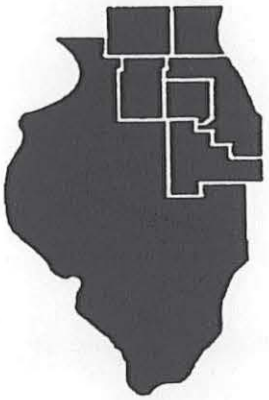
Evaluation of Transit-Related Transportation Control Measures
Final Report



Prepared for the

The Regional Transportation Authority

by

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EVALUATION OF TRANSIT-RELATED TRANSPORTATION CONTROL MEASURES

EXECUTIVE SUMMARY

Introduction

The Northeastern Illinois region has been designated as a severe nonattainment area for ozone. Mobile sources provide a significant portion of ozone precursor emissions in the region. Transportation control measures (TCMs) must be used in nonattainment areas to achieve reductions in vehicle miles traveled (VMT) and mobile source emissions. The Regional Transportation Authority (RTA), as the agency charged with providing comprehensive planning for the region's transit system, has taken a lead role in developing transit-related (TCMs) for the region's mobile source component of the State Implementation Plan (SIP).

To assist in the evaluation of TCMs, the RTA contracted with Barton-Aschman Associates, in association with Cambridge Systematics and Beata Welsh to develop an analytical "screening methodology" tool to provide an assessment of the effectiveness of selected transit-related TCMs in reducing VMT and mobile source emissions. The techniques developed to estimate the air quality impacts are designed to be transferable among TCM projects to allow the evaluation of similar types of transit projects. In addition, the analytical approach is designed to be "technically defensible" and includes the determination of key measures, such as changes in auto/transit mode split, changes in VMT, and the changes in emissions resulting from the implementation of transit TCM projects.

Clean Air Act Amendments of 1990

The Clean Air Act Amendments of 1990 (CAAA) reaffirmed the nations commitment to air quality. The CAAA recognizes that the reduction in mobile source emissions resulting from improved technology has been offset by increases in the number of vehicle trips and in VMT. Northeastern Illinois has been designated as a severe nonattainment area for ozone, which means that the region has 15 years to reach attainment of the primary standard for ozone. By November 1996, the region must reduce hydrocarbon emissions by 15 percent, and then approximately three percent each year thereafter.

The SIP is the plan under which the state defines a series of specific, legally enforceable measures to reduce emissions. Reductions in pollutants from motor vehicles include those resulting from tighter restrictions on motor vehicle emissions, improvements in motor vehicle fuels, enhanced vehicle inspection and maintenance, employer commute options programs, and

TCMs. Section 108(f) of the CAAA lists 16 available TCMs that have the potential for encouraging trip diversion and reducing the overall demand for travel.

Projects Selected for Evaluation

The TCMs selected by the RTA for evaluation generally come under the heading of Improved Public Transit, but may also qualify as Traffic Flow Improvements, Areawide Rideshare Incentives, and Park-n-Ride/Fringe Parking. A Transit TCM Technical Committee was established to identify projects for analysis, coordinate data collection, and review the consultant's products. The committee was composed of the RTA, RTA Service Boards, (Chicago Transit Authority, Pace Suburban Bus Company, and Metra Commuter Rail), the Illinois Environmental Protection Agency, the Illinois Department of Transportation, and the Chicago Area Transportation Study (the region's metropolitan planning organization). Twelve candidate projects were selected for analysis, including park-n-ride lots, bus signal preemption, subscription bus, transportation centers, and the Transit Check Program.

Overview of Methodologies

The screening methodology process developed determines the air quality impacts of specific transit-related TCMs, based on two linked analytical procedures:

- A mode shift methodology that estimates changes in VMT by speed category.

- An emissions methodology that uses VMT by speed and MOBILE5 factors to estimate changes in volatile organic compounds (VOCs), carbon monoxide (CO), and nitrogen oxide (NOx) emissions.

Existing (1990) and future (2010) regional travel forecasts are used as the basis of the calculation process. Each TCM was analyzed for its potential impact on mode choice components, such as travel time or cost, and affected origin and destination zones. By estimating the effects of each TCM on the regional travel forecast in terms of change in auto share and transit share, changes in VMT by speed are generated. VMT by speed is a necessary input to the MOBILE5 emissions factor model. The A.M. peak hour was used as the basis for the analysis.

The mode share methodology is a logit mode choice model that is used in an "incremental" fashion that begins with existing mode shares and modifies these baseline values on the basis of changes in the characteristics of the transit network. The principal advantage of this technique is that it requires descriptions of only those aspects of the system that are anticipated to change.

The emissions methodology provides a means for analyzing the impacts of alternative TCM

strategies on mobile source emissions. It is designed to provide an easy-to-use means of analysis, using available travel data and emission factors generated through the U.S. Environmental Protection Agency's (EPA) MOBILE5 emission factor model. The emission spreadsheet applies emission factors by speed to a given volume of traffic to calculate total tons of VOC, CO, and NOx for a given project.

Evaluation Results

Results for each TCM were generated using the mode shift and emissions methodologies. The following results were calculated for each TCM:

- Area of Impact (origin and destination zones)
- Travel Markets Impacted
- Travel Time and Cost Impacts
- Number of Impacted Zones
- Changes in Peak VMT (by CBD work, nonCBD work, and nonwork trips)
- Changes in Daily Emissions
- Trip Table Summary for A.M. Peak Hour
- Potential Secondary Impacts

Conclusions

Each TCM was evaluated on the basis of its relative effectiveness in reducing VMT and emissions using information currently available from the sponsoring agency and from CATS. Those projects with the most impact on travel time and/or travel cost have greater effects on mode share, reduced auto trips, and emissions.

In addition to identifying those projects with the least and greatest impacts, it is also important to distinguish between those projects that reduce VMT and those that eliminate trips altogether. Projects including park-n-ride lots, such as rapid transit/commuter rail stations, vanpool services, or subscription bus services may reduce VMT, but still generate auto trips to and from park-n-ride or pickup/drop-off locations. These projects will still generate significant emissions by vehicles driven in the cold start mode.

The methodology was developed for this project as a screening tool to be used at the regional level. In addition, the methodology employed was designed to estimate results consistent with regional travel models, but without rerunning the regional models. Based on these, there are inherent limitations in the process. Some of these limitations may be overcome by rerunning the regional models, conducting sensitivity analysis, or supplementing survey data for the regional travel data. It is important to identify and take into consideration these limitations when results are interpreted and conclusions made about the impact of specific TCMs.

1.
Introduction

The Northeastern Illinois region has been designated as a severe nonattainment area for ozone. Mobile sources provide a significant portion of ozone precursor emissions in the region. Section 108 of the Clean Air Act Amendments of 1990 lists 16 Transportation Control Measures (TCMs) that nonattainment areas may use to achieve reductions in vehicle miles traveled (VMT) and mobile source emissions. The U.S. Environmental Protection Agency (U.S. EPA) has also identified a typology of "improved public transit" measures within its TCM information document, "Transportation Control Measures: State Implementation Plan Guidance," issued September 1990.

The VMT and emissions reduction potential of transit-related TCMs must be evaluated for development of the State Implementation Plan (SIP), for conformity analysis of the region's Transportation Improvement Program (TIP), and for funding of transit projects through the Congestion Mitigation and Air Quality Improvement Program under the Intermodal Surface Transportation Efficiency Act (ISTEA).

To assist in the evaluation of TCMs, the Regional Transportation Authority requested the development of a screening methodology tool. The purpose of this screening tool is to provide an assessment of the effectiveness of selected transit-related TCMs in reducing VMT and mobile source emissions. To be effective, this screening tool is designed to use estimation techniques that are transferable among projects. The tool also is designed to provide the supporting technical documentation needed for inclusion in the SIP of transit-related TCMs.

The screening methodology described in this report determines the air quality impacts of specific transit projects that are currently planned or programmed. The techniques developed to estimate these air quality impacts are designed to be transferred among TCM projects to allow the evaluation of similar types of transit projects. In addition, the analytical approach is "technically

defensible" and includes the determination of key measures, such as changes in auto/transit mode split, changes in vehicle miles traveled (VMT), and the changes in emissions resulting from the implementation of the transit TCM projects.

This summary report of findings, in conjunction with the two companion documents, comprises the full documentation for this evaluation tool development process. The two documents are as follows:

- *Task 1.1 Technical Memorandum—Project Identification.* Contains a description of the data available for each TCM, summaries of interviews with project sponsors, and identification of project issues.

- *User Guide.* Contains step-by-step instructions for applying the evaluation tool to future projects.

2.
The Clean Air Act and Amendments through 1990

The federal Clean Air Act, originally enacted in 1963, is the nation's central air pollution control legislation. In the Clean Air Act Amendments of 1970, the federal government assumed major responsibility for air quality standards and the deadlines for meeting the standards.

The 1970 amendments included the following provisions:

- The establishment of National Ambient Air Quality Standards (NAAQS) for six pollutants: carbon monoxide (CO), hydrocarbons (HO), nitrogen dioxide, photochemical oxidants, sulfur oxides, and total suspended particulates.

- The establishment of a motor vehicle emissions control program.

- The initiation of requirements for State Implementation Plans (SIP) that detail how areas that exceed standards (nonattainment areas) plan to attain and maintain those standards.

By 1977, significant progress had been made toward improving air quality, but problems with carbon monoxide and ozone levels persisted. Additional amendments to the Act placed special emphasis on mobile source emissions and Transportation Control Measures (TCMs) that would help decrease these emissions and their related pollutants.

The U.S. Environmental Protection Agency (U.S. EPA) was given authority to impose sanctions where SIP programs were not being planned or effectively implemented. Air quality planning was to be coordinated with transportation planning. Metropolitan Planning Organizations (MPOs) were prohibited from approving any transit project, program, or plan in the Transportation Improvement Program (TIP) that did not conform to the SIP.

The Clean Air Act Amendments (CAAA) of 1990 reaffirmed the nation's commitment to air quality. CAAA addressed air toxins, acid rain, and stratospheric ozone as well as mobile sources. It recognized that the reduction in mobile source emissions resulting from improved technology has been offset by the impact of increases in number of vehicle trips and in vehicle miles traveled (VMT). Timetables were established for attaining the NAAQS, which specify the concentration of pollutants in the outdoor air that are considered safe.

Nearly every major metropolitan area in the United States fails to meet at least one of these standards. The Northeastern Illinois region is in attainment for carbon monoxide (CO), but has been classified by the U.S. EPA as a severe non-attainment area for ozone. The severe non-attainment classification means that the region has 15 years to reach attainment of the primary standard for ozone. This translates to a 50 percent reduction in hydrocarbon emissions, the precursors to ozone formation. A new requirement stipulates that six years after November 1990, the region will need to reduce hydrocarbon emissions by 15 percent, and then approximately 3 percent each year thereafter.

2.1 Transportation Control Measures (TCMs)

The U.S. EPA's *Transportation Control Measures Information Documents*, issued March 1992, provide basic information on the interrelationship between transportation and air quality and the manner in which TCM's can affect emissions and vehicle miles traveled (VMT).

The regional SIP is the plan under which the state defines a series of specific, legally enforceable measures to reduce pollutant emissions from motor vehicles and local industry. Reductions in pollutants from motor vehicles include those resulting from tighter restrictions on motor vehicle emissions, improvements in motor vehicle fuels, enhanced vehicle inspection and maintenance, employer trip reduction plans, and transportation control measures.

TCMs are transportation strategies that are intended to both reduce vehicle miles of travel and to make the miles that are traveled more efficient. The goal of the TCMs is to reduce auto dependency by diverting trips to other modes or by reducing demand for travel by adding to the cost of automobile usage.

The term TCM generally includes projects that affect both system management and the demand for transportation. Many TCM projects may overlap into both areas.

Transportation System Management (TSM) usually refers to low capital-intensive projects, such as carpool and vanpool programs, parking management, traffic flow improvements, and park-n-ride lots.

Transportation Demand Management (TDM) is considered to be the policies, programs, and actions that encourage the use of high-occupancy vehicles (HOV) (transit, subscription services, carpools and vanpools); bicycling; walking to work; and the use of alternative work programs (flextime, compressed time, flexplace).

The implementation of successful TCMs requires the initiation of a cooperative process involving the commitment of air quality and transportation planning and operating agencies. With the requirements for Employee Commute Options (ECO) programs, employers will also play a critical role in the process.

TCMs reduce emissions through a change in the amount of travel generated or through a change in the lengths of trips. Peter Stopher, in his paper, "Deficiencies in Travel Forecasting Procedures Relevant to the 1990 Clean Air Act Amendment Requirements" (December 1991), has constructed a table that presents the TCM impacts on travel behavior categories. It is shown here as Table 1.

Table 1
CORRESPONDENCE BETWEEN TRAVEL BEHAVIOR IMPACTS AND TCMs

Transportation Control Measures	Impact									
	In-vehicle Time	Walk Time	Wait Time	Cost	Time of Day	Convenience	Walk All the Way	Bicycle	Number of Trips Made	New Destination
Transit Improvements	✓	✓	✓		✓					✓
HOV lanes	✓					✓				
Employer TRP's		✓		✓		✓	✓	✓	✓	
Trip-Red. Ord.				✓	✓	✓			✓	✓
Traffic Flow	✓									✓
Park-and-Ride	✓		✓	✓	✓					
Restricted Areas		✓			✓	✓	✓	✓	✓	✓
Ride Matching	✓									
Bike/ped. paths	✓						✓	✓		✓
Bike Lanes/ Storage	✓							✓		✓
Flex Time	✓	✓	✓		✓				✓	
Non-Auto Travel	✓	✓	✓	✓			✓	✓		✓
ROW Conversion	✓						✓	✓		✓

Source: "Deficiencies in Travel Forecasting Procedures Relevant to the 1990 Clean Air Act Amendment Requirements," Peter Stopher, December 1991.

Section 108(f) of the Clean Air Act Amendments of 1990 lists 16 available TCMs that have the potential for encouraging trip diversion and for reducing the overall demand for travel. They are as follows:

- Trip Reduction Ordinances
- Employer-Based Transportation Management Programs
- Work Schedule Changes
- Areawide Rideshare Incentives
- Improved Public Transit
- High Occupancy Vehicle Lanes
- Traffic Flow Improvements
- Parking Management
- Park-n-Ride/Fringe Parking
- Bicycle and Pedestrian Programs
- Special Events
- Vehicle Use Limitations/Restrictions
- Activity Centers
- Accelerated Retirement of Vehicles
- Extended Vehicle Idling
- Extreme Low-Temperature Cold Starts

TCM programs work best when they are implemented as a system of changes. Some TCMs are mutually supportive in that, when implemented together, they can increase the effectiveness of an individual TCM. Trip Reduction Ordinances can be enhanced when alternatives to single-occupant vehicle travel such as Improved Public Transit, Bicycle and Pedestrian Programs and Areawide Ridesharing are also implemented. Park-n-Ride/Fringe Parking improvements can support the provision of Improved Public Transit and High Occupancy Vehicle (HOV) Lanes.

The areawide implementation of a system can also work to avoid potential conflict in TCMs. The conflicts between Areawide Rideshare Incentives and Improved Public Transit can be eliminated when planned for in a unified manner.

3.
Projects Selected for Evaluation

The Transportation Control Measures (TCMs) selected by the RTA for evaluation generally come under the heading of Improved Public Transit. There are some that may also qualify as projects under Traffic Flow Improvements, Areawide Rideshare Incentives, and Park-n-Ride/ Fringe Parking. Other selected TCMs will increase the effectiveness of a strategy. The regional Employer Trip Reduction Program could be made more effective if employers were encouraged to participate in the regional Transit Check program at the same time. This overlap of categories can have additive benefits for other projects.

In general, Improved Public Transit is defined by the U.S. EPA as the implementation of new and expanded public transit services relevant to all transit modes, such as paratransit, buses, rapid transit, and commuter rail. The strategies that are developed in this TCM fall into three areas: System/Service Expansion, System/Service Operational Improvements, and Demand Market Strategies.

A series of 12 TCM candidate projects were selected by the RTA and its Service Boards (CTA, Pace, Metra) for consideration in this analysis. Further detail on each of the TCMs is provided in Appendix A, Profiles of Transportation Control Measures. A comparative matrix of the TCMs is shown in Table 2. The projects selected for analysis and the areas into which they fall are as follows:

1. Transit station park-n-ride lots, Metra—West Chicago rail station, Chicago & North Western—West line; system/service operational improvements. Additional park-n-ride lot is added at this station.

2. Transit station park-n-ride lots, CTA—Cumberland station, O'Hare rail line; system/service operational improvements. Increased capacity at parking facility by 750 spaces to 1,500

TRANSPORTATION CONTROL MEASURES

Table 2

SUMMARY MATRIX

TCM Type	Physical Description	Location	Service Change (change in bus or rail service)	TCM Capacity	Ridership		Connecting roadway impacts	Potential Benefits	Potential Deficits	Cost	Relationship to ETR plans
					Current	Expected change					
1.Transit station Park & Ride lots	parking lot at rail station	Metra rail station		same				Reallocate rail riders from buses, other rail stations or other rail lines. More balanced loading.	Cold Start issue		Only if employer is supporting parking and/or rail fare
2.Transit station Park & Ride lots	Increased parking capacity at facility with 750 spaces to 1500. Facility has reserved first floor for HOV (350 spaces) and Disabled (25 spaces). Facility directly connected to rail line, bus terminal, and kiss and ride.	CTA-Cumberland, O'Hare line. Opened May 92	Not direct service change. GFI fare box data can be reviewed for CTA service. Changes in rail and bus ridership not analyzed to date.	750 new spaces on two new decks.	'91 rail traf- 1.48 mil. Bus wkd 2.7k	needs to be measured	Cumberland ATD may be 40 k. New capacity may add 2 k. or one lane of traffic. Need to verify.	Increased use of O'Hare Line. Decreased use of Expressway	Cold Start issue and increased local roadways. Decreased use of feeder buses		Only if employer is supporting parking and/or rail fare
3.Transit station re-design	Station platform extension, bus bridge extension and vertical access facilities.	CTA-95th Street Station, Dan Ryan Line	Separation of boarding and alighting. Allow more reliable service because of ability to schedule recovery time.	same	'91 rail traf- 6 mil 20k/ day	needs to be measured	none	Facilitate bus movement; Shorten trip time; increase attractiveness	Need to assure buses do not idle during recovery	$24.9 mil (1986 dollars)	Only if employer is supporting parking and/or rail fare
4.Transportation center/Transfer facility	Facility with 10 berths for buses, 200 park n ride spaces, and accom for dial a ride, vanpools and express bus	Pace-Martingale and Kimberly, Schaumburg	Bus staging. Bring many services together. Pulse boardings. Provide service to Sears and NW suburbs. May replace Woodfield as terminal (service will still go through).	same		4.8k	local streets - high. Minimal on arterials.	Faster, safer, more comfortable, more reliable transfers, reduction in VMT	Cold start issue for park n ride. Need to assure buses do not idle during recovery. Increased usage of local roads	$3M	Direct through van pools and dial a ride
5.Feeder bus route design/Schedule Coordination	New bus route at rail station to accom.commuters walking to offices	Metra rail station Wood Dale, MIL-West line	No current bus service. Rail service changed in Sept.	same	none	need 46+	AM gridlock, need data	Mode shifting from auto. Reduction of auto trips	None as provided by Metra	$12,600 for 1 bus for 3 months	Direct if shift from auto. Employers could help with funding.

Table 2(cont'd)

6.Bus Signal Preemption	Buses may pre-empt signal changes except when ahead of schedule	Pace and CTA-Cermak-54th to IL43, Route No 304, 322 - Pace; No. 25 - CTA	May result in faster and more reliable service.	same	CTA 930, Pace 510 1	CTA +2% Pace +5%	only a 3 second change. Negligible impact	Faster roadway movement. Mode shifting	Minimal impacts on connecting	IDOT ?, Pace & Vapor $45,000	Indirect - only if a mode shift
7.Restricted use lanes/facilities for transit vehicles	Toll plaza reconstruction buses allowed to use automatic lanes	Pace-I294/83rd St. Toll Plaza. Route No. 888,877	May allow increase in bus service	same	1.1k	+	Plaza heavily used, long delays	Faster roadway movement. Mode shifting	Increases in expressway usage,	$40 @ month + tolls	Indirect - only if a mode shift
8.Automatic Vehicle Location/Control, includes signal preemption	Permits management of bus schedule adherence. 45 buses 5 intersection	CTA-# 3 King Drive bus route	May result in reduction of bus bunching, faster service and number of buses needed on route	same	18k total /64 per bus	+3% /66 per bus	only a 3 second change. Negligible impact	Faster roadway movement. Mode shifting	Minimal impacts on connecting	$850k allocation of $40m to 45 buses and 5 intersections	Indirect - only if a mode shift
9.Subscription bus service	Buses from standard locations to one site in suburbs	Pace-Service from SW side of Chgo to new Sears headquarters in Hoffman Estates	New service of 13 routes. Pick up in parking lots of Sears stores	up to 13 buses	none	Aver 30 per bus 390	all new roadways	Development of a park or walk n ride area	Increased traffic around stores, mode shift from current transit	Need specific.	Direct, Sears required to comply with ETR
10.Vanpools	Vans operated from common (or multiple) pick up point to one site in suburbs	Pace sponsored drivers keep vans and drive others to Sears headquarters in Hoffman Estates	New service of 13 vans with a goal of 42. Sized from minivans (8) to conversion vans (15). Goal to divert auto drivers to transit.	up to 42 vans	110	Aver 8.5 per bus, 350 to 400	nine cars out of 10 driven by individual. Suburban veh occp 1.16	diversion from auto may be 90%	Increased traffic around central pick up point, cold start issue	$2.2 M revenue = 90% cost recovery. 7-30¢ subsidy	Direct, Sears required to comply with ETR
11.Transit fare subsidy/ marketing	Transit check, employer buys for up to $21.00 and gives to employee.	RTA sponsored and administered. Available to all regional employers.	Tax free to employee and a tax deductible business expense to employer. RTA survey said 15% might use.	N/A	275 co. 6.5k	+ unlim	If 15% of users new to transit would lower usage	mode shifting, reduce auto trips and VMT	Induced travel. Employers need to understand tax effects	Funding neutral except admin costs	Direct if employer picks up costs
12.Capacity/ speed improvements for transit service	Grade separation of roadway and rail line	Metra-Franklin Park rail station, Rose/25th Ave. MIL-W	Train stop at station blocks road and pedestrian access. Separation will imp. movement.	same	490 bds	+ ?	usage 12,800. Expected change unknown	Increased access to parking lots, improved traffic movement	Increased roadway usage	$6M	Indirect, if employer pays rail costs

spaces. Facility has reserved first floor: 350 spaces for HOV (carpools) and 25 spaces for the disabled. CATS has supplied staff to enforce HOV parking. The facility is directly connected to rapid transit rail line, bus terminal, and kiss-n-ride area.

