		5.1	
145 Wilson/Michigan Exp	3.6	15	3.7	15
146 Marine/Michigan Exp	4	15	3.5	15
147 Outer Drive Express	3	10	4	10
151 Sheridan	1.9	3.5	1.8	5
152 Addison	2.3	7.5	2.5	10
155 Devon	4.7	10	4.8	10
156 LaSalle	1.7	10	1.8	10
157 Streeterville	5.5	10	6	12
162 Pulaski/Stevenson Exp	4		3.8	
164 Narragansett Exp	9.2	30	6.9	30
201 Central/Sherman	15	30	15	30
202 Main/Emerson	15	30	15	30
203 Ridge/Grant	12	30	15	30
204 Dodge	12	30	12	30

Exhibit 4-2
Comparison of Modeled and Scheduled Peak Rail Times
(Original Travel Time Procedures)



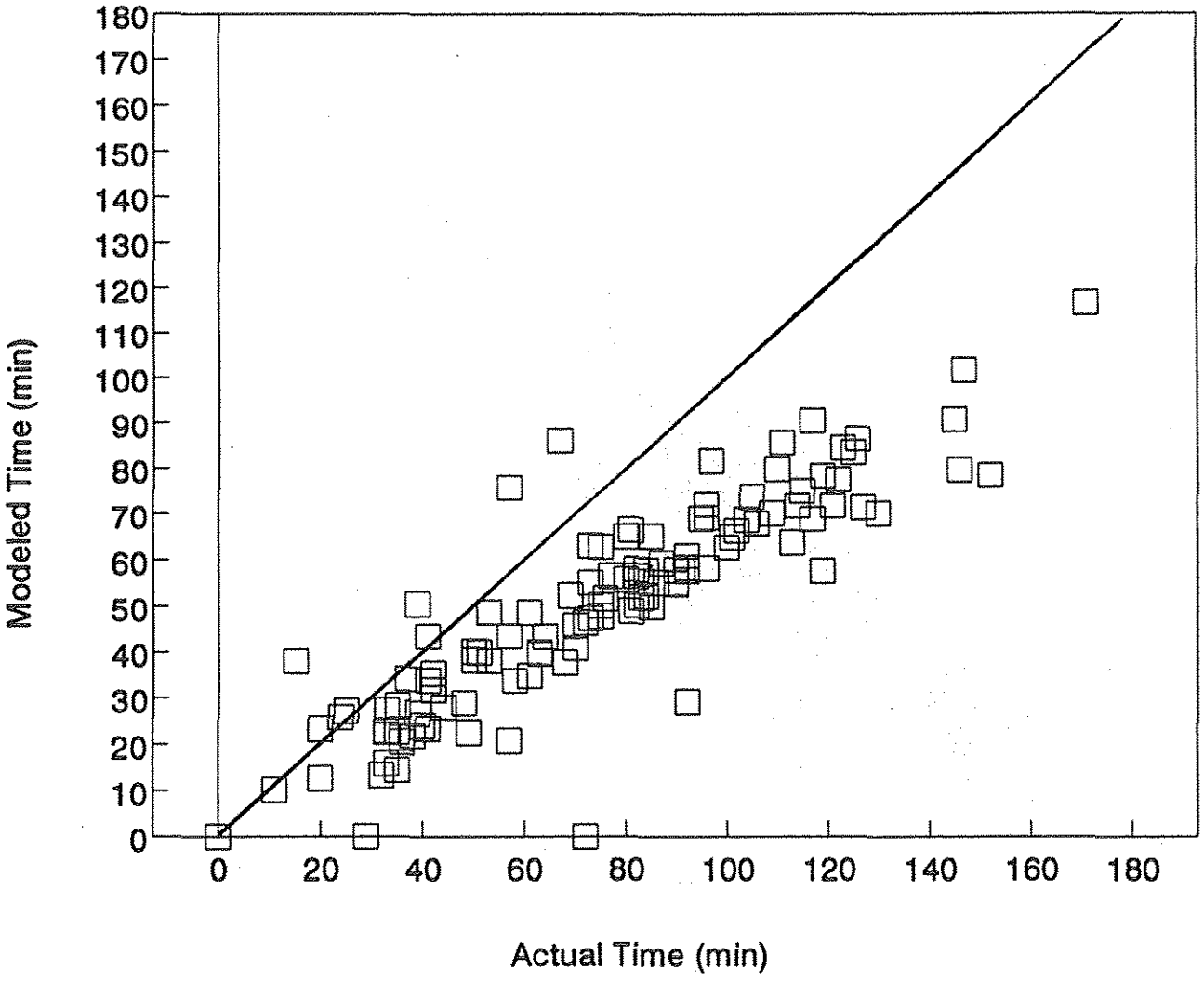
Source: KPMG Peat Marwick

Exhibit 4-3
Comparison of Modeled and Scheduled Peak Bus Times
(Original Travel Time Procedures)



Source: KPMG Peat Marwick

Exhibit 4-4
Comparison of Modeled and Scheduled Off Peak Bus Times
(Original Travel Time Procedures)



Source: KPMG Peat Marwick

Because these models are to be used evaluate alternative transit scenarios that may involve subtle changes in running times, revised procedures were developed to more accurately estimate the average rail and bus running times. Different approaches were used for commuter rail/rapid transit and bus as described below:

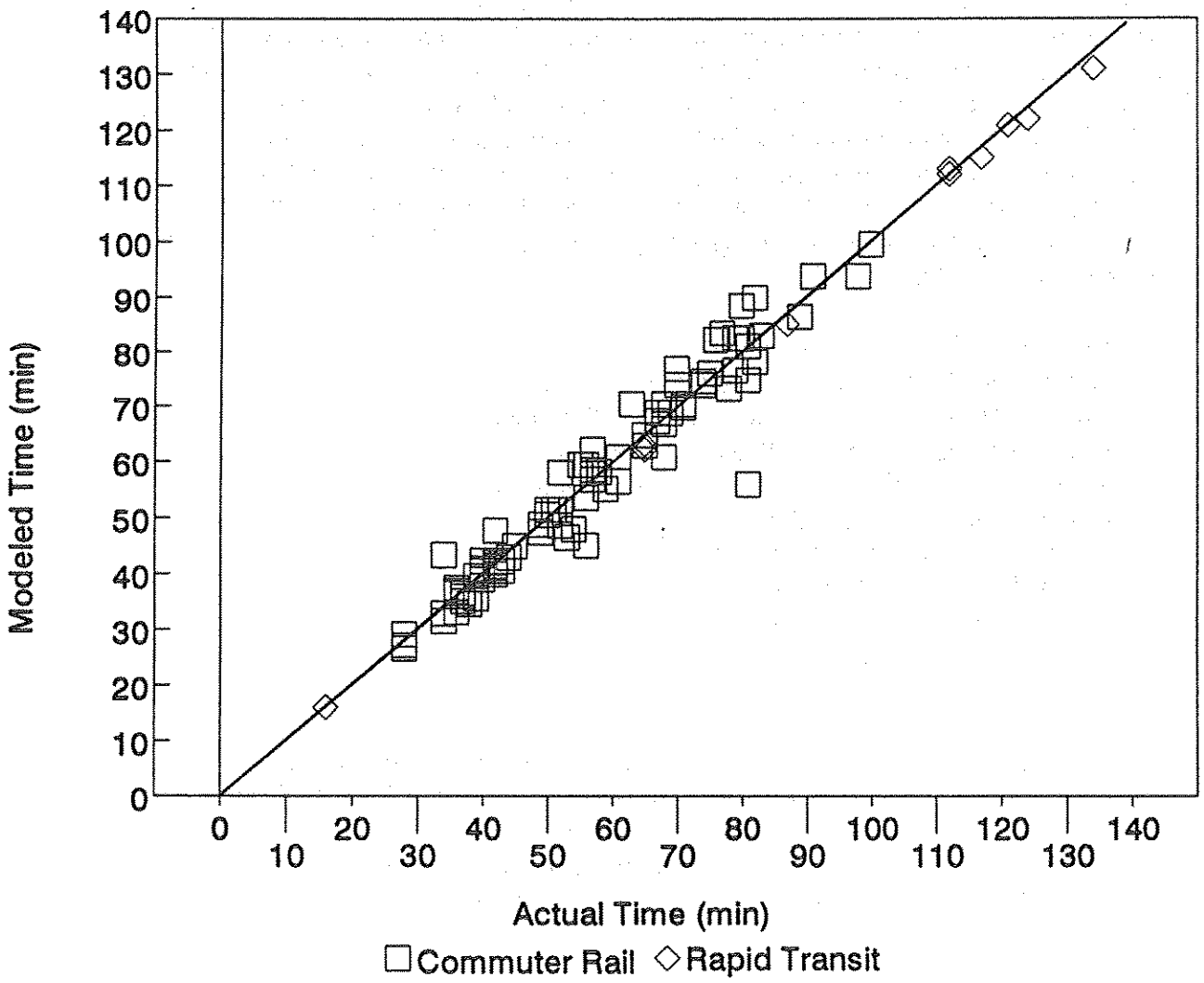
- **Commuter Rail/Rapid Transit:** The revised travel time procedures for commuter rail and rapid transit are based on the 1990 Metra passenger schedules and the 1990 CTA operator schedules. These schedules were used to determine the peak and offpeak station-to-station running time for each link in the commuter rail network assuming that the train is operating in local service and stops at every station along the line. This running time is manually coded in user field 1 (peak travel time) and user field 2 (off peak travel time) in the link file. The train itinerary is coded with the average delay (including acceleration, deceleration, and dwell) associated with a station stop. The delay is based on the average scheduled travel time savings for skip-stop operation and is computed separately for each line. The average delay per stop used in the 1990 network is:

  - Burlington Northern: 1.49 minutes
  - Chicago & Northwestern - North: 1.46 minutes
  - Chicago & Northwestern - Northwest: 2.06 minutes
  - Chicago & Northwestern - West: 1.44 minutes
  - Metra Electric/Chicago South Shore: 0.90 minutes
  - Metra Heritage: 1.5 minutes
  - Milwaukee - North: 1.48 minutes
  - Milwaukee - West: 1.29 minutes
  - Norfolk Southern: 1.5 minutes
  - Rock Island: 1.5 minutes
  - Rapid Transit: 0.45 minutes

  The average delay is used as the dwell time for all station stops and is also posted to user field 1 for each itinerary record. The travel time function subtracts off the dwell for trains that skip stops. The results of the revised rail travel time procedures are shown in Exhibits 4-5 and 4-6. As these exhibit show, the modeled travel times closely replicate the scheduled travel times for both commuter rail and rapid transit services.

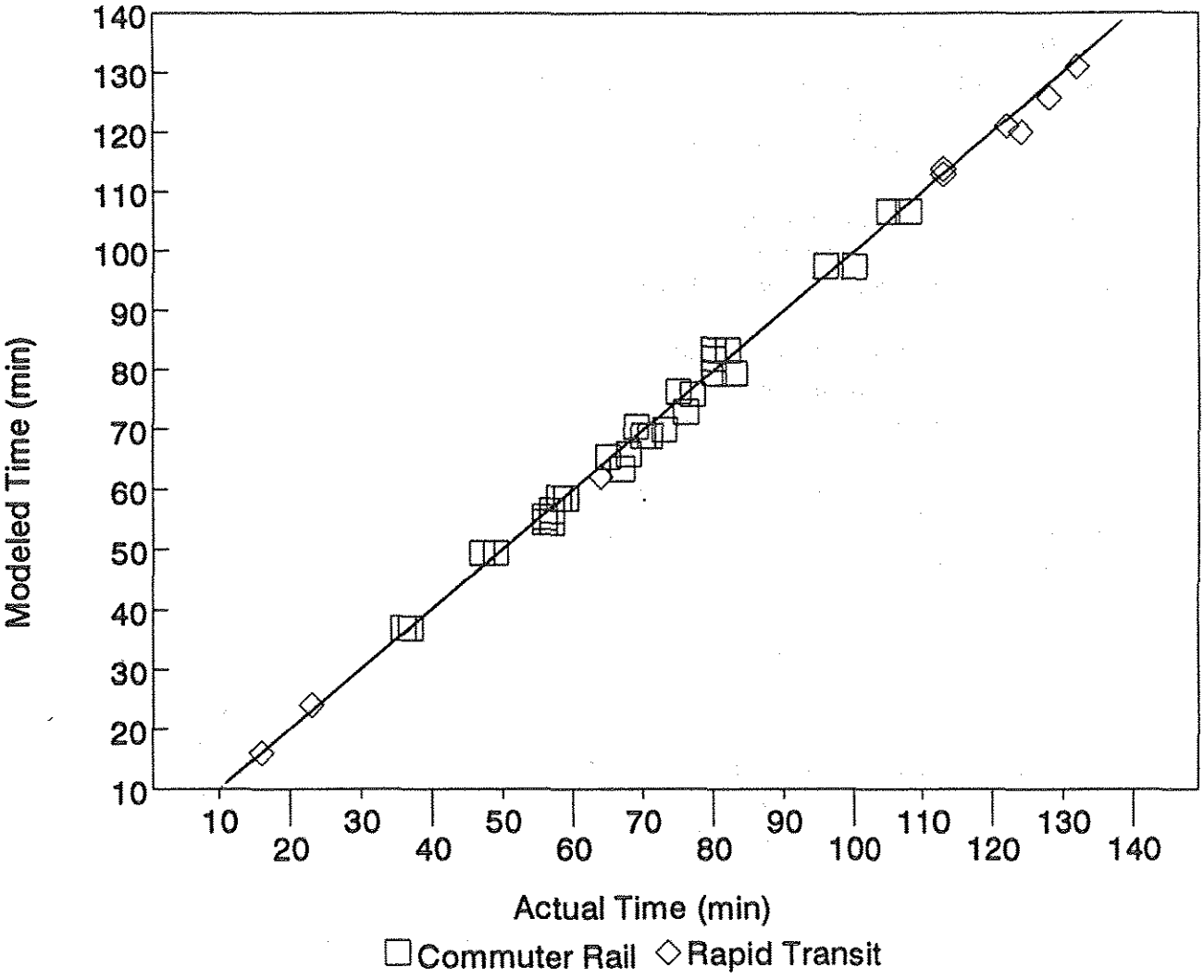
- **CTA Bus:** Bus travel times are very difficult to estimate without a model that accurately represents automobile travel times. Since this model (like nearly all others) estimates the link travel time inputs to the transit path builder based on average highway speeds, modeled bus travel time cannot be closely matched to observed travel times without extensive use of adjustment factors.

Exhibit 4-5
Comparison of Modeled and Scheduled Peak Rail Times
(Revised Travel Time Procedures)



Source: KPMG Peat Marwick

Exhibit 4-6
Comparison of Modeled and Scheduled Off Peak Rail Times
(Revised Travel Time Procedures)



Source: KPMG Peat Marwick

Our initial use of the model indicates that the sub-mode choice and assignments are relatively sensitive to the bus travel times in situations where buses compete with commuter rail and rapid transit. To correct early problems with bus assignment results, a series of adjustment factors were developed that:

1. Corrects for systematic under-prediction of bus travel times

2. Errors in bus travel times at the line level.

These adjustments are as follows:

- Peak Local Bus Travel Time (inside Cook County):
  Before: 1.6 * automobile time
  After: 1.8 * automobile time * LINEFAC

- Peak Express Bus Travel Time:
  Before: 1.1 * automobile time
  After: 1.1 * automobile time * LINEFAC

- Peak Local Bus Travel Time (outside Cook County):
  Before: 1.4 * automobile time
  After: 1.4 * automobile time * LINEFAC

- Off Peak Local Bus Travel Time (inside Cook County)
  Before: 1.6 * automobile time
  After: 2.2 * automobile time

- Off Peak Express Bus Travel Time:
  Before: 1.1 * automobile time
  After: 1.1 * automobile time * LINEFAC

- Off Local Bus Travel Time (outside Cook County):
  Before: 1.4 * automobile time
  After: 1.4 * automobile time * LINEFAC

The LINEFAC variable is a line-specific adjustment factor that accounts for any differences between the modeled travel time (before adjustment) and the scheduled travel time. It is computed by running the EMME/2 assignment macros with LINEFAC for all lines temporarily set to 1.00 and comparing the resulting transit travel times to the scheduled travel times. The final value of LINEFAC is set equal to the ratio of the scheduled travel time to the modeled (with LINEFAC set equal to 1.0) travel time. Most values of LINEFAC fall in the range between 0.7 and 1.4.

The results of these revised functions are shown in Exhibits 4-7 and 4-8. The points appearing as outliers are one-way express runs where the definition of running time is somewhat ambiguous.

Because the revised travel time procedures are not compatible with the input assumptions used to create the work distribution and the mode choice models for all purposes, the distribution and mode choice models were adjusted to account for changes in the transit travel time functions. Two adjustments were applied:

- In-vehicle travel times are multiplied by 0.85 to account for the impact that the new travel time procedures have on commuter rail travel time. This figure was selected because:

  1. The same adjustment factor should be applied to all transit modes to prevent unreasonable sub-modal biases.

  2. Metra validated the model for commuter rail ridership only and has not validated the model for bus or rapid transit services.

- A constant of -0.268 was added to the bus modes to account for the relatively small adjustment made to bus as compared to the significantly larger adjustment made to rapid transit.