3. Transit station redesign, CTA—95th Street station, Dan Ryan rail line; system/service operational improvements, improved transfer. Expansion and enlargement of existing station and alteration of usage patterns to facilitate flow through the station. The length of the train platform would be nearly doubled by adding approximately 400 feet. The bus bridge will be extended by 400 feet to allow for separation of boarding and alighting from buses. Conflicts between intercity and city buses will be eliminated. The station will be made accessible to people with disabilities.

4. Transportation center/transfer facility, Pace—Schaumburg, system/service operational improvements, improved transfer and demand/market strategies, passenger amenities. A facility designed to open with 10 bus berths, which includes some excess capacity. Some berths are for the limited and express bus routes, and others are for two dial-a-ride services. Vanpools will use the facility as a pickup point utilizing the kiss-n-ride area. A 200-space park-n-ride lot is also provided.

5. Distributor bus route, Metra—Wood Dale rail station, Milwaukee—West line; system/service operational improvements and service expansion. Initiation of distributor bus service from the rail station to the surrounding commercial and industrial businesses.

6. Bus signal preemption, Pace and CTA—Cermak Road; system/service operational improvements. Pace buses will be able to preempt signal changes at 15 signalized intersections in a 1.5-mile corridor on Cermak Road from 54th Avenue (Douglas L) to North Riverside Mall. To be used when behind schedule and not in conflict with emergency vehicles.

7. Restricted use lanes/facilities for transit vehicles, Pace—Interstate 294/83rd Street Toll Plaza; system/service operational improvements, road operational changes. Pace bus routes #888 and #877 will be able to go through the automated toll lane without stopping by using automatic vehicle identification (AVI).

8. Bus service management system (BSMS), CTA—King Drive; system/service operational improvements, operations monitoring and bus traffic signal preemption. Automatic vehicle location/control and bus signal preemption systems that permit management of bus schedule adherence, bus location, and assurance of employee and rider security. Buses may preempt signal changes except when ahead of schedule. In the initial stage BSMS includes five signalized intersections on a one-mile section of King Drive and 162 buses (including 45 for King Drive). Upon acceptance, the RFP calls for the rest of CTA's buses and 195 additional intersections throughout the system to be equipped.

9. Subscription bus service, Pace—Hoffman Estates; service expansion and system/service operational improvements. Pace service will be provided from southwest side of Chicago to new Sears Headquarters in Hoffman Estates.

Pace will offer this specialized service to address the specific needs of suburban employees. The service provides direct transportation between a residential collection area and a place of employment for groups of 30 or more individuals. It operates according to a prescribed schedule and travels along a designated route, with passengers offered a guaranteed seat in return for reserving transportation on a monthly basis. Service is "open door" in that it is not restricted to employees of specific firms.

Vehicles and drivers are provided by a private carrier. The vehicle is normally an "over the road" bus.

Sears is assisting in the development of up to 13 routes. Service will be phasing in as people are transferred from the Sears Tower to Hoffman Estates. Sears store parking lots to be used as pickup points.

10. Vanpools, Pace—Hoffman Estates and regionwide; service expansion. Pace subscription vanpool service with concentration on the Sears service from a variety of Chicago and suburban locations to new Sears Headquarters in Hoffman Estates. Sears is assisting in the development of up to 42 vanpools. Two different types of pickups. One is the collection of individuals along the route at a single common pickup point. The second is the collection of individuals at multiple of common pickup points.

    As a new service initiative, Pace is integrating vanpool operations into its service mix. These operations address the transit needs of area employees on a smaller scale than subscription bus service. Vanpools generally consist of 6 to 15 persons commuting to a common employment site.

11. Transit fare subsidy/marketing, regionwide RTA Transit Check Program; demand/market strategies, employer offered incentives. RTA-sponsored and -administered Transit Check Program. Available to any regional employer that sends form and check to RTA. Checks can be issued in various denominations up to $60.00. Transit Check can be used like cash anywhere that tokens or passes are sold.

    The checks can be ordered three months in advance and are good for 120 days after date of issue. The checks are tax-free to employees and are a tax-deductible business expense to employers.

12. Capacity/speed improvements, Metra—Franklin Park rail station, Rose Street/25th Avenue, Milwaukee West Line; system/service operational improvements, road operational changes and improved transfers; grade separation, at railroad crossing, of roadway (FAU 2714) and Metra commuter rail line (Milwaukee West Line). Substantial freight movements slow traffic. Commuter trains block the roadway when stopping for the station and also block pedestrians from crossing the tracks when walking from the parking lots to the station. Two of the three parking lots are opposite the inbound platform.

4.
Overview of Methodologies

The overall objective for analyzing each transit TCM selected by the RTA is to develop a methodology that would evaluate and compare the impact of each TCM on travel behavior and pollutant emissions. This methodology must also:

1. Be "technically defensible" relative to U.S. EPA and IEPA reviews.

2. Provide a consistent evaluation of transit-related TCMs.

3. Be based on existing regional travel data to provide realistic results.

4.1 Evaluation Process

The screening methodology process, as described below, determines the air quality impacts of specific transit TCMs. This process, as shown in Figure 1, is based on two specific methodologies:

- A travel demand impact methodology that estimates changes in vehicle miles traveled (VMT) by speed categories.

- An emissions methodology that uses VMT by speed and MOBILE5 factors to estimate changes in volatile organic compounds (VOCs), carbon monoxide (CO), and nitrogen oxide (NO_x) emissions.

Existing (1990) and future (2010) regional travel models are used as the base of the calculation process. Each TCM was analyzed for its potential impact on mode choice components, such as travel time or cost, and affected origin and destination zones. The origin/destination zones

TCM EVALUATION MODEL

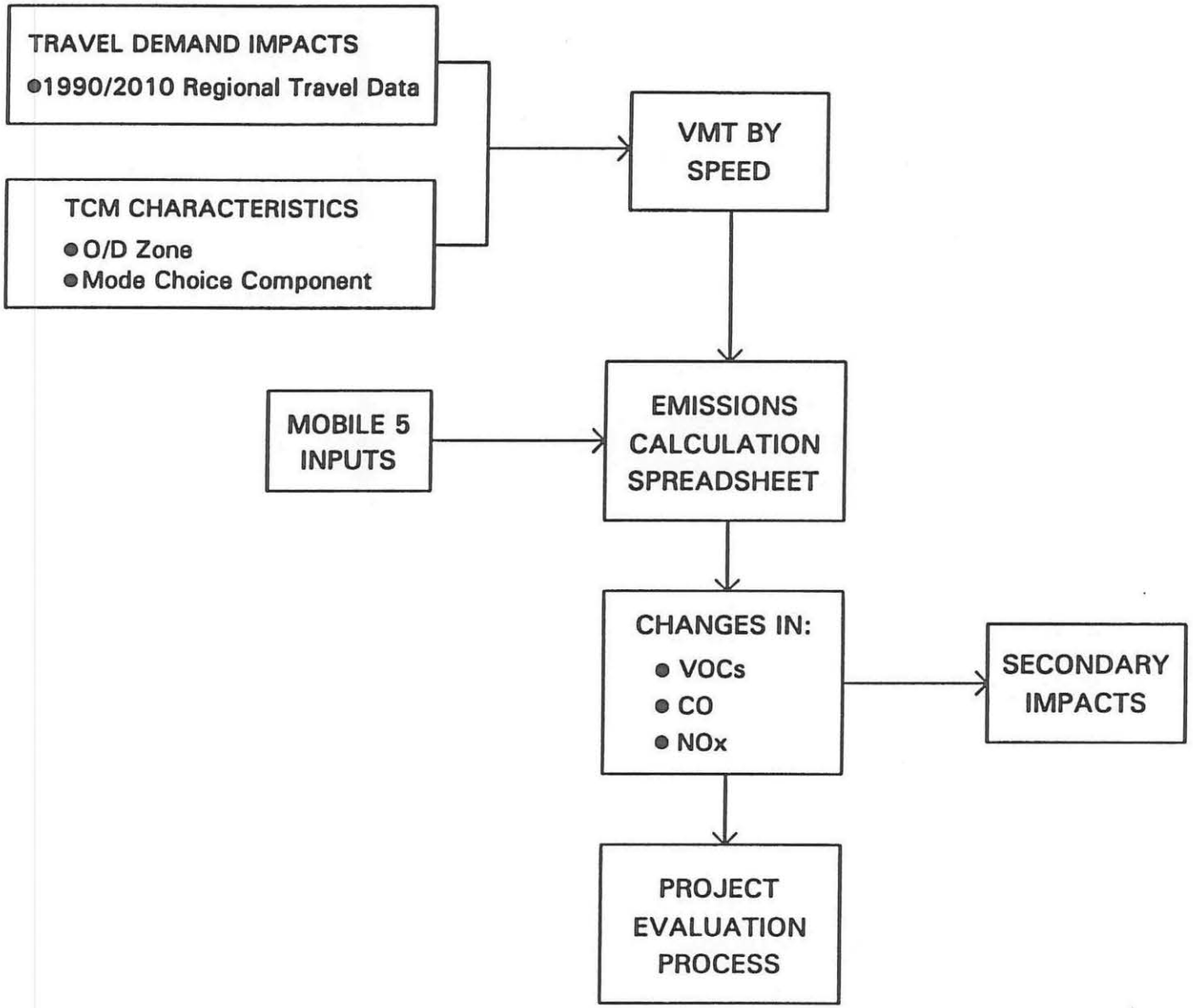

Figure 1

were based on regional travel analysis zones, since the regional travel models are based on those zones. In some cases, the origin and destination zones were different, such as origin zones around a park-n-ride lot and destination zones in the downtown. Other TCMs had origin and destination zones that were the same, such as a line-haul transit route.

By estimating the effects of each TCM on the regional travel model, changes in VMT by speed are generated. VMT by speed is a necessary input to the MOBILE5 emissions factor model. MOBILE5 then calculates changes in VOC, CO, and NO_x.

This process was designed to estimate results consistent with the regional database without rerunning the regional travel models. For this process to produce results, transit trips must currently exist in the regional model. To analyze TCMs in areas where there are no existing transit trips, such as the new vanpool or subscription bus service to Sears in Hoffman Estates, these must be calculated manually, or the regional models must be rerun.

The travel demand impact methodology and the emissions calculation methodologies are described below. More detailed information on the mechanics of each methodology can be found in the *User's Guide.*

4.2 Travel Demand Impact Methodology

The purpose of this methodology is to estimate the effect of selected TCMs on VMT and speed. Regional travel data for 1990 and 2010 were provided by the Chicago Area Transportation Study (CATS).

The methodology selected is a logit mode choice model that is used in an "incremental" fashion that begins with existing mode shares and modifies these baseline values based on changes in the characteristics of the transit network.[1] The principal advantage of this technique is that it requires descriptions of only those aspects of the system that are anticipated to change.

The incremental form of the logit model is a simple derivation of the standard multinomial logit formulation. Both forms of the logit model yield identical estimates of a traveler's responses to changes in the highway and transit systems, assuming that the standard form has been sufficiently validated against existing conditions.

The standard logit formulation is:

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[1] This methodology is adapted from the methodology used in the Honolulu Rapid Transit Program, as outlined in the report, *Task 3.03—Service and Patronage Forecasting Methodology*, prepared for the Department of Transportation Services, Office of Rapid Transit, City and County of Honolulu, by Barton-Aschman Associates, Inc., and Parsons Brinckerhoff Quade & Douglas, Inc., March 1992.

$$P_i = \frac{\exp(U_i)}{\Sigma_m[\exp(U_m)]}$$

where: P_i = the probability of using mode i
U_i = the utility of mode i
Σ_m = the summation over all available modes
exp = the natural logarithm

The incremental form of the logit formulation is:

$$P'_i = \frac{P_i \times \exp(\Delta U_i)}{\Sigma_m[P_m \times \exp(\Delta U_m)]}$$

where: P'_i = the revised probability of using mode i
ΔU_i = the change in utility of mode i

Because the incremental form is an exact derivative of the standard form, it preserves the variable elasticities present in the standard logit model. The direct elasticity for either formulation for P_i with respect to a change in an attribute of alternative i is:

$$E(i,x_i) = B_{xi}X_i(1 - P_i)$$

where: B_{xi} = the coefficient of x_i in the utility expression for alternative i
X_i = the value of x_i at the point for which elasticity is evaluated

It can be seen clearly from this expression that the elasticity varies across travel markets. In markets with high existing transit shares, the elasticity tends to be lower than in markets with lower existing shares. Similarly, where x_i is large, elasticities tend to be larger. Because both P_i and x_i can vary substantially from one market to another, the incremental logit approach is able to capture the wide variations in elasticities that are ignored in the application of constant elasticities to all travel markets.

In forecasts of aggregate travel patterns, the probability P_i applied to person-trips from each zone-to-zone interchange becomes the *share* of all trips attracted to mode i. In order to estimate the revised transit share of all trips, it is necessary to know only the base share P_i held by transit and the change in utility for each of the modes m that are available, including transit. The estimate of utility for each mode includes its time and costs, often with some descriptor of the traveler.

The utility expression is written as:

$$U_i = C_i + B_1x_i + B_2y_i \ldots .$$

where: C_i = the mode-specific constant for mode i
x_i, y_i = attributes of mode i, typically times and costs
B_1, B_2 = coefficients describing the relative importance of x and y in determining the utility of i

In a model where x and y are the only variables, then the change or difference in utility ΔU_i can be expressed as:

$$\Delta U_i = (C_i + B_1 x_i' + B_2 y_i') - (C_i + B_1 x_i + B_2 y_i)$$

$$= B_1(x_i' - x_i) + B_2(y_i' - y_i)$$

where ′ indicates the value in the forecast year. Thus, the mode-specific constants fall out of the computations. Indeed, the only terms entering the equation are those for which a change occurs.

4.2.1 CATS Model Form

The CATS regional binary mode choice model is the basis for this analysis. The estimated coefficients for the binary mode choice model are shown in Table 3.

The *in-vehicle time* is the time spent in the transit vehicle. If several transit vehicles are ridden, then the combined time spent in each of these is the in-vehicle time. The *out-of-vehicle time* (or transfer time) is the time spent transferring between transit vehicles. This time includes walk egress from transit, but does *not* include walk access time. There is no time provided for walk access, since the data is not available. CATS uses walk access within the mode split portion of its modeling process. During that process, walk access is combined with several other factors and is never computed separately. *First wait time* is the time spent waiting for the first transit vehicle. If transfers are made

Table 3
REGIONAL BINARY MODE CHOICE COEFFICIENTS

	Work		Non-Work	
	Non-CBD	CBD	Non-CBD	CBD
In vehicle time (minutes)	0.0186	0.0159	0.0114	0.0114
Transfer time (minutes)	0.0399	0.0290	0.0589	0.0589
Cost (1970 ¢)	0.0072	0.0085	0.0329	0.0329
Walk time (minutes)	0.0584	0.0468	0.0663	0.0663
First wait time (minutes)	0.0811	0.0173	0.0610	0.0610
Bias	–0.4983	–0.6059	–0.2726	–0.2726

Source: Chicago Circulator AA/DEIS Model Methodology Report, Appendix A, Barton-Aschman Associates, Inc., December 1990.

to other vehicles along the trip path, the wait associated with these other vehicles is *not* included. Instead, the additional wait time for other vehicles is included in the out-of-vehicle (or transfer) time. Fare is the cost incurred by using transit. All times are in minutes and all fares are in cents.

The bias coefficients will not be used in any part of the analysis. Note that the coefficients listed are utilities. In the logit model, the disutilities, or negatives of the listed values, will be used.

4.2.2 Required Regional Model Input

The inputs required from CATS for this process are the following regional matrices:

- Person-trips made in autos (by purpose).
- Transit person-trips (by purpose).
- Auto travel time skims.
- Auto travel distance skims.
- Transit in-vehicle travel time.
- Transit transfer travel time.
- Transit walk time.
- Transit first wait time.
- Transit cost.

4.2.3 Travel Time Period

The A.M. peak hour was determined to be the most appropriate basis for this analysis for the following reasons:

- Most transit TCMs are directed at work-related commuter travel.
- The A.M. peak hour has the largest proportion of work-related commuter travel to total volume of traffic.
- The A.M. peak hour has the closest relationship to the data base from which the elasticity factors are drawn (home-based work trip) and is thus most representative of those conditions.

The trip tables available from CATS are daily person-trip tables, so peak-hour factors were applied. Table 4 shows peak-hour factors for auto driver/passenger and transit person-trips. These factors were calculated from the CATS 1970 home interview survey. The A.M. peak hour includes all trips beginning between the hours of 7:00 and 8:00 A.M. The P.M. peak-hour trips start between 4:00 and 5:00 P.M.

Table 4
A.M./P.M. PEAK-HOUR FACTORS BY MODE AND TRIP PURPOSE

Mode and Trip Purpose	Percent of Trips in A.M. Peak Hour	Percent of Trips in P.M. Peak Hour
Auto Driver/Passenger		
Home-to-Work	30.5%	1.6%
Work-to-Home	1.0	27.9
Home-to-Nonwork	3.6	4.8
Nonwork-to-Home	1.6	6.4
Nonhome-to-Nonhome	0.8	6.9
Transit		
Home-to-Work	40.1	1.1
Work-to-Home	0.6	37.1
Home-to-Nonwork	17.0	2.9
Nonwork-to-Home	0.0	10.6
Nonhome-to-Nonhome	2.0	15.3

The transit person-trip table separated trips into the three trip purposes: home-to-work, home-to-nonwork, and other. The corresponding A.M. peak-hour factors were applied.

To convert auto person-trips to vehicle trips, the auto person-trip table was divided by a vehicle occupancy factor. This was done only for the auto trip tables and only when calculating VMT. The vehicle occupancy factor used for work trips (based on 1990 Census Data) was 1.09 and the factor used for nonwork trips (based on the 1970 Home Interview Study) was 1.345.

4.2.4 Application Process

The following general process was followed to analyze the effects of the transit TCMs:

1. Identify the travel analysis zones impacted by the change. Specific origin and destination zones are to be identified.

2. Identify the change in transit service characteristics (e.g., travel time, travel cost).

3. Calculate the base mode shares (auto and transit) from the CATS trip tables.

4. Calculate the alternative shares on an interchange-by-interchange basis using the incremental logit formulation.

5. Calculate the revised VMT by speed for the interchange based on Items 3 and 4 above.

The auto speed for each interchange is calculated by dividing the auto distance in miles by the auto travel time to yield speed in miles per hour.

In addition to the above five steps, the base (no TCM project) VMT was calculated for each to allow the change in VMT to be calculated following Step 5 above. The following process was applied to each TCM.

- Step One. The area for which each TCM is anticipated to have an impact was identified by origin and destination zones using the CATS travel analysis zone map as the base. CATS zones were used to define the boundaries, as CATS regional travel model data was used. These zones typically range from one-half to one square mile.

- Step Two. After identifying the impacted origin and destination travel analysis zones, the mode choice model component or components that would be affected were determined and the change was estimated.

  The mode choice model components that were affected by the TCM projects include:
  - In-vehicle time (minutes)
  - Transfer time (minutes)
  - Cost (1970¢)
  - Walk time (minutes)
  - First wait time (minutes)

- Steps Three through Five. Each of these steps involved matrix calculations to apply the incremental logit formulas and were accomplished using the EMME/2 transportation planning model. The procedures involved are described in more detail in the *User's Guide*.

The output of this process was a lotus spreadsheet summarizing base and new VMT for 1990 and 2010 by speed. This spreadsheet was then used as an input to the emissions calculation spreadsheet.

4.3 Emissions Calculation Methodology

The Total Emissions Spreadsheet provides a means of analyzing the impacts of alternative transportation control measure (TCM) strategies on mobile source (transportation-related) air

pollutant emissions. It is designed to provide an easy-to-use means of analysis, using available travel data and emission factors generated through EPA's MOBILE emission factor model. The spreadsheet uses an emission factor look-up table to apply emission factors by speed to a given volume of traffic (defined in terms of vehicle miles of travel or VMT) to calculate total tons of mobile source VOC, CO, and NOx emissions for a given scenario. The design of the spreadsheet allows for two scenarios, a base condition and a new condition, to be run concurrently and compared in terms of total emission impacts.

In order to apply the spreadsheet, alternative scenarios should be defined for a specified analysis area for which there is available travel data describing vehicle miles of travel by average speed. A few guidelines should be observed in developing these data:

- Ideally, the analysis area should be confined to the area potentially impacted by the proposed alternative in order to minimize processing of unnecessary data.

- If the analysis is intended to identify changes in emissions produced by a particular market group or category of trip purpose, data should be defined for the specified travel market and should be consistent between scenarios. Markets that are unaffected or that remain constant as a result of the scenario can be "zeroed out."

- The season or time period covered by the data should be consistent for comparable scenarios.

The spreadsheet is organized into two parts: an emission factor look-up table, and a section that integrates travel data and emission factors to sum and compare total emissions between scenarios. Two spreadsheet templates are provided: 1990TEST.WK1 to analyze year 1990 impacts, and 2010TEST.WK1 for year 2010 impacts.

The following sections describe the data used in these sections and the operation of the overall spreadsheet.

4.3.1 Emission Factors

In the prototype Total Emissions Spreadsheet, emission factors were generated for a range of speeds using EPA's recently-released draft MOBILE5 emission factor model. Inputs for MOBILE5 to produce 1990 emission factors were obtained from the Illinois Environmental Protection Agency and are consistent with inputs used in IEPA's 1990 input file for the State Implementation Plan (SIP) inventory. The IEPA input file is included in Appendix B.