Fares

Fares are based on those used in the 1985 validation and adjusted to account for:

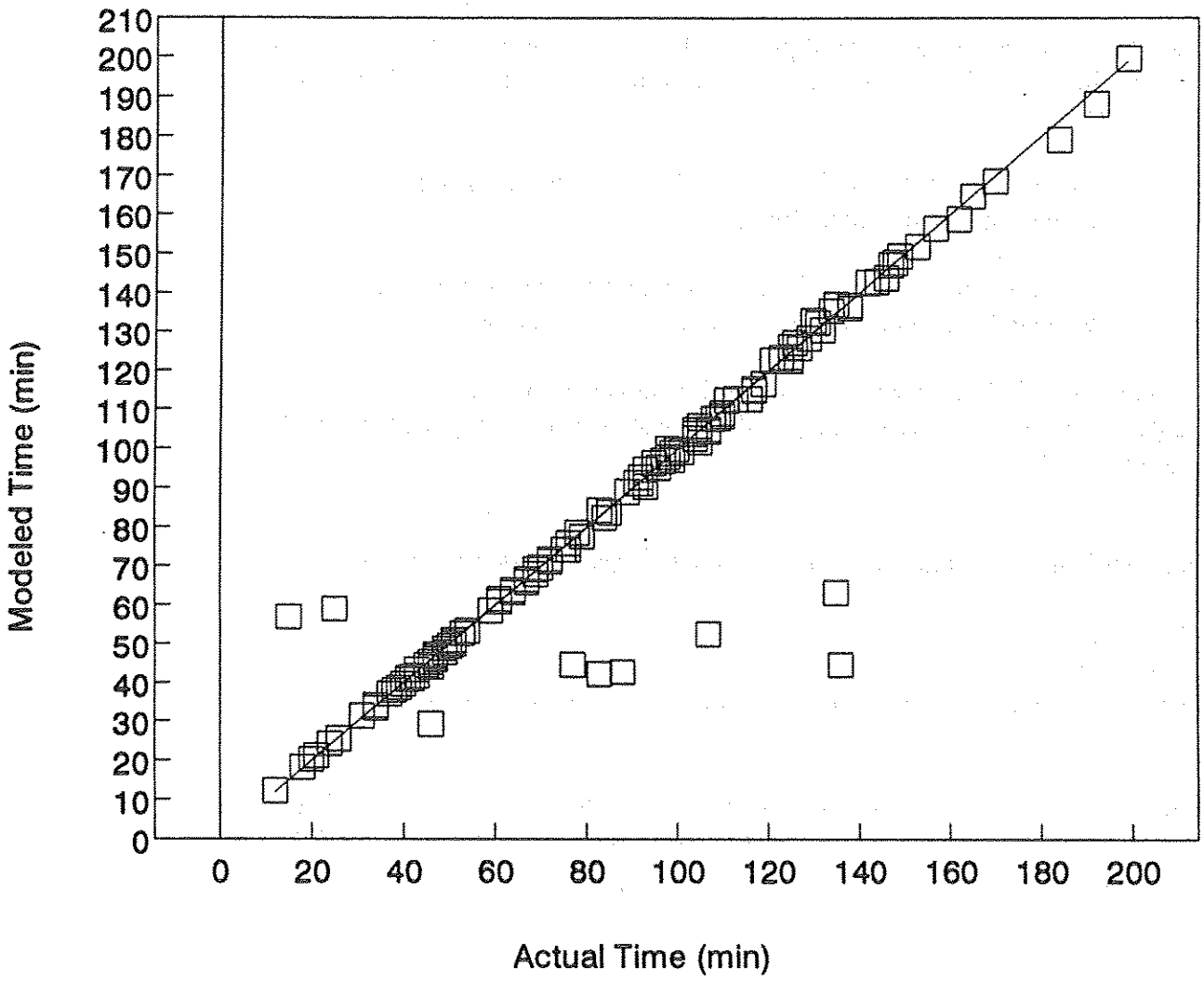
- Inflation
- Fare increases
- Changes in the availability and utilization of discounted passes

As described in Chapter 2, all fares are stated in 1970 dollars. Fares are deflated from current-year dollars to 1970 dollars using the Consumer Price Index (CPI) for the Chicago Metropolitan Area as shown below:

Month/Year	CPI
June 1970	38.8
June 1985	108.5
June 1990	131.7

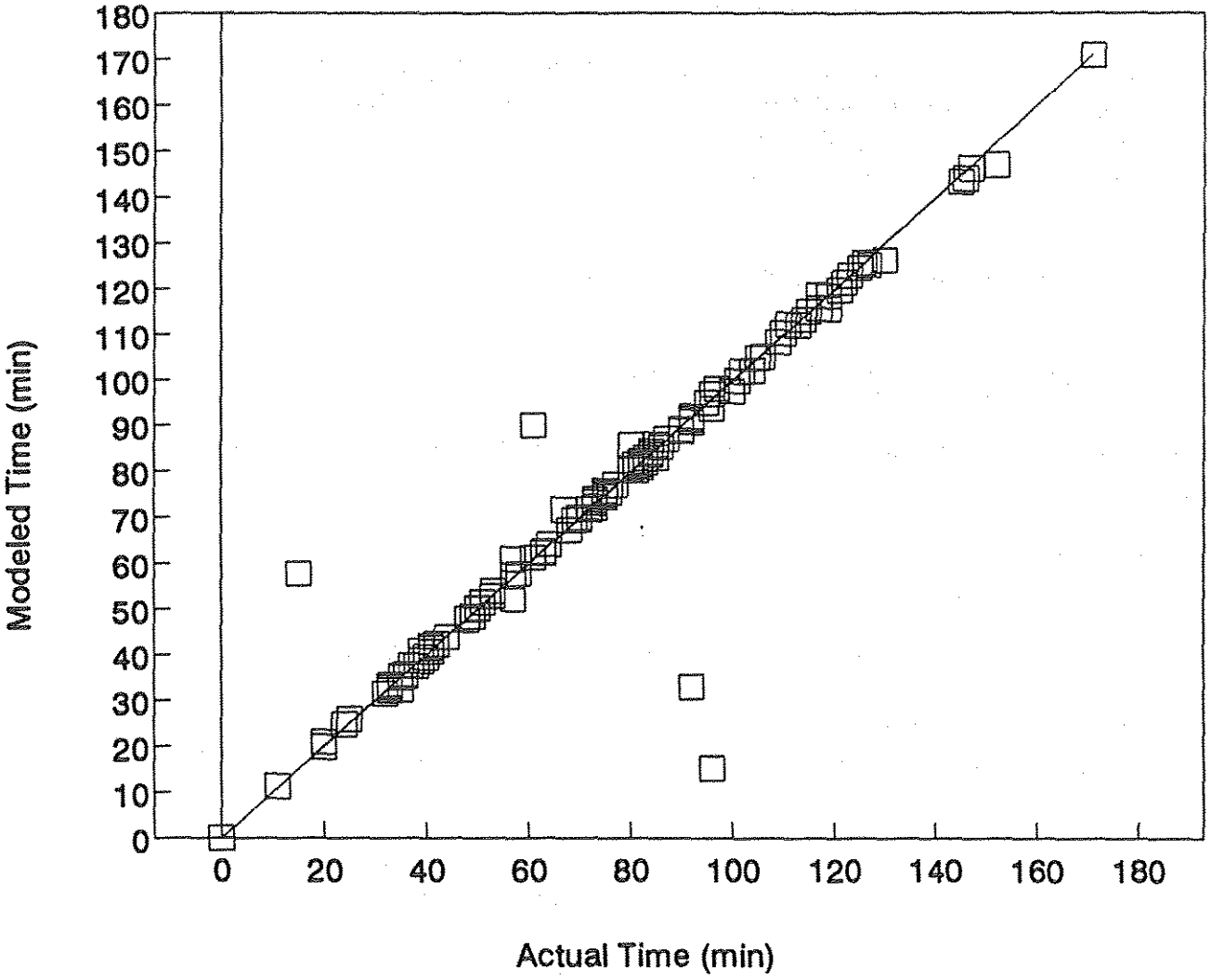
The following discusses the computation of commuter rail and non-commuter rail fares.

Exhibit 4-7
Comparison of Modeled and Scheduled Peak Bus Times
(Revised Travel Time Procedures)



Source: KPMG Peat Marwick

Exhibit 4-8
Comparison of Modeled and Scheduled Off Peak Bus Times
(Revised Travel Time Procedures)



Source: KPMG Peat Marwick

Commuter Rail Fares

The Metra 1985 fare procedures were modified to represent 1990 by accounting for the following:

- **Overall Fare Increase.** Fares (as measured in current-year dollars) increased between 1985 and 1990 at a rate of 9 to 11 percent depending on location. For purposes of developing estimates of 1990 fares, fares were assumed to increase uniformly at a rate of 10 percent between 1985 and 1990.

- **Change in Discount Pass Usage.** The change in the mix of persons using different fare types, is shown in Exhibit 4-9. This table shows that the average fare paid is approximately 70 percent of the full fare and that this ratio did not change significantly between 1985 and 1990.

The net impact of the fare increase, the change in the mix of fare media used, and the inflation factor is calculated as:

NET IMPACT = 1.1 x (0.706/0.699) x (108.5/131.7) = 0.915

Accordingly, the Metra 1985 fare table is multiplied by 0.915 to represent commuter rail fares in 1990.

Non-Commuter Rail Fares

Bus and Rapid transit fares assumed for 1990 are shown in Exhibit 4-10.

These fares are based on the full CTA fares and is consistent with the model calibration.

OTHER MODEL MODIFICATIONS

As part of the validation process, four additional modifications were made to the original modeling process. These include:

1. Express bus headways were modified to include an extra 2 minutes. This adjustment accounts for the 20 cent (1990 dollars) express service premium.

2. Express bus running times (while in express mode) were factored by 1.25 to account for apparent perceptions of in-vehicle time. Before this change, express bus services in the South, Southwest, and North corridors attracted far too many trips (the model predicted that some services carry five times more than the actual number). The travel time adjustment factor was determined through trial-and-error until the model divided trips between local bus and express bus services in approximately the same proportion as in the observed travel patterns.

Exhibit 4-9
Analysis of Average Metra Discounts for 1985 and 1990

Fare Type	1985	1990
One-Way (100% of Full Fare)	17.6%	13.7%
Ten-Day (85% of Full Fare)	7.0%	18.8%
Weekly (80% of Full Fare)	5.5%	2.2%
Monthly (60% of Full Fare assuming 45 trips per month)	69.9%	65.3%
Average Percent of Full Fare Paid	69.9%	70.6

Source: Metra

Exhibit 4-10
1990 Bus and Rapid Transit Fare Assumptions

	Fare in 1990 Dollars	Fare in 1970 Dollars (as used in model)
PEAK PERIOD		
Rapid Transit Boarding Charge	$1.25	$0.37
Bus Boarding Charge	$1.25	$0.37
Transfer	$0.25	$0.07
OFF PEAK		
Rapid Transit Boarding Charge	$1.25	$0.37
Bus Boarding Charge	$1.00	$0.29
Transfer	$0.25	$0.07

Source: KPMG Peat Marwick

3. Network coding practices and model coefficients were adjusted to treat drive-to-rapid transit trips more similarly to drive-to-commuter rail trips. This change was in response to underpredictions of rapid transit trips at Ashland and other stations with drive-access connections to the rapid transit system.

4. The home-based work trip table output by the distribution model was found to produce too many transit trips between South Chicago/southern suburbs and the Chicago CBD. To correct this problem, the trip table was factored as follows:

   - To/From South Chicago: Factor = 0.766
   - To/From southern suburbs: Factor = 0.752

1990 TRIP GENERATION RESULTS

The results of the trip generation model for 1990 are summarized in Exhibit 4-11. The model indicates the work trips in the 1990 validation are 11.3 percent greater than those used in the 1985 validation and that all trips are 5.3 percent greater in 1990 than in 1985. Although some of this increase may be caused by regional population and employment growth, it is also affected by corrections made to the 1990 socioeconomic inputs based on more recent census and employment survey data.

1990 TRIP DISTRIBUTION RESULTS (PRIOR TO SOUTH CORRIDOR FACTORING)

The 1990 trip distribution results for the home-based work, home-based non-work, and non-home based models are presented in Exhibits 4-12, 4-13, and 4-14, respectively. These exhibits present the 1990 district-to-district trip tables as compared to the 1985 trip tables for each purpose. The results show that the 1990 model predicts similar trip patterns to the 1985 model given the differences in total trip ends in each district. Key differences between the 1985 and 1990 distribution runs are:

- The largest increases in work trips (on a percentage basis) attracted in the CBD come from furthest away. Trips from Lake, McHenry, Will and South Cook Counties to the CBD have increased by the largest percentage. This increase is caused by large growth rates in population and modest growth rates in employment. Because employment is constrained in these areas, the model sends them to the CBD which is highly accessible via transit and has a large number of available jobs. The increase to Will and South Cook Counties is also partially affected by changes in the transportation network which increases the attractiveness of these areas.

- The South Chicago district shows a general decline in work trip productions and attractions. This is caused by adjustments to zonal population and employment estimates to represent the 1990 census and current employment records. Trips from the South Chicago district to the CBD actually show a modest increase caused by the larger increase in CBD attractions.

Exhibit 4-11
Comparison of 1985 and 1990 Trip Generation Results

	1985	1990	Percentage Difference
Households by Household Size			
1 person			
2 person	575,432	617,718	7.35%
3 person	742,346	775,922	4.52%
4 person	447,696	455,522	1.75%
5 person	396,108	393,641	-0.62%
6+ person	223,555	220,020	-1.58%
	162,735	157,024	-3.51%
Unnormalized Productions			
Work			
Shop	4,826,803	4,937,278	2.29%
Other	3,200,545	3,297,590	3.03%
Non-Home Based	4,988,867	5,167,993	3.59%
School	3,190,491	3,294,287	3.25%
	1,090,786	1,055,250	-3.26%
Unnormalized Attractions			
Work	4,785,740	5,326,672	11.30%
Shop	2,265,214	2,821,766	24.57%
Other	4,211,479	4,767,544	13.20%
Non-Home Based	2,735,672	3,110,035	13.68%
School	694,879	670,557	-3.50%
Normalized Productions			
Work	4,785,738	5,326,675	11.30%
Shop	3,200,545	3,297,590	3.03%
Other	4,988,867	5,167,993	3.59%
Non-Home Based	3,190,492	3,294,289	3.25%
School	1,060,786	1,055,250	-0.52%
TOTAL	17,226,428	18,141,797	5.31%
Normalized Attractions			
Work			
Shop	4,785,740	5,326,672	11.30%
Other	3,200,545	3,297,592	3.03%
Non-Home Based	4,988,868	5,167,986	3.59%
School	3,190,492	3,294,289	3.25%
TOTAL	1,060,785	1,055,250	-0.52%
	17,226,430	18,141,789	5.31%

Source: KPMG Peat Marwick

Exhibit 4-14
Comparison of 1985 and 1990 Non-Home Based Trip Distribution Results

Origin Groups		Destination Groups							Total
		1 CBD	2 Cook	4 DuPage	5 Kane	6 Lake	7 McHenry	8 Will	
1	1985	22687	52781	404	4	37	0	16	75929
	1990	9049	34861	269	3	24	0	10	44216
	Difference	-60.11%	-33.95%	-33.42%	-25.00%	-35.14%	NA	-37.50%	-41.77%
2	1985	52657	1979383	69020	6653	24466	503	10055	2142737
	1990	34820	2020609	77119	8045	29000	616	10529	2180738
	Difference	-33.87%	2.08%	11.73%	20.92%	18.53%	22.47%	4.71%	1.77%
4	1985	352	65591	346541	9806	369	28	4726	427413
	1990	237	74239	385430	11444	474	32	7490	479346
	Difference	-32.67%	13.18%	11.22%	16.70%	28.46%	14.29%	58.48%	12.15%
5	1985	4	6815	9487	131129	660	1459	170	149724
	1990	3	8186	11194	141646	668	1610	208	163515
	Difference	-25.00%	20.12%	17.99%	8.02%	1.21%	10.35%	22.35%	9.21%
6	1985	39	25757	408	685	184976	2750	1	214616
	1990	27	30398	509	674	208961	2166	2	242737
	Difference	-30.77%	18.02%	24.75%	-1.61%	12.97%	-21.24%	100.00%	13.10%
7	1985	0	684	38	1837	3347	55877	0	61783
	1990	0	807	41	2012	2670	59298	0	64828
	Difference	NA	17.98%	7.89%	9.53%	-20.23%	6.12%	NA	4.93%
8	1985	17	10755	5382	279	2	0	101847	118282
	1990	10	11220	8219	282	3	0	99234	118968
	Difference	-41.18%	4.32%	52.71%	1.08%	50.00%	NA	-2.57%	0.58%
Tot	1985	75756	2141766	431280	150393	213857	60617	116815	3190484
	1990	44146	2180320	482781	164106	241800	63722	117473	3294348
	Difference	-41.73%	1.80%	11.94%	9.12%	13.07%	5.12%	0.56%	3.26%

Source: KPMG Peat Marwick

- Non-work and non-home based trips to the CBD declined by approximately 40 percent. This mirrors the drop in CBD retail employment of 36 percent which is the driving variable in the non-work trip attraction equations.

- The remainder of the trip tables are relatively stable although large percentage differences do occur in cells with relatively small numbers of trips. This is caused by the trip table balancing routines and is not unexpected.

For the areas of concern to this project (the South Corridor in Chicago), the 1990 trip distribution appears to represent a reasonable change from the validated 1985 trip tables and are therefore usable as inputs to the mode choice process.

MODE CHOICE RESULTS (WITH FACTORED PERSON TRIP TABLE)

The results of the mode choice model are summarized in Exhibit 4-15 and 4-16. Exhibit 4-15 presents a summary of the 1990 mode choice trips and market shares for each purpose. Exhibit 4-16 compares these results to the 1985 validation. Because of the differences between the 1985 and 1990 socioeconomic data and modeling procedures, this table is presented to establish that the mode choice model is still generating similar-magnitude results. This table should not be used to identify ridership trends between 1985 and 1990.