Inputs can be modified as necessary to obtain emission factors representing different conditions (e.g., inspection/maintenance program, fuel programs), analysis years, and/or seasons. At this time, Illinois has not determined the design of the state's future inspection/maintenance program. Inspection/maintenance programs must be modified in response to 1990 Clean Air Act Amendments requirements for severe ozone non-attainment areas. Therefore, to simulate year 2010 emission factors for use in the Total Emissions Spreadsheet, MOBILE5 was run with an

input file that duplicates U.S. EPA's recommended enhanced inspection/maintenance performance standards. Once the final design of the Illinois inspection/maintenance program is determined, MOBILE5 can be rerun to reflect any discrepancies between U.S. EPA's model program and the program that Illinois ultimately implements.

The MOBILE model is run independently from the Total Emissions Spreadsheet, and the resulting emission factors are then entered into the look-up table of the spreadsheet. Information on the operation of the MOBILE model can be found in the User's Guide to MOBILE4.1 and the addendum prepared for the draft version of MOBILE5.

Because of concern over issues related to cold start impacts, it should be noted that IEPA input file used to develop the emission factors included in the prototype spreadsheet assumes national default characteristics in the operating mode fractions and trip length distributions. However, as discussed in the MOBILE User's Guide, operating mode fractions can be modified in the scenario section to reflect more localized conditions. Localized trip length distributions can also be specified through options provided under the SPDFLG. In both cases, these options can be used to more precisely determine emission factors for travel conditions and/or travel markets affected by strategies that might affect trip lengths and/or cold start percentages. The ability to specify localized characteristics in these cases is dependent upon the availability of travel data at a level of detail which can reasonably quantify the characteristics of the affected market groups.

4.3.2 Travel Data

As indicated above, travel data is entered into the spreadsheet in the form of vehicle miles of travel (VMT) at a corresponding travel speed. The disaggregation of these data is dependent upon the level of detail available through the output of the travel demand model used to analyze a given alternative. Travel demand model output should be formatted in a manner that facilitates integration into the Total Emissions Spreadsheet to minimize the need for manual data entry.

Travel data can be input into the Total Emissions Spreadsheet in the form of total travel for an entire study area or, depending upon data availability and analysis needs, disaggregated by geographic area, vehicle type, time of day, or trip purpose. (For more detailed analysis, the general approach used in the spreadsheet can be applied at the roadway link level, although this more data-intensive approach necessitates a more direct integration of the MOBILE model with the travel demand model for the study area.)

The spreadsheet is designed to accept data in the form of VMT at a given speed. If the data are available in some form other than VMT by speed, such as VMT by speed for individual zone pairs, the spreadsheet can be modified accordingly, depending upon the format of the data.

Although VMT by speed is generated for the A.M. peak hour, the results of the emissions calculations are presented in tons per day. The peak-hour emissions have been factored to daily emissions on the basis of the relationship between daily transit travel and peak-hour transit travel. A factor of 4 is derived from the following condition and assumptions:

- The A.M. peak hour contains 40 percent of the home-to-work transit trips.
- The P.M. peak hour contains 37 percent of the work-to-home trips.
- The majority of home-to-work trips occur in the A.M. peak period.
- The majority of work-to-home trips occur in the P.M. peak period.
- The home-to-work trips are equivalent to the work-to-home trips.

Multiplying the A.M. peak-hour emissions results by 4 represents expanding the A.M. peak hour to a two-hour A.M. peak period and a two-hour P.M. peak period, and also represents a conservative estimate of daily emissions because the A.M. and P.M. peak hours include 80 percent of the daily transit trips.

5.
Evaluation Results

As discussed in Chapter 4, the output of the travel demand impact methodology is changes in vehicle miles traveled (VMT) by speed category for 1990 and 2010. These data are then input into the emissions spreadsheet, which produces changes in emissions. This chapter presents the analysis results for each TCM, including:

- Area of Impact: Identifies the impacted origin and destination zones. Zones are based on CATS travel analysis zones.
- Primary Travel Markets Impacted: Identifies what type of trips are affected, e.g., CBD work trips, nonwork trips, etc.
- Travel Time and Cost Impacts: Identifies the impacted mode choice model component, e.g. travel time, cost, etc., which causes a change in travel mode.
- Number of Zones: Identifies the number of travel analysis zones that are affected by changes in VMT and emissions are distributed among.
- Changes in Peak VMT: By CBD work, nonCBD work, and nonwork trips. Presented in A.M. peak hour VMT.
- Changes in Daily Emissions: Includes volatile organic compounds (VOCs), carbon monoxide (CO), and nitrogen oxide (NO_x). The emissions calculations in Appendix C generate A.M. peak-hour emissions, which are then multiplied by 4 (as described on page 21) to generate tons per day.
- Trip Summary Table for A.M. Peak Hour: Summarizes total base auto trips, base transit trips, revised auto trips, and revised transit trips by trip purpose. Base auto and transit trips come directly from the CATS model for each alternative. New auto trips are the product of total trips and the new auto share as derived using the incremental logit process. (Where the incremental logit process could not be applied, an abbreviated trip summary is provided.)
- Other comments related to time of day travel and potential secondary impacts.

A map of the impacted area is shown for each TCM. The emissions calculations for each TCM are included in Appendix C.

Transportation Control Measure

#1: West Chicago Metra station park-n-ride lot. Additional park-n-ride lot with 255 spaces is added to the West Chicago station.

Primary Travel Market Impacted

CBD work trips.

Area of Impact

Origin: Travel shed for the West Chicago Metra station, including West Chicago, Batavia, St. Charles, Warrenville, and Geneva.

Destination: One mile corridor between Warrenville and downtown Chicago (excluding West Chicago).

Travel Time and Cost Impacts

Reduced Access Time: (-10) minutes for all zonal interchanges. With more parking available in West Chicago, reduces number of commuters who drive to park-n-ride lots located farther away.

Results

Number of Origin Zones: 11

Number of Destination Zones:

CBD	12
NonCBD	35
Nonwork	47

Total Zonal Interchanges for Change in VMT Calculations:

CBD	132
NonCBD	385
Nonwork	517

Changes in A.M. Peak Hour VMT:

1990	Work CBD	-274
	Work NonCBD	-36
	Nonwork	0
2010	Work CBD	-806
	Work NonCBD	-32
	Nonwork	-1

Changes in Emissions (Tons per day):

1990	VOCs	-0.004
	CO	-0.028
	NOx	-0.004
2010	VOCs	-0.004
	CO	-0.024
	NOx	-0.004

TRIP SUMMARY - A.M. PEAK HOUR				
	Trip Type			
Trip Purpose	Base Auto Trips	Base Transit Trips	Revised Auto Trips	Revised Transit Trips
1990				
Work-CBD	22	443	14	451
Work-NonCBD	1,589	26	1,578	37
Nonwork	915	0	915	0
2010				
Work-CBD	65	661	43	683
Work-NonCBD	1,959	35	1,947	47
Nonwork	1,134	5	1,133	6

Comments

Park-n-ride lots generally do not eliminate auto trips, but reduce travel times and distances to the nearest facility from the home origin. As a result, VMT is reduced, but since trips are not eliminated, effectiveness as an air quality measure is limited by the amount of travel conducted with vehicle in cold start mode. This TCM impacts primarily peak-period trips, reducing total travel time approximately 10 to 20 percent.

Figure 2

Insert
11 x 17

Transportation Control Measure

#2: Cumberland Park-n-Ride Lot, O'Hare CTA line. An additional 750 parking spaces have been added to the Cumberland park-n-ride lot.

Primary Travel Markets Impacted

CBD work trips, nonCBD work trips.

Area of Impact

Origin: Cumberland station travel shed, including the CTA River Road station, Hoffman Estates, Des Plaines, Arlington Heights and Mount Prospect.

Destination: All zones between Harlem Ave. and downtown Chicago.

Travel Time and Cost Impacts

Reduced Access Time: (-3) minutes for all zonal interchanges. With additional parking, reduces the number of commuters who may drive to the River Road station.

Results

Number of Origin Zones 29

Number of Destination Zones:

CBD	10
NonCBD	22
Nonwork	32

Total Zonal Interchanges for Change in VMT Calculations:

CBD	290
NonCBD	638
Nonwork	928

Changes in A.M. Peak Hour VMT:

1990	Work CBD	-317
	Work NonCBD	-72
	Nonwork	-3
2010	Work CBD	-204
	Work NonCBD	-43
	Nonwork	-1

Changes in Emissions (Tons per day):

1990	VOCs	-0.008
	CO	-0.040
	NOx	-0.004
2010	VOCs	-0.000
	CO	-0.008
	NOx	-0.000

TRIP SUMMARY - A.M. PEAK HOUR				
	Trip Type			
Trip Purpose	Base Auto Trips	Base Transit Trips	Revised Auto Trips	Revised Transit Trips
1990				
Work-CBD	177	1,514	158	1,533
Work-NonCBD	508	86	497	97
Nonwork	142	37	142	37
2010				
Work-CBD	111	1,629	98	1,642
Work-NonCBD	311	55	305	61
Nonwork	146	38	146	38

Comments

Providing park-n-ride spaces generally does not eliminate auto trips, but reduces travel times and distances to the nearest facility from the home origin. As a result, VMT is reduced, but since trips are not eliminated, effectiveness as an air quality measure is limited by the amount of travel conducted with vehicle in cold start mode. This TCM impacts primarily peak-period trips, reducing total travel time approximately 5 percent.

Figure 3

Insert
1 x 17

Transportation Control Measure

#3: CTA-95th St. Transit Station Redesign. Expansion of platform and bus bridge.

Primary Travel Markets Impacted

CBD work trips, nonCBD work trips, nonwork trips.

Area of Impact

Origin: Two mile radius around the 95th St. Station.

Destination: All zones between 95 St. and downtown Chicago.

Travel Time and Cost Impacts

Reduced Access Time: (-2) minutes for origins around station based on more efficient bus operations.

Reduced Out-of-Vehicle (Transfer) Time: (-3) minutes for remainder of origins based on reduced time transferring between bus and rail.

Results

Number of Origin Zones 12

Number of Destination Zones:

CBD	9
NonCBD	18
Nonwork	27

Total Zonal Interchanges for Change in VMT Calculations:

CBD	108
NonCBD	216
Nonwork	324

Changes in A.M. Peak Hour VMT:

1990	Work CBD	-432
	Work NonCBD	-131
	Nonwork	-98
2010	Work CBD	-410
	Work NonCBD	-152
	Nonwork	-87

Changes in Emissions (Tons per day):

1990	VOCs	-0.012
	CO	-0.068
	NOx	-0.008
2010	VOCs	-0.004
	CO	-0.024
	NOx	-0.004

TRIP SUMMARY - A.M. PEAK HOUR				
	Trip Type			
Trip Purpose	Base Auto Trips	Base Transit Trips	Revised Auto Trips	Revised Transit Trips
1990				
Work-CBD	837	2,449	799	2,487
Work-NonCBD	565	482	547	500
Nonwork	174	417	163	428
2010				
Work-CBD	787	2,159	751	2,195
Work-NonCBD	531	531	511	551
Nonwork	126	451	116	461

Comments

Improvements to the efficiency of the transit station primarily impact peak period work trips, as this is the most congested travel period causing the greatest delays. Should reduce bus running times and idling times, contributing to further air quality improvements in the vicinity of the station as a result of reduced bus emissions. May reduce total travel time by approximately 5 to 10 percent.

Figure 4

Insert

11 x 17

Transportation Control Measure

#4: Schaumburg Transportation Center/Transfer Facility. New Woodfield transit center.

Primary Travel Market Impacted

Non CBD work and nonwork trips.

Area of Impact

Origin: One mile zone on each side of the 5 bus routes serving Woodfield.

Destination: Same as origin zones.

Travel Time and Cost Impacts

Reduced Out-of-Vehicle Time: Actual reduction based on existing transfer times. The new transfer time will be 0, where previously ranged from 5 to 20 minutes.

Results

Number of Origin Zones 84

Number of Destination Zones:

CBD	0
NonCBD	67
Nonwork	67

Total Zonal Interchanges for Change in VMT Calculations:

CBD	0
NonCBD	5628
Nonwork	5628

Changes in A.M. Peak Hour VMT:

1990	Work CBD	0
	Work NonCBD	-20
	Nonwork	0
2010	Work CBD	0
	Work NonCBD	-137
	Nonwork	0

Changes in Emissions (Tons per day):

1990	VOCs	0.000
	CO	-0.004
	NOx	-0.000
2010	VOCs	0.000
	CO	-0.004
	NOx	0.000

TRIP SUMMARY - A.M. PEAK HOUR				
	Trip Type			
Trip Purpose	Base Auto Trips	Base Transit Trips	Revised Auto Trips	Revised Transit Trips
1990				
Work-CBD	0	0	0	0
Work-NonCBD	15,661	184	15,658	187
Nonwork	8,217	75	8,217	75
2010				
Work-CBD	0	0	0	0
Work-NonCBD	20,410	399	20,392	417
Nonwork	8,286	49	8,286	49

Comments

Impacts both peak and off-peak trips. Since existing transfer is inefficient, out-of-vehicle travel time (OVTT) is relatively high. Pulsing of bus operations can reduce wait time, or OVTT, making transit a more desirable alternative to auto travel. Resulting mode switches can potentially generate significant emission reductions. This TCM may also reduce bus vehicle miles while increasing efficiency. Emissions may also be reduced by decreased bus idling. May reduce total travel time by approximately 10 to 25 percent.

Figure 5

11 x 17

ment

Transportation Control Measure

#5: Wood Dale Metra Station Distributor Bus Route. New bus route to distribute reverse commuters to work destinations.

Primary Travel Markets Impacted

NonCBD work trips.

Area of Impact

Origin: One mile zone on each side of the Milwaukee-West line from Elgin to Chicago, excluding Wood Dale.

Destination: Two mile radius around station.

Travel Time and Cost Impacts

Increased Transit Cost: $0.85 one-way cash fare for transfer between bus and rail (converted to 1970 dollars).

Increased Out-of-Vehicle Time: + 2 minutes for train to bus transfer time.

Reduced In-Vehicle Time: (-5) minutes to zones 760, 766, 767; (-3) minutes to zone 761 based on previous walk times.

Results

Number of Origin Zones 68

Number of Destination Zones:

CBD	0
NonCBD	14
Nonwork	14

Total Zonal Interchanges for Change in VMT Calculations:

CBD	0
NonCBD	952
Nonwork	952

Changes in A.M. Peak Hour VMT:

1990	Work CBD	0
	Work NonCBD	16
	Nonwork	0

2010	Work CBD	0
	Work NonCBD	69
	Nonwork	0

Changes in Emissions (Tons per day):

1990	VOCs	0.000
	CO	0.000
	NOx	0.000
2010	VOCs	0.000
	CO	0.004
	NOx	0.000

TRIP SUMMARY - A.M. PEAK HOUR				
	Trip Type			
Trip Purpose	Base Auto Trips	Base Transit Trips	Revised Auto Trips	Revised Transit Trips
1990				
Work-CBD	0	0	0	0
Work-NonCBD	2,085	24	2,087	22
Nonwork	417	0	417	0
2010				
Work-CBD	0	0	0	0
Work-NonCBD	4,002	59	4,011	50
Nonwork	664	0	664	0

Comments

Impacts peak-period travel only. Eliminates some auto trips (and associated cold starts) due to improvement in transit in-vehicle time. However, due to sensitivity to increased cost (new transfer cost), mode switches are limited, and emissions actually increase.

Figure 6

Insert
11x17

Transportation Control Measure

#6: Cermak Ave. Bus Signal Preemption.

Primary Travel Markets Impacted

All trips.

Area of Impact

Origin: All zones along Cermak Ave. between Harlem Ave. and downtown Chicago.

Destination: Same as origin zones.

Travel Time and Cost Impacts

Reduced In-Vehicle Time: (-3) seconds per signalized intersection. Includes 15 signalized intersections.

Results

Number of Origin Zones 51

Number of Destination Zones:

CBD	9
NonCBD	42
Nonwork	51

Total Zonal Interchanges for Change in VMT Calculations:

CBD	459
NonCBD	2142
Nonwork	2601

Changes in A.M. Peak Hour VMT:

1990	Work CBD	-51
	Work NonCBD	-7
	Nonwork	-2
2010	Work CBD	-64
	Work NonCBD	-8
	Nonwork	-2

Changes in Emissions (Tons per day):

1990	VOCs	-0.000
	CO	-0.008
	NOx	-0.000
2010	VOCs	-0.000
	CO	-0.004
	NOx	-0.000

TRIP SUMMARY - A.M. PEAK HOUR				
	Trip Type			
Trip Purpose	Base Auto Trips	Base Transit Trips	Revised Auto Trips	Revised Transit Trips
1990				
Work-CBD	3,670	10,171	3,665	10,176
Work-NonCBD	7,932	1,901	7,931	1,902
Nonwork	3,274	1,242	3,274	1,242
2010				
Work-CBD	4,607	12,535	4,601	12,541
Work-NonCBD	7,784	2,342	7,783	2,343
Nonwork	2,768	1,673	2,768	1,673

Comments

Affects peak and off-peak trips. Does not eliminate auto trips, but reduces travel time. Signal preemption increases travel speed, which generates emissions reductions. Signal preemption affects both buses and autos. May decrease total travel time by less than 5 percent.

Figure 7

1/x/7
insert

Transportation Control Measure

#7: I-294 Toll Plaza Bypass.

Primary Travel Markets Impacted

NonCBD work trips.

Area of Impact

Origin: One mile zone around bus pick-up points at southern end of routes

Destination: One mile zone around bus drop-off points at western end of line near Downers Grove and Lisle.

Travel Time and Cost Impacts

Reduced In-Vehicle Time: (-15) minutes based on current delays being experienced.

Results

Number of Origin Zones 24

Number of Destination Zones:

CBD	0
NonCBD	15
Nonwork	15

Total Zonal Interchanges for Change in VMT Calculations:

CBD	0
NonCBD	360
Nonwork	360

Changes in A.M. Peak Hour VMT:

1990	Work CBD	0
	Work NonCBD	-128
	Nonwork	0

Changes in Emissions (Tons per day):

1990	VOCs	0.000
	CO	0.003
	NOx	0.000

TRIP SUMMARY - A.M. PEAK HOUR				
	Trip Type			
Trip Purpose	Base Auto Trips	Base Transit Trips	Revised Auto Trips	Revised Transit Trips
1990				
Work-CBD	0	0	0	0
Work-NonCBD	7	0	0	7
Nonwork	0	0	0	0

Comments

Impacts peak hour trips only. Potential to eliminate auto trips plus reduce travel times as a result of decreases in bus running times. May decrease total travel time by 20 to 25 percent.

This TCM is being constrained by the regional travel model, which assigned few trips between the affected zones in the base year and none in the future. The above results are based on the travel in the regional forecast. This service currently carries about 350 daily riders, of which the average is about 20 riders per run on the 14 runs per day currently provided.

Figure 8

11x17

insert

Transportation Control Measure

#8: CTA Route 3, King Dr. Bus Service Management System (Automatic Vehicle Location, AVL, and Bus Signal Preemption).

Primary Travel Markets Impacted

All trips.

Area of Impact

Origin: One mile south of 95th St.; 2.5 miles east & west of King Drive from 95th St. to Roosevelt Rd.

Destination: One mile on each side of bus route between 95th St. to Chicago Ave.

Travel Time and Cost Impacts

Reduced In-Vehicle Time: (-3) seconds per signalized intersection.

Reduced Out-of-Vehicle (Transfer) Time: (-3) to (-5) minutes bus to bus transfer time.

Results

Number of Origin Zones 60

Number of Destination Zones:

CBD	6
NonCBD	10
Nonwork	16

Total Zonal Interchanges for Change in VMT Calculations:

CBD	360
NonCBD	600
Nonwork	960

Changes in A.M. Peak Hour VMT:

1990	Work CBD	0	
	Work NonCBD	-1	
	Nonwork	0	
2010	Work CBD	0	This number has been rounded from -0.000001.
	Work NonCBD	-2	
	Nonwork	–0.233	

Changes in Emissions (Tons per day):

1990	VOCs	0.000
	CO	0.000
	NOx	0.000
2010	VOCs	-0.000
	CO	-0.000
	NOx	0.000

TRIP SUMMARY - A.M. PEAK HOUR				
	Trip Type			
Trip Purpose	Base Auto Trips	Base Transit Trips	Revised Auto Trips	Revised Transit Trips
1990				
Work-CBD	9,860	27,978	9,860	29,978
Work-NonCBD	2,586	1,817	2,586	1,817
Nonwork	1,565	2,593	1,565	2,593
2010				
Work-CBD	10,442	28,695	10,442	28,695
Work-NonCBD	3,502	2,746	3,501	2,747
Nonwork	1,322	3,664	1,322	3,664

Comments

Impacts peak and nonpeak trips. Potential to eliminate auto trips plus reduce transit travel times. Increases service reliability and schedule adherence. May decrease total travel time by 5 to 10 percent.

Figure 9

11 x 17
insert

Transportation Control Measure

#9: Pace Subscription Bus Service from southwest Chicago to Sears in Hoffman Estates.

Primary Travel Markets Impacted

NonCBD work trips.

Area of Impact

Origin: Four square mile zone around subscription bus pickup points.

Destination: Sears in Hoffman Estates.

Travel Time and Cost Impacts

Not calculated by incremental logit process; used empirical calculation of number of subscription bus routes multiplied by 30 riders per bus.

Results

Changes in Emission (Tons per day):

1990	VOCs	-0.164
	CO	-0.896
	NOx	-0.152

Trip Summary

Would convert 303 auto trips to transit trips.

Comments

Peak-period impact only. Would convert long-distance auto commute trips to short-distance auto trips to pickup points; would have similar cold-start characteristics to park-n-ride lot projects; could eliminate auto trips based on proximity to pickup point; would add bus VMT in place of auto VMT (included in above calculation).

Air quality benefit is based on an assumption about mode switching that may be hard to rationalize. All trips are assumed to have been previously made by single-occupant vehicles. Therefore, the subscription bus is assumed to remove all of these trips, resulting in an equivalent air quality benefit.

Figure 10

11 x 17

insert

Transportation Control Measure

#10: Pace Subscription Vanpool Service from southwest Chicago to Sears in Hoffman Estates.

Primary Travel Markets Impacted

NonCBD work trips.

Area of Impact

Origin: Four square mile zone around vanpool pickup points.

Destination: Sears in Hoffman Estates.

Travel Time and Cost Impacts

Not calculated by incremental logit process; used empirical calculation of number of vanpools multiplied by 12 riders per van.