TRANSIT BOARDINGS AND SCREENLINE CROSSINGS

The key test performed in the 1990 validation is a comparison of modeled and observed transit boardings and screenline crossings by line. Observed ridership volumes were compiled from the following sources:

- Commuter Rail System Boarding/Alighting Count, Train-by-Train Detail, Fall 1991, Metra.

- Bus and Rapid Transit Station Performance Report, Period 4, 1991, CTA. (Rail Station data is reported from November 1990 and bus data represents March 31, 1991 through April 27, 1991).

- Loop Cordon Count, CTA, May 1990.

Where both boarding and alighting information is available for a line or station, the number of "observed" boardings is computed as the average of boardings and alightings and exclude trip activity at the downtown stations.

The results of this comparison are presented in Exhibit 4-17. As this table shows, most services within the South Corridor are predicted to within plus or minus 15 percent for both total boardings and for screenline crossings. This level of error is well within level of error usually achieved for such models. Key situations where the error is larger than 15 percent are:

Exhibit 4-15
Summary of 1990 Mode Choice Model Validation Results

	Trips and Modal Shares (compared to total person trips) by Purpose			Total
	HBW	HB-NW	NHB	
Drive Alone Auto Trips		3,006,054 (33.0%)	1,468,574 (44.6%)	
Shared Ride Auto Trips		5,509,951 (60.6%)	1,784,305 (54.2%)	
Total Auto Trips	4,076,188 (80.2%)	8,516,005 (93.6%)	3,252,879 (98.7%)	15,845,072 (90.7%)
Walk-to-Transit Trips	798,066 (15.7%)	569,447 (6.3%)	38,887 (1.2%)	1,406,400 (8.0%)
Drive-to-Transit Trips	205,889 (4.1%)	12,140 (0.0%)	2,535 (0.1%)	220,564 (1.3%)
Total Transit Trips	1,003,955 (19.8%)	581,587 (6.4%)	41,422 (1.3%)	1,626,964 (9.3%)
Walk-to-Commuter Rail Trips	78,671 (1.5%)			
Walk-to-Rapid Transit Trips	313,256 (6.2%)			
Walk-to-Bus Trips	406,139 (8.0%)			
Auto-to-Commuter Rail Trips	178,915 (3.5%)			
Auto-to-Rapid Transit Trips	24,641 (0.5%)			
Auto-to-Bus Trips	2,333 (0.0%)			
Total Person Trips	5,080,143	9,097,593	3,294,299	17,472,035

Exhibit 4-16
Comparison of 1985 and 1990 Mode Choice Model Results

Purpose	Trip Category	1985	1990	%Diff.
Home-Based Work	Total Person Trips			
	- Before S Corr Factoring	4,785,725	5,326,663	11.3%
	- After S Corr Factoring	4,785,708	5,080,143	6.2%
	Automobile Trips	3,606,474	4,076,188	13.0%
	Total Transit Trips	1,179,234	1,003,955	-14.9%
	Walk-to-Transit Trips	1,023,376	798,066	-22.0%
	Auto-to-Transit Trips	155,858	205,889	32.1%
	Walk-to-Comm Rail Trips	69,351	78,671	13.4%
	Auto-to-Comm Rail Trips	138,259	178,915	29.4%
	Walk-to-Rapid Trnst Trips	430,764	313,256	-27.3%
	Auto-to-Rapid Trnst Trips	16,411	24,641	50.1%
	Walk-to-Bus Trips	523,261	406,139	-22.4%
	Auto-to-Bus Trips	1,188	2,333	96.4%
Home-Based Non-Work	Total Person Trips	8,828,530	9,097,593	3.0%
	Drive Alone	2,890,979	3,006,054	4.0%
	Shared Ride	5,278,063	5,509,951	4.4%
	Walk-to-Transit Trips	653,214	569,447	-12.8%
	Auto-to-Transit Trips	6,274	12,140	93.5%
Non-Home Based	Total Person Trips	3,190,484	3,294,299	3.3%
	Drive Alone	1,429,246	1,468,574	2.8%
	Shared Ride	1,681,775	1,784,305	6.1%
	Walk-to-Transit Trips	77,477	38,887	-49.8%
	Auto-to-Transit Trips	1,987	2,535	27.6%

Note: Socioeconomic data and model procedures changed between the 1985 and 1990 model runs and, accordingly, this table should not be used for estimating ridership trends.

Exhibit 4-17
Comparison of 1990 Modeled and Observed Transit Ridership Results

	BOARDINGS BY LINE			CBD SCREENLINE CROSSINGS		
	Observed	Modeled	Difference	Observed	Modeled	Difference
SOUTH CORRIDOR						
COMMUTER RAIL						
Metra Electric						
Blue Island Branch	1,058	796	−24.8%			
South Chicago Branch	3,429	2,970	−13.4%			
Main Line (University−Riverdale)	14,764	15,186	2.9%			
Main Line (115th−75th)	2,051	2,573	25.5%			
Main Line (63rd−18th)	3,161	4,742	50.0%			
Total Metra Electric	24,463	26,267	7.4%			
Rock Island						
Beverly Branch	6,753	5,899	−12.6%			
Main (Blue Island−95th)	1,015	590	−41.9%			
Total Rock Island (Blue Island and North)	7,768	6,489	−16.5%			
Total South Corridor Commuter Rail	32,231	32,756	1.6%			
RAPID TRANSIT						
South Line						
Main Line (Harrison−59th)	18,400	14,924	−18.9%			
Jackson Park Branch	5,450	4,498	−17.5%			
Englewood Branch	8,250	4,775	−42.1%			
Total South Line	32,100	24,197	−24.6%	42,490	38,018	−10.5%
Dan Ryan	57,900	45,287	−21.8%	70,600	63,924	−9.5%
Total South Corridor Rapid Transit	90,000	69,484	−22.8%	113,090	101,942	−9.9%
BUS SERVICE						
Michigan/Balbo				26,751	32,757	22.5%
Michigan/Roosevelt				18,308	19,070	4.2%
State/Roosevelt				37,744	49,740	31.8%
Clark/Roosevelt				3,101	4,331	39.7%
Total South Corridor Bus Service				85,904	105,898	23.3%
TOTAL SOUTH SCREENLINE CROSSINGS				198,994	207,840	4.4%
WEST CORRIDOR						
RAPID TRANSIT						
Congress/Douglas				63,729	50,598	−20.6%
Lake				36,358	23,482	−35.4%
O'Hare				81,810	58,859	−28.1%
Total West Corridor Rapid Transit				181,897	132,939	−26.9%
BUS				42,606	50,497	18.5%
TOTAL WEST SCREENLINE CROSSINGS				224,503	183,436	−18.3%
NORTH CORRIDOR						
RAPID TRANSIT						
Ravenswood				38,945	22,270	−42.8%
Evanston				13,611	12,331	−9.4%
Howard				88,422	49,685	−43.8%
Total North Corridor Rapid Transit				140,978	84,286	−40.2%
BUS				70,012	85,293	21.8%
TOTAL NORTH SCREENLINE CROSSINGS				210,990	169,579	−19.6%
ALL SCREENLINES						
Rapid Transit				435,965	319,167	−26.8%
Bus				198,522	241,688	21.7%
Total				634,487	560,855	−11.6%

- Metra Electric Main Line (63rd to 18th) - 3,161 observed vs. 4,718 modeled (49.3 percent overestimation)

- Rock Island Main Line (Blue Island to 95th) - 1,105 observed vs. 649 modeled (36.1 percent underestimation)

- Englewood Branch - 8,250 vs. 5,348 (35.2 percent underestimation)

The errors on the two Metra lines are relatively small on an absolute basis. The more important error occurs on the Englewood Branch. It is interesting to note that although boardings on the entire Englewood/Jackson Park Line are underpredicted by 17.4 percent (much of that error is the difference in the Englewood Branch), the error in screenline crossings is considerably less (4.3 percent underprediction). This suggests that the model is properly calculating longer trips to and from the CBD but is underestimating the attractiveness of rapid transit for shorter trips.

In lieu of developing more sophisticated procedures to improve the assignment results, the analysis of future alternative will consider these prediction errors when interpreting ridership results.

Exhibit A-2
Area Type by Employment and Population Density

Employment Density Strata	Population Density Strata				
	1	2	3	4	5
1	1	2	2	3	3
2	2	2	3	3	4
3	2	2	3	4	4
4	3	3	3	4	4
5	4	4	4	5	5

Appendix B
1985 Rapid Transit and Commuter Rail Stopping Patterns and Headways

Appendix A
Model For Computing Area Type

The appendix summarizes Metra's area type model used to characterize the density of residential and commercial development surrounding each roadway. This model is used as part of the speed estimation process in which estimated loaded speeds are determined from a lookup table stratified by area type and functional classification. Area types are determined from the following 3-step process:

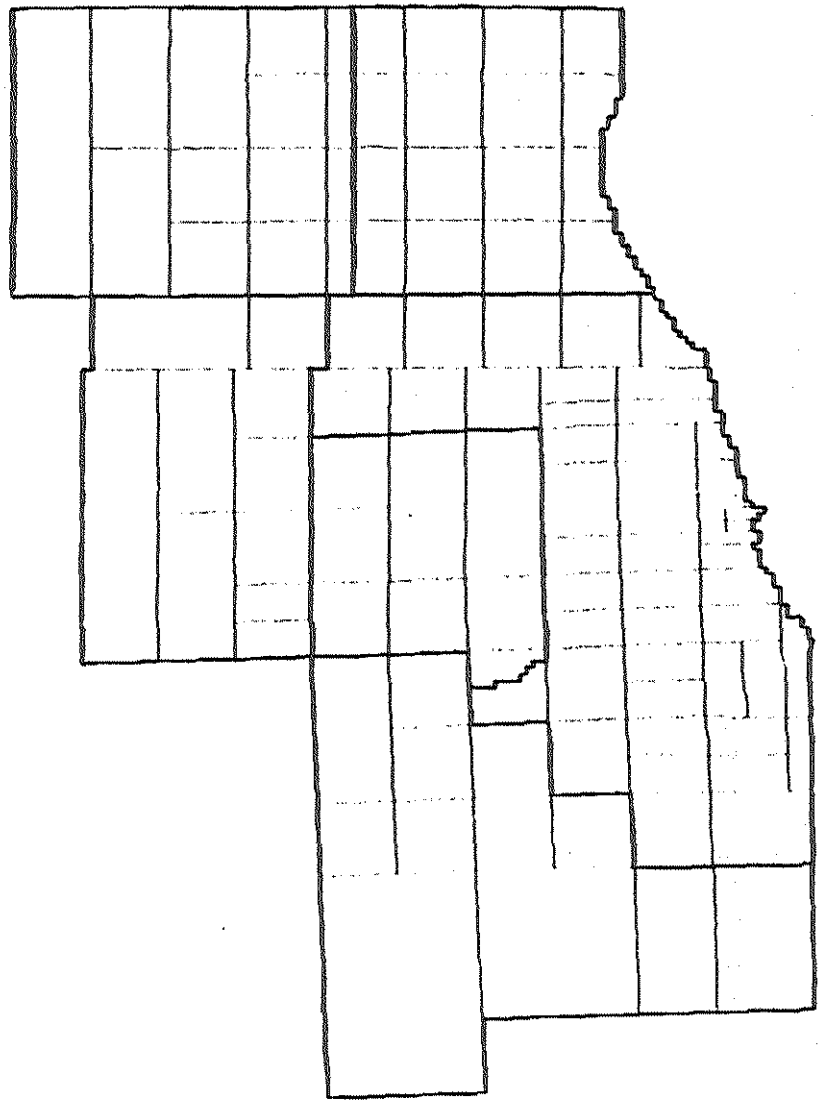
1. Compute the population and employment density for each district in the region. The Metra system uses 105 districts shown in Exhibit A-1.

2. Determine the area type from the lookup table shown in Exhibit A-2.

3. Assign area types to links based on the link's district.

Exhibit A-1
Metra Districts

METRA TRANSPORTATION PLANNING DISTRICTS



PREPARED BY: METRA OFFICE OF
PLANNING & ANALYSIS

Worksheet Showing 1985 Trains

PEAK SERVICE

Burlington Northern Line (BN)			1206	1208	1210	1212	1214	1218	1222	1226				Trn/hr
Headway		1	15	60	30	20	60	60	60	60	1	1	1	
Direction			Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn				
Aurora	9941		1				1							5
Naperville	9942						1		1					2
Lisle	9943			1		1	1		1					6
Belmont	9944					1	1		1					5
Main	9945			1		1	1		1					6
Fairview	9946				1		1	1	1	1				6
Westmont	9947				1		1	1	1					5
Clarendon Hills	9948				1		1	1	1					5
West Hinsdale	9949				1		1		1					4
Hinsdale	9950				1		1	1	1	1				6
Highlands	9951			1			1		1	1				4
Western Springs	9952			1			1	1	1	1				5
Stone Avenue	9953			1			1	1	1	1				5
La Grange	9954			1			1	1	1	1				5
Congress Park	9955						1		1					2
Brookfield	9956						1		1					2
Hollywood	9957						1		1					2
Riverside	9958						1		1					2
Harlem	9959						1		1					2
Berwyn	9960						1		1					2
LaVergne	9961						1		1					2
Clyde	9962						1		1					2
Cicero	9963						1		1					2
Western	9964						1		1					2
Halsted	9965						1		1					2
Union Station	8827		1	1	1	1	1	1	1	1				14

C&NW--North (CNN)		304	306			312	314	316						Trn/hr
Headway		30	30	1	1	60	60	60	1	1	1	1	1	
Direction		Dn	Dn			Dn	Dn	Dn						
Kenosha	9773	1					1							3
Winthrop Harbor	9772	1												2
Zion	9771	1					1							3
Waukegan	9770	1				1	1	1						5
North Chicago	9769	1				1								3
Great Lakes	9768													0
Lake Bluff	9767	1					1	1						4
Lake Forest	9766	1				1		1						4
Fort Sheridan	9765	1					1							3
Highwood	9764	1					1	1						4
Highland Park	9763	1				1		1						4
Ravinia	9762	1					1							3
Braeside	9761	1					1							3
Glencoe	9760	1				1		1						4
Hubbard Woods	9759	1				1								3
Winnetka	9758	1	1				1	1						6
Indian Hills	9757	1	1					1						5
Kenilworth	9756	1	1					1						5
Wilmette	9755	1	1					1						5
Central	9754	1	1					1						5
Evanston	9753	1	1			1	1	1						7
Main	9752		1				1							3
Rogers Park	9751		1					1						3
Ravenswood	9750		1											2

Worksheet Showing 1985 Trains

		PEAK SERVICE												Trn/hr
Clybourn	9749	1	1			1	1	1						7
CNW Station	9748	1	1			1	1	1						7

C&NW – Northwest (CNW)			608	610	612	614	616	618	620	622				
Headway		1	60	60	60	60	60	60	60	60	1	1	1	1
Direction			Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn				
! Lake Geneva	9938													0
! Pell Lake	9939													0
! Genoa City	9995													0
! Richmond	9996													0
! Ringwood	9997													0
McHenry	9998								1					1
Harvard	9794		1					1						2
! Hartland	9793													0
Woodstock	9792		1					1						2
Crystal Lake	9791		1		1	1		1		1				5
	9837													0
Cary	9790				1			1						2
Fox River Grove	9789				1			1						2
Barrington	9788		1	1	1			1	1	1				6
Palatine	9787		1	1	1	1		1		1				6
Arlington Park	9840		1	1	1		1			1				5
Arlington Heights	9785		1	1	1	1	1			1				6
Mt. Prospect	9784		1	1	1		1			1				5
Cumberland	9783		1		1			1		1				4
Des Plaines	9782		1	1	1	1			1	1				6
Dee Road	9781			1		1			1					3
Park Ridge	9780			1	1	1			1					4
Edison Park	9779			1		1				1				3
Norwood Park	9778			1		1				1				3
Gladston Park	9777			1						1				2
Jefferson Park	9776			1		1				1				3
Irving Park	9775			1						1				2
Clybourn	9749		1	1	1	1	1	1	1	1				8
CNW Station	9748		1	1	1	1	1	1	1	1				8

C&NW – West (CNWW)		20		22	24	26	28	30	32	34				
Headway		60	1	30	60	60	60	60	60	60	1	1	1	
Direction		Dn		Dn	Dn	Dn	Dn	Dn	Dn	Dn				
Geneva	9814				1			1		1				3
West Chicago	9813	1			1	1	1	1	1	1				7
Winfield	9812				1		1	1	1					4
Wheaton	9811				1		1		1	1				4
College Avenue	9810				1		1		1					3
Glen Ellyn	9809	1					1		1	1				4
Lombard	9808	1					1	1	1					4
Villa Park	9807	1				1		1	1					4
Elmhurst	9806	1		1		1		1	1					6
Berkeley	9805			1					1					3
Bellwood	9804			1				1						3
Melrose Park	9803			1				1						3
Maywood	9802			1				1						3
River Forest	9801			1					1					3
Oak Park	9800			1		1			1					4
Kedzie	9799			1	1					1				4
CNW Station	9748	1		1	1	1	1	1	1	1				9