Results

Changes in Emission (Tons per day):

1990	VOCs	-0.092
	CO	-0.500
	NOx	-0.840

Trip Summary

Would convert 224 auto trips to transit trips.

Comments

Peak-period impact only. Would convert long-distance auto commute trips to short-distance auto trips to pickup points; would have similar cold-start characteristics to park-n-ride lot projects; could eliminate auto trips based on proximity to pickup point (e.g., if van made house pickups rather than park-n-ride facility); would add van VMT in place of auto VMT (included in above calculation).

Air quality benefit is based on an assumption about mode switching that may be hard to rationalize. All trips are assumed to have been previously made by single-occupant vehicle. Therefore, the subscription vanpool is assumed to remove all of these trips, resulting in an equivalent air quality benefit.

Figure 11

11 x 17

insert

Transportation Control Measure

#11: RTA Transit Fare Subsidy.

Primary Travel Markets Impacted

All trips.

Area of Impact

Origin: Total region.

Destination: Total region.

Travel Time and Cost Impacts

Reduced Cost: -$0.20 cost savings per trip (1990$).

Results

Number of Origin Zones 1,600

Number of Destination Zones:

CBD	12
NonCBD	1,588
Nonwork	1,600

Total Zonal Interchanges for Change in VMT Calculations (based on all transit users receiving transit fare subsidy):

CBD	19,200
NonCBD	2,540,800
Nonwork	2,560,000

Changes in A.M. Peak Hour VMT (adjusted to reflect percentage of employees using transit fare subsidy in relation to total regional employment):

1990	Work CBD	- 81
	Work NonCBD	-109
	Nonwork	- 54
2010	Work CBD	- 94
	Work NonCBD	- 98
	Nonwork	- 49

Changes in Emissions (Tons per day) (adjusted to reflect percentage of employees using transit fare subsidy in relation to total regional employment):

1990	VOCs	-0.004
	CO	-0.026
	NOx	-0.003
2010	VOCs	-0.001
	CO	-0.009
	NOx	-0.002

TRIP SUMMARY - A.M. PEAK HOUR				
	Trip Type			
Trip Purpose	Base Auto Trips	Base Transit Trips	Revised Auto Trips	Revised Transit Trips
1990				
Work-CBD	46,418	139,351	41,315	144,454
Work-NonCBD	689,060	115,993	680,144	124,909
Nonwork	235,138	39,661	229,282	45,517
2010				
Work-CBD	53,842	167,560	47,853	173,549
Work-NonCBD	820,912	122,198	812,242	130,868
Nonwork	245,686	41,975	240,281	47,380

Comments

The transit fare subsidy reduces the cost of transit in relation to auto travel, resulting in auto trip reductions. Changes in transit share were calculated based on two assumptions:

1. Fare subsidy is available to all transit users.

2. $21.00 fare subsidy used by all.

Because the fare subsidy is administered by employers, not all transit users have access to the fare subsidy. Accordingly, the changes in VMT were factored to represent the existing level of transit fare subsidy use. The factor is the ratio of the total number of transit pass users in relation to total regionwide employment for both 1990 (3,834,898) and 2010 (4,170,846).

Figure 12

insert

Transportation Control Measure

#12: Metra-Franklin Park station grade separation.

Primary Travel Markets Impacted

CBD and nonCBD work trips.

Area of Impact

Origin: Four square mile zone around Franklin Park station.

Destination: Zones along Metra line between end of line and downtown Chicago, excluding Franklin Park.

Travel Time and Cost Impacts

Reduced Access Time: -(5) minutes based on current delay.

Results

Number of Origin Zones 4

Number of Destination Zones:

CBD	12
NonCBD	46
Nonwork	58

Total Zonal Interchanges for Change in VMT Calculations:

CBD	48
NonCBD	184
Nonwork	232

Changes in A.M. Peak Hour VMT:

1990	Work CBD	-96
	Work NonCBD	-1
	Nonwork	0
2010	Work CBD	-113
	Work NonCBD	-1
	Nonwork	0

Changes in Emissions (Tons per day):

1990	VOCs	0.000
	CO	-0.008
	NOx	0.000
2010	VOCs	0.000
	CO	-0.004
	NOx	0.000

TRIP SUMMARY - A.M. PEAK HOUR				
	Trip Type			
Trip Purpose	Base Auto Trips	Base Transit Trips	Revised Auto Trips	Revised Transit Trips
1990				
Work-CBD	35	175	29	181
Work-NonCBD	374	2	374	2
Nonwork	162	0	162	0
2010				
Work-CBD	39	247	32	254
Work-NonCBD	311	2	310	3
Nonwork	111	0	111	0

Comments

Impacts peak period travel, when most delay occurs. Results in improved traffic flow and increased travel speeds. Increased speeds result in emission reductions. However, may also increase attractiveness of auto mode in relation to transit, causing mode switch to auto and induced travel. May reduce total travel time by approximately 5 to 10 percent.

Figure 13

11x17

insert

6.
Conclusions

As the screening methodology was developed and alternative TCM projects were analyzed, issues were raised concerning several areas: general limitations of the process employed, the overall effectiveness of different types of transit projects, and modeling enhancements/refinements to generate better estimates of VMT and emissions changes.

6.1 Limitations of Evaluation Process

The methodology was developed for this project as a screening tool to be used at the regional level. In addition, the methodology employed was designed to estimate results consistent with the regional travel models, but without rerunning the regional models. Based on these, there are inherent limitations in the process. Some of these limitations may be overcome by rerunning the regional models, conducting sensitivity analyses, or supplementing survey data for the regional travel data. It is important to identify and take into consideration these limitations listed below when the results are interpreted and conclusions made about the impact of specific TCMs.

- The evaluation process only works for areas with existing transit service. Areas without transit service will not have any transit trips in the regional model. Because of this, results are better for line-haul service to the downtown, as the travel data is more complete. For new transit markets, TCM impacts must be calculated manually, rerun on the regional model, or regional travel data must be supplemented with survey data.
- Regional travel models are not designed for an analysis generating this level of detail, such as off-peak travel and nonwork trips.
- The speed data from the regional model has limitations. Speed data tends not to be as accurate as volume data, so most models are calibrated to volumes, not speeds. This is because speeds are more variable and therefore more difficult to calibrate.

- Secondary impacts are difficult to determine, as this process does not distinguish between eliminating trips completely and reducing trip lengths. The output of this process is the change in VMT, which is composed of both trips eliminated and trips shortened.
- This process only predicts the impact of a single TCM, not TCMs implemented together. Some TCMs are synergistic, while others are conflicting. Some TCMs may be additive because they affect different transit markets and the benefits of several TCMs may be added together. Other TCMs affect the same transit market and commuters will choose one TCM over another, so benefits cannot be added together.

These limitations should be evaluated for those changes that are desired and/or additional research should be conducted. More current data should be available as the model is updated with the 1990 census journey-to-work data and as other model changes are made in response to U.S. EPA requirements.

6.2 Effectiveness of Transit Projects

Each TCM was evaluated based on its relative effectiveness in reducing VMT and pollutant emissions. From the results of this evaluation, it becomes clearer what types of projects generate the greatest reductions. Those projects that involve changes in cost show the most sensitivity. The Wood Dale Metra station distributor bus had a higher cost and resulted in the least impact on VMT and emissions. The RTA Transit Fare Subsidy was evaluated based on availability to all transit users (regardless of employer participation) and then factored to reflect existing use of the subsidy. Even with a relatively small proportion of existing transit fare subsidy users in relation to total employment, reductions in emissions were generated.

It is important to identify the relative impact of each TCM on cost and travel time. The transit fare subsidy of $21.00 may represent 30 percent of a transit user's total cost, whereas a 3- to 5-minute change in travel time savings may represent only 5 to 10 percent of total travel time. Therefore, a sensitivity analysis may be warranted to identify what changes would be needed to generate travel time savings of a comparable percentage and how this would change VMT and emissions.

In addition to identifying those projects with the least and greatest impacts, it is also important to distinguish between those projects that reduce VMT and those that eliminate trips. Projects including park-n-ride lots, such as rapid transit/commuter rail stations, vanpool services, or subscription bus services, may reduce VMT but still generate auto trips to and from the park-n-ride or pickup/drop-off locations. These projects will still generate significant emissions by vehicles driven in the cold start mode.

Additional comparisons recommended for future analysis of TCMs include cost-effectiveness, the use of sensitivity analysis, and combinations of TCMs. An evaluation should be conducted of the cost-effectiveness of each TCM based on the cost per ton of emissions reduced compared to the cost of the TCM. The cost-effectiveness should be compared for all TCMs to identify those TCMs that reduce the greatest amount of emissions for the least cost.

6.3 Future Model Enhancements

The results presented in Chapter 5 show the impact of each TCM on emissions and VMT to the extent that the TCMs can be analyzed with the regional travel forecast model systems. Throughout this study, however, enhancements and/or refinements to the regional modeling process were identified. These enhancements/refinements were grouped into two categories: those applicable to existing TCMs that affect transit services, and those applicable to new transit services and employer programs.

6.3.1 Existing Services and Facilities

If the existing transit service has been coded into the regional travel forecasting model, then TCMs affecting this service can generally be easily analyzed using the incremental logit and elasticity approaches based on these models. As has been done in this study, each TCM can be represented by changing travel times on existing links, headways for existing transit lines, and/or fares for limited subsets of origin/destination pairs.

In several instances, as noted above, the regional model did not include transit trips where transit services currently exist. Similarly, the regional model is currently calibrated primarily for work-related travel. Because nonwork trips are based on home interview data, they are only as accurate as the most recent update of this data. In a region that has experienced change like that in the Chicago metropolitan area, it may be necessary to update the model calibration process on a more frequent basis so that the regional forecasts more closely mirror the changes in travel patterns.

The primary enhancements to the modeling process to support TCM evaluation are twofold. Iterative validation of base year data to adequately represent known transit trips is one step that could resolve some of the inconsistencies found during this study. The second step is to update trip behavior data so that work and nonwork patterns can be more accurately represented in the modeling process.

Sensitivity analyses should be used to test adjustments to TCMs, such as different fare structures, increased speeds, or improvements over larger areas. The initial run would be the baseline against which to compare a sensitivity test. This may be a time-consuming process, as multiple runs will be required, but the benefit would be a greater understanding of what types of adjustments generate greater reductions in emissions. A sensitivity test also could be used to determine the amount of VMT to be reduced to offset cold starts.

6.3.2 New Transit Services

The existing regional and sketch planning models also can be used to analyze many new transit services, but not as easily or completely as for existing transit services. If the regional models are used, new links, transit lines, transfer facilities, and possibly fare matrices should be coded to provide the basis for determining changes in in-vehicle times, out-of-vehicle times, and travel

costs for transit trips. Sketch planning methods will be applicable on a more limited basis. If transit use from the new service area is not currently significant, then there will be no basis to "pivot" to estimates of new higher patronage levels. Furthermore, the existing regional models may not provide the features required to address some aspects of these strategies.

Existing regional models provide the needed analysis methods for evaluating new transfer facilities and new routes, but may need to be refined or supplemented for dial-a-ride, subscription bus, and park-n-ride projects, or employer-based programs such as carpool, vanpool, and transit fare subsidies. Model enhancements for these projects are described below.

1. *New Commuter Rail Stations and/or Park-n-Ride Lots; Expanded Park-n-Ride Lots.* In most cases, these facility changes will have no impact on the inputs to the regional models; thus, their impacts on transit patronage cannot be estimated by these models. If it is assumed that the regional models overestimate park-n-ride demand because they do not take parking capacity limitations into account, then the regional models could be extended to provide realistic estimates of park-n-ride facility usage. This can be done by checking the model results to determine if capacity constraints are exceeded. Ideally, the revision process requires "shadow" parking lot prices applied iteratively until parking demand equals supply, but sketch planning approximations can be used to adjust the changes in emissions to be consistent with the available capacity. The regional models are also likely to require extension to ensure that the emissions of autos used for park-n-ride and kiss-n-ride are also measured. For detailed analysis of these emissions, changes in trip lengths and operating mode fractions will be necessary as inputs to the MOBILE5 emission factor model. For sketch planning analysis, in most cases it will be appropriate to assume that all of the available additional park-n-ride capacity will be used, due to existing deficits in capacity at the stations selected for parking expansion. Thus, the difference between the existing VMT for auto travelers in the area served by the expanded facility and their new VMT level if they use the park-n-ride facility can be attributed to each new parking space to estimate the impacts of the expanded facility on auto VMT.

2. *Park-n-Ride Lots with HOV Preferences.* Special procedures or approximations may be required to supplement the regional models if parking demand, by either general park-n-ride autos or HOVs, exceeds capacity. Similarly, the emissions of parkers must be measured. In addition, extended HOV analysis methods such as those included in the CATS model will be required to obtain both HOV and general auto access demand levels. Sketch planning methods will be applicable to these strategies.

3. *New Dial-a-Ride Services.* The flexible schedules and routes of dial-a-ride do not lend this strategy to analysis using the existing model systems or sketch planning approaches. Experience with similar systems elsewhere, preferably in the Chicago region, should be used to estimate the usage and VMT reduction characteristics of this strategy. The best sources of information on such systems at the national level are provided by the TDM analysis systems and extension of the traditional mode choice forecasting strategies.

4. *Subscription Bus Service.* If these services have a limited (i.e., restricted) set of qualified users, they cannot be handled accurately in the existing model system. However, if a person

trip table including only qualified users can be specified (as in the example of Sears employees in Hoffman Estates), then the existing mode choice model could be used as a sketch planning tool to predict trips by mode and VMT by origin/destination pair under alternative subscription bus service assumptions.

5. *Vanpools*. If a person-trip table including only qualified users can be specified (as in the example of Sears employees in Hoffman Estates), then existing mode choice models and HOV forecasting processes may be usable in a sketch planning procedure for predicting trips by mode and VMT by origin/destination pair under alternative vanpool service assumptions. In the more general case, single-employer analyses using information from comparable programs (TDM) will be required, possibly with expansions to zonal totals based on assumptions concerning the numbers of employers by size category, and the percentages of employers in each category likely to participate in vanpool programs.

6. *Transit Fare Subsidies*. Generally, single-employer analyses using information from comparable programs (TDM) will be required, possibly with expansion to zonal totals in the case of programs for which participation by many employers is likely, as discussed in Item 5.

Table 5
EVALUATION OF TRANSIT–RELATED TRANSPORTATION CONTROL MEASURES
SUMMARY TABLE ON PROJECTS AND PRELIMINARY RESULTS

Transportation Control Measure	Travel Market Impact	Travel Time & Cost Impacts	Change in Emissions (Tons per day)					
			1990			2010		
			VOCs	CO	NOx	VOCs	CO	NOx
West Chicago Metra Station Park–n–Ride Lot	CBD Work	–10 min. access time	–0.004	–0.028	–0.004	–0.004	–0.024	–0.004
Cumberland Ave. Park–n–Ride Lot CTA – O'Hare Line	CBD Work; NonCBD Work	–3 min. access time	–0.008	–0.040	–0.004	0.000	–0.008	0.000
95th St. Station Redesign CTA – Dan Ryan Line	CBD Work; nonCBD work; Nonwork	–2 min. access time –3 min. transfer time	–0.012	–0.068	–0.008	–0.004	–0.024	–0.004
Schaumburg Transportation Center Woodfield Mall	NonCBD Work; Nonwork	–5 to –20 min. transfer time	0.000	–0.004	0.000	0.000	–0.004	0.000
Wood Dale Metra Station Distributor Bus	NonCBD Work	+$.85 fare; +2 min. transfer time; –5 min. in–vehicle time	0.000	0.000	0.000	0.000	–0.004	0.000
Cermack Ave. Bus Signal Pre–emption	All Trips	–3 seconds per signalized intersection	0.000	–0.008	0.000	0.000	–0.004	0.000
I–294 Toll Plaza Bypass	NonCBD Work	–15 min. in–vehicle time	0.000	0.003	0.000	NA	NA	NA
CTA Rt. 3 King Dr. Bus Service Management System	All Trips	–3 seconds per signalized intersection; –3 to–5 min. transfer time	0.000	0.000	0.000	0.000	0.000	0.000
Pace Subscription Bus Service to Sears, Hoffman Estates	NonCBD Work	Calculated manually	–0.164	–0.896	–0.152	NA	NA	NA
Pace Subscription Vanpool Service to Sears, Hoffman Estates	NonCBD Work	Calculated manually	–0.092	–0.500	–0.840	NA	NA	NA
RTA Transit Fare Subsidy	All Trips	–$.20 per trip	–0.004	–0.026	–0.003	–0.001	–0.009	–0.002
Franklin Park Metra Station Grade Separation	CBD Work; NonCBD Work	–5 min. access time	0.000	–0.008	0.000	0.000	–0.004	0.000

Prepared by: Barton–Aschman Associates, Inc. 3/93

Appendix A
Profiles of Transportation Control Measures

PROJECT PROFILE

1. TCM TYPE

2. PHYSICAL DESCRIPTION

3. LOCATION

4. SERVICE CHANGE (Change in bus or rail service)

5. TCM CAPACITY (Increase in space or usage)

6. RIDERSHIP
   a. Current
   b. Expected Change (+/-)

7. CONNECTING ROADWAY IMPACTS
   a. Capacity
   b. Usage
   c. Expected Change

8. POTENTIAL BENEFITS

9. POTENTIAL DEFICITS

10. COST

11. RELATIONSHIP TO ETR PLANS
    a. Direct
    b. Indirect

12. ISSUES/CONCERNS

PROJECT PROFILE

1. TCM TYPE: Number 2, Transit Station Park-n-Ride lots

2. PHYSICAL DESCRIPTION: Increased parking capacity at parking facility with 750 spaces to 1500 spaces. Facility has reserved first floor, 350 spaces for HOV (car pools) and 25 spaces for Disabled. CATS has supplied staff to enforce HOV parking. The facility is directly connected to rapid transit rail line, bus terminal, and Kiss-n-Ride area.

3. LOCATION: CTA Cumberland Station, O'Hare line. Opened May 1992

4. SERVICE CHANGE (Change in bus or rail service): Not direct service change. CTA can review GFI farebox data for time period since May to study impact on bus service. Pace may have to perform same analysis. CTA has requested information from CDOT on any impact studies performed before project. Rail ridership has been off since the April flooding. Additionally, rail ridership is being affected by the economy, fare increases, Kennedy construction, and the increased availability of parking in the CBD. In August 1992, CTA distributed a free, one day parking voucher at the toll booths on the Tollway. It was good during a one week period. The voucher had a small ridership survey on back, data not available at this time.

5. TCM CAPACITY (Increase in space or usage): 750 new spaces on two new decks. HOV and Disabled occupancy on first floor.

6. RIDERSHIP:
   a. Current: 1991 annual rail traffic at Cumberland station 1.48 million. November weekday station entering traffic 5,050.

CTA Route	Ridership		Headways				Bus Req'ts.	Bus Miles
	Mar. '91	Mar. '92	A.M.	Base	P.M.	Eve.	Rush/Base	
69	500	530	20 min	20 min	20 min	20 min	1/1	197
81W	2,210	2,220	12 min	20 min	12 min	20 min	5/3	1,827

Pace routes, average weekday riders, 2nd Quarter 1992:

Route 240	924
Route 241	639
Route 290	5,506
Route 331	1,726

b. Expected Change (+/-): needs to be measured

7. CONNECTING ROADWAY IMPACTS
   a. Capacity: Cumberland at entrance ADT estimated at 40,000
   b. Usage: 2,000 or one lane
   c. Expected Change: not known

8. SECONDARY BENEFITS: Increased use of O'Hare line; increase in non-CBD commuters parking in lot and riding a bus or walking to work); decreased use of expressway; people who are using commercial space for transit parking may shift to lot.

9. SECONDARY DEFICITS: Cold start issue and increased use of local roadways. Possibility of decreased use of feeder buses.

10. COST: CTA will get from CDOT. Was an FHWA funded project.

11. RELATIONSHIP TO ETR PLANS
   a. Direct: none
   b. Indirect: only if employer is supporting parking and/or rail fare

12. ISSUES/CONCERNS: Difficulty in estimating changes in bus ridership due to other ridership variables. May have to fund user surveys. (Note: Survey of Preferential Parking performed in September by NIPC. Results due to Operation Green Light, Local Development Policy Task Force in November.)

PROJECT PROFILE

1. TCM TYPE: Number 3, Train Station Redesign

2. PHYSICAL DESCRIPTION: Expansion and enlargement of existing station and alteration of usage patterns to facilitate flow through the station of 20,000 boarding passengers. The length of the train platform would be nearly doubled by adding approximately 400 feet. The installation of an elevator will be added to allow access to disabled individuals. The bus bridge will be extended by 406 feet to allow for the separation of boarding and alighting of buses. Greyhound's intercity buses would be relocated to the east side of the station to reduce conflicts with CTA feeder buses.

3. LOCATION: CTA 95th Street Station, Dan Ryan line (west- south) 95th and State Streets

4. SERVICE CHANGE (Change in bus or rail service): The station was designed for approximately 11,000 patrons. The volume of users (20,000), the large number of buses, the general traffic congestion around station, result in inconvenience and travel time delays. While not a direct service change. May result in faster service, and reduced number of buses after reduction of congestion. In 1993 Dan Ryan will be paired with Howard(north) line. CTA can review GFI farebox data. Rail ridership off since April flooding and additionally rail ridership off due to economy, fare increases, Kennedy construction, increased availability of parking in the CBD.

5. TCM CAPACITY (Increase in space or usage): The extended train station platform would provide more space per passenger--even if ridership levels increased--and reduce the potential for conflicts between boarding and alighting passengers.

6. RIDERSHIP

   a. Current: 1991 annual rail traffic at 95th station 6 million. November weekday station entering traffic 20,150. Over 4/5 of the riders arrive at the station via one of fourteen bus routes, thirteen of which must maneuver through heavy traffic on 95th Street.