Worksheet Showing 1985 Trains

PEAK SERVICE

Chicago, S.S. & S. B. (CSSB)		10	106	108	304									Trn/hr
Headway		60	60	60	60	1	1	1	1	1	1	1	1	
Direction		Dn	Dn	Dn	Dn									
Gary (Metro Center)	9874			1										1
Gary	9875			1										1
East Chicago	9876	1	1	1										3
Hammond	9877	1	1	1										3
Hegewisch	9878	1	1	1	1									4
	9879													0
Kensington/115th	9910	a	a		a									0
Pullman/111th	9909													0
107th	9908													0
103rd	9907													0
95th	9906													0
91st	9905													0
87th	9904													0
83rd	9903													0
79th	9902													0
75th	9901													0
	9900													0
63rd	9899	a												0
U of C/59th	9898	a	a		a									0
55–57th	9897													0
Hyde Park/53rd	9896													0
Kenwood/47th	9895													0
27th	9894													0
23rd	9893													0
18th	9892													0
Roosevelt	9891	a	a		a									0
Van Buren	9967	a	a	a	a									0
Randolph	9966	1	1	1	1									4

Metra Electric -- Blue Is. Br. (EBI)			502	504										
Headway		1	60	30	1	1	1	1	1	1	1	1	1	
Direction			Dn	Dn										
Blue Island	9937		1	1										3
Burr Oak	9936		1	1										3
Ashland Avenue	9935		1	1										3
Racine Avenue	9934		1	1										3
West Pullman	9933		1	1										3
Stewart Ridge	9932		1	1										3
State Street	9931		1	1										3
Kensington/115th	9910		1	1										3
Pullman/111th	9909													0
107th	9908													0
103rd	9907													0
95th	9906													0
91st	9905													0
87th	9904													0
83rd	9903													0
79th	9902													0
75th	9901													0
	9900													0
63rd	9899													0
U of C/59th	9898													0
55–57th	9897		1											1
Hyde Park/53rd	9896													0

Worksheet Showing 1985 Trains

		PEAK SERVICE												Trn/hr
Kenwood/47th	9895													0
27th	9894													0
23rd	9893													0
18th	9892													0
Roosevelt	9891		1	1										3
Van Buren	9967		1	1										3
Randolph	9966		1	1										3

Metra Electric – Main (EML)		106	108		604	702	704	730	734	736	752	754	758	
Headway		60	60	1	60	60	60	60	60	60	60	30	60	
Direction		Dn	Dn		Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn	
University Park	9890	1	1			1	1							4
Richton Park	9922	1	1			1	1							4
Matteson	9921	1	1			1	1							4
211th	9920	1	1			1	1							4
Olympia Fields	9919	1	1			1	1							4
Flossmoor	9918	1	1					1	1	1				5
Homewood	9917	1	1					1	1	1				5
Calumet	9916	1	1					1	1	1				5
Hazel Crest	9915	1	1					1	1	1				5
Harvey	9914	1	1							1	1	1	1	7
147th	9913	1	1								1	1	1	6
Ivanhoe	9912	1	1								1	1	1	6
Riverdale	9911	1	1								1	1	1	6
Kensington/115th	9910	1	1		1					1	1	1	1	8
Pullman/111th	9909		1		1									2
107th	9908		1		1									2
103rd	9907		1		1									2
95th	9906		1		1									2
91st	9905		1		1									2
87th	9904		1		1									2
83rd	9903		1		1									2
79th	9902		1		1									2
75th	9901		1		1									2
	9900													0
63rd	9899		1		1									2
U of C/59th	9898	1	1		1			1					1	5
55–57th	9897		1		1	1					1			4
Hyde Park/53rd	9896		1		1								1	3
Kenwood/47th	9895		1		1									2
27th	9894		1		1									2
23rd	9893	1	1		1									3
18th	9892		1											1
Roosevelt	9891	1	1		1	1	1	1	1	1	1	1	1	12
Van Buren	9967	1	1		1	1	1	1	1	1	1	1	1	12
Randolph	9966	1	1		1	1	1	1	1	1	1	1	1	12

Metra Electric – S. Chicago (ESC		306		400										
Headway		60	1	20	1	1	1	1	1	1	1	1	1	
Direction		Dn		Dn										
91st/South Chicago	9930	1		1										4
87th	9929	1		1										4
83rd	9928	1		1										4
Cheltenham	9927	1		1										4
Windsor Park	9926	1		1										4
South Shore	9925	1		1										4
Bryn Mawr	9924	1		1										4

Worksheet Showing 1985 Trains

			PEAK SERVICE					Trn/hr
	99th	9976	1	1	1	1		6
	95th	9975	1	1	1	1		6
	91st	9974	1	1	1	1		6
	Brainard	9973	1	1	1	1		6
	Gresham	9972		1	1			4
!	Auburn Park	9971						0
!	Hamlin Park	9970						0
!	Englewood	9969						0
	LaSalle	9968	1	1	1	1		6

Rock Island -- Main (RKM)		406		700										
Headway		60	1	60	1	1	1	1	1	1	1	1	1	
Direction		Dn		Dn										
	Joliet	9940	1											1
	New Lennox	9994	1		1									2
	Mokena	9993	1		1									2
	Tinley Park/80th	9988	1		1									2
	Tinley Park	9992	1		1									2
	Oak Forest	9991	1		1									2
	Midlothian	9990	1		1									2
	Robbins	9989			1									1
	Blue Island/Vermont	9984	1		1									2
	Prarie Street	9983												0
	123rd	9982												0
	119th	9981												0
	115th	9980												0
	111th	9979												0
	107th	9978												0
	103rd	9977												0
	99th	9976												0
	95th	9975												0
	91st	9974												0
	Brainard	9973												0
!	Givens	9996												0
	Washington Heights	9987			1									1
!	Longwood/99th	9986												0
	Manor/95th	9985	1		1									2
	Gresham	9972			1									1
!	Auburn Park	9971												0
!	Hamlin Park	9970												0
!	Englewood	9969												0
	LaSalle	9968	1		1									2

RAPID TRANSIT		
Evanston Express		EVANST
Headway		8
Direction		Dn
	Linden	9584 1
	Central	9585 1
	Noyes	9586 1
	Foster	9587 1
	Davis	9588 1
	Dempster	9589 1
	Main	9590 1
	South Blvd.	9591 1
	Howard	9733 1
	Jarvis	9593

Worksheet Showing 1985 Trains

		PEAK SERVICE		Trn/hr
Morse	9594			
Loyola	9595			
Granville	9596			
Thorndale	9597			
Bryn Mawr	9598		Note: This Line has an extra loop	
Berwyn	9599		9598–9599–9598–9600	
Argyle	9600			
Lawrence	9601			
Wilson	9602			
Sheridan	9603			
Addison	9604			
Belmont	9746			
Fullerton	9606			
Armitage	9648			
Sedgewick	9649			
Chicago	9650			
Merchandise Mart	9652	1		
Clark/Lake	9674	1		
State/Lake	9672	1		
Randolph/Wabash	9681	1		
Madison/Wabash	9680	1		
Adams/Wabash	9679	1		
LaSalle/Van Buren	9656	1		
Quincy/Wells	9655	1		
Madison/Wells	9654	1		
Randolph/Wells	9653	1		
Merchandise Mart	9652	1		
Chicago	9650			
Sedgwick	9649			
Armitage	9648			
Fullerton	9606			
Belmont	9746			
Addison	9604			
Sheridan	9603			
Wilson	9602			
Lawrence	9601			
Argyle	9600			
Berwyn	9599		Note: This Line has an extra loop	
Bryn Mawr	9598		9598–9599–9598–9600	
Thorndale	9597			
Granville	9596			
Loyola	9595			
Morse	9594			
Jarvis	9593			
Howard	9733	1		
South Blvd	9591	1		
Main	9590	1		
Dempster	9589	1		
Davis	9588	1		
Foster	9587	1		
Noyes	9586	1		
Central	9585	1		
Linden	9584	1		

Worksheet Showing 1985 Trains

		PEAK SERVICE		Trn/hr
Stoney Island	9923	1	1	4
U of C/59th	9898	1	1	4
55–57th	9897	1	1	4
Hyde Park/53rd	9896	1	1	4
Kenwood/47th	9895	1		1
27th	9894	1	1	4
23rd	9893	1	1	4
18th	9892	1		1
Roosevelt	9891	1	1	4
Van Buren	9967	1	1	4
Randolph	9966	1	1	4

Metra Heritage Corridor (HERT)		16													
Headway		75	1	1	1	1	1	1	1	1	1	1	1	1	
Direction		Dn													
Joliet	9940	1													0.8
Lockport	9999	1													0.8
! Lockport – 5th	8816														0
Lemont	8799	1													0.8
Willow Springs	8801	1													0.8
Summit	8803	1													0.8
Glenn	8804	1													0.8
! Brighton Park	8805														0
! Halsted	8806														0
Union Station	8827	1													0.8

Milwaukee – North (MN)		2104	2106	2108		2110	2112	2114	2116					
Headway		60	60	60	1	60	60	60	60	1	1	1	1	
Direction		Dn	Dn	Dn		Dn	Dn	Dn	Dn					
! Walworth	9886													0
! Zenda	8828													0
! Solon Mills	9839													0
! Spring Grove	9838													0
Fox Lake	9841	1	1	1		1	1		1					6
Ingleside	9842			1										1
Wilson Road	9843													0
! Long Lake	9844	1		1			1		1					4
Round Lake	9845	1	1			1	1							4
Grayslake	9846		1	1			1		1					4
Libertyville	9847	1	1	1		1			1					5
! Rondout	9848													0
Lake Forest	9849	1	1	1			1		1					5
Deerfield	9850	1	1	1			1	1	1					6
Northbrook	9851	1	1	1		1		1	1					6
! Techny	9836													0
Glenview	9852	1	1			1	1	1	1					6
Golf	9853	1		1				1						3
Morton Grove	9854	1	1			1	1	1						5
Edgebrook	9855	1	1				1	1	1					5
Forest Glen	9856	1		1				1						3
Mayfair	9857	1		1				1						3
Grayland	9858	1		1				1						3
Healy	9859	1	1	1		1	1	1	1					7
Western Avenue	9835	1	1	1		1	1	1	1					7
Union Station	8827	1	1	1		1	1	1	1					7

Worksheet Showing 1985 Trains

PEAK SERVICE

															Trn/hr
Milwaukee – West (MW)			2208	2210	2212	2214	2216	2218	2220						
Headway		1	60	60	60	60	60	60	60	1	1	1	1		
Direction			Dn	Dn	Dn	Dn	Dn	Dn	Dn						
Big Timber	9888		1						1						2
Elgin	9816		1			1			1						3
National Street	9817		1			1			1						3
Bartlett	9818		1			1			1						3
Hanover Park	9819		1			1			1						3
! Schaumburg	9887		1			1			1						3
Roselle	9820		1	1	1			1							4
Medinah	9821		1		1			1							3
Itasca	9822		1		1			1							3
Wood Dale	9823		1		1			1							3
Bensenville	9824		1		1			1							3
Mannheim	9825			1											1
Franklin Park	9826			1	1		1	1	1						5
River Grove	9827			1			1								2
Elmwood Park	9828			1			1								2
Mont Clare	9829			1			1								2
Mars	9830			1			1								2
Galewood	9831			1			1								2
Hanson Park	9832			1			1								2
Cragin	9833			1			1								2
Hermosa	9834			1			1								2
Western Avenue	9835			1			1	1	1						4
Union Station	8827		1	1	1	1	1	1	1						7

														Trn/hr
Norfolk Southern (NS)		4												
Headway		40	1	1	1	1	1	1	1	1	1	1	1	
Direction		Dn												
Orland Park	8807	1												1.5
! Southmoor	8808													0
Palos Park	8809	1												1.5
Worth	8810	1												1.5
Chicago Ridge	8811	1												1.5
Oak Lawn	8812	1												1.5
! Ashbum	8813	1												1.5
Landers	8815	1												1.5
! Western	8817													0
! Ashland	8818													0
! Racine	8821													0
! Halsted	8824													0
! Englewood	8825													0
! 47th	8826													0
Union Station	8827	1												1.5

														Trn/hr
Rock Island – Beverly (RKB)		604	606	612	614									
Headway		60	20	60	60	1	1	1	1	1	1	1	1	
Direction		Dn	Dn	Dn	Dn									
Blue Island/Vermont	9984		1		1									4
Prarie Street	9983	1	1	1	1									6
123rd	9982	1	1	1	1									6
119th	9981	1	1	1	1									6
115th	9980	1	1	1	1									6
111th	9979	1	1	1	1									6
107th	9978	1	1	1	1									6
103rd	9977	1	1	1	1									6

Worksheet Showing 1985 Trains

		PEAK SERVICE		Trn/hr
35th	9737	1	1	
47th	9738	1		
Garfield	9739		1	
63rd	9740	1		
69th	9741	1	1	
79th	9742	1	1	
87th	9743	1	1	
95th	9744	1	1	
87th	9743	1	1	
79th	9742	1	1	
69th	9741	1	1	
63rd	9740	1		
Garfield	9739		1	
47th	9738	1		
35th	9737	1	1	
Cermack	9736		1	
Roosevelt	9615			
Adams/Wabash	9679	1	1	
Madison/Wabash	9680	1	1	
Randolph/Wabash	9681	1	1	
State/Lake	9672	1	1	
Clark/Lake	9674	1	1	
Clinton/NW Passage	9676	1	1	
Halsted	9695		1	
Ashland	9694	1		
California	9693		1	
Kedzie	9692	1		
Homan	9691		1	Lines loop at 9690 and goes back to Dan Ryan/95th
Pulaski	9690	1		
Cicero	9689			
Laramie	9688			
Central	9687			
Austin	9686			
Ridgeland	9685			
Oak Park	9684			
Harlem	9683			

OHare/Douglas		ohareeohareb	
Headway		3.3	3.3
Direction		Dn	Dn
O'Hare	9583	1	1
River Road	9582	1	1
Cumberland	9581	1	1
Harlem	9580	1	1
Jefferson Park	9673	1	1
Montrose	9647	1	
Irving Park	9659	1	1
Addison	9671		1
Belmont	9675	1	1
Logan Square	9660	1	1
California	9661	1	
Western	9662		1
Damen	9663	1	1
Division	9664	1	1
Chicago	9665	1	
Grand	9666		1
Lake Transfer	9731	1	1

Worksheet Showing 1985 Trains

		PEAK SERVICE		Trn/hr
Washington	9670	1	1	
Monroe	9658	1	1	
Jackson	9657	1	1	
LaSalle	9678	1	1	
Clinton	9677	1	1	
U of I	9708	1	1	
Racine	9707	1	1	
Congress St Line				
Medical Center	9706	1		
Western	9705	1		
Kedzie	9703	1		
Pulaski	9702	1		
Cicero	9700	1		
Austin	9699	1		
Oak Park	9698	1		
Harlem	9697	1		
Des Plaines	9696	1		
Harlem	9697	1		
Oak Park	9698	1		
Austin	9699	1		
Cicero	9700	1		
Pulaski	9702	1		
Kedzie	9703	1		
Western	9705	1		
Medical Center	9706	1		
Douglas Line				
Polk	9720		1	
18th	9719		1	
Hoyne	9718		1	
Western	9717		1	
California	9716		1	
Kedzie	9715		1	
Central Park	9714		1	
Pulaski	9713		1	
Kildare	9712		1	
Cicero	9711		1	
Laramie	9710		1	
Cicero–Berwyn	9709		1	
Laramie	9710		1	
Cicero	9711		1	
Kildare	9712		1	
Pulaski	9713		1	
Central Park	9714		1	
Kedzie	9715		1	
California	9716		1	
Western	9717		1	
Hoyne	9718		1	
18th	9719		1	
Polk	9720		1	
End Douglas Line				
Racine	9707	1	1	
U of I	9708	1	1	
Clinton	9677	1	1	
LaSalle	9678	1	1	
Jackson	9657	1	1	
Monroe	9658	1	1	
Washington	9670	1	1	

Worksheet Showing 1985 Trains

		PEAK SERVICE		Trn/hr
Lake Transfer	9731	1	1	
Grand	9666		1	
Chicago	9665	1		
Division	9664	1	1	
Damen	9663	1	1	
Western	9662		1	
California	9661	1		
Logan Square	9660	1	1	
Belmont	9675	1	1	
Addison	9671		1	
Irving Park	9659	1	1	
Montrose	9647	1		
Jefferson Park	9673	1	1	
Harlem	9580	1	1	
Cumberland	9581	1	1	
River Road	9582	1	1	
O'Hare	9583	1	1	

Ravenswood		raven	ravenb	
Headway		4.1	4.1	
Direction		Dn	Dn	
Kimball	9633	1	1	
Kedzie	9634	1	1	
Francisco	9635	1		
Rockwell	9636		1	
Western	9637	1	1	
Damen	9638	1		
Montrose	9639		1	
Irving Park	9640	1	1	
Addison	9641	1		
Paulina	9642	1		
Southport	9643		1	
Belmont	9746	1	1	
Wellington	9645			
Diversey	9646		1	
Fullerton	9606	1	1	
Armitage	9648	1	1	
Sedgwick	9649		1	
Chicago	9650	1	1	
Merchandise Mart	9652	1	1	
Randolph/Wells	9653	1	1	
Madison/Wells	9654	1	1	
Quincy/Wells	9655	1	1	
LaSalle/Van Buren	9656	1	1	
Adams/Wabash	9679	1	1	
Madison/Wabash	9680	1	1	
Randolph/Wabash	9681	1	1	
State/Lake	9672	1	1	
Clark/Lake	9674	1	1	
Merchandise Mart	9652	1	1	
Chicago	9650	1	1	
Sedgwick	9649		1	
Armitage	9648	1	1	
Fullerton	9606	1	1	
Diversey	9646		1	
Wellington	9645			
Belmont	9746	1	1	