   CTA Bus route performance March 1992:

Route 29	14,910
Routes 34/119	12,560
Route 108	4,730
Route 112	3,610
Route 111/104	7,230
Route 95E	6,500
Route 95W	5,900

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Route 100	1,040
Route 106	4,730
Route 103	4,220

Pace has three routes into the station:

Route 352	5,886
Route 353	4,515
Route 381	5,171

b. Expected Change (+/-): needs to be measured

7. CONNECTING ROADWAY IMPACTS
   a. Capacity:
   b. Usage: Approximately 37,000 vehicles pass the station entrance at 95th Street every day. To the east and west are State and Lafayette streets which combined carry 20,000 vehicles daily. During the peak morning hour 288 bus movements occur at the station. These compete with the 4,200 other traffic movements through the two nearby intersections.
   c. Expected Change: none expected

8. POTENTIAL BENEFITS: Facilitate bus movement; improve reliability of bus service; shorten trip time; increase attractiveness; and improvement in local roadway speeds.

9. POTENTIAL DEFICITS: Bus idling issue. Many of the vehicles on the streets adjacent to the 95th/Dan Ryan station are exiting or entering the expressway. Modifications to the station would not eliminate traffic congestion.

10. COST: $24.9 million in 1986 dollars

11. RELATIONSHIP TO ETR PLANS
   a. Direct: none
   b. Indirect: only if employer is supporting rail fare

12. ISSUES/CONCERNS: The project remains in the planning phase. It is not in the TIP for capital funding. If other plans go forward for line extension the project would be changed.

PROJECT PROFILE

1. TCM TYPE: Number 4, Transportation Center/Transfer Facility

2. PHYSICAL DESCRIPTION: The transportation center/transfer facility is designed to open with 10 bus berths, which includes some excess capacity. Some berths are for the Limited and Express bus routes and others are for two Dial-a-Ride services. Vanpools will use facility as a pick up point coming through the Kiss-n-Ride area. A 200 space Park-n-Ride lot is also provided.

   The project is in the TIP for land acquisition and design engineering. Will be ready to go to a capital grant in FY 1993.

3. LOCATION: Pace facility on a 5 acre site at Martingale and Kimberly in Schaumburg. Near Higgins and Woodfield Roads

4. SERVICE CHANGE (Change in bus or rail service): Pace Routes #606 primarily reverse commute and #757 a reverse commute service, as well as Woodfield routes #209, #696, #699, will be routed into facility with Dial-a-Ride services. The Dial-a-Ride services are in the general Schaumburg area and a midday shuttle. Shuttle service may increase to all day. All services into the facility will be pulse operations.

   Park-n-Ride lot will have 200 spaces because of the high residential nature of market area. May people riding these routes are currently parking in commercial lots along the route. May be able to fill 80% of the spaces when facility opens.

   Regular routes coming into this facility are really Limited Express Buses. They have an express portion but actually use major arterials for long periods.

   Vanpool service started up in September '91. Currently 50 vans are in service with 70 expected by the end of October '92.

   Facility will replace Woodfield Shopping Center as a terminal but service will still go through Woodfield.

5. TCM CAPACITY (Increase in space or usage): Same, this is a new facility.

6. RIDERSHIP

   a. Current: Average weekday riders, 2nd quarter 1992:

Route 606	1,396
Route 757	314
Route 209	2,261

Route 696	454
Route 699	389

b. Expected Change (+/-) Facility can accommodate 7,000 riders per day or 32,000 trips. Expect some trips will be related to Sears move to Hoffman Estates.

7. CONNECTING ROADWAY IMPACTS:

a. Capacity:

b. Usage: Martingale and Kimberly are minor street with low usage. Higgins and Woodfield road are major arterials. The impact of Pace service on the roadways is so low that it could be considered part of the error curve.

c. Expected Change: Change on minor streets would possibly be significant, but they are low volume roadways now. Intersection with major arterials is signalized and movements are planned for right in and right out.

8. POTENTIAL BENEFITS: Faster inter- and intra-modal transfers. More safe, comfortable and reliable transfers. More reliable bus service. Mode shifting possible with increase in reliability of bus service. Possible reductions in VMT for autos, auto trips and emissions.

9. POTENTIAL DEFICITS: Increases in bus emissions from increases in service. Cold start issue for Park-n-Ride lot. Bus idling issues unless controlled. Increased usage of local roads.

10. COST: $3,000,000

11. RELATIONSHIP TO ETR PLANS:

a. Direct: If employers are encouraging transit usage and/or subsidizing transit costs.

b. Indirect: Possible mode shift

12. ISSUES/CONCERNS:

a. Bus idling is a difficult issue. Some older buses may not restart when turned off at transfer facilities. May be causing more emission difficulties due to need to cold start a new bus to replace bus in service.

b. Concerned that regional focus is on maintaining the current system. Pace's projects have growth in market area focus. The real issue may be the relative importance to air quality of these different focuses.

c. Issues for Pace are service reliability and speed.

PROJECT PROFILE

1. TCM TYPE: Number 5, Distributor Bus Route Design/Schedule Coordination

2. PHYSICAL DESCRIPTION: Initiation of feeder bus service from the rail station to the surrounding commercial and industrial businesses. Metra is paying Pace to perform a three month (Oct 19 to Jan 19) test of bus service.

   While studying reverse commute found 32 people were getting off outbound trains and walking to destinations. Do not have hard numbers on suburb to suburb commuters. In a survey of 38 companies in the Wood Dale area received responses from 19 companies that 350 people live along the Milwaukee Road Line both east and west of Wood Dale.

3. LOCATION: Metra, Wood Dale rail station, Milwaukee District/West Line.

4. SERVICE CHANGE (Change in bus or rail service): Among service changes effective 9/6/92 a train stop was added in Wood Dale to accommodate suburb to suburb commute and additional City of Chicago stops were added to attract reverse commuters. These changes were made within the capacity of currently scheduled trains. Two buses with a 2-3 minute connection will meet every inbound and outbound train. During the month of October (October 10-31) the bus ride will be free. In November the fare will go to 85 cents or riders can buy the Link-up pass for $36.00. This will be in addition to the regular Metra zone fare. Service will be provided to the Oakwood, Chancellary, and Hamiliton Lakes business parks. Metra is attempting to attract people driving from west as well as reverse commuters.

   Metra is working with Wood Dale companies to offer a free round trip ticket promotion to employees living in specific zip codes along the rail line.

5. TCM CAPACITY (Increase in space or usage): As a new service will be the same.

6. RIDERSHIP:
   a. Current: 32 riders on 3 outbound trains from 6:28am to 7:50am;
   12 riders on 6 inbound trains from 5:00am to 7:42am.
   b. Expected Change (+/-) The minimum fare box recovery rate of 17% would be met with 46 riders. This is not enough to keeping service without a subsidy.

7. CONNECTING ROADWAY IMPACTS:
   a. Capacity:
   b. Usage: Mayor of Wood Dale reports 7-9 a.m. gridlock and vacant streets after 10 a.m.
   c. Expected Change: Dependent on success of service

8. POTENTIAL BENEFITS: Mode shifting from auto to bus and rail. Reduction in auto trips.

9. POTENTIAL DEFICITS: None identified by Metra

10. COST: One bus costs $12,500 for the three month period.

11. RELATIONSHIP TO ETR PLANS:
    a. Direct: employers in area are required to achieve a 25% increase in single auto occupancy by November 1996.
    b. Indirect: none

12. ISSUES/CONCERNS: The service is only a three month test. The service will be evaluated after the test period to determine the success in creating a market of reverse and suburb-to-suburb commuters on public transportation.

PROJECT PROFILE

1. TCM TYPE: Number 6, Bus Signal Preemption

2. PHYSICAL DESCRIPTION: Buses will only preempt signal changes when behind schedule and not in conflict with emergency vehicles.

3. LOCATION: Cermak Road, 54th Ave. (Douglas 'L') to North Riverside Park Mall (1.5 miles)

4. SERVICE CHANGE (Change in bus or rail service): Pace Route #304--30 minute service, Route #322--30 minute service; CTA Route #25--30 minute service. Translates into 10 minute headway on the common section which is where signal preemption is being studied. If becomes a capital grant IDOT Highway Division will probably install equipment at intersections. Pace and CTA will install equipment on vehicles. May result in faster service and reduced number of buses. May affect VMT if increases the number of riders who change modes.

   Separate from the IDOT study, Pace has acquired from Vapor Corp. equipment to test the technique of signal preemption. Actual preemption will not occur but Pace will be able to collect data from buses to assure that information is coming in clearly and to test for false positives and negatives. The current IDOT signal equipment may be good enough to use as is. IDOT will install necessary equipment in the street.

5. TCM CAPACITY (Increase in space or usage): Same, any excess capacity on vehicles will be able to accommodate increases in ridership.

6. RIDERSHIP

   a. Current:

CTA Route	Ridership		Headways, Combined with Pace				Bus Req'ts.	Bus Miles
	Wkday.	Sat.	A.M.	Base	P.M.	Eve.	Rush/Base	
25	930	1,140	12 min	10 min	10 min	10 min	2/2	199

Pace routes, average weekday riders, 2nd quarter 1992:

Route 322 3,753
Route 304 1,348.

b. Expected Change (+/-) +2% for CTA. On a weekday this would translate into approximately 18 passengers. Pace expects ridership increases of +5%.

7. CONNECTING ROADWAY IMPACTS:

   a. Capacity: need data

   b. Usage: need data

   c. Expected Change: may increase on roadways with bus preemption.

European practice is for bus signal preemption to give the buses as little as 3 seconds out of the standard cycle. The impact on cross streets should be negligible.

8. POTENTIAL BENEFITS: Faster roadway movements on bus streets, reduction in bus stopping and start up emissions, reduced street congestion and reduced bus bunching. Mode shifting possible with increase in reliability of bus service. Possible reduction in VMT for autos, auto trips and emissions. Possible increase in arterial operating speeds.

9. POTENTIAL DEFICITS: Increases in emissions from autos on connecting streets were traffic movement is altered.

10. COST: IDOT study need amount; Pace technique test $45,000

11. RELATIONSHIP TO ETR PLANS:

   a. Direct: none

   b. Indirect: Possible mode shift

12. ISSUES/CONCERNS:

   a. Technology is new to USA and impacts are difficult to quantify. IDOT has agreed not to evaluate cost reductions in terms of saving whole buses but rather in percent of running time saved, because percentage issue is a better number to apply to other routes.

   b. Issues for Pace are service reliability and speed.

PROJECT PROFILE

1. TCM TYPE: Number 7, Restricted Use Lanes/Facilities for Transit Vehicles

2. PHYSICAL DESCRIPTION: Pace buses will be able to go through the automated toll lane without stopping by using Automatic Vehicle Identification (AVI). The tollway is rebuilding the toll plaza to widen all automatic lanes to 10 feet. Previously they were 8 1/2 feet and buses could not fit. Tollway has a Request for Proposals out for a prototype AVI system on the North-South Tollway. The leasing of the transmitter will be about $40.00.

3. LOCATION: Pace service on tollway. Toll Plaza located at Interstate 294 and Route 83.

4. SERVICE CHANGE (Change in bus or rail service): Pace Routes #888 and #877 use the plaza. Bumper to bumper delays are currently experience. May be able to cut running time on these routes. Expect to be able to handle any increases in ridership with current capacity.

5. TCM CAPACITY (Increase in space or usage): Same no capacity change is expected.

6. RIDERSHIP:
   a. Current: Pace routes, average weekday riders, 2nd quarter 1992:

Route 888	80
Route 877	222

   b. Expected Change (+/-): Expect increases in ridership no calculation made.

7. CONNECTING ROADWAY IMPACTS:
   a. Capacity: need data
   b. Usage: Toll plaza is heavily used and major delays are experienced.
   c. Expected Change: No change or increase in usage as congestion decreases.

8. POTENTIAL BENEFITS: Reducing bus delays, increases in safety, and faster roadway movement. Possible reductions in VMT if mode shifting occurs.

9. POTENTIAL DEFICITS: Increases in bus emissions from increases in service. Increased usage of expressway.

10. COST: to Pace $40.00 per month plus tolls

11. RELATIONSHIP TO ETR PLANS:

a. Direct: none

b. Indirect: Possible mode shift

12. ISSUES/CONCERNS:

a. The physical limits of the area's geography prevent addition of a transit lane at this plaza.

b. Concerned that regional focus is on maintaining the current system. Pace's projects have growth in market area focus. The real issue may be the relative importance to air quality of these different focuses.

c. Issues for Pace are service reliability and speed.

PROJECT PROFILE

1. TCM TYPE: Number 8, Automatic Vehicle Location/Control and Bus Signal Preemption

2. PHYSICAL DESCRIPTION: CTA's Bus Service Management System (BSMS) is a RTA and FTA funded capital project. Permits management of bus schedule adherence, bus location and assurance of employee and rider security. Buses may preempt signal changes except when ahead of schedule. City of Chicago will install equipment at intersections (as a subcontractor). CTA contractor installs on vehicles. In initial portion BSMS includes 5 signalized intersections on King Drive and 162 buses (including 45 for King Drive). Upon acceptance, RFP calls for the rest of CTA's buses and 195 additional intersections throughout the system to be equipped.

3. LOCATION: King Drive, 43rd to 51st (1 mile)

4. SERVICE CHANGE (Change in bus or rail service): Route #3 King Drive requires 41 buses in the rush; every four to five minutes of running time equals a bus (1 interval). May result in reduction of bus bunching, faster service, decreased stopping, and decrease in number of buses needed on the route.

5. TCM CAPACITY (Increase in space or usage): Same, any excess capacity resulting from same number of vehicles being able to make more trips will be able to accommodate increases in ridership induced by more reliable, faster service.

6. RIDERSHIP

   a. Current: From Operating Facts (5/11/92) Average weekday 64 riders per bus. Weekday round trips 180.

CTA route	Ridership		Headways				Bus Req'ts.	Bus Miles
	Wkday.	Sat	A.M.	Base	P.M.	Eve.	Rush/Base	
3	18,000	10,000	4 min	6 min	5 min	7.5 min	41/22	4,543

   b. Expected Change (+/-) +3% for CTA. On a weekday this would translate into approximately 540 additional passengers, increasing ridership to 66 per bus.

7. CONNECTING ROADWAY IMPACTS:

   a. Capacity: need data

   b. Usage: need data

   c.Expected Change: may increase on roadways with bus preemption.European practice for bus signal preemption is to give buses as little as 3 additional seconds out of the standard cycle. The impact on cross streets should be negligible.

8. POTENTIAL BENEFITS: Faster roadway movements on bus streets, reduction in bus stopping and start up emissions, reduced street congestion and reduced bus bunching. Mode shifting possible with increase in reliability and faster bus service. Possible reduction in VMT for autos, auto trips and emissions. Increase in employee and rider safety and security. Decrease in operational costs due to reduction in bus supervision expenses.

9. POTENTIAL DEFICITS: Increases in emissions from autos on connecting streets where traffic movement is altered.

10. COST: $850,000--allocation of costs for 45 buses (including spares and signal equipment from total project costs of $40 million.

11. RELATIONSHIP TO ETR PLANS:

   a. Direct: none

   b. Indirect: Possible mode shift

12. ISSUES/CONCERNS:

   a. Technology is new to USA and impacts are difficult to quantify. On King Drive test, have agreed not to evaluate cost reductions in terms of saving whole buses but rather in percent of running time saved, because percentage of time saved is a better number to apply to other routes.

   b. CTA Bus Service Management System implementation is moving faster than the feasibility study on Cermak Road and may be operational before the feasibility study is finished.

   c. Impact on transit ridership may be underestimated since the signal pre-emption is in place for only a small portion of the total bus route at this time.

PROJECT PROFILE

1. TCM TYPE: Number 9, Subscription Bus Service

2. PHYSICAL DESCRIPTION: Pace will offer specialized service to address the specific needs of suburban employees. The service provides direct transportation between a residential collection area and a place of employment for groups of 30 or more individuals. It operates according to a prescribed schedule and travels along a designated route, with passengers offered a guaranteed seat in return for reserving transportation in a monthly basis. Service is "open door" in that it is not restricted to employees of specific firms.

   Vehicles and drivers are provided by a private carrier. The vehicle is normally an "over the road" bus.

3. LOCATION: Pace service will be provided from SW side of Chicago to new Sears Headquarters in Hoffman Estates.

   New service will reflect that currently provided to Sears Catalog sales facilities. Route runs from Naperville to Skokie.

4. SERVICE CHANGE (Change in bus or rail service): Sears is assisting in the development of up to 14 routes. Service will be phasing in as people are transferred from the Sears Tower to Hoffman Estates. Transition will occur through November. Sears store parking lots to be used as pick-up points.

   Service will mirror Naperville-Skokie Route. It has 2 pick-up points, one at a Park-n-Ride lot and another at a train station. Actually picking up riders who travel by train from further out suburbs. Other riders use a variety of approaches to pick-up point: drive, kiss-n-ride, and bus.

5. TCM CAPACITY (Increase in space or usage): Up to 14 new routes.

6. RIDERSHIP:
   a. Current: none
   b. Expected Change (+/-) Average of 30 riders per vehicle. Sears is looking to get a 30% share of trips into the new headquarters. Transit, including car pools, had an 80% share of trips to the Sears Tower.

7. CONNECTING ROADWAY IMPACTS:
   a. Capacity:
   b. Usage:
   c. Expected Change: All new roadways for Sears new headquarters.

8. POTENTIAL BENEFITS: Capturing of the people in carpools onto Subscription service or vanpools. Increases in safety and faster roadway movement. Possible reductions in auto trips if mode shifting occurs. Development of Park-n-Ride or walk to transit users.

9. POTENTIAL DEFICITS: Increases in bus emissions from increases in service. Increased usage of expressway. Increased traffic in Hoffman Estates. Increased traffic around stores. Mode shift from regular bus and train service to autos causing a increase in trips.

10. COST: Naperville-Skokie fare is $70.00 per month. Yearly costs to Pace is $73,000 for driver and fuel. Farebox recovery is 60%. Sears will underwrite new service for a year.

11. RELATIONSHIP TO ETR PLANS:
   a. Direct: Sears is required to comply with ETR programs and agreement with Hoffman Estates requires provision of transit service.
   b. Indirect: Not applicable

12. ISSUES/CONCERNS:
   a. If transit service grows at these locations it may justify the initiation of Express bus service from certain locations to Hoffman Estates.

   b. Need to remember that a significant number of Sears Tower employees were carpool riders. Initiation of subscription service may actually transferring these riders to higher occupancy vehicles.

   c. Concerned that regional focus is on maintaining the current system. Pace's projects have growth in market area focus. The real issue may be the relative importance to air quality of these different focuses.

   d. The market area for this subscription service is very diffuse and could not effectively supply ridership for a fixed route service.

   e. Issues for Pace are service reliability and speed.

PROJECT PROFILE

1. TCM TYPE: Number 10, Vanpools

2. PHYSICAL DESCRIPTION: As a new service initiative, Pace is integrating vanpool operations into its service mix. These operations address the transit needs of area employees on a smaller scale than subscription bus service. Vanpools generally consist of six to fifteen persons commuting to a common employment site. Three vehicle sizes;: Mini - 6 to 7, Conversion - 8 to 11, and Maxi - 12 to 15 persons; are available to participants to accommodate groups of various sizes.

   Vanpool operations have fares based on the distance travelled and number of van passengers. Program administration, including vanpool matching, is handled by Pace staff. Fleet maintenance is provided by a variety private contractors. Fueling is at private gas stations through the use of a credit card. A guaranteed ride home in emergencies is provided at a limit of up to $90.00 each year.

   Each vanpool customer reserves and pays for service in advance and is issued a pass. Drivers are permitted 300 free miles per month personal use of the van and receive a credit of up to the amount of the applicable fare for that van in consideration of their driving the vehicle. Drivers must pass a Department of Transportation approved physical and must comply with transit drug testing procedures.

3. LOCATION: Entire Pace service area with some analysis potential on the Sears service from a variety of Chicago and suburban locations to new Sears Headquarters in Hoffman Estates.

4. SERVICE CHANGE (Change in bus or rail service): Sears is assisting in the development of up to 42 vanpools. Thirteen are currently organized. Service will be phased in as people are transferred from the Sears Tower to Hoffman Estates. Transition will occur through November.

   Two different types of pick-ups. One is the collection of individuals along the route with others at some common point. The second is the collection of individuals at a multiple of common points.

5. TCM CAPACITY (Increase in space or usage): Up to 42 new routes by November 1992. Regional service beyond the Sears component is 52. Projection of 70 by end of October, with authorization by Pace Board for 123 by of 1992.

6. RIDERSHIP:

a. Current: On an average of 8.5 passengers per van. Regional program of 52 vans is carrying 495 to 500 as of September 8, 1992.

b. Expected Change (+/-) The total Sears program of 42 would be carrying 350 to 400 riders. The projected additional program of 70 would be carrying about 600 to 650 riders per day and could expect 300,000 trips during the year.

Sears is looking to get a 30% share of trips into the new headquarters. Transit, including car pools, had an 80% share of trips to the Sears Tower.

7. CONNECTING ROADWAY IMPACTS:

a. Capacity:
b. Usage:
c. Expected Change: All new roadways for Sears new headquarters. May reduce usage on three different corridors leading into site.

8. POTENTIAL BENEFITS: Diversion from auto may be as high as 90%. Capturing of the carpool riders onto service or vanpools. Increases in safety and faster roadway movement. Possible reductions in auto trips if mode shifting occurs. Development of Park-n-Ride or walk to transit users.

9. POTENTIAL DEFICITS: Increases in emissions from increases in service. Increased usage of expressway. Increased traffic in Hoffman Estates. Increased traffic around stores. Mode shift from regular bus and train service to autos causing a increase in trips. Cold start issue at Park-n-Ride lots. It should be noted that the absolute number of vehicles at headquarters will be much less due to the existence of the vanpools

10. COST: Entire vanpool service costs $2.2 million each year. Farebox recovery is 90%. Average per trip subsidy is 7 cents. Sears will underwrite new service for a year. The 7 cents per trip is a weighted amount. As the program expands the mix of fare zones and subsidies will vary even though farebox recovery will be the same. The current average range is 7 to 30 cents per trip.

Fares are on a matrix by zones, by distance.

11. RELATIONSHIP TO ETR PLANS

a. Direct: Sears is required to comply with ETR programs and agreement with Hoffman Estates requires provision of transit service. Sears has agreed to support up to 42 van pools. Pace is working with other area employers to establish vanpool operations.
b. Indirect: Not applicable

12. ISSUES/CONCERNS:

a. If transit service grows at these locations it may justify the initiation of other subscription buses and hopefully Express bus service from certain locations to Hoffman Estates.

b. Need to remember that large numbers of Sears Tower employees were carpool riders. Initiation of vanpool service may actually transferring these riders to higher occupancy vehicles.

c. There is a difficulty in measuring the actual effects of vanpools on the connecting corridors.

d. Will soon survey all vanpools to ask how riders would have gotten to work if the van was not available.

e. Would prefer that entire vanpool service be analyzed and not just the Sears component.

f. Concerned that regional focus is on maintaining the current system. Pace's projects have growth in market area focus. The real issue may be the relative importance to air quality of these different focuses.

g. Issues for Pace are service reliability and speed.