Worksheet Showing 1985 Trains

		PEAK SERVICE		Trn/hr
Southport	9643		1	
Paulina	9642	1		
Addison	9641	1		
Irving Park	9640	1	1	
Montrose	9639		1	
Damen	9638	1		
Western	9637	1	1	
Rockwell	9636		1	
Francisco	9635	1		
Kedzie	9634	1	1	
Kimball	9633	1	1	

Skokie Swift		skokie
Headway		5.5
Direction		Dn
Dempster	9605	1
Howard	9733	1
Dempster	9605	1

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE								Trn/hr	OFF–PEAK SERVICE				Trn/hr
Burlington Northern Line (BN)		1203	1297								1ac	2ac	3ca	4ca	
Headway		60	60	1	1	1	1	1	1		120	60	120	110	
Direction		Up	Up								Dn	Dn	Up	UP	
Aurora	9941	1				1				2.5454	1	1	1	1	2.5454
Naperville	9942	1				1				2.5454	1	1	1	1	2.5454
Lisle	9943	1				1				2.5454	1	1	1	1	2.5454
Belmont	9944	1				1				2.5454	1	1	1	1	2.5454
Main	9945	1	1			2				2.5454	1	1	1	1	2.5454
Fairview	9946	1				1				2.5454	1	1	1	1	2.5454
Westmont	9947	1				1				2.5454	1	1	1	1	2.5454
Clarendon Hills	9948	1				1				2.5454	1	1	1	1	2.5454
West Hinsdale	9949					0				0.5454				1	0.5454
Hinsdale	9950	1	1			2				2.5454	1	1	1	1	2.5454
Highlands	9951					0				1.5454		1		1	1.5454
Western Springs	9952	1				1				2.5454	1	1	1	1	2.5454
Stone Avenue	9953	1				1				2.5454	1	1	1	1	2.5454
La Grange	9954	1	1			2				2.5454	1	1	1	1	2.5454
Congress Park	9955					0				0.5454				1	0.5454
Brookfield	9956	1				1				2.5454	1	1	1	1	2.5454
Hollywood	9957					0				2.5454	1	1	1	1	2.5454
Riverside	9958	1				1				2.5454	1	1	1	1	2.5454
Harlem	9959	1				1				2.5454	1	1	1	1	2.5454
Berwyn	9960	1				1				2.5454	1	1	1	1	2.5454
LaVergne	9961					0				0.5454				1	0.5454
Clyde	9962	1				1				2.5454	1	1	1	1	2.5454
Cicero	9963	1				1				2.5454	1	1	1	1	2.5454
Western	9964	1	1			2				2.5454	1	1	1	1	2.5454
Halsted	9965					0				2.0454		1	1	1	2.0454
Union Station	8827	1	1			2				2.5454	1	1	1	1	2.5454

		309	311								1kc	2kc	3ck	4ck	
C&NW–North (CNN)															
Headway		60	60	1	1	1	1	1	1		60	30	10	60	
Direction		Up	Up								Dn	Dn	Up	Up	
Kenosha	9773					0				3		1		1	3
Winthrop Harbor	9772					0				3		1		1	3
Zion	9771					0				3		1		1	3
Waukegan	9770		1			1				10	1	1	1	1	10
North Chicago	9769		1			1				10	1	1	1	1	10
Great Lakes	9768		1			1				10	1	1	1	1	10
Lake Bluff	9767		1			1				10	1	1	1	1	10
Lake Forest	9766		1			1				10	1	1	1	1	10
Fort Sheridan	9765		1			1				10	1	1	1	1	10
Highwood	9764		1			1				10	1	1	1	1	10
Highland Park	9763	1	1			2				10	1	1	1	1	10
Ravinia	9762	1	1			2				10	1	1	1	1	10
Braeside	9761	1	1			2				10	1	1	1	1	10
Glencoe	9760	1	1			2				10	1	1	1	1	10
Hubbard Woods	9759	1	1			2				10	1	1	1	1	10
Winnetka	9758	1	1			2				10	1	1	1	1	10
Indian Hills	9757		1			1				10	1	1	1	1	10
Kenilworth	9756		1			1				10	1	1	1	1	10
Wilmette	9755		1			1				10	1	1	1	1	10
Central	9754		1			1				10	1	1	1	1	10
Evanston	9753	1	1			2				10	1	1	1	1	10
Main	9752		1			1				10	1	1	1	1	10
Rogers Park	9751		1			1				10	1	1	1	1	10
Ravenswood	9750		1			1				10	1	1	1	1	10

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE			Trn/hr	OFF--PEAK SERVICE				Trn/hr
Clybourn	9749	1	1		2	1	1	1	1	10
CNW Station	9748	1	1		2	1	1	1	1	10

C&NW -- Northwest (CNW)		605								1hc	2hc	3ch	4ch	
Headway		60	1	1	1	1	1	1	1	180	60	120	120	1
Direction		Up								Dn	Dn	Up	Up	
! Lake Geneva	9938					0								0
! Pell Lake	9939					0								0
! Genoa City	9995					0								0
! Richmond	9996					0								0
! Ringwood	9997					0								0
McHenry	9998					0								0
Harvard	9794	1				1				1			1	0.8333
! Hartland	9793					0				1			1	0.8333
Woodstock	9792	1				1				1			1	0.8333
Crystal Lake	9791	1				1				1	1	1	1	2.3333
	9837					0				1	1	1	1	2.3333
Cary	9790	1				1				1	1	1	1	2.3333
Fox River Grove	9789	1				1				1	1	1	1	2.3333
Barrington	9788	1				1				1	1	1	1	2.3333
Palatine	9787	1				1				1	1	1	1	2.3333
Arlington Park	9840	1				1				1	1	1	1	2.3333
Arlington Heights	9785	1				1				1	1	1	1	2.3333
Mt. Prospect	9784	1				1				1	1	1	1	2.3333
Cumberland	9783	1				1				1	1	1	1	2.3333
Des Plaines	9782	1				1				1	1	1	1	2.3333
Dee Road	9781	1				1				1	1	1	1	2.3333
Park Ridge	9780	1				1				1	1	1	1	2.3333
Edison Park	9779	1				1				1	1	1	1	2.3333
Norwood Park	9778	1				1				1	1	1	1	2.3333
Gladston Park	9777					0								0
Jefferson Park	9776	1				1				1	1	1	1	2.3333
Irving Park	9775	1				1				1	1	1	1	2.3333
Clybourn	9749	1				1				1	1	1	1	2.3333
CNW Station	9748	1				1				1	1	1	1	2.3333

C&NW -- West (CNWW)		21								#1	#2	#3	#4	
Headway		60	1	1	1	1	1	1	1	120	120	120	120	
Direction		Up								Dn	Dn	Up	Up	
Geneva	9814	1				1				1			1	1
West Chicago	9813	1				1				1	1	1	1	2
Winfield	9812	1				1				1	1	1	1	2
Wheaton	9811	1				1				1	1	1	1	2
College Avenue	9810	1				1				1	1	1	1	2
Glen Ellyn	9809	1				1				1	1	1	1	2
Lombard	9808	1				1				1	1	1	1	2
Villa Park	9807	1				1				1	1	1	1	2
Elmhurst	9806	1				1				1	1	1	1	2
Berkeley	9805					0				1	1	1	1	2
Bellwood	9804					0				1	1	1	1	2
Melrose Park	9803					0				1	1	1	1	2
Maywood	9802					0				1	1	1	1	2
River Forest	9801					0							1	0.5
Oak Park	9800					0				1	1	1	1	2
Kedzie	9799					0				1	1	1	1	2
CNW Station	9748	1				1				1	1	1	1	2

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE								Trn/hr	OFF–PEAK SERVICE				Trn/hr
Chicago, S.S. & S. B. (CSSB)		305									#1	#2	#3		
Headway		60	1	1	1	1	1	1	1		60	120	45	1	
Direction		Up									Dn	Up	Up		
Gary (Metro Center)	9874					0				0					0
Gary	9875					0				0					0
East Chicago	9876					0				0					0
Hammond	9877					0				0	1	1	1		2.8333
Hegewisch	9878	1				1				1	1	1	1		2.8333
	9879					0				0					0
Kensington/115th	9910	b				0				0	1	1	1		2.8333
Pullman/111th	9909					0				0			1		1.3333
107th	9908					0				0					0
103rd	9907					0				0					0
95th	9906					0				0					0
91st	9905					0				0					0
87th	9904					0				0					0
83rd	9903					0				0					0
79th	9902					0				0					0
75th	9901					0				0			1		1.3333
	9900					0				0			1		1.3333
63rd	9899					0				0					0
U of C/59th	9898					0				0	1	1	1		2.8333
55–57th	9897					0				0					0
Hyde Park/53rd	9896					0				0					0
Kenwood/47th	9895					0				0					0
27th	9894					0				0					0
23rd	9893					0				0					0
18th	9892					0				0					0
Roosevelt	9891					0				0	1	1	1		2.8333
Van Buren	9967					0				0	1	1	1		2.8333
Randolph	9966	1				1				1	1	1	1		2.8333

Metra Electric – Blue Is. Br. (EBI)		211									#1	#2			
Headway		60	1	1	1	1	1	1	1		120	120	1	1	
Direction		Up									Dn	Up			
Blue Island	9937	1				1				1	1	1			1
Burr Oak	9936	1				1				1	1	1			1
Ashland Avenue	9935	1				1				1	1	1			1
Racine Avenue	9934	1				1				1	1	1			1
West Pullman	9933	1				1				1	1	1			1
Stewart Ridge	9932	1				1				1	1	1			1
State Street	9931	1				1				1	1	1			1
Kensington/115th	9910	1				1				1	1	1			1
Pullman/111th	9909	1				1				1	1	1			1
107th	9908	1				1				1	1	1			1
103rd	9907	1				1				1	1	1			1
95th	9906	1				1				1	1	1			1
91st	9905	1				1				1	1	1			1
87th	9904	1				1				1	1	1			1
83rd	9903	1				1				1	1	1			1
79th	9902	1				1				1	1	1			1
75th	9901	1				1				1	1	1			1
	9900					0				1	1	1			1
63rd	9899	1				1				1	1	1			1
U of C/59th	9898	1				1				1	1	1			1
55–57th	9897					0				0					0
Hyde Park/53rd	9896					0				0					0

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE								Trn/hr	OFF-PEAK SERVICE				Trn/hr
Kenwood/47th	9895									0					0
27th	9894									0					0
23rd	9893									0					0
18th	9892									0					0
Roosevelt	9891	1								1	1	1			1
Van Buren	9967	1								1	1	1			1
Randolph	9966	1								1	1	1			1
Metra Electric -- Main (EML)		111									#1	#2			
Headway		60	1	1	1	1	1	1	1		60	60	1	1	
Direction		Up									Dn	Up			
University Park	9890	1								1	1	1			2
Richton Park	9922	1								1	1	1			2
Matteson	9921	1								1	1	1			2
211th	9920	1								1	1	1			2
Olympia Fields	9919	1								1	1	1			2
Flossmoor	9918	1								1	1	1			2
Homewood	9917	1								1	1	1			2
Calumet	9916	1								1	1	1			2
Hazel Crest	9915	1								1	1	1			2
Harvey	9914	1								1	1	1			2
147th	9913	1								1	1	1			2
Ivanhoe	9912	1								1	1	1			2
Riverdale	9911	1								1	1	1			2
Kensington/115th	9910	1								1	1	1			2
Pullman/111th	9909									0					0
107th	9908									0					0
103rd	9907									0					0
95th	9906									0					0
91st	9905									0					0
87th	9904									0					0
83rd	9903									0					0
79th	9902									0					0
75th	9901									0					0
	9900									0					0
63rd	9899									0					0
U of C/59th	9898	1								1	1	1			2
55-57th	9897									0					0
Hyde Park/53rd	9896									0					0
Kenwood/47th	9895									0					0
27th	9894									0					0
23rd	9893									0					0
18th	9892									0					0
Roosevelt	9891	1								1	1	1			2
Van Buren	9967	1								1	1	1			2
Randolph	9966	1								1	1	1			2
Metra Electric -- S. Chicago (ESC)		311									#1	#2			
Headway		60	1	1	1	1	1	1	1		60	60	1	1	
Direction		Up									Up	Down			
91st/South Chicago	9930	1								1	1	1			2
87th	9929	1								1	1	1			2
83rd	9928	1								1	1	1			2
Cheltenham	9927	1								1	1	1			2
Windsor Park	9926	1								1	1	1			2
South Shore	9925	1								1	1	1			2
Bryn Mawr	9924	1								1	1	1			2

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE								OFF-PEAK SERVICE				Trn/hr
Stoney Island	9923	1				1				1	1			2
U of C/59th	9898	1				1				1	1			2
55-57th	9897	1				1				1	1			2
Hyde Park/53rd	9896	1				1				1	1			2
Kenwood/47th	9895	1				1				1	1			2
27th	9894	1				1				1	1			2
23rd	9893	1				1				1	1			2
18th	9892	1				1				1	1			2
Roosevelt	9891	1				1				1	1			2
Van Buren	9967	1				1				1	1			2
Randolph	9966	1				1				1	1			2

Metra Heritage Corridor (HERT)

Headway		1	1	1	1		1	1	1	1	1	1	1	
Direction														
Joliet	9940					0								0
Lockport	9999					0								0
! Lockport – 5th	8816					0								0
Lemont	8799					0								0
Willow Springs	8801					0								0
Summit	8803					0								0
Glenn	8804					0								0
! Brighton Park	8805					0								0
! Halsted	8806					0								0
Union Station	8827					0								0

Milwaukee – North (MN)		2109								c-fl	fl-c			
Headway		60	1	1	1		1	1	1	1	60	75	1	
Direction		Up									Up	Dn		
! Walworth	9886					0								0
! Zenda	8828					0								0
! Solon Mills	9839					0								0
! Spring Grove	9838					0								0
Fox Lake	9841	1				1					1	1		1.8
Ingleside	9842	1				1					1	1		1.8
Wilson Road	9843					0					1	1		1.8
! Long Lake	9844	1				1					1	1		1.8
Round Lake	9845	1				1					1	1		1.8
Grayslake	9846	1				1					1	1		1.8
Libertyville	9847	1				1					1	1		1.8
! Rondout	9848					0								0
Lake Forest	9849	1				1					1	1		1.8
Deerfield	9850	1				1					1	1		1.8
Northbrook	9851	1				1					1	1		1.8
! Techny	9836					0								0
Glenview	9852	1				1					1	1		1.8
Golf	9853	1				1					1	1		1.8
Morton Grove	9854	1				1					1	1		1.8
Edgebrook	9855	1				1					1	1		1.8
Forest Glen	9856	1				1					1	1		1.8
Mayfair	9857	1				1					1	1		1.8
Grayland	9858	1				1					1	1		1.8
Healy	9859	1				1					1	1		1.8
Western Avenue	9835	1				1					1	1		1.8
Union Station	8827	1				1					1	1		1.8

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE									OFF-PEAK SERVICE			Trn/hr
Milwaukee -- West (MW)		2205									c--ee--c			
Headway		60	1	1	1	1	1	1	1	1	60	90	1	1
Direction		Up									Up	Dn		
Big Timber	9888					0								0
Elgin	9816	1				1						1		0.6666
National Street	9817	1				1						1		0.6666
Bartlett	9818	1				1					1	1		1.6666
Hanover Park	9819	1				1					1	1		1.6666
! Schaumburg	9887	1				1					1	1		1.6666
Roselle	9820	1				1					1	1		1.6666
Medinah	9821	1				1					1	1		1.6666
Itasca	9822	1				1					1	1		1.6666
Wood Dale	9823	1				1					1	1		1.6666
Bensenville	9824	1				1					1	1		1.6666
Mannheim	9825	1				1					1			1
Franklin Park	9826	1				1					1	1		1.6666
River Grove	9827	1				1					1	1		1.6666
Elmwood Park	9828	1				1					1	1		1.6666
Mont Clare	9829	1				1					1	1		1.6666
Mars	9830	1				1								0
Galewood	9831	1				1					1	1		1.6666
Hanson Park	9832	1				1								0
Cragin	9833	1				1								0
Hermosa	9834	1				1								0
Western Avenue	9835	1				1								0
Union Station	8827	1				1					1	1		1.6666
Norfolk Southern (NS)														
Headway		1	1	1	1		1	1	1	1	1	1	1	
Direction														
Orland Park	8807					0								0
! Southmoor	8808					0								0
Palos Park	8809					0								0
Worth	8810					0								0
Chicago Ridge	8811					0								0
Oak Lawn	8812					0								0
! Ashburn	8813					0								0
Landers	8815					0								0
! Western	8817					0								0
! Ashland	8818					0								0
! Racine	8821					0								0
! Halsted	8824					0								0
! Englewood	8825					0								0
! 47th	8826					0								0
Union Station	8827					0								0
Rock Island -- Beverly (RKB)														
Headway		1	1	1	1		1	1	1	1	1	1	1	
Direction														
Blue Island/Vermont	9984					0								0
Prarie Street	9983					0								0
123rd	9982					0								0
119th	9981					0								0
115th	9980					0								0
111th	9979					0								0
107th	9978					0								0
103rd	9977					0								0

Worksheet Showing 1985 Trains

			REVERSE PEAK SERVICE	Trn/hr		OFF-PEAK SERVICE	Trn/hr
	99th	9976		0			0
	95th	9975		0			0
	91st	9974		0			0
	Brainard	9973		0			0
	Gresham	9972		0			0
!	Auburn Park	9971		0			0
!	Hamlin Park	9970		0			0
!	Englewood	9969		0			0
	LaSalle	9968		0			0

Rock Island -- Main (RKM)		505										rkb#1	rkb#2	rkm#1	rkm#2		
Headway		60	1	1	1		1	1	1	120	90	90	110				
Direction		Up								Dn	Up	Dn	Up				
	Joliet	9940	1				1			1	1						1.1666
	New Lennox	9994	1				1			1	1						1.1666
	Mokena	9993	1				1			1	1						1.1666
	Tinley Park/80th	9988	1				1			1	1						1.1666
	Tinley Park	9992	1				1			1	1						1.1666
	Oak Forest	9991	1				1			1	1						1.1666
	Midlothian	9990	1				1			1	1						1.1666
	Robbins	9989	1				1			1	1						1.1666
	Blue Island/Vermont	9984	1				1			1	1	1	1				2.3787
	Prarie Street	9983	1				1			1	1	1	1				2.3787
	123rd	9982	1				1			1	1	1	1				2.3787
	119th	9981	1				1			1	1	1	1				2.3787
	115th	9980	1				1			1	1	1	1				2.3787
	111th	9979	1				1			1	1	1	1				2.3787
	107th	9978	1				1			1	1	1	1				2.3787
	103rd	9977	1				1			1	1	1	1				2.3787
	99th	9976	1				1			1	1	1	1				2.3787
	95th	9975	1				1			1	1	1	1				2.3787
	91st	9974	1				1			1	1	1	1				2.3787
	Brainard	9973	1				1			1	1	1	1				2.3787
!	Givens	9996					0										0
	Washington Heights	9987					0										0
!	Longwood/99th	9986					0										0
	Manor/95th	9985					0										0
	Gresham	9972	1				1			1	1	1	1				2.3787
!	Auburn Park	9971					0			1	1	1	1				2.3787
!	Hamlin Park	9970					0			1	1	1	1				2.3787
!	Englewood	9969					0			1	1	1	1				2.3787
	LaSalle	9968	1				1			1	1	1	1				2.3787

RAPID TRANSIT			
Evanston Express		evanst	
Headway		8	
Direction		Dn	
	Linden	9584	1
	Central	9585	1
	Noyes	9586	1
	Foster	9587	1
	Davis	9588	1
	Dempster	9589	1
	Main	9590	1
	South Blvd.	9591	1
	Howard	9733	1
	Jarvis	9593	

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE Trn/hr	OFF-PEAK SERVICE Trn/hr
Morse	9594		
Loyola	9595		
Granville	9596		
Thorndale	9597		
Bryn Mawr	9598		
Berwyn	9599		
Argyle	9600		
Lawrence	9601		
Wilson	9602		
Sheridan	9603		
Addison	9604		
Belmont	9746		
Fullerton	9606		
Armitage	9648		
Sedgewick	9649		
Chicago	9650		
Merchandise Mart	9652		
Clark/Lake	9674		
State/Lake	9672		
Randolph/Wabash	9681		
Madison/Wabash	9680		
Adams/Wabash	9679		
LaSalle/Van Buren	9656		
Quincy/Wells	9655		
Madison/Wells	9654		
Randolph/Wells	9653		
Merchandise Mart	9652		
Chicago	9650		
Sedgwick	9649		
Armitage	9648		
Fullerton	9606		
Belmont	9746		
Addison	9604		
Sheridan	9603		
Wilson	9602		
Lawrence	9601		
Argyle	9600		
Berwyn	9599		
Bryn Mawr	9598		
Thorndale	9597		
Granville	9596		
Loyola	9595		
Morse	9594		
Jarvis	9593		
Howard	9733		
South Blvd	9591	1	
Main	9590	1	
Dempster	9589	1	
Davis	9588	1	
Foster	9587	1	
Noyes	9586	1	
Central	9585	1	
Linden	9584	1	

Worksheet Showing 1985 Trains

REVERSE PEAK SERVICETrn/hr OFF--PEAK SERVICE Trn/hr

Howard		howrd	howrdb	
Headway		10	10	
Direction		Dn	Dn	
Howard	9733	1	1	
Jarvis	9593	1		
Morse	9594	1	1	
Loyola	9595	1	1	
Granville	9596		1	
Thorndale	9597	1		
Bryn Mawr	9598	1	1	Loop at 9598
Berwyn	9599		1	
Argyle	9600	1		
Lawrence	9601		1	
Wilson	9602	1	1	
Sheridan	9603	1		
Addison	9604		1	
Belmont	9746	1	1	howrdb goes 9746--9645--9606
Fullerton	9606	1	1	
North/Clybourn	9607	1		
Clark/Division	9608	1	1	
Chicago	9609	1	1	
Grand	9610	1	1	
Washington	9611	1	1	
Monroe	9612	1	1	
Jackson	9613	1	1	
Harrison	9614		1	
Roosevelt	9615	1	1	
35th	9616	1	1	
Indiana	9617	1		
43rd	9618	1	1	
47th	9619	1	1	
51st	9620	1	1	
Garfield	9621	1	1	
58th	9622	1		
Jackson Park				
61st	9628		1	
King Drive	9629		1	
Cottage Grove	9630		1	
University	9631		1	
! Jackson Park	9632			
University	9631			
Cottage Grove	9630		1	
King Drive	9629		1	
61st	9628		1	
Englewood				
Wentworth	9623	1		
Harvard	9624	1		
Halsted	9625	1		
Racine	9626	1		
Ashland	9627	1		
Racine	9626	1		
Halsted	9625	1		
Harvard	9624	1		
Wentworth	9623	1		

Worksheet Showing 1985 Trains

South Main		REVERSE PEAK SERVICE Trn/hr		OFF-PEAK SERVICE Trn/hr	
58th	9622	1			
Garfield	9621	1	1		
51st	9620	1	1		
47th	9619	1	1		
43rd	9618	1	1		
Indiana	9617	1			
35th	9616	1	1		
Roosevelt	9615	1	1		
Harrison	9614		1		
Jackson	9613	1	1		
Monroe	9612	1	1		
Washington	9611	1	1		
Grand	9610	1	1		
Chicago	9609	1	1		
Clark/Division	9608	1	1		
North/Clybourn	9607	1			
Fullerton	9606	1	1		
Belmont	9746	1	1	howrdb goes 9606-9646-9645-9746	
Addison	9604		1		
Sheridan	9603	1			
Wilson	9602	1	1		
Lawrence	9601		1		
Argyle	9600	1			
Berwyn	9599		1		
Bryn Mawr	9598	1	1		
Thorndale	9597	1		Loop at 9598	
Granville	9596		1		
Loyola	9595	1	1	14 min dwell at 9595	
Morse	9594	1	1		
Jarvis	9593	1			
Howard	9733	1	1		

Lake		lakea	lakeb
Headway		10	10
Direction		Dn	Dn
Harlem	9683	1	1
Oak Park	9684	1	1
Ridgeland	9685	1	1
Austin	9686	1	1
Central	9687	1	1
Laramie	9688	1	1
Cicero	9689	1	1
Pulaski	9690	1	1
Homan	9691		1
Kedzie	9692	1	
California	9693		1
Ashland	9694	1	
Halsted	9695		1
Clinton/NW Passage	9676	1	1
Clark/Lake	9674	1	1
State/Lake	9672	1	1
Randolph/Wabash	9681	1	1
Madison/Wabash	9680	1	1
Adams/Wabash	9679	1	1
Roosevelt	9615		
Cermack	9736		1

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE	Trn/hr	OFF-PEAK SERVICE	Trn/hr
35th	9737	1	1		
47th	9738	1			
Garfield	9739		1		
63rd	9740	1			
69th	9741	1	1		
79th	9742	1	1		
87th	9743	1	1		
95th	9744	1	1		
87th	9743	1	1		
79th	9742	1	1		
69th	9741	1	1		
63rd	9740	1			
Garfield	9739		1		
47th	9738	1			
35th	9737	1	1		
Cermack	9736		1		
Roosevelt	9615				
Adams/Wabash	9679	1	1		
Madison/Wabash	9680	1	1		
Randolph/Wabash	9681	1	1		
State/Lake	9672	1	1		
Clark/Lake	9674	1	1		
Clinton/NW Passage	9676	1	1		
Halsted	9695		1		
Ashland	9694	1			
California	9693		1		
Kedzie	9692	1			
Homan	9691		1		
Pulaski	9690	1	1		
Cicero	9689	1	1		
Laramie	9688	1	1		
Central	9687	1	1		
Austin	9686	1	1		
Ridgeland	9685	1	1		
Oak Park	9684	1	1		
Harlem	9683	1	1		

OHare/Douglas		ohareb	ohareb
Headway		8	8
Direction		Dn	Dn
O'Hare	9583	1	1
River Road	9582	1	1
Cumberland	9581	1	1
Harlem	9580	1	1
Jefferson Park	9673	1	1
Montrose	9647		1
Irving Park	9659	1	1
Addison	9671	1	
Belmont	9675	1	1
Logan Square	9660	1	1
California	9661		1
Western	9662	1	
Damen	9663	1	1
Division	9664	1	1
Chicago	9665		1
Grand	9666	1	
Lake Transfer	9731	1	1

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE Trn/hr		OFF–PEAK SERVICE	Trn/hr
Washington	9670	1	1		
Monroe	9658	1	1		
Jackson	9657	1	1		
LaSalle	9678	1	1		
Clinton	9677	1	1		
U of I	9708	1	1		
Racine	9707	1	1		
Congress St Line					
Medical Center	9706		1		
Western	9705		1		
Kedzie	9703		1		
Pulaski	9702		1		
Cicero	9700		1		
Austin	9699		1		
Oak Park	9698		1		
Harlem	9697		1		
Des Plaines	9696		1		
Harlem	9697		1		
Oak Park	9698		1		
Austin	9699		1		
Cicero	9700		1		
Pulaski	9702		1		
Kedzie	9703		1		
Western	9705		1		
Medical Center	9706		1		
Douglas Line					
Polk	9720	1			
18th	9719	1			
Hoyne	9718	1			
Western	9717	1			
California	9716	1			
Kedzie	9715	1			
Central Park	9714	1			
Pulaski	9713	1			
Kildare	9712	1			
Cicero	9711	1			
Laramie	9710	1			
Cicero–Berwyn	9709	1			
Laramie	9710	1			
Cicero	9711	1			
Kildare	9712	1			
Pulaski	9713	1			
Central Park	9714	1			
Kedzie	9715	1			
California	9716	1			
Western	9717	1			
Hoyne	9718	1			
18th	9719	1			
Polk	9720	1			
End Douglas Line					
Racine	9707	1	1		
U of I	9708	1	1		
Clinton	9677	1	1		
LaSalle	9678	1	1		
Jackson	9657	1	1		
Monroe	9658	1	1		
Washington	9670	1	1		

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE	Trn/hr	OFF--PEAK SERVICE	Trn/hr
Lake Transfer	9731	1	1		
Grand	9666	1			
Chicago	9665		1		
Division	9664	1	1		
Damen	9663	1	1		
Western	9662	1			
California	9661		1		
Logan Square	9660	1	1		
Belmont	9675	1	1		
Addison	9671	1			
Irving Park	9659	1	1		
Montrose	9647		1		
Jefferson Park	9673	1	1		
Harlem	9580	1	1		
Cumberland	9581	1	1		
River Road	9582	1	1		
O'Hare	9583	1	1		

Ravenswood		raven
Headway		8
Direction		Dn
Kimball	9633	1
Kedzie	9634	1
Francisco	9635	1
Rockwell	9636	1
Western	9637	1
Damen	9638	1
Montrose	9639	1
Irving Park	9640	1
Addison	9641	1
Paulina	9642	1
Southport	9643	1
Belmont	9746	1
Wellington	9645	1
Diversey	9646	1
Fullerton	9606	1
Armitage	9648	1
Sedgwick	9649	1
Chicago	9650	1
Merchandise Mart	9652	1
Randolph/Wells	9653	1
Madison/Wells	9654	1
Quincy/Wells	9655	1
LaSalle/Van Buren	9656	1
Adams/Wabash	9679	1
Madison/Wabash	9680	1
Randolph/Wabash	9681	1
State/Lake	9672	1
Clark/Lake	9674	1
Merchandise Mart	9652	1
Chicago	9650	1
Sedgwick	9649	1
Armitage	9648	1
Fullerton	9606	1
Diversey	9646	1
Wellington	9645	1
Belmont	9746	1

Worksheet Showing 1985 Trains

		REVERSE PEAK SERVICE Trn/hr	OFF–PEAK SERVICE	Trn/hr
Southport	9643	1		
Paulina	9642	1		
Addison	9641	1		
Irving Park	9640	1		
Montrose	9639	1		
Damen	9638	1		
Western	9637	1		
Rockwell	9636	1		
Francisco	9635	1		
Kedzie	9634	1		
Kimball	9633	1		

Skokie Swift
Headway
Direction

Dempster	9605			
Howard	9733			
Dempster	9605			

Worksheet Showing 1990 Trains

		PEAK SERVICE												Trn/hr
==========			CNW	CNW	CNW	CNW	CNW	CNW	CNW	CNW				
C&NW -- Northwest			610	612	614	616	618	620	622	608				
Headway		1	60	60	60	60	60	60	60	60	1	1	1	1
Direction			Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn				
Speed			70	70	70	70	70	70	70	70				
Mode			c	c	c	c	c	c	c	c				
Vehicle			1	1	1	1	1	1	1	1				
Dwell			2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06				
Lake Geneva	9938	x	x	x	x	x	x	x		x				0
Pell Lake	9939	x	x	x	x	x	x	x		x				0
Genoa City	9995	x	x	x	x	x	x	x		x				0
Richmond	9996	x	x	x	x	x	x	x		x				0
Ringwood	9997	x	x	x	x	x	x	x		x				0
McHenry	9998	x	x	x	x	x	x	x	1	x				1
Harvard	9794		1					1	x					2
Hartland	9793								x					0
Woodstock	9792		1					1	x					2
Crystal Lake	9791		1		1	1		1	x					4
	9837													0
Cary	9790		1		1			1	1					4
Fox River Grove	9789		1		1			1	1					4
Barrington	9788		1	1	1			1	1	1				6
Palatine	9787			1	1	1		1		1				5
Arlington Park	9840		1	1	1		1			1				5
Arlington Heights	9785			1	1	1	1			1				5
Mt. Prospect	9784			1	1		1			1				4
Cumberland	9783				1			1		1				3
Des Plaines	9782		1	1	1	1			1					5
Dee Road	9781			1		1			1					3
Park Ridge	9780			1	1	1			1					4
Edison Park	9779			1		1								2
Norwood Park	9778			1		1								2
Gladston Park	9777			1										1
Jefferson Park	9776			1		1								2
Irving Park	9775			1		1								2
Clybourn	9749		1	1	1	1	1	1	1	1				8
CNW Station	9748		1	1	1	1	1	1	1	1				8
==========		CNWW		CNW\C	NW\C	NW\C	NW\C	NW\C	NW\C	NWW				
C&NW -- West		22		20	24	26	28	30	32	34				
Headway		60	1	30	60	60	60	60	60	60	1	1	1	
Direction		Dn		Dn	Dn	Dn	Dn	Dn	Dn	Dn				
Speed		70		70	70	70	70	70	70	70				
Mode		c		c	c	c	c	c	c	c				
Vehicle		1		1	1	1	1	1	1	1				
Dwell		1.44		1.44	1.44	1.44	1.44	1.44	1.44	1.44				
Geneva	9814				1			1		1				3
West Chicago	9813	1				1	1	1	1	1				6
Winfield	9812				1		1	1	1					4
Wheaton	9811				1		1		1	1				4
College Avenue	9810				1		1		1					3
Glen Ellyn	9809	1			1		1		1	1				5
Lombard	9808	1					1	1	1					4
Villa Park	9807	1				1		1	1					4
Elmhurst	9806	1		1		1		1	1					6
Berkeley	9805			1					1					3
Bellwood	9804			1				1						3
Melrose Park	9803			1				1						3
Maywood	9802			1				1						3
River Forest	9801			1					1					3
Oak Park	9800			1		1			1					4
Kedzie	9799			1	1									3
CNW Station	9748	1		1	1	1	1	1	1	1				9

Worksheet Showing 1990 Trains

		PEAK SERVICE												Trn/hr
==========		CSB	CSB	CSB										
Chicago, S.S. & S.B.		10	106	108										
Headway		30	60	60	1	1	1	1	1	1	1	1	1	
Direction		Dn	Dn	Dn										
Speed		65	65	65										
Mode		c	c	c										
Vehicle		1	1	1										
Dwell		0.9	0.9	0.9										
Gary (Metro Center)	9874	1	1	1										4
Gary	9875		1	1										2
East Chicago	9876	1	1	1										4
Hammond	9877	1	1	1										4
Hegewisch	9878	1		1										3
	9879													0
Kensington/115th	9910	a	a											0
Pullman/111th	9909													0
107th	9908													0
103rd	9907													0
95th	9906													0
91st	9905													0
87th	9904													0
83rd	9903													0
79th	9902													0
75th	9901													0
	9900													0
63rd	9899	a												0
U of C/59th	9898	a	a											0
55–57th	9897													0
Hyde Park/53rd	9896													0
Kenwood/47th	9895													0
27th	9894													0
23rd	9893													0
18th	9892													0
Roosevelt	9891	a	a											0
Van Buren	9967	a	a	a										0
Randolph	9966	1	1	1										4