PROJECT PROFILE

1. TCM TYPE: Number 11, Transit Fare Subsidy/Marketing

2. PHYSICAL DESCRIPTION: Transit Check program. Employer sends form and check to RTA. Checks can be issued in denominations of $10.00, $15.00 or $21.00. Transit Check can be used like cash any where that tokens or passes are sold.

   The checks can be ordered three months in advance and are good for 120 days after date of issue.

   The checks are tax free to employee and a tax deductible business expense to employers.

3. LOCATION: RTA sponsored and administered and available to any regional employer.

4. SERVICE CHANGE (Change in bus or rail service): No effect on bus or rail service.

5. TCM CAPACITY (Increase in space or usage): Not applicable

6. RIDERSHIP:
   a. Current: 6,500 checks issued through 275 employers.
   b. Expected Change (+/-) The effect of this TCM should be positive, especially if subsidy level is raised to $60.00 as proposed in Energy bill.

7. CONNECTING ROADWAY IMPACTS:
   a. Capacity: None
   b. Usage: None
   c. Expected Change: If early service survey is correct and 15% of users are new transit riders could reduce roadway usage.

8. POTENTIAL BENEFITS: Mode shifting from auto to bus and rail. Reduction in auto trips and vehicle miles traveled.

9. POTENTIAL DEFICITS: Induced travel possible if an additional vehicle is available for family usage. Employers need to understand that RTA is not responsible for employer getting tax benefits.

10. COST: RTA currently includes cost in employees salary and not from income from Transit Check. The cost to employers is the actual amounts of the transit checks.

11. RELATIONSHIP TO ETR PLANS:

    a. Direct: employers in area are required to increase auto vehicle occupancy 25% by November 1996.

12. ISSUES/CONCERNS: Some employers did not realize that only one check could be used per person, per month. This could be especially important if the level is raised to $60.00 and more companies become involved.

PROJECT PROFILE

1. TCM TYPE: Number 12, Capacity/Speed Improvements for Transit Service

2. PHYSICAL DESCRIPTION: Grade Separation, at rubber railroad crossing, of roadway (FAU2714) and Metra commuter rail line (Milwaukee Road, West line). The crossing was installed in 1990. The roadway is within the municipality and is maintained by the municipality. At this crossing there are four tracks. Two are under Metra's jurisdiction, one is under the Indiana Harbor Belt RR and the fourth is under the Soo Line's jurisdiction. The Indiana Harbor Belt a freight line. The Soo Line's track is a freight line and a yard lead. Substantial freight movements slow traffic.
   Commuter trains block the roadway when stopping for the station. Pedestrian traffic is blocked from crossing the tracks when walking from the parking lots to the station. Two of the three parking lots are opposite the inbound platform. Parking lot spaces equal 264 and are used at the 86.7% rate. Some capacity is available.

3. LOCATION: Metra, Franklin Park rail station, Rose Street/25th Avenue; Milwaukee Road West line.

4. SERVICE CHANGE (Change in bus or rail service): None anticipated at this time. Where ridership to increase and train capacity an issue, would first add a car, if possible, before adding a train. Most trains from Elgin to Chicago stop at this station. Although some run at near capacity others have additional capacity.

5. TCM CAPACITY (Increase in space or usage): Same

6. RIDERSHIP
   a. Current: Fall 1991 weekday, inbound boardings = 490; outbound alightings = 441.
   b. Expected Change (+/-): Should have a positive impact. Metra has no handle in travel time change or elasticity information. Could say that easy access to parking and to walk-in traffic will encourage usage. With parking spaces numbering 264, up to 46% of the riders could be walking or riding buses in the station.

7. CONNECTING ROADWAY IMPACTS
   a. Capacity: need data
   b. Usage: 12,900
   c. Expected Change: May go up as roadway congestion decreases.

8. POTENTIAL BENEFITS: Train movements currently slow roadway and pedestrian traffic. Access to parking lots will be improved. Decreases in congestion will possibly reduce emissions causes by stopping and idling. With grade separations remove the risk of train/vehicle collisions.

9. POTENTIAL DEFICITS: Increased capacity and reduced roadway congestion can lead to increases in induced travel.

10. COST: Current general cost estimates for grade separations is $6,000,000.

11. RELATIONSHIP TO ETR PLANS:
    a. Direct: None
    b. Indirect: Only if employer is paying for parking or rail fare.

12. ISSUES/CONCERNS: The project is still in the idea stage of the planning phase. It is difficult to analyze at this stage. No idea if separation will occur above or below grade. May have been better to compare a project further along in the developmental process. Hanover Park could be considered.

Appendix B
MOBILE5 Input File

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1           PROMPT -
MOBILE5 Emission Factors for Chicago Area for 1990 with basic I/M
1           TAMFLG -
1           SPDFLG -
1           VMFLAG -
1           MYMRFG -
1           NEWFLG -
2           IMFLAG - enter I/M program
1           ALHFLG -
1           ATPFLG - enter ATP, Press & Purge
5           RLFLAG - do not compute refueling emission factors
2           LOCFLG - enter LAP record once
1           TEMFLG -
3           OUTFMT - print 112 column descriptive output format
4           PRTFLG - print exhaust HC, CO and NOx results
1           IDLFLG - no idle emission factors
3           NMHFLG - print VOC
2           HCFLAG - print HC components
87 15 68 20 05 08 095 1 1 2222 2111                    I/M 2500/Idle Test
Chicago 2Sp.Idle C  70.  96. 09.2 09.2 90 2 1 1        LAP record
.000 .300 .000 .035 2                                  Oxyfuel record.
1 90  3.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90  4.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90  5.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90  6.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90  7.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90  8.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90  9.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 10.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 11.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 12.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 13.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 14.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 15.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 16.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 17.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 18.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 19.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 20.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 21.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 22.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 23.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 24.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 25.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 26.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 27.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 28.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 29.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 30.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 31.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 32.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 33.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 34.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 35.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 36.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 37.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 38.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 39.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 40.0 87.0 20.6 27.3 20.6 1                        Scenario Record
1 90 41.0 87.0 20.6 27.3 20.6 1                        Scenario Record
```

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1 90 42.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 43.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 44.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 45.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 46.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 47.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 48.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 49.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 50.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 51.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 52.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 53.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 54.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 55.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 56.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 57.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 58.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 59.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 90 60.0 87.0 20.6 27.3 20.6 1          Scenario Record
```