Appendix C
1990 Rapid Transit and Commuter Rail Stopping Patterns and Headways

Worksheet Showing 1990 Trains

		PEAK SERVICE												Trn/hr
==========			BN	BN	BN	BN	BN	BN	BN	BN				
Burlington Northern			1210	1212	1214	1208	1206	1222	1226	1230				
Headway		1	20	60	30	20	30	60	60	60	1	1	1	
Direction			Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn				
Speed			65	65	65	65	65	65	65	65				
Mode			c	c	c	c	c	c	c	c				
Vehicles			1	1	1	1	1	1	1	1				
Stop Dwell			1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49				
Aurora	9941		1				1							5
Naperville	9942		1				1		1					6
Lisle	9943					1	1		1					6
Belmont	9944					1	1		1					6
Main	9945					1	1		1					6
Fairview	9946				1		1	1	1	1				7
Westmont	9947				1		1	1	1					6
Clarendon Hills	9948				1		1	1	1					6
West Hinsdale	9949				1		1		1					5
Hinsdale	9950				1		1	1	1	1				7
Highlands	9951			1			1		1	1				5
Western Springs	9952			1			1	1	1	1				6
Stone Avenue	9953			1			1	1	1	1				6
La Grange	9954			1			1	1	1	1				6
Congress Park	9955						1		1					3
Brookfield	9956						1		1					3
Hollywood	9957						1		1					3
Riverside	9958						1		1					3
Harlem	9959						1		1					3
Berwyn	9960						1		1					3
LaVergne	9961						1		1					3
Clyde	9962						1		1					3
Cicero	9963						1		1					3
Western	9964						1		1					3
Halsted	9965						1		1					3
Union Station	8827		1	1	1	1	1	1	1	1				14
==========		CNN	CNN			CNN	CNN	CNN						
C&NW–North		306	312			314	316	318						
Headway		30	30	1	1	60	60	60	1	1	1	1	1	
Direction		Dn	Dn			Dn	Dn	Dn						
Speed		70	70			70	70	70						
Mode		c	c			c	c	c						
Vehicles		1	1			1	1	1						
Dwell		1.46	1.46			1.46	1.46	1.46						
Kenosha	9773	1					1							3
Winthrop Harbor	9772	1												2
Zion	9771	1					1							3
Waukegan	9770	1				1	1	1						5
North Chicago	9769	1				1		1						4
Great Lakes	9768													0
Lake Bluff	9767	1					1	1						4
Lake Forest	9766	1				1		1						4
Fort Sheridan	9765	1					1	1						4
Highwood	9764	1					1	1						4
Highland Park	9763	1				1		1						4
Ravinia	9762	1					1							3
Braeside	9761	1					1							3
Glencoe	9760	1				1		1						4
Hubbard Woods	9759	1				1								3
Winnetka	9758	1	1				1	1						6
Indian Hills	9757	1	1					1						5
Kenilworth	9756	1	1					1						5
Wilmette	9755	1	1					1						5
Central	9754	1	1					1						5
Evanston	9753	1	1			1	1	1						7
Main	9752		1				1							3
Rogers Park	9751		1					1						3
Ravenswood	9750		1											2
Clybourn	9749	1	1			1	1	1						7
CNW Station	9748	1	1			1	1	1						7

Worksheet Showing 1990 Trains

		PEAK SERVICE												Trn/hr
==========			RKB	RKB										
Rock Island -- Beverly			606	610										
Headway		1	20	60	1	1	1	1	1	1	1	1	1	
Direction			Dn	Dn										
Speed			30	30										
Mode			c	c										
Vehicle			1	1										
Dwell			1.5	1.5										
Blue Island/Vermont	9984		1											3
Prarie Street	9983		1	1										4
123rd	9982		1	1										4
119th	9981		1	1										4
115th	9980		1	1										4
111th	9979		1	1										4
107th	9978		1	1										4
103rd	9977		1	1										4
99th	9976		1	1										4
95th	9975		1	1										4
91st	9974		1	1										4
Brainard	9973		1	1										4
Gresham	9972		1	1										4
! Auburn Park	9971													0
! Hamlin Park	9970													0
! Englewood	9969													0
LaSalle	9968		1	1										4
==========		RKM		RKM	RKM	RKM								
Rock Island -- Main		412		408	414	410								
Headway		60	1	60	60	60	1	1	1	1	1	1	1	
Direction		Dn		Dn	Dn	Dn								
Speed		70		70	70	70								
Mode		c		c	c	c								
Vehicle		1		1	1	1								
Dwell		1.5		1.5	1.5	1.5								
Joliet	9940	1		1	1	1								4
New Lennox	9994	1		1	1	1								4
Mokena	9993	1		1	1	1								4
Tinley Park/80th	9988	1		1	1	1								4
Tinley Park	9992	1		1	1	1								4
Oak Forest	9991	1		1	1	1								4
Midlothian	9990	1		1	1	1								4
Robbins	9989			1										1
Blue Island/Vermont	9984	1		1		1								3
Prarie Street	9983	x		x	x	x								0
123rd	9982	x		x	x	x								0
119th	9981	x		x	x	x								0
115th	9980	x		x	x	x								0
111th	9979	x		x	x	x								0
107th	9978	x		x	x	x								0
103rd	9977	x		x	x	x								0
99th	9976	x		x	x	x								0
95th	9975	x		x	x	x								0
91st	9974	x		x	x	x								0
Brainard	9973	x		x	x	x								0
! Givens	9996	x		x	x	x								0
Washington Heights	9987													0
! Longwood/99th	9986													0
Manor/95th	9985					1								1
Gresham	9972													0
! Auburn Park	9971													0
! Hamlin Park	9970													0
! Englewood	9969													0
LaSalle	9968	1		1	1	1								4

Worksheet Showing 1990 Trains

PEAK SERVICE

Trn/hr

RAPID TRANSIT

==========		evan
Evanston		st
Headway		9.1
Direction		Dn
Speed		25
Mode		r
Vehicle		3
Dwell		0.45
Linden	9584	1
Central	9585	1
Noyes	9586	1
Foster	9587	1
Davis	9588	1
Dempster	9589	1
Main	9590	1
South Blvd.	9591	1
Howard	9733	1
Jarvis	9593	
Morse	9594	
Loyola	9595	
Granville	9596	
Thorndale	9597	
Bryn Mawr	9598	
Berwyn	9599	
Argyle	9600	
Lawrence	9601	
Wilson	9602	
Sheridan	9603	
Addison	9604	
Belmont	9746	1
Fullerton	9606	1
Armitage	9648	
Sedgewick	9649	
Chicago	9650	1
Merchandise Mart	9652	1
Clark/Lake	9674	1
State/Lake	9672	1
Randolph/Wabash	9681	1
Madison/Wabash	9680	1
Adams/Wabash	9679	1
LaSalle/Van Buren	9656	1
Quincy/Wells	9655	1
Madison/Wells	9654	1
Randolph/Wells	9653	1
Merchandise Mart	9652	1
Chicago	9650	1
Sedgwick	9649	
Armitage	9648	
Fullerton	9606	1
Belmont	9746	1
Addison	9604	
Sheridan	9603	
Wilson	9602	
Lawrence	9601	
Argyle	9600	
Berwyn	9599	
Bryn Mawr	9598	
Thorndale	9597	
Granville	9596	
Loyola	9595	
Morse	9594	
Jarvis	9593	
Howard	9733	1
South Blvd	9591	1
Main	9590	1
Dempster	9589	1
Davis	9588	1

Worksheet Showing 1990 Trains

		PEAK SERVICE	Trn/hr
Foster	9587	1	
Noyes	9586	1	
Central	9585	1	
Linden	9584	1	

Worksheet Showing 1990 Trains

PEAK SERVICE

Trn/hr

		how rda	how rdb
Howard			
Headway		7	7
Direction		Dn	Dn
Speed		55	55
Mode		r	r
Vehicle		3	3
Dwell		0.45	0.45
Howard	9733	1	1
Jarvis	9593	1	
Morse	9594	1	1
Loyola	9595	1	1
Granville	9596		1
Thorndale	9597	1	
Bryn Mawr	9598	1	1
Berwyn	9599		1
Argyle	9600	1	
Lawrence	9601		1
Wilson	9602	1	1
Sheridan	9603	1	
Addison	9604		1
Belmont	9746	1	1
Fullerton	9606	1	1
North/Clybourn	9607	1	
Clark/Division	9608	1	1
Chicago	9609	1	1
Grand	9610	1	1
Washington	9611	1	1
Monroe	9612	1	1
Jackson	9613	1	1
Harrison	9614		1
Roosevelt	9615	1	1
35th	9616	1	1
Indiana	9617	1	
43rd	9618	1	1
47th	9619	1	1
51st	9620	1	1
Garfield	9621	1	1
58th	9622	1	
Jackson Park		x	x
61st	9628	x	1
King Drive	9629	x	a
Cottage Grove	9630	x	a
University	9631	x	1
Jackson Park	9632	x	x
University	9631	x	x
Cottage Grove	9630	x	1
King Drive	9629	x	1
61st	9628	x	1
Englewood		x	x
Wentworth	9623	1	x
Harvard	9624	1	x
Halsted	9625	1	x
Racine	9626	1	x
Ashland	9627	1	x
Racine	9626	1	x
Halsted	9625	1	x
Harvard	9624	1	x
Wentworth	9623	1	x
South Main		x	x
58th	9622	1	
Garfield	9621	1	1
51st	9620	1	1
47th	9619	1	1
43rd	9618	1	1
Indiana	9617	1	
35th	9616	1	1
Roosevelt	9615	1	1
Harrison	9614		1

Worksheet Showing 1990 Trains

PEAK SERVICE

Trn/hr

==========		ohare	ohare
OHare/Douglas		a	b
Headway		7	7
Direction		Dn	Dn
Speed		55	55
Mode		r	r
Vehicle		3	3
Dwell		0.45	0.45
O'Hare	9583	1	1
River Road	9582	1	1
Cumberland	9581	1	1
Harlem	9580	1	1
Jefferson Park	9673	1	1
Montrose	9647	1	
Irving Park	9659	1	1
Addison	9671		1
Belmont	9675	1	1
Logan Square	9660	1	1
California	9661	1	
Western	9662		1
Damen	9663	1	1
Division	9664	1	1
Chicago	9665	1	
Grand	9666		1
Lake Transfer	9731	1	1
Washington	9670	1	1
Monroe	9658	1	1
Jackson	9657	1	1
LaSalle	9678	1	1
Clinton	9677	1	1
U of I	9708	1	1
Racine	9707	1	1
Congress St Line		s	x
Medical Center	9706	1	x
Western	9705	1	x
Kedzie	9703	1	x
Pulaski	9702	1	x
Cicero	9700	1	x
Austin	9699	1	x
Oak Park	9698	1	x
Harlem	9697	1	x
Des Plaines	9696	1	x
Harlem	9697	1	x
Oak Park	9698	1	x
Austin	9699	1	x
Cicero	9700	1	x
Pulaski	9702	1	x
Kedzie	9703	1	x
Western	9705	1	x
Medical Center	9706	1	x
Douglas Line		x	x
Polk	9720	x	1
18th	9719	x	1
Hoyne	9718	x	1
Western	9717	x	1
California	9716	x	1
Kedzie	9715	x	1
Central Park	9714	x	1
Pulaski	9713	x	1
Kildare	9712	x	1
Cicero	9711	x	1
Laramie	9710	x	1
Cicero–Berwyn	9709	x	1
Laramie	9710	x	1
Cicero	9711	x	1
Kildare	9712	x	1
Pulaski	9713	x	1
Central Park	9714	x	1
Kedzie	9715	x	1

Worksheet Showing 1990 Trains

		PEAK SERVICE		Trn/hr
California	9716	x	1	
Western	9717	x	1	
Hoyne	9718	x	1	
18th	9719	x	1	
Polk	9720	x	1	
End Douglas Line		x	x	
Racine	9707	1	1	
U of I	9708	1	1	
Clinton	9677	1	1	
LaSalle	9678	1	1	
Jackson	9657	1	1	
Monroe	9658	1	1	
Washington	9670	1	1	
Lake Transfer	9731	1	1	
Grand	9666		1	
Chicago	9665	1		
Division	9664	1	1	
Damen	9663	1	1	
Western	9662		1	
California	9661	1		
Logan Square	9660	1	1	
Belmont	9675	1	1	
Addison	9671		1	
Irving Park	9659	1	1	
Montrose	9647	1		
Jefferson Park	9673	1	1	
Harlem	9580	1	1	
Cumberland	9581	1	1	
River Road	9582	1	1	
O'Hare	9583	1	1	

Worksheet Showing 1990 Trains

		PEAK SERVICE		Trn/hr
Jackson	9613	1	1	
Monroe	9612	1	1	
Washington	9611	1	1	
Grand	9610	1	1	
Chicago	9609	1	1	
Clark/Division	9608	1	1	
North/Clybourn	9607	1		
Fullerton	9606	1	1	
Belmont	9746	1	1	
Addison	9604		1	
Sheridan	9603	1		
Wilson	9602	1	1	
Lawrence	9601		1	
Argyle	9600	1		
Berwyn	9599		1	
Bryn Mawr	9598	1	1	
Thorndale	9597	1		
Granville	9596		1	
Loyola	9595	1	1	
Morse	9594	1	1	
Jarvis	9593	1		
Howard	9733	1	1	

Worksheet Showing 1990 Trains

		PEAK SERVICE		Trn/hr
==========		lakea	lakeb	
Lake				
Headway		7.8	7.8	
Direction		Dn	Dn	
Speed		55	55	
Mode		r	r	
Vehicle		3	3	
Dwell		0.45	0.45	
Harlem	9683	1	1	
Oak Park	9684	1	1	
Ridgeland	9685	1	1	
Austin	9686	1	1	
Central	9687	1	1	
Laramie	9688	1	1	
Cicero	9689	1	1	
Pulaski	9690	1	1	
Homan	9691		1	
Kedzie	9692	1		
California	9693		1	
Ashland	9694	1		
Halsted	9695		1	
Clinton/NW Passage	9676	1	1	
Clark/Lake	9674	1	1	
State/Lake	9672	1	1	
Randolph/Wabash	9681	1	1	
Madison/Wabash	9680	1	1	
Adams/Wabash	9679	1	1	
Roosevelt	9615			
Cermack	9736		1	
35th	9737	1	1	
47th	9738	1		
Garfield	9739		1	
63rd	9740	1		
69th	9741	1	1	
79th	9742	1	1	
87th	9743	1	1	
95th	9744	1	1	
87th	9743	1	1	
79th	9742	1	1	
69th	9741	1	1	
63rd	9740	1		
Garfield	9739		1	
47th	9738	1		
35th	9737	1	1	
Cermack	9736		1	
Roosevelt	9615			
Adams/Wabash	9679	1	1	
Madison/Wabash	9680	1	1	
Randolph/Wabash	9681	1	1	
State/Lake	9672	1	1	
Clark/Lake	9674	1	1	
Clinton/NW Passage	9676	1	1	
Halsted	9695		1	
Ashland	9694	1		
California	9693		1	
Kedzie	9692	1		
Homan	9691		1	
Pulaski	9690	1	1	
Cicero	9689	1	1	
Laramie	9688	a	a	
Central	9687	1	1	
Austin	9686	1	1	
Ridgeland	9685	1	1	
Oak Park	9684	1	1	
Harlem	9683	1	1	

Worksheet Showing 1990 Trains

PEAK SERVICE

Trn/hr

		raven	raven
Ravenswood		a	b
Headway		8.8	8.8
Direction		Dn	Dn
Speed		55	55
Mode		r	r
		3	3
		0.45	0.45
Kimball	9633	1	1
Kedzie	9634	1	1
Francisco	9635	1	
Rockwell	9636		1
Western	9637	1	1
Damen	9638	1	
Montrose	9639		1
Irving Park	9640	1	1
Addison	9641	1	
Paulina	9642	1	
Southport	9643		1
Belmont	9746	1	1
Wellington	9645	1	
Diversey	9646	1	1
Fullerton	9606	1	1
Armitage	9648	1	1
Sedgwick	9649		1
Chicago	9650	1	1
Merchandise Mart	9652	1	1
Randolph/Wells	9653	1	1
Madison/Wells	9654	1	1
Quincy/Wells	9655	1	1
LaSalle/Van Buren	9656	1	1
Adams/Wabash	9679	1	1
Madison/Wabash	9680	1	1
Randolph/Wabash	9681	1	1
State/Lake	9672	1	1
Clark/Lake	9674	1	1
Merchandise Mart	9652	1	1
Chicago	9650	1	1
Sedgwick	9649		1
Armitage	9648	1	1
Fullerton	9606	1	1
Diversey	9646	1	1
Wellington	9645	1	
Belmont	9746	1	1
Southport	9643		1
Paulina	9642	1	
Addison	9641	1	
Irving Park	9640	1	1
Montrose	9639		1
Damen	9638	1	
Western	9637	1	1
Rockwell	9636		1
Francisco	9635	1	
Kedzie	9634	1	1
Kimball	9633	1	1

		sko
Skokie Swift		kie
Headway		7
Direction		Dn
Speed		55
Mode		r
Vehicle		3
Dwell		0.45
Dempster	9605	1
Howard	9733	1
Dempster	9605	1

Worksheet Showing 1990 Trains

PEAK SERVICE

==========			EBI	EBI	EBI									Trn/hr
Metra Elec–Blue Island			502	504	500									
Headway		1	60	60	60	1	1	1	1	1	1	1	1	
Direction			Dn	Dn	Dn									
Speed			35	35	35									
Mode			c	c	c									
Vehicle			2	2	2									
Dwell			0.9	0.9	0.9									
Blue Island	9937		1	1	1									3
Burr Oak	9936		1	1	1									3
Ashland Avenue	9935		1	1	1									3
Racine Avenue	9934		1	1	1									3
West Pullman	9933		1	1	1									3
Stewart Ridge	9932		1	1	1									3
State Street	9931		1	1	1									3
Kensington/115th	9910		1	1										2
Pullman/111th	9909													0
107th	9908													0
103rd	9907													0
95th	9906													0
91st	9905													0
87th	9904													0
83rd	9903													0
79th	9902													0
75th	9901													0
	9900													0
63rd	9899													0
U of C/59th	9898				1									1
55–57th	9897		1		1									2
Hyde Park/53rd	9896				1									1
Kenwood/47th	9895													0
27th	9894													0
23rd	9893													0
18th	9892													0
Roosevelt	9891		1	1	1									3
Van Buren	9967		1	1	1									3
Randolph	9966		1	1	1									3