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1           PROMPT -
MOBILE5 Emission Factors for Chicago Area for 2020 with enhanced I/M
1           TAMFLG -
1           SPDFLG -
1           VMFLAG -
1           MYMRFG -
1           NEWFLG -
3           IMFLAG - enter I/M program
1           ALHFLG -
8           ATPFLG - enter ATP, Press & Purge
5           RLFLAG - do not compute refueling emission factors
2           LOCFLG - enter LAP record once
1           TEMFLG -
3           OUTFMT - print 112 column descriptive output format
4           PRTFLG - print exhaust HC, CO and NOx results
1           IDLFLG - no idle emission factors
3           NMHFLG - print VOC
2           HCFLAG - print HC components
83 20 68 20 03 03 096 1 1 2221 2211 220. 1.20 999. I/M 2500/Idle Test
83 20 86 20 03 03 096 1 1 2221 4211 0.80 20.0 2.00 I/M240 Program
83 84 20 2221 11 096. 12211111                     ATP
83 83 20 2221 11 096.                              Pressure Check
83 86 20 2221 11 096.                              Purge Check
Chicago Enhn. IM C  70.  96. 09.2 09.2 90 2 1 1    LAP record
.000 .300 .000 .035 2                              Oxyfuel record
1 10  3.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10  4.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10  5.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10  6.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10  7.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10  8.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10  9.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 10.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 11.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 12.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 13.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 14.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 15.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 16.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 17.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 18.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 19.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 20.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 21.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 22.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 23.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 24.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 25.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 26.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 27.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 28.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 29.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 30.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 31.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 32.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 33.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 34.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 35.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 36.0 87.0 20.6 27.3 20.6 1                    Scenario Record
1 10 37.0 87.0 20.6 27.3 20.6 1                    Scenario Record
```

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1 10 38.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 39.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 40.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 41.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 42.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 43.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 44.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 45.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 46.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 47.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 48.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 49.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 50.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 51.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 52.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 53.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 54.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 55.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 56.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 57.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 58.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 59.0 87.0 20.6 27.3 20.6 1          Scenario Record
1 10 60.0 87.0 20.6 27.3 20.6 1          Scenario Record
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Appendix C
Emissions Calculations

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
PROTOTYPE TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 1 – W. Chicago St. – CNW West line
Additional Pk-n-Ride Lot

COLUMN #:

1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.982	70.381	3.491	0	0	0	0	0	0
9	0	0	9.139	63.056	3.411	0	0	0	0	0	0
10	0	0	8.443	57.146	3.340	0	0	0	0	0	0
11	0	0	7.855	52.285	3.278	0	0	0	0	0	0
12	0	0	7.349	48.220	3.222	0	0	0	0	0	0
13	0	0	6.906	44.772	3.173	0	0	0	0	0	0
14	0	0	6.514	41.810	3.128	0	0	0	0	0	0
15	0	0	6.162	39.238	3.089	0	0	0	0	0	0
16	0	0	5.842	36.980	3.054	0	0	0	0	0	0
17	0	0	5.550	34.980	3.022	0	0	0	0	0	0
18	0	0	5.279	33.194	2.994	0	0	0	0	0	0
19	0	0	5.027	31.585	2.969	0	0	0	0	0	0
20	0	0	4.822	30.209	2.951	0	0	0	0	0	0
21	26	26	4.670	28.971	2.942	119	739	75	121	753	76
22	530	519	4.531	27.834	2.936	2400	14740	1555	2352	14446	1524
23	483	474	4.401	26.784	2.930	2126	12941	1416	2086	12696	1389
24	441	441	4.281	25.812	2.926	1888	11385	1291	1888	11383	1290
25	987	979	4.168	24.908	2.923	4112	24573	2884	4080	24385	2862
26	901	895	4.063	24.066	2.922	3660	21681	2632	3636	21539	2615
27	632	632	3.964	23.280	2.922	2504	14708	1846	2505	14713	1847
28	513	513	3.872	22.545	2.923	1988	11574	1501	1986	11566	1499
29	796	792	3.784	21.859	2.925	3014	17410	2330	2997	17312	2317
30	533	533	3.702	21.218	2.929	1972	11300	1560	1973	11309	1561
31	528	527	3.624	20.620	2.934	1915	10896	1550	1910	10867	1546
32	615	615	3.550	20.062	2.939	2183	12339	1808	2183	12338	1807
33	709	711	3.481	19.543	2.946	2468	13857	2089	2475	13895	2095
34	490	465	3.415	19.061	2.955	1672	9332	1447	1588	8863	1374
35	736	712	3.353	18.614	2.964	2467	13697	2181	2387	13253	2110
36	569	476	3.294	18.201	2.975	1875	10361	1694	1568	8664	1416
37	271	220	3.238	17.820	2.987	876	4823	808	712	3920	657
38	460	391	3.186	17.471	3.000	1467	8042	1381	1246	6831	1173
39	245	231	3.136	17.151	3.015	769	4208	740	724	3962	696
40	29	29	3.089	16.859	3.031	88	482	87	90	489	88
41	21	21	3.044	16.595	3.049	64	347	64	64	348	64
42	0	0	3.002	16.356	3.068	0	0	0	0	0	0
43	0	0	2.962	16.142	3.089	0	0	0	0	0	0
44	0	0	2.924	15.950	3.113	0	0	0	0	0	0
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	10,514	10,202									
		-312				39,629	229,437	30,936	38,573	223,533	30,008

TOTAL TONS (Base):	
VOCs =	0.044
CO =	0.253
NOx =	0.034

TOTAL TONS (New):	
VOCs =	0.043
CO =	0.246
NOx =	0.033

CHANGE FROM BASE TO NEW:	
VOCs =	-0.001
CO =	-0.007
NOx =	-0.001

NOTE...Multiply by 4 to get tons per day.

CHICAGO 2010 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 1 – W. Chicago St. – CNW West line
Additional Pk-n-Ride Lot

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	6.736	46.190	2.406	0	0	0	0	0	0
4	0	0	4.939	37.032	2.253	0	0	0	0	0	0
5	0	0	3.969	31.385	2.148	0	0	0	0	0	0
6	0	0	3.363	27.519	2.069	0	0	0	0	0	0
7	0	0	2.949	24.688	2.005	0	0	0	0	0	0
8	0	0	2.704	22.515	1.951	0	0	0	0	0	0
9	0	0	2.510	20.789	1.905	0	0	0	0	0	0
10	0	0	2.347	19.381	1.865	0	0	0	0	0	0
11	0	0	2.207	18.208	1.829	0	0	0	0	0	0
12	0	0	2.084	17.217	1.797	0	0	0	0	0	0
13	0	0	1.975	16.366	1.769	0	0	0	0	0	0
14	0	0	1.877	15.628	1.743	0	0	0	0	0	0
15	0	0	1.787	14.982	1.720	0	0	0	0	0	0
16	0	0	1.705	14.412	1.699	0	0	0	0	0	0
17	0	0	1.629	13.906	1.680	0	0	0	0	0	0
18	0	0	1.558	13.453	1.663	0	0	0	0	0	0
19	437	436	1.491	13.046	1.647	651	5695	719	650	5688	718
20	13	13	1.427	12.497	1.636	18	159	21	19	162	21
21	44	44	1.377	11.820	1.630	61	524	72	61	520	72
22	703	690	1.331	11.204	1.626	936	7879	1143	918	7731	1122
23	661	653	1.288	10.641	1.622	852	7038	1073	841	6949	1059
24	730	727	1.248	10.126	1.618	911	7389	1181	907	7362	1176
25	1,245	1,241	1.212	9.652	1.615	1509	12019	2011	1504	11978	2004
26	713	707	1.178	9.214	1.613	839	6565	1149	833	6514	1140
27	1,029	1,028	1.146	8.810	1.611	1180	9068	1658	1178	9057	1656
28	694	694	1.116	8.436	1.610	774	5851	1117	775	5855	1117
29	1,056	1,059	1.088	8.087	1.610	1149	8543	1701	1152	8564	1705
30	519	518	1.062	7.763	1.610	551	4027	835	550	4021	834
31	858	858	1.037	7.461	1.611	890	6401	1382	890	6402	1382
32	407	307	1.014	7.179	1.612	412	2920	656	311	2204	495
33	660	515	0.992	6.915	1.614	655	4565	1066	511	3561	831
34	1,068	838	0.971	6.667	1.616	1037	7123	1727	814	5587	1354
35	727	585	0.951	6.434	1.620	691	4678	1178	556	3764	948
36	415	301	0.932	6.216	1.623	387	2582	674	281	1871	489
37	216	179	0.914	6.011	1.628	197	1296	351	164	1076	291
38	264	228	0.897	5.817	1.633	237	1537	431	205	1326	372
39	117	117	0.881	5.635	1.639	103	658	191	103	659	192
40	0	0	0.866	5.464	1.645	0	0	0	0	0	0
41	0	0	0.851	5.302	1.652	0	0	0	0	0	0
42	0	0	0.837	5.149	1.660	0	0	0	0	0	0
43	0	0	0.823	5.004	1.669	0	0	0	0	0	0
44	0	0	0.810	4.868	1.678	0	0	0	0	0	0
45	0	0	0.798	4.739	1.689	0	0	0	0	0	0
46	0	0	0.786	4.618	1.700	0	0	0	0	0	0
47	0	0	0.774	4.503	1.712	0	0	0	0	0	0
48	0	0	0.763	4.395	1.725	0	0	0	0	0	0
49	0	0	0.760	4.399	1.770	0	0	0	0	0	0
50	0	0	0.756	4.404	1.816	0	0	0	0	0	0
51	0	0	0.753	4.411	1.863	0	0	0	0	0	0
52	0	0	0.750	4.420	1.911	0	0	0	0	0	0
53	0	0	0.748	4.431	1.961	0	0	0	0	0	0
54	0	0	0.745	4.443	2.012	0	0	0	0	0	0
55	0	0	0.743	4.458	2.064	0	0	0	0	0	0
56	0	0	0.752	4.801	2.118	0	0	0	0	0	0
57	0	0	0.762	5.146	2.174	0	0	0	0	0	0
58	0	0	0.772	5.493	2.232	0	0	0	0	0	0
59	0	0	0.782	5.843	2.292	0	0	0	0	0	0
60	0	0	0.792	6.195	2.354	0	0	0	0	0	0
	12,576	11,738									
		-838				14,041	106,518	20,336	13,221	100,851	18,980

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.015	VOCs =	0.015
CO =	0.117	CO =	0.111
NOx =	0.022	NOx =	0.021

CHANGE FROM BASE TO NEW:	
VOCs =	-0.001
CO =	-0.006
NOx =	-0.001

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
PROTOTYPE TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 2 – Cumberland St. – CTA Ohare line
Additional Parking for Pk-n-Ride

COLUMN #:

1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.682	70.381	3.491	0	0	0	0	0	0
9	0	0	9.139	63.056	3.411	0	0	0	0	0	0
10	0	0	8.443	57.146	3.340	0	0	0	0	0	0
11	0	0	7.855	52.285	3.278	0	0	0	0	0	0
12	0	0	7.349	48.220	3.222	0	0	0	0	0	0
13	0	0	6.906	44.772	3.173	0	0	0	0	0	0
14	0	0	6.514	41.810	3.128	0	0	0	0	0	0
15	0	0	6.162	39.238	3.089	0	0	0	0	0	0
16	0	0	5.842	36.980	3.054	0	0	0	0	0	0
17	0	0	5.550	34.980	3.022	0	0	0	0	0	0
18	0	0	5.279	33.194	2.994	0	0	0	0	0	0
19	32	31	5.027	31.585	2.969	162	1017	96	156	979	92
20	0	0	4.822	30.209	2.951	0	0	0	0	0	0
21	57	55	4.670	28.971	2.942	267	1654	168	257	1593	162
22	336	332	4.531	27.834	2.936	1523	9358	987	1504	9241	975
23	219	213	4.401	26.784	2.930	964	5867	642	937	5705	624
24	274	271	4.281	25.812	2.926	1173	7070	801	1160	6995	793
25	1,039	976	4.168	24.908	2.923	4331	25884	3038	4068	24310	2853
26	524	497	4.063	24.066	2.922	2128	12605	1530	2019	11961	1452
27	1,160	1,085	3.964	23.280	2.922	4597	26999	3389	4301	25259	3170
28	1,304	1,229	3.872	22.545	2.923	5051	29407	3813	4759	27708	3592
29	922	873	3.784	21.859	2.925	3487	20144	2695	3303	19083	2554
30	609	579	3.702	21.218	2.929	2255	12926	1784	2143	12285	1696
31	267	259	3.624	20.620	2.934	966	5496	782	939	5341	760
32	229	221	3.550	20.062	2.939	813	4596	673	785	4434	650
33	138	132	3.481	19.543	2.946	481	2700	407	459	2580	389
34	239	213	3.415	19.061	2.955	817	4560	707	727	4060	629
35	86	78	3.353	18.614	2.964	287	1595	254	262	1452	231
36	183	183	3.294	18.201	2.975	602	3326	544	603	3331	544
37	186	187	3.238	17.820	2.987	602	3315	556	606	3332	559
38	187	188	3.186	17.471	3.000	597	3273	562	599	3285	564
39	19	19	3.136	17.151	3.015	61	331	58	60	326	57
40	0	0	3.089	16.859	3.031	0	0	0	0	0	0
41	0	0	3.044	16.595	3.049	0	0	0	0	0	0
42	0	0	3.002	16.356	3.068	0	0	0	0	0	0
43	0	0	2.962	16.142	3.089	0	0	0	0	0	0
44	0	0	2.924	15.950	3.113	0	0	0	0	0	0
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	8,010	7,621									
		-389				31,164	182,124	23,486	29,647	173,259	22,346

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.034	VOCs =	0.033
CO =	0.201	CO =	0.191
NOx =	0.026	NOx =	0.025

CHANGE FROM BASE TO NEW:	
VOCs =	-0.002
CO =	-0.010
NOx =	-0.001

NOTE...Multiply by 4 to get tons per day.

CHICAGO 2010 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 2 – Cumberland St. – CTA OHare line
Additional Parking for Pk-n-Ride

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	6.736	46.190	2.406	0	0	0	0	0	0
4	0	0	4.939	37.032	2.253	0	0	0	0	0	0
5	0	0	3.969	31.385	2.148	0	0	0	0	0	0
6	0	0	3.363	27.519	2.069	0	0	0	0	0	0
7	0	0	2.949	24.688	2.005	0	0	0	0	0	0
8	0	0	2.704	22.515	1.951	0	0	0	0	0	0
9	0	0	2.510	20.789	1.905	0	0	0	0	0	0
10	0	0	2.347	19.381	1.865	0	0	0	0	0	0
11	0	0	2.207	18.208	1.829	0	0	0	0	0	0
12	0	0	2.084	17.217	1.797	0	0	0	0	0	0
13	0	0	1.975	16.366	1.769	0	0	0	0	0	0
14	0	0	1.877	15.628	1.743	0	0	0	0	0	0
15	0	0	1.787	14.982	1.720	0	0	0	0	0	0
16	0	0	1.705	14.412	1.699	0	0	0	0	0	0
17	0	0	1.629	13.906	1.680	0	0	0	0	0	0
18	0	0	1.558	13.453	1.663	0	0	0	0	0	0
19	14	14	1.491	13.046	1.647	20	178	22	21	183	23
20	0	0	1.427	12.497	1.636	0	0	0	0	0	0
21	16	17	1.377	11.820	1.630	22	193	27	23	201	28
22	69	69	1.331	11.204	1.626	92	775	112	92	773	112
23	155	152	1.288	10.641	1.622	200	1654	252	196	1617	247
24	204	199	1.248	10.126	1.618	255	2068	330	248	2015	322
25	296	285	1.212	9.652	1.615	358	2855	478	345	2751	460
26	190	189	1.178	9.214	1.613	223	1746	306	223	1741	305
27	673	635	1.146	8.810	1.611	771	5929	1084	728	5594	1023
28	975	922	1.116	8.436	1.610	1088	8227	1570	1029	7778	1484
29	703	672	1.088	8.087	1.610	765	5686	1132	731	5434	1082
30	530	496	1.062	7.763	1.610	563	4113	853	527	3850	799
31	400	364	1.037	7.461	1.611	415	2984	644	377	2716	586
32	113	102	1.014	7.179	1.612	114	810	182	103	732	164
33	52	52	0.992	6.915	1.614	51	356	83	52	360	84
34	8	8	0.971	6.667	1.616	8	52	13	8	53	13
35	88	78	0.951	6.434	1.620	84	569	143	74	502	126
36	62	54	0.932	6.216	1.623	58	384	100	50	336	88
37	133	128	0.914	6.011	1.628	122	802	217	117	769	208
38	119	119	0.897	5.817	1.633	107	695	195	107	692	194
39	84	85	0.881	5.635	1.639	74	476	138	75	479	139
40	20	20	0.866	5.464	1.645	17	107	32	17	109	33
41	19	19	0.851	5.302	1.652	16	102	32	16	101	31
42	0	0	0.837	5.149	1.660	0	0	0	0	0	0
43	0	0	0.823	5.004	1.669	0	0	0	0	0	0
44	0	0	0.810	4.868	1.678	0	0	0	0	0	0
45	0	0	0.798	4.739	1.689	0	0	0	0	0	0
46	0	0	0.786	4.618	1.700	0	0	0	0	0	0
47	0	0	0.774	4.503	1.712	0	0	0	0	0	0
48	0	0	0.763	4.395	1.725	0	0	0	0	0	0
49	0	0	0.760	4.399	1.770	0	0	0	0	0	0
50	0	0	0.756	4.404	1.816	0	0	0	0	0	0
51	0	0	0.753	4.411	1.863	0	0	0	0	0	0
52	0	0	0.750	4.420	1.911	0	0	0	0	0	0
53	0	0	0.748	4.431	1.961	0	0	0	0	0	0
54	0	0	0.745	4.443	2.012	0	0	0	0	0	0
55	0	0	0.743	4.458	2.064	0	0	0	0	0	0
56	0	0	0.752	4.801	2.118	0	0	0	0	0	0
57	0	0	0.762	5.146	2.174	0	0	0	0	0	0
58	0	0	0.772	5.493	2.232	0	0	0	0	0	0
59	0	0	0.782	5.843	2.292	0	0	0	0	0	0
60	0	0	0.792	6.195	2.354	0	0	0	0	0	0
	4,923	4,679									
		-244				5,425	40,759	7,947	5,160	38,788	7,553

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.006	VOCs =	0.006
CO =	0.045	CO =	0.043
NOx =	0.009	NOx =	0.008

CHANGE FROM BASE TO NEW:	
VOCs =	-0.000
CO =	-0.002
NOx =	-0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
PROTOTYPE TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 3 – 95th St. Station – CTA Dan Ryan Line Station Expansion

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.982	70.381	3.491	0	0	0	0	0	0
9	0	0	9.139	63.056	3.411	0	0	0	0	0	0
10	0	0	8.443	57.146	3.340	0	0	0	0	0	0
11	0	0	7.855	52.285	3.278	0	0	0	0	0	0
12	0	0	7.349	48.220	3.222	0	0	0	0	0	0
13	0	0	6.906	44.772	3.173	0	0	0	0	0	0
14	0	0	6.514	41.810	3.128	0	0	0	0	0	0
15	0	0	6.162	39.238	3.089	0	0	0	0	0	0
16	0	0	5.842	36.980	3.054	0	0	0	0	0	0
17	0	0	5.550	34.980	3.022	0	0	0	0	0	0
18	0	0	5.279	33.194	2.994	0	0	0	0	0	0
19	7	7	5.027	31.585	2.969	36	228	21	35	221	21
20	0	0	4.822	30.209	2.951	0	0	0	0	0	0
21	6	6	4.670	28.971	2.942	26	164	17	28	174	18
22	0	0	4.531	27.834	2.936	0	0	0	0	0	0
23	11	10	4.401	26.784	2.930	48	295	32	44	268	29
24	970	914	4.281	25.812	2.926	4151	25028	2837	3913	23592	2674
25	2,166	2,042	4.168	24.908	2.923	9029	53958	6332	8511	50862	5969
26	2,821	2,657	4.063	24.066	2.922	11462	67894	8243	10795	63943	7764
27	1,826	1,780	3.964	23.280	2.922	7239	42515	5336	7056	41438	5201
28	2,017	1,944	3.872	22.545	2.923	7810	45473	5896	7527	43827	5682
29	2,372	2,273	3.784	21.859	2.925	8976	51852	6938	8601	49686	6649
30	2,271	2,198	3.702	21.218	2.929	8409	48195	6653	8137	46637	6438
31	785	769	3.624	20.620	2.934	2845	16185	2303	2787	15857	2256
32	175	168	3.550	20.062	2.939	622	3513	515	596	3370	494
33	52	52	3.481	19.543	2.946	182	1023	154	181	1016	153
34	25	24	3.415	19.061	2.955	85	475	74	82	457	71
35	6	6	3.353	18.614	2.964	21	119	19	20	112	18
36	0	0	3.294	18.201	2.975	0	0	0	0	0	0
37	0	0	3.238	17.820	2.987	0	0	0	0	0	0
38	0	0	3.186	17.471	3.000	0	0	0	0	0	0
39	0	0	3.136	17.151	3.015	0	0	0	0	0	0
40	0	0	3.089	16.859	3.031	0	0	0	0	0	0
41	0	0	3.044	16.595	3.049	0	0	0	0	0	0
42	0	0	3.002	16.356	3.068	0	0	0	0	0	0
43	0	0	2.962	16.142	3.089	0	0	0	0	0	0
44	0	0	2.924	15.950	3.113	0	0	0	0	0	0
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	15,512	14,850									
		-662				60,943	356,919	45,371	58,314	341,462	43,436

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.067	VOCs =	0.064
CO =	0.393	CO =	0.376
NOx =	0.050	NOx =	0.048

CHANGE FROM BASE TO NEW:	
VOCs =	-0.003
CO =	-0.017
NOx =	-0.002

NOTE...Multiply by 4 to get tons per day.

CHICAGO 2010 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
PROTOTYPE TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 3 – 95th St. Station – CTA Dan Ryan Line Station Expansion

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	6.736	46.190	2.406	0	0	0	0	0	0
4	0	0	4.939	37.032	2.253	0	0	0	0	0	0
5	0	0	3.969	31.385	2.148	0	0	0	0	0	0
6	0	0	3.363	27.519	2.069	0	0	0	0	0	0
7	0	0	2.949	24.688	2.005	0	0	0	0	0	0
8	0	0	2.704	22.515	1.951	0	0	0	0	0	0
9	0	0	2.510	20.789	1.905	0	0	0	0	0	0
10	0	0	2.347	19.381	1.865	0	0	0	0	0	0
11	0	0	2.207	18.208	1.829	0	0	0	0	0	0
12	0	0	2.084	17.217	1.797	0	0	0	0	0	0
13	0	0	1.975	16.366	1.769	0	0	0	0	0	0
14	0	0	1.877	15.628	1.743	0	0	0	0	0	0
15	0	0	1.787	14.982	1.720	0	0	0	0	0	0
16	0	0	1.705	14.412	1.699	0	0	0	0	0	0
17	0	0	1.629	13.906	1.680	0	0	0	0	0	0
18	0	0	1.558	13.453	1.663	0	0	0	0	0	0
19	9	8	1.491	13.046	1.647	13	114	14	12	104	13
20	5	5	1.427	12.497	1.636	8	68	9	7	62	8
21	6	6	1.377	11.820	1.630	8	67	9	8	71	10
22	0	0	1.331	11.204	1.626	0	0	0	0	0	0
23	5	5	1.288	10.641	1.622	6	53	8	6	53	8
24	24	24	1.248	10.126	1.618	31	248	40	30	243	39
25	762	716	1.212	9.652	1.615	923	7351	1230	868	6911	1156
26	1,450	1,353	1.178	9.214	1.613	1708	13363	2339	1594	12467	2182
27	1,462	1,385	1.146	8.810	1.611	1675	12880	2355	1587	12202	2231
28	1,922	1,821	1.116	8.436	1.610	2145	16213	3094	2032	15362	2932
29	2,075	1,995	1.088	8.087	1.610	2257	16777	3340	2171	16134	3212
30	933	900	1.062	7.763	1.610	991	7244	1502	956	6987	1449
31	1,672	1,601	1.037	7.461	1.611	1733	12472	2693	1660	11945	2579
32	959	919	1.014	7.179	1.612	972	6884	1546	932	6598	1481
33	1,391	1,346	0.992	6.915	1.614	1380	9620	2245	1335	9308	2172
34	1,175	1,141	0.971	6.667	1.616	1141	7835	1899	1108	7607	1844
35	667	648	0.951	6.434	1.620	635	4294	1081	616	4169	1050
36	11	11	0.932	6.216	1.623	10	68	18	10	68	18
37	0	0	0.914	6.011	1.628	0	0	0	0	0	0
38	0	0	0.897	5.817	1.633	0	0	0	0	0	0
39	0	0	0.881	5.635	1.639	0	0	0	0	0	0
40	0	0	0.866	5.464	1.645	0	0	0	0	0	0
41	0	0	0.851	5.302	1.652	0	0	0	0	0	0
42	0	0	0.837	5.149	1.660	0	0	0	0	0	0
43	0	0	0.823	5.004	1.669	0	0	0	0	0	0
44	0	0	0.810	4.868	1.678	0	0	0	0	0	0
45	0	0	0.798	4.739	1.689	0	0	0	0	0	0
46	0	0	0.786	4.618	1.700	0	0	0	0	0	0
47	0	0	0.774	4.503	1.712	0	0	0	0	0	0
48	0	0	0.763	4.395	1.725	0	0	0	0	0	0
49	0	0	0.760	4.399	1.770	0	0	0	0	0	0
50	0	0	0.756	4.404	1.816	0	0	0	0	0	0
51	0	0	0.753	4.411	1.863	0	0	0	0	0	0
52	0	0	0.750	4.420	1.911	0	0	0	0	0	0
53	0	0	0.748	4.431	1.961	0	0	0	0	0	0
54	0	0	0.745	4.443	2.012	0	0	0	0	0	0
55	0	0	0.743	4.458	2.064	0	0	0	0	0	0
56	0	0	0.752	4.801	2.118	0	0	0	0	0	0
57	0	0	0.762	5.146	2.174	0	0	0	0	0	0
58	0	0	0.772	5.493	2.232	0	0	0	0	0	0
59	0	0	0.782	5.843	2.292	0	0	0	0	0	0
60	0	0	0.792	6.195	2.354	0	0	0	0	0	0
	14,528	13,884									
		-644				15,637	115,551	23,424	14,933	110,290	22,385

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.017	VOCs =	0.016
CO =	0.127	CO =	0.122
NOx =	0.026	NOx =	0.025

CHANGE FROM BASE TO NEW:	
VOCs =	-0.001
CO =	-0.006
NOx =	-0.001

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
PROTOTYPE TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 4 – PACE – Martingale and Kimberly in Schaumburg Transportation Center and Transfer Facility

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	9	61	2	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.982	70.381	3.491	0	0	0	0	0	0
9	0	0	9.139	63.056	3.411	0	0	0	0	0	0
10	29	29	8.443	57.146	3.340	248	1675	98	245	1657	97
11	116	116	7.855	52.285	3.278	914	6086	382	911	6065	380
12	27	27	7.349	48.220	3.222	199	1303	87	198	1302	87
13	179	179	6.906	44.772	3.173	1238	8027	569	1236	8014	568
14	1,167	1,168	6.514	41.810	3.128	7603	48799	3651	7608	48834	3654
15	76	76	6.162	39.238	3.089	467	2973	234	468	2982	235
16	376	376	5.842	36.980	3.054	2197	13905	1148	2197	13904	1148
17	1,688	1,687	5.550	34.980	3.022	9369	59048	5101	9363	59011	5098
18	1,008	1,006	5.279	33.194	2.994	5323	33470	3019	5311	33393	3012
19	1,095	1,098	5.027	31.585	2.969	5503	34575	3250	5520	34680	3260
20	1,870	1,869	4.822	30.209	2.951	9018	56498	5519	9012	56461	5515
21	3,078	3,079	4.670	28.971	2.942	14376	89182	9056	14379	89202	9058
22	3,569	3,566	4.531	27.834	2.936	16172	99347	10479	16158	99256	10470
23	5,504	5,502	4.401	26.784	2.930	24223	147416	16126	24214	147366	16121