Worksheet Showing 1990 Trains

		PEAK SERVICE														Trn/hr
==========		EML	EML	EML	EML	EML	EML	EML	EML	EML	EML	EML	EML	EML	EML	
Metra Elec–Main		706	106	700	604	702	704	730	734	736	752	754	758	732	750	
Headway		60	60	60	60	60	60	60	60	60	60	30	60	60	60	
Direction		Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn	Dn	
Speed		65	65	65	65	65	65	65	65	65	65	65	65	65	65	
Mode		c	c	c	c	c	c	c	c	c	c	c	c	c	c	
Vehicle		2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Dwell		0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	
University Park	9890	1	1	1		1	1									5
Richton Park	9922	1	1	1		1	1									5
Matteson	9921	1	1	1		1	1									5
211th	9920	1	1	1		1	1									5
Olympia Fields	9919	1	1	1		1	1									5
Flossmoor	9918		1					1	1	1				1		5
Homewood	9917		1					1	1	1				1		5
Calumet	9916		1					1	1	1				1		5
Hazel Crest	9915		1					1	1	1				1		5
Harvey	9914		1								1	1	1		1	6
147th	9913		1								1	1	1		1	6
Ivanhoe	9912		1								1	1	1		1	6
Riverdale	9911		1								1	1	1		1	6
Kensington/115th	9910	1	1		1					1	1	1	1		1	9
Pullman/111th	9909		1		1											2
107th	9908		1		1											2
103rd	9907		1		1											2
95th	9906		1		1											2
91st	9905		1		1											2
87th	9904		1		1											2
83rd	9903		1		1											2
79th	9902		1		1											2
75th	9901		1		1											2
	9900															0
63rd	9899		1		1											2
U of C/59th	9898		1	1	1			1					1		1	6
55–57th	9897		1		1	1					1			1		5
Hyde Park/53rd	9896		1		1								1			3
Kenwood/47th	9895		1		1											2
27th	9894		1		1											2
23rd	9893		1		1											2
18th	9892		1													1
Roosevelt	9891	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
Van Buren	9967	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
Randolph	9966	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
==========		ESC		ESC												
Metra Elec– S Chicago		400		402												
Headway		60	1	30	1	1	1	1	1	1	1	1	1			
Direction		Dn		Dn												
Speed		30		30												
Mode		c		c												
Vehicle		2		2												
Dwell		0.9		0.9												
91st/South Chicago	9930	1		1												3
87th	9929	1		1												3
83rd	9928	1		1												3
Cheltenham	9927	1		1												3
Windsor Park	9926	1		1												3
South Shore	9925	1		1												3
Bryn Mawr	9924	1		1												3
Stoney Island	9923	1		1												3
U of C/59th	9898	1		1												3
55–57th	9897	1		1												3
Hyde Park/53rd	9896	1		1												3
Kenwood/47th	9895	1														1
27th	9894	1		1												3
23rd	9893	1		1												3
18th	9892															0
Roosevelt	9891	1		1												3
Van Buren	9967	1		1												3
Randolph	9966	1		1												3

Worksheet Showing 1990 Trains

PEAK SERVICE

															Trn/hr
==========		HERT													
Metra Heritage		16													
Headway		30	1	1	1	1	1	1	1	1	1	1	1		
Direction		Dn													
Speed		70													
Mode		c													
Vehicle		1													
Dwell		1.5													
Joliet	9940	1													2
Lockport	9999	1													2
! Lockport – 5th	8816	x													0
Lemont	8799	1													2
Willow Springs	8801	1													2
Summit	8803	1													2
Glenn	8804														0
! Brighton Park	8805														0
! Halsted	8806														0
Union Station	8827	1													2
==========		MN	MN	MN				MN	MN						
Milwaukee – North		2110	2108	2118				2114	2120						
Headway		60	20	60	1	1	1	60	60	1	1	1	1		
Direction		Dn	Dn	Dn				Dn	Dn						
Speed		70	70	70				70	70						
Mode		c	c	c				c	c						
Vehicle		1	1	1				1	1						
Dwell		1.48	1.48	1.48				1.48	1.48						
! Walworth	9886														0
! Zenda	8828														0
! Solon Mills	9839														0
! Spring Grove	9838														0
Fox Lake	9841	1	1	1				1							6
Ingleside	9842							1							1
Wilson Road	9843														0
! Long Lake	9844	1		1				1							3
Round Lake	9845	1		1				1							3
Grayslake	9846	1		1				1							3
Libertyville	9847	1	1	1				1							6
! Rondout	9848														0
Lake Forest	9849		1	1											4
Deerfield	9850		1	1					1						5
Northbrook	9851		1						1						4
! Techny	9836	x	x	x	x	x	x	x	x						0
Glenview	9852		1						1						4
Golf	9853		1						1						4
Morton Grove	9854	1	1					1	1						6
Edgebrook	9855	1		1				1							3
Forest Glen	9856	1		1				1							3
Mayfair	9857	1		1				1							3
Grayland	9858	1		1				1							3
Healy	9859	1		1				1							3
Western Avenue	9835	1	1	1				1	1						7
Union Station	8827	1	1	1				1	1						7

Worksheet Showing 1990 Trains

		PEAK SERVICE											Trn/hr
			MW	MW	MW	MW	MW	MW	MW					
Milwaukee – West			2210	2212	2214	2218	2208	2220	2216					
Headway		1	60	60	60	60	60	60	60	1	1	1	1	
Direction			Dn	Dn	Dn	Dn	Dn	Dn	Dn					
Speed			70	70	70	70	70	70	70					
Mode			c	c	c	c	c	c	c					
Vehicle			1	1	1	1	1	1	1					
Dwell			1.29	1.29	1.29	1.29	1.29	1.29	1.29					
Big Timber	9888		1						1					2
Elgin	9816		1						1					2
National Street	9817		1						1					2
Bartlett	9818		1			1			1					3
Hanover Park	9819		1						1					2
! Schaumburg	9887		1			1			1					3
Roselle	9820		1	1	1		1	1						5
Medinah	9821		1		1			1						3
Itasca	9822		1		1			1						3
Wood Dale	9823		1		1	1		1						4
Bensenville	9824		1		1			1						3
Mannheim	9825			1										1
Franklin Park	9826		1	1	1	1	1	1	1					7
River Grove	9827			1		1	1							3
Elmwood Park	9828			1		1	1							3
Mont Clare	9829			1		1	1							3
Mars	9830			1		1	1							3
Galewood	9831			1		1	1							3
Hanson Park	9832			1		1	1							3
Cragin	9833			1		1	1							3
Hermosa	9834			1		1	1							3
Western Avenue	9835		1	1	1	1	1	1	1					7
Union Station	8827		1	1	1	1	1	1	1					7
		NS												
Norfolk Southern		4												
Headway		30	1	1	1	1	1	1	1	1	1	1	1	
Direction		Dn												
Speed		60												
Mode		c												
Vehicle		1												
Dwell		1.5												
Orland Park	8807	1												2
! Southmoor	8808													0
Palos Park	8809	1												2
Worth	8810	1												2
Chicago Ridge	8811	1												2
Oak Lawn	8812	1												2
! Ashburn	8813	1												2
Landers	8815	1												2
! Western	8817													0
! Ashland	8818													0
! Racine	8821													0
! Halsted	8824													0
! Englewood	8825													0
! 47th	8826													0
Union Station	8827	1												2

Exhibit 4-12
Comparison of 1985 and 1990 Home-Based Work Trip Distribution Results
(Prior to South Corridor Factoring)

Origin Groups		Destination Groups										Total
		1 CBD	2 N Chicago	3 S Chicago	4 N Cook	5 S Cook	6 DuPage	7 Kane	8 Lake	9 McHenry	10 Will	
1	1985	4008	5954	3682	911	396	244	22	56	4	11	15288
	1990	6878	9634	4926	1397	695	508	24	92	4	24	24182
	Difference	71.6%	61.8%	33.8%	53.3%	75.5%	108.2%	9.1%	64.3%	0.0%	118.2%	58.2%
2	1985	242704	433669	81950	158217	24962	26268	1891	5867	404	389	976321
	1990	258763	460629	65572	171405	27175	31959	1341	6411	276	440	1023971
	Difference	6.6%	6.2%	-20.0%	8.3%	8.9%	21.7%	-29.1%	9.3%	-31.7%	13.1%	4.9%
3	1985	275188	99679	422763	32944	90528	20352	1357	1813	141	1762	946527
	1990	300370	96928	358185	32769	98546	24918	875	1907	101	2506	917105
	Difference	9.2%	-2.8%	-15.3%	-0.5%	8.9%	22.4%	-35.5%	5.2%	-28.4%	42.2%	-3.1%
4	1985	88368	108175	15740	446932	16915	63181	14414	26920	2410	407	783462
	1990	102406	116262	13710	510040	19485	90241	17464	39326	2663	383	912000
	Difference	15.9%	7.5%	-12.9%	14.1%	15.2%	42.8%	21.3%	46.1%	10.5%	-5.9%	16.4%
5	1985	105911	50567	122747	49760	333792	65803	3278	2416	291	12563	747148
	1990	161968	50224	110654	42582	364657	72721	1827	1550	169	15956	822308
	Difference	52.9%	-0.7%	-9.9%	-14.5%	9.2%	10.5%	-44.3%	-35.8%	-41.9%	27.0%	10.1%
6	1985	45305	25750	9987	69539	27045	298937	19993	2746	632	4395	504329
	1990	52501	26258	9262	68773	29672	406190	22254	2857	615	6214	624596
	Difference	15.9%	2.0%	-7.3%	-1.1%	9.7%	35.9%	11.3%	4.0%	-2.7%	41.4%	23.8%
7	1985	12254	3687	1391	17079	1718	27494	119236	2109	4233	580	189781
	1990	12866	3611	1136	20938	1786	39017	141664	2702	5187	845	229752
	Difference	5.0%	-2.1%	-18.3%	22.6%	4.0%	41.9%	18.8%	28.1%	22.5%	45.7%	21.1%
8	1985	16014	11843	2461	66637	1451	6441	2228	189605	6628	82	303390
	1990	24137	11769	2447	79632	1442	9046	2511	244753	6898	69	382704
	Difference	50.7%	-0.6%	-0.6%	19.5%	-0.6%	40.4%	12.7%	29.1%	4.1%	-15.9%	26.1%
9	1985	8561	2851	651	11854	407	2668	6386	9722	62083	29	105212
	1990	13376	3332	717	15128	501	4105	8896	14358	75818	36	136267
	Difference	56.2%	16.9%	10.1%	27.6%	23.1%	53.9%	39.3%	47.7%	22.1%	24.1%	29.5%
10	1985	9856	6083	9806	9723	36455	35734	5746	738	108	100018	214267
	1990	28439	5787	8746	7037	41393	45096	4945	480	75	111780	253778
	Difference	188.5%	-4.9%	-10.8%	-27.6%	13.5%	26.2%	-13.9%	-35.0%	-30.6%	11.8%	18.4%
Tot	1985	808169	748258	671178	863616	533669	547122	174551	241992	76934	120236	4785725
	1990	961704	784434	575355	949701	585352	723801	201821	314436	91806	138253	5326663
	Difference	19.0%	4.8%	-14.3%	10.0%	9.7%	32.3%	15.6%	29.9%	19.3%	15.0%	11.3%

Source: KPMG Peat Marwick

Exhibit 4-13
Comparison of 1985 and 1990 Home-Based Non-Work Trip Distribution Results

Origin Groups		Destination Groups							Total
		1 CBD	2 Cook	4 DuPage	5 Kane	6 Lake	7 McHenry	8 Will	
1	1985	5933	9509	21	0	2	0	0	15466
	1990	6693	16712	43	0	3	0	0	23452
	Difference	12.80%	75.75%	105.93%	43.76%	62.18%	-27.08%	116.74%	51.64%
2	1985	158892	5711952	141697	20763	42037	541	10263	6086145
	1990	97844	5683578	148069	20144	43914	342	11138	6005029
	Difference	-38.42%	-0.50%	4.50%	-2.98%	4.46%	-36.80%	8.53%	-1.33%
4	1985	1406	156857	880178	16209	401	23	8220	1063293
	1990	845	186644	985964	19694	477	17	10972	1204613
	Difference	-39.86%	18.99%	12.02%	21.50%	18.94%	-23.85%	33.48%	13.29%
5	1985	36	14027	26391	361488	817	1201	194	404154
	1990	29	20082	32227	395658	847	1278	172	450292
	Difference	-18.26%	43.17%	22.11%	9.45%	3.68%	6.35%	-11.49%	11.42%
6	1985	233	82261	1389	1413	530138	3769	1	619204
	1990	170	103800	2280	1207	595205	2517	3	705183
	Difference	-26.86%	26.18%	64.18%	-14.53%	12.27%	-33.21%	144.39%	13.89%
7	1985	8	4148	354	16819	19861	161253	0	202443
	1990	14	10774	814	22055	23855	172632	1	230145
	Difference	67.67%	159.73%	130.25%	31.13%	20.11%	7.06%	370.06%	13.68%
8	1985	488	79266	34603	1189	17	0	322317	437880
	1990	325	90816	62438	1666	20	0	323615	478880
	Difference	-33.51%	14.57%	80.44%	40.16%	15.57%	-15.64%	0.40%	9.36%
Tot	1985	166996	6058020	1084631	417881	593273	166788	340995	8828585
	1990	105920	6112404	1231836	460425	664321	176787	345902	9097594
	Difference	-36.57%	0.90%	13.57%	10.18%	11.98%	5.99%	1.44%	3.05%

Source: KPMG Peat Marwick

Worksheet Showing 1985 Trains

PEAK SERVICE

Trn/hr

Howard		HOWRDA	HOWRDB	
Headway		3.9	309	
Direction		Dn	Dn	
Howard	9733	1	1	
Jarvis	9593	1		
Morse	9594	1	1	
Loyola	9595	1	1	
Granville	9596		1	
Thorndale	9597	1		
Bryn Mawr	9598	1	1	Note: These Lines have an extra loop
Berwyn	9599		1	9598–9599–9598–9600
Argyle	9600	1		
Lawrence	9601		1	
Wilson	9602	1	1	
Sheridan	9603	1		
Addison	9604		1	
Belmont	9746	1	1	
Fullerton	9606	1	1	
North/Clybourn	9607	1		
Clark/Division	9608	1	1	
Chicago	9609	1	1	
Grand	9610	1	1	
Washington	9611	1	1	
Monroe	9612	1	1	
Jackson	9613	1	1	
Harrison	9614		1	
Roosevelt	9615	1	1	
35th	9616	1	1	
Indiana	9617	1		
43rd	9618	1	1	
47th	9619	1	1	
51st	9620	1	1	
Garfield	9621	1	1	
58th	9622	1		
Jackson Park				
61st	9628		b	
King Drive	9629		b	
Cottage Grove	9630		b	
University	9631		b	
Jackson Park	9632		b	
University	9631		b	
Cottage Grove	9630		b	
King Drive	9629		b	
61st	9628		b	
Englewood				
Wentworth	9623	1		
Harvard	9624	1		
Halsted	9625	1		
Racine	9626	1		
Ashland	9627	1		
Racine	9626	1		
Halsted	9625	1		
Harvard	9624	1		
Wentworth	9623	1		

Worksheet Showing 1985 Trains

South Main		PEAK SERVICE		Trn/hr	
58th	9622	1			
Garfield	9621	1	1		
51st	9620	1	1		
47th	9619	1	1		
43rd	9618	1	1		
Indiana	9617	1			
35th	9616	1	1		
Roosevelt	9615	1	1		
Harrison	9614		1		
Jackson	9613	1	1		
Monroe	9612	1	1		
Washington	9611	1	1		
Grand	9610	1	1		
Chicago	9609	1	1		
Clark/Division	9608	1	1		
North/Clybourn	9607	1			
Fullerton	9606	1	1		
Belmont	9746	1	1		
Addison	9604		1		
Sheridan	9603	1		Note HOWRDB has an extra loop!	
Wilson	9602	1	1	9603–9604–9603–9602	
Lawrence	9601		1		
Argyle	9600	1			
Berwyn	9599		1	Note: These Lines have an extra loop	
Bryn Mawr	9598	1	1	9598–9599–9598–9600	
Thorndale	9597	1			
Granville	9596		1		
Loyola	9595	1	1		
Morse	9594	1	1		
Jarvis	9593	1			
Howard	9733	1	1		

Lake		lakea	lakeb
Headway		3.6	3.6
Direction		Dn	Dn
Harlem	9683	1	1
Oak Park	9684	1	1
Ridgeland	9685	1	1
Austin	9686	1	1
Central	9687	1	1
Laramie	9688	1	1
Cicero	9689	1	1
Pulaski	9690	1	1
Homan	9691		1
Kedzie	9692	1	
California	9693		1
Ashland	9694	1	
Halsted	9695		1
Clinton/NW Passage	9676	1	1
Clark/Lake	9674	1	1
State/Lake	9672	1	1
Randolph/Wabash	9681	1	1
Madison/Wabash	9680	1	1
Adams/Wabash	9679	1	1
Roosevelt	9615		
Cermack	9736		1