24	6,570	6,569	4.281	25.812	2.926	28128	169593	19225	28122	169559	19221
25	9,427	9,427	4.168	24.908	2.923	39293	234813	27556	39292	234808	27555
26	8,860	8,844	4.063	24.066	2.922	35998	213222	25889	35933	212840	25842
27	8,984	8,983	3.964	23.280	2.922	35614	209157	26252	35609	209124	26248
28	6,975	6,981	3.872	22.545	2.923	27006	157242	20387	27030	157387	20405
29	6,116	6,112	3.784	21.859	2.925	23141	133679	17888	23128	133602	17878
30	3,417	3,415	3.702	21.218	2.929	12648	72492	10007	12642	72459	10003
31	5,454	5,456	3.624	20.620	2.934	19765	112462	16002	19773	112503	16008
32	1,879	1,879	3.550	20.062	2.939	6671	37699	5523	6670	37696	5522
33	1,555	1,562	3.481	19.543	2.946	5413	30389	4581	5437	30526	4602
34	1,421	1,417	3.415	19.061	2.955	4852	27083	4199	4839	27009	4187
35	1,280	1,283	3.353	18.614	2.964	4292	23829	3794	4302	23882	3803
36	2,701	2,699	3.294	18.201	2.975	8896	49156	8035	8891	49124	8030
37	1,286	1,287	3.238	17.820	2.987	4163	22910	3840	4167	22934	3844
38	647	648	3.186	17.471	3.000	2062	11307	1942	2065	11321	1944
39	1,193	1,192	3.136	17.151	3.015	3741	20461	3597	3738	20444	3594
40	293	293	3.089	16.859	3.031	906	4944	889	905	4940	888
41	180	181	3.044	16.595	3.049	547	2985	548	551	3004	552
42	229	229	3.002	16.356	3.068	689	3752	704	687	3746	703
43	0	0	2.962	16.142	3.089	0	0	0	0	0	0
44	13	13	2.924	15.950	3.113	39	213	42	38	207	40
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	88,264	88,248									
		-16				360,722	2,139,754	259,620	360,639	2,139,244	259,572

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.398	VOCs =	0.398
CO =	2.359	CO =	2.358
NOx =	0.286	NOx =	0.286

CHANGE FROM BASE TO NEW:	
VOCs =	-0.000
CO =	-0.001
NOx =	-0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 2010 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
PROTOTYPE TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 4 – PACE – Martingale and Kimberly in Schaumburg
Transportation Center and Transfer Facility

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	6.736	46.190	2.406	0	0	0	0	0	0
4	0	0	4.939	37.032	2.253	0	0	0	0	0	0
5	0	0	3.969	31.385	2.148	0	0	0	0	0	0
6	8	8	3.363	27.519	2.069	28	226	17	27	220	17
7	327	328	2.949	24.688	2.005	966	8083	656	967	8098	658
8	1,701	1,700	2.704	22.515	1.951	4599	38291	3318	4597	38276	3317
9	735	733	2.510	20.789	1.905	1846	15288	1401	1840	15238	1396
10	977	977	2.347	19.381	1.865	2294	18942	1823	2293	18935	1822
11	640	640	2.207	18.208	1.829	1412	11647	1170	1412	11653	1171
12	1,363	1,363	2.084	17.217	1.797	2840	23464	2449	2840	23467	2449
13	452	451	1.975	16.366	1.769	892	7393	799	891	7381	798
14	857	855	1.877	15.628	1.743	1608	13391	1494	1605	13362	1490
15	1,079	1,080	1.787	14.982	1.720	1928	16168	1856	1930	16181	1858
16	1,639	1,641	1.705	14.412	1.699	2794	23618	2784	2798	23650	2788
17	1,185	1,185	1.629	13.906	1.680	1930	16472	1990	1930	16479	1991
18	621	622	1.558	13.453	1.663	967	8349	1032	969	8368	1034
19	547	548	1.491	13.046	1.647	816	7136	901	817	7149	903
20	2,899	2,898	1.427	12.497	1.636	4136	36223	4742	4135	36216	4741
21	1,831	1,835	1.377	11.820	1.630	2521	21643	2985	2527	21690	2991
22	4,691	4,686	1.331	11.204	1.626	6244	52562	7628	6237	52502	7619
23	5,856	5,853	1.288	10.641	1.622	7542	62313	9498	7539	62282	9494
24	6,008	6,003	1.248	10.126	1.618	7498	60836	9721	7492	60786	9713
25	10,273	10,261	1.212	9.652	1.615	12450	99152	16590	12436	99039	16572
26	9,190	9,148	1.178	9.214	1.613	10826	84676	14823	10776	84290	14756
27	10,030	10,018	1.146	8.810	1.611	11495	88367	16159	11481	88259	16139
28	9,661	9,654	1.116	8.436	1.610	10781	81498	15554	10774	81441	15543
29	8,854	8,841	1.088	8.087	1.610	9633	71604	14255	9619	71497	14234
30	7,047	7,040	1.062	7.763	1.610	7484	54706	11346	7476	54652	11334
31	5,310	5,285	1.037	7.461	1.611	5506	39617	8554	5481	39431	8514
32	2,625	2,629	1.014	7.179	1.612	2662	18847	4232	2666	18874	4238
33	1,710	1,708	0.992	6.915	1.614	1697	11826	2760	1694	11811	2757
34	2,190	2,182	0.971	6.667	1.616	2126	14600	3539	2119	14547	3526
35	2,722	2,718	0.951	6.434	1.620	2589	17513	4410	2585	17488	4403
36	2,300	2,294	0.932	6.216	1.623	2144	14297	3733	2138	14260	3723
37	1,828	1,822	0.914	6.011	1.628	1671	10989	2976	1665	10952	2966
38	1,210	1,213	0.897	5.817	1.633	1086	7041	1977	1088	7056	1981
39	326	326	0.881	5.635	1.639	287	1836	534	287	1837	534
40	73	73	0.866	5.464	1.645	64	401	121	63	399	120
41	23	23	0.851	5.302	1.652	20	122	38	20	122	38
42	15	15	0.837	5.149	1.660	12	76	24	13	77	25
43	0	0	0.823	5.004	1.669	0	0	0	0	0	0
44	0	0	0.810	4.868	1.678	0	0	0	0	0	0
45	0	0	0.798	4.739	1.689	0	0	0	0	0	0
46	0	0	0.786	4.618	1.700	0	0	0	0	0	0
47	0	0	0.774	4.503	1.712	0	0	0	0	0	0
48	0	0	0.763	4.395	1.725	0	0	0	0	0	0
49	0	0	0.760	4.399	1.770	0	0	0	0	0	0
50	0	0	0.756	4.404	1.816	0	0	0	0	0	0
51	0	0	0.753	4.411	1.863	0	0	0	0	0	0
52	0	0	0.750	4.420	1.911	0	0	0	0	0	0
53	0	0	0.748	4.431	1.961	0	0	0	0	0	0
54	0	0	0.745	4.443	2.012	0	0	0	0	0	0
55	0	0	0.743	4.458	2.064	0	0	0	0	0	0
56	0	0	0.752	4.801	2.118	0	0	0	0	0	0
57	0	0	0.762	5.146	2.174	0	0	0	0	0	0
58	0	0	0.772	5.493	2.232	0	0	0	0	0	0
59	0	0	0.782	5.843	2.292	0	0	0	0	0	0
60	0	0	0.792	6.195	2.354	0	0	0	0	0	0
	108,803	108,656									
		-147				135,393	1,059,216	177,890	135,227	1,057,963	177,652

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.149	VOCs =	0.149
CO =	1.168	CO =	1.166
NOx =	0.196	NOx =	0.196

CHANGE FROM BASE TO NEW:	
VOCs =	-0.000
CO =	-0.001
NOx =	-0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
PROTOTYPE TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 5 – Metra – Wood Dale – Milw West Line
New Distributor Bus Route

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.982	70.381	3.491	0	0	0	0	0	0
9	0	0	9.139	63.056	3.411	0	0	0	0	0	0
10	0	0	8.443	57.146	3.340	0	0	0	0	0	0
11	0	0	7.855	52.285	3.278	0	0	0	0	0	0
12	0	0	7.349	48.220	3.222	0	0	0	0	0	0
13	0	0	6.906	44.772	3.173	0	0	0	0	0	0
14	0	0	6.514	41.810	3.128	0	0	0	0	0	0
15	0	0	6.162	39.238	3.089	0	0	0	0	0	0
16	0	0	5.842	36.980	3.054	0	0	0	0	0	0
17	21	21	5.550	34.980	3.022	115	725	63	117	735	63
18	452	452	5.279	33.194	2.994	2388	15017	1354	2386	15004	1353
19	806	808	5.027	31.585	2.969	4049	25443	2392	4062	25521	2399
20	1,770	1,772	4.822	30.209	2.951	8537	53480	5224	8545	53530	5229
21	1,404	1,401	4.670	28.971	2.942	6556	40672	4130	6543	40588	4122
22	1,483	1,482	4.531	27.834	2.936	6717	41266	4353	6715	41250	4351
23	2,192	2,197	4.401	26.784	2.930	9647	58710	6422	9669	58844	6437
24	2,585	2,589	4.281	25.812	2.926	11067	66728	7564	11084	66827	7575
25	738	737	4.168	24.908	2.923	3075	18379	2157	3072	18357	2154
26	795	795	4.063	24.066	2.922	3230	19133	2323	3230	19132	2323
27	509	511	3.964	23.280	2.922	2019	11859	1488	2026	11896	1493
28	145	146	3.872	22.545	2.923	563	3278	425	565	3292	427
29	240	241	3.784	21.859	2.925	908	5246	702	912	5268	705
30	115	114	3.702	21.218	2.929	427	2448	338	422	2419	334
31	0	0	3.624	20.620	2.934	0	0	0	0	0	0
32	162	162	3.550	20.062	2.939	575	3252	476	575	3250	476
33	132	135	3.481	19.543	2.946	460	2580	389	470	2638	398
34	213	212	3.415	19.061	2.955	726	4052	628	724	4041	626
35	145	145	3.353	18.614	2.964	485	2692	429	486	2699	430
36	42	42	3.294	18.201	2.975	138	765	125	138	764	125
37	130	129	3.238	17.820	2.987	421	2315	388	418	2299	385
38	0	0	3.186	17.471	3.000	0	0	0	0	0	0
39	0	0	3.136	17.151	3.015	0	0	0	0	0	0
40	0	0	3.089	16.859	3.031	0	0	0	0	0	0
41	0	0	3.044	16.595	3.049	0	0	0	0	0	0
42	0	0	3.002	16.356	3.068	0	0	0	0	0	0
43	0	0	2.962	16.142	3.089	0	0	0	0	0	0
44	0	0	2.924	15.950	3.113	0	0	0	0	0	0
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	14,079	14,091				62,105	378,039	41,371	62,157	378,355	41,407
		12									

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.068	VOCs =	0.069
CO =	0.417	CO =	0.417
NOx =	0.046	NOx =	0.046

CHANGE FROM BASE TO NEW:	
VOCs =	0.000
CO =	0.000
NOx =	0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 2010 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
PROTOTYPE TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 5 – Metra – Wood Dale – Milw West Line
New Distributor Bus Route

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	6.736	46.190	2.406	0	0	0	0	0	0
4	0	0	4.939	37.032	2.253	0	0	0	0	0	0
5	0	0	3.969	31.385	2.148	0	0	0	0	0	0
6	0	0	3.363	27.519	2.069	0	0	0	0	0	0
7	0	0	2.949	24.688	2.005	0	0	0	0	0	0
8	0	0	2.704	22.515	1.951	0	0	0	0	0	0
9	0	0	2.510	20.789	1.905	0	0	0	0	0	0
10	0	0	2.347	19.381	1.865	0	0	0	0	0	0
11	0	0	2.207	18.208	1.829	0	0	0	0	0	0
12	0	0	2.084	17.217	1.797	0	0	0	0	0	0
13	0	0	1.975	16.366	1.769	0	0	0	0	0	0
14	40	40	1.877	15.628	1.743	74	618	69	75	625	70
15	0	0	1.787	14.982	1.720	0	0	0	0	0	0
16	0	0	1.705	14.412	1.699	0	0	0	0	0	0
17	0	0	1.629	13.908	1.680	0	0	0	0	0	0
18	0	0	1.558	13.453	1.663	0	0	0	0	0	0
19	520	521	1.491	13.046	1.647	775	6779	856	777	6797	858
20	21	21	1.427	12.497	1.636	30	266	35	30	262	34
21	424	424	1.377	11.820	1.630	584	5013	691	584	5012	691
22	225	224	1.331	11.204	1.626	299	2521	366	298	2510	364
23	1,248	1,249	1.288	10.641	1.622	1607	13276	2024	1609	13291	2026
24	372	375	1.248	10.128	1.618	465	3770	602	468	3797	607
25	916	917	1.212	9.652	1.615	1110	8840	1479	1111	8851	1481
26	1,603	1,607	1.178	9.214	1.613	1888	14769	2585	1893	14807	2592
27	1,349	1,356	1.146	8.810	1.611	1546	11883	2173	1554	11946	2185
28	2,919	2,928	1.116	8.436	1.610	3257	24623	4699	3268	24701	4714
29	1,976	1,977	1.088	8.087	1.610	2149	15976	3181	2151	15988	3183
30	2,031	2,044	1.062	7.763	1.610	2157	15764	3269	2171	15868	3291
31	1,891	1,902	1.037	7.461	1.611	1961	14109	3047	1972	14191	3064
32	1,563	1,563	1.014	7.179	1.612	1584	11217	2519	1585	11221	2520
33	887	890	0.992	6.915	1.614	880	6133	1431	883	6154	1436
34	1,291	1,293	0.971	6.667	1.616	1253	8605	2086	1256	8620	2089
35	1,976	1,980	0.951	6.434	1.620	1879	12711	3201	1883	12739	3208
36	975	974	0.932	6.216	1.623	909	6061	1583	908	6054	1581
37	1,520	1,522	0.914	6.011	1.628	1389	9137	2475	1391	9149	2478
38	1,373	1,375	0.897	5.817	1.633	1232	7987	2242	1233	7998	2245
39	2,031	2,031	0.881	5.635	1.639	1790	11447	3330	1789	11445	3329
40	1,962	1,963	0.866	5.464	1.645	1699	10721	3228	1700	10726	3229
41	1,020	1,026	0.851	5.302	1.652	868	5410	1686	873	5440	1695
42	388	387	0.837	5.149	1.660	324	1995	643	324	1993	642
43	107	107	0.823	5.004	1.669	88	538	179	88	535	179
44	160	160	0.810	4.868	1.678	129	778	268	130	779	268
45	38	38	0.798	4.739	1.689	30	181	64	30	180	64
46	476	476	0.786	4.618	1.700	374	2199	810	374	2198	809
47	43	43	0.774	4.503	1.712	33	194	74	33	194	74
48	140	140	0.763	4.395	1.725	107	615	242	107	615	242
49	216	217	0.760	4.399	1.770	164	950	382	165	955	384
50	188	188	0.756	4.404	1.816	142	826	341	142	828	341
51	110	111	0.753	4.411	1.863	83	484	204	84	490	207
52	0	0	0.750	4.420	1.911	0	0	0	0	0	0
53	128	128	0.748	4.431	1.961	96	568	252	96	567	251
54	44	44	0.745	4.443	2.012	33	197	89	33	195	89
55	0	0	0.743	4.458	2.064	0	0	0	0	0	0
56	0	0	0.752	4.801	2.118	0	0	0	0	0	0
57	0	0	0.762	5.146	2.174	0	0	0	0	0	0
58	0	0	0.772	5.493	2.232	0	0	0	0	0	0
59	0	0	0.782	5.843	2.292	0	0	0	0	0	0
60	0	0	0.792	6.195	2.354	0	0	0	0	0	0
	32,170	32,241									
		71				32,991	237,166	52,404	33,067	237,721	52,520

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.036	VOCs =	0.036
CO =	0.261	CO =	0.262
NOx =	0.058	NOx =	0.058

CHANGE FROM BASE TO NEW:	
VOCs =	0.000
CO =	0.001
NOx =	0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 6 – PACE – Routes #304, 322 CTA #25
Cermak/54th to IL43 – Signal Prempt'n

COLUMN #:

1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.982	70.381	3.491	0	0	0	0	0	0
9	20	19	9.139	63.056	3.411	180	1239	67	174	1198	65
10	6	6	8.443	57.146	3.340	54	362	21	51	343	20
11	7	7	7.855	52.285	3.278	51	340	21	55	366	23
12	43	43	7.349	48.220	3.222	317	2078	139	316	2073	139
13	19	20	6.906	44.772	3.173	134	867	61	138	895	63
14	4	4	6.514	41.810	3.128	29	184	14	26	167	13
15	39	40	6.162	39.238	3.089	242	1539	121	246	1570	124
16	39	39	5.842	36.980	3.054	230	1458	120	228	1442	119
17	37	37	5.550	34.980	3.022	205	1294	112	205	1294	112
18	105	106	5.279	33.194	2.994	555	3487	314	560	3519	317
19	195	194	5.027	31.585	2.969	979	6151	578	975	6127	576
20	822	822	4.822	30.209	2.951	3966	24846	2427	3964	24832	2426
21	1,514	1,514	4.670	28.971	2.942	7069	43853	4453	7070	43862	4454
22	2,732	2,728	4.531	27.834	2.936	12381	76056	8023	12361	75931	8009
23	4,975	4,964	4.401	26.784	2.930	21895	133253	14577	21847	132956	14545
24	8,428	8,428	4.281	25.812	2.926	36079	217534	24659	36080	217544	24660
25	9,139	9,141	4.168	24.908	2.923	38093	227643	26714	38100	227684	26719
26	5,217	5,218	4.063	24.066	2.922	21196	125547	15243	21201	125576	15247
27	3,555	3,555	3.964	23.280	2.922	14093	82767	10389	14092	82760	10388
28	1,210	1,209	3.872	22.545	2.923	4687	27289	3538	4681	27257	3534
29	1,238	1,233	3.784	21.859	2.925	4686	27068	3622	4666	26952	3607
30	3,263	3,253	3.702	21.218	2.929	12080	69235	9557	12043	69022	9528
31	3,070	3,062	3.624	20.620	2.934	11126	63303	9007	11097	63138	8984
32	3,718	3,703	3.550	20.062	2.939	13199	74589	10927	13146	74290	10883
33	2,114	2,111	3.481	19.543	2.946	7359	41315	6228	7348	41255	6219
34	1,032	1,028	3.415	19.061	2.955	3525	19675	3050	3511	19595	3038
35	200	198	3.353	18.614	2.964	672	3730	594	664	3686	587
36	158	157	3.294	18.201	2.975	520	2876	470	517	2858	467
37	0	0	3.238	17.820	2.987	0	0	0	0	0	0
38	48	48	3.186	17.471	3.000	152	833	143	153	839	144
39	0	0	3.136	17.151	3.015	0	0	0	0	0	0
40	0	0	3.089	16.859	3.031	0	0	0	0	0	0
41	0	0	3.044	16.595	3.049	0	0	0	0	0	0
42	0	0	3.002	16.356	3.068	0	0	0	0	0	0
43	0	0	2.962	16.142	3.089	0	0	0	0	0	0
44	0	0	2.924	15.950	3.113	0	0	0	0	0	0
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	52,950	52,887									
		-63				215,751	1,280,413	155,192	215,513	1,279,031	155,008

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.238	VOCs =	0.238
CO =	1.411	CO =	1.410
NOx =	0.171	NOx =	0.171

CHANGE FROM BASE TO NEW:	
VOCs =	-0.000
CO =	-0.002
NOx =	-0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 2010 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 6 – PACE – Routes #304, 322 CTA #25
Cermak/54th to IL43 – Signal Premptn

COLUMN #:

1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	6.736	46.190	2.406	0	0	0	0	0	0
4	3	3	4.939	37.032	2.253	14	104	6	15	111	7
5	10	9	3.969	31.385	2.148	38	301	21	36	282	19
6	0	0	3.363	27.519	2.069	0	0	0	0	0	0
7	14	13	2.949	24.688	2.005	41	344	28	38	321	26
8	43	42	2.704	22.515	1.951	116	965	84	114	946	82
9	22	22	2.510	20.789	1.905	56	461	42	55	457	42
10	117	117	2.347	19.381	1.865	275	2273	219	275	2268	218
11	20	20	2.207	18.208	1.829	45	368	37	44	364	37
12	7	7	2.084	17.217	1.797	14	118	12	15	121	13
13	29	29	1.975	16.368	1.769	57	473	51	57	475	51
14	124	123	1.877	15.628	1.743	233	1939	216	231	1922	214
15	13	13	1.787	14.982	1.720	22	188	22	23	195	22
16	90	91	1.705	14.412	1.699	154	1299	153	155	1311	155
17	19	19	1.629	13.906	1.680	31	268	32	31	264	32
18	532	532	1.558	13.453	1.663	829	7161	885	829	7157	885
19	62	62	1.491	13.046	1.647	93	814	103	92	809	102
20	667	669	1.427	12.497	1.636	952	8337	1091	955	8360	1094
21	487	486	1.377	11.820	1.630	670	5753	793	669	5745	792
22	1,621	1,623	1.331	11.204	1.626	2158	18167	2637	2160	18184	2639
23	3,544	3,541	1.288	10.641	1.622	4565	37716	5749	4561	37680	5744
24	6,617	6,610	1.248	10.126	1.618	8258	67004	10706	8249	66933	10695
25	8,297	8,295	1.212	9.652	1.615	10056	80079	13399	10054	80063	13396
26	6,308	6,299	1.178	9.214	1.613	7431	58122	10175	7420	58039	10160
27	7,269	7,273	1.146	8.810	1.611	8330	64039	11710	8335	64075	11717
28	4,919	4,910	1.116	8.436	1.610	5490	41500	7920	5480	41421	7905
29	4,692	4,684	1.088	8.087	1.610	5105	37945	7554	5096	37880	7541
30	4,145	4,129	1.062	7.763	1.610	4402	32177	6673	4385	32053	6648
31	1,958	1,954	1.037	7.461	1.611	2030	14605	3154	2026	14579	3148
32	2,004	1,999	1.014	7.179	1.612	2032	14383	3230	2027	14351	3222
33	2,101	2,098	0.992	6.915	1.614	2085	14531	3392	2081	14508	3386
34	1,254	1,251	0.971	6.667	1.616	1218	8362	2027	1215	8340	2022
35	393	392	0.951	6.434	1.620	374	2530	637	373	2522	635
36	290	289	0.932	6.216	1.623	270	1802	471	269	1796	469
37	37	37	0.914	6.011	1.628	34	225	61	34	222	60
38	104	104	0.897	5.817	1.633	93	606	170	93	605	170
39	0	0	0.881	5.635	1.639	0	0	0	0	0	0
40	0	0	0.866	5.464	1.645	0	0	0	0	0	0
41	11	11	0.851	5.302	1.652	9	58	18	9	58	18
42	0	0	0.837	5.149	1.660	0	0	0	0	0	0
43	7	7	0.823	5.004	1.669	6	35	12	6	35	12
44	0	0	0.810	4.868	1.678	0	0	0	0	0	0
45	0	0	0.798	4.739	1.689	0	0	0	0	0	0
46	0	0	0.786	4.618	1.700	0	0	0	0	0	0
47	0	0	0.774	4.503	1.712	0	0	0	0	0	0
48	0	0	0.763	4.395	1.725	0	0	0	0	0	0
49	0	0	0.760	4.399	1.770	0	0	0	0	0	0
50	0	0	0.756	4.404	1.816	0	0	0	0	0	0
51	0	0	0.753	4.411	1.863	0	0	0	0	0	0
52	0	0	0.750	4.420	1.911	0	0	0	0	0	0
53	0	0	0.748	4.431	1.961	0	0	0	0	0	0
54	0	0	0.745	4.443	2.012	0	0	0	0	0	0
55	0	0	0.743	4.458	2.064	0	0	0	0	0	0
56	0	0	0.752	4.801	2.118	0	0	0	0	0	0
57	0	0	0.762	5.146	2.174	0	0	0	0	0	0
58	0	0	0.772	5.493	2.232	0	0	0	0	0	0
59	0	0	0.782	5.843	2.292	0	0	0	0	0	0
60	0	0	0.792	6.195	2.354	0	0	0	0	0	0
	57,832	57,763				67,587	525,055	93,490	67,507	524,453	93,379
		-69									

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.075	VOCs =	0.074
CO =	0.579	CO =	0.578
NOx =	0.103	NOx =	0.103

CHANGE FROM BASE TO NEW:	
VOCs =	-0.000
CO =	-0.001
NOx =	-0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 7 – PACE – I-294 Toll Plaza Bypass

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.982	70.381	3.491	0	0	0	0	0	0
9	0	0	9.139	63.056	3.411	0	0	0	0	0	0
10	0	0	8.443	57.146	3.340	0	0	0	0	0	0
11	0	0	7.855	52.285	3.278	0	0	0	0	0	0
12	0	0	7.349	48.220	3.222	0	0	0	0	0	0
13	0	0	6.906	44.772	3.173	0	0	0	0	0	0
14	0	0	6.514	41.810	3.128	0	0	0	0	0	0
15	0	0	6.162	39.238	3.089	0	0	0	0	0	0
16	0	0	5.842	36.980	3.054	0	0	0	0	0	0
17	0	0	5.550	34.980	3.022	0	0	0	0	0	0
18	0	0	5.279	33.194	2.994	0	0	0	0	0	0
19	0	0	5.027	31.585	2.969	0	0	0	0	0	0
20	0	0	4.822	30.209	2.951	0	0	0	0	0	0
21	0	0	4.670	28.971	2.942	0	0	0	0	0	0
22	0	0	4.531	27.834	2.936	0	0	0	0	0	0
23	0	0	4.401	26.784	2.930	0	0	0	0	0	0
24	0	0	4.281	25.812	2.926	0	0	0	0	0	0
25	0	0	4.168	24.908	2.923	0	0	0	0	0	0
26	0	0	4.063	24.066	2.922	0	0	0	0	0	0
27	0	0	3.964	23.280	2.922	0	0	0	0	0	0
28	0	0	3.872	22.545	2.923	0	0	0	0	0	0
29	0	0	3.784	21.859	2.925	0	0	0	0	0	0
30	0	0	3.702	21.218	2.929	0	0	0	0	0	0
31	0	0	3.624	20.620	2.934	0	0	0	0	0	0
32	56	0	3.550	20.062	2.939	199	1125	165	0	0	0
33	19	0	3.481	19.543	2.946	66	371	56	0	0	0
34	35	0	3.415	19.061	2.955	120	667	103	0	0	0
35	17	0	3.353	18.614	2.964	59	325	52	0	0	0
36	0	0	3.294	18.201	2.975	0	0	0	0	0	0
37	0	0	3.238	17.820	2.987	0	0	0	0	0	0
38	0	0	3.186	17.471	3.000	0	0	0	0	0	0
39	0	0	3.136	17.151	3.015	0	0	0	0	0	0
40	0	0	3.089	16.859	3.031	0	0	0	0	0	0
41	0	0	3.044	16.595	3.049	0	0	0	0	0	0
42	0	0	3.002	16.356	3.068	0	0	0	0	0	0
43	0	0	2.962	16.142	3.089	0	0	0	0	0	0
44	0	0	2.924	15.950	3.113	0	0	0	0	0	0
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	128	0									
		-128				443	2,488	376	0	0	0

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.000	VOCs =	0.000
CO =	0.003	CO =	0.000
NOx =	0.000	NOx =	0.000

CHANGE FROM BASE TO NEW:	
VOCs =	-0.000
CO =	-0.003
NOx =	-0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 8 – CTA – King Dr. #3 – Automated Vehicle Control, w/ Signal Premptn

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.982	70.381	3.491	0	0	0	0	0	0
9	20	19	9.139	63.056	3.411	180	1239	67	174	1198	65
10	6	6	8.443	57.146	3.340	54	362	21	51	343	20
11	7	7	7.855	52.285	3.278	51	340	21	55	366	23
12	94	94	7.349	48.220	3.222	689	4523	302	691	4533	303
13	219	219	6.906	44.772	3.173	1509	9783	693	1512	9805	695
14	40	40	6.514	41.810	3.128	264	1693	127	261	1672	125
15	122	124	6.162	39.238	3.089	754	4803	378	764	4866	383
16	57	57	5.842	36.980	3.054	335	2120	175	333	2108	174
17	57	58	5.550	34.980	3.022	318	2006	173	322	2029	175
18	27	27	5.279	33.194	2.994	144	908	82	143	896	81
19	82	81	5.027	31.585	2.969	410	2575	242	407	2558	240
20	863	863	4.822	30.209	2.951	4164	26085	2548	4161	26070	2547
21	334	334	4.670	28.971	2.942	1559	9673	982	1560	9676	983
22	2,059	2,059	4.531	27.834	2.936	9329	57310	6045	9329	57310	6045
23	2,808	2,807	4.401	26.784	2.930	12360	75222	8229	12354	75183	8225
24	5,445	5,444	4.281	25.812	2.926	23308	140536	15931	23306	140521	15929
25	3,236	3,237	4.168	24.908	2.923	13487	80598	9458	13492	80627	9462
26	1,447	1,448	4.063	24.066	2.922	5878	34816	4227	5883	34848	4231
27	741	740	3.964	23.280	2.922	2939	17258	2166	2933	17227	2162
28	577	577	3.872	22.545	2.923	2236	13020	1688	2234	13008	1687
29	700	701	3.784	21.859	2.925	2649	15303	2048	2653	15323	2050
30	117	119	3.702	21.218	2.929	435	2493	344	441	2525	349
31	32	32	3.624	20.620	2.934	116	663	94	116	660	94
32	15	16	3.550	20.062	2.939	55	311	46	57	321	47
33	0	0	3.481	19.543	2.946	0	0	0	0	0	0
34	8	8	3.415	19.061	2.955	28	157	24	27	152	24
35	0	0	3.353	18.614	2.964	0	0	0	0	0	0
36	0	0	3.294	18.201	2.975	0	0	0	0	0	0
37	0	0	3.238	17.820	2.987	0	0	0	0	0	0
38	0	0	3.186	17.471	3.000	0	0	0	0	0	0
39	0	0	3.136	17.151	3.015	0	0	0	0	0	0
40	0	0	3.089	16.859	3.031	0	0	0	0	0	0
41	0	0	3.044	16.595	3.049	0	0	0	0	0	0
42	0	0	3.002	16.356	3.068	0	0	0	0	0	0
43	0	0	2.962	16.142	3.089	0	0	0	0	0	0
44	0	0	2.924	15.950	3.113	0	0	0	0	0	0
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	19,116	19,117				83,252	503,799	56,113	83,257	503,826	56,118
		1									

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.092	VOCs =	0.092
CO =	0.555	CO =	0.555
NOx =	0.062	NOx =	0.062

CHANGE FROM BASE TO NEW:	
VOCs =	0.000
CO =	0.000
NOx =	0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 2010 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 8 – CTA – King Dr. #3 – Automated Vehicle Control, w/ Signal Premptn

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	6.736	46.190	2.406	0	0	0	0	0	0
4	3	3	4.939	37.032	2.253	14	104	6	15	111	7
5	10	9	3.969	31.385	2.148	38	301	21	36	282	19
6	0	0	3.363	27.519	2.069	0	0	0	0	0	0
7	12	11	2.949	24.688	2.005	35	292	24	32	272	22
8	297	295	2.704	22.515	1.951	802	6676	578	798	6642	576
9	22	22	2.510	20.789	1.905	56	461	42	55	457	42
10	197	198	2.347	19.381	1.865	462	3819	367	465	3837	369
11	65	65	2.207	18.208	1.829	143	1177	118	143	1184	119
12	3	3	2.084	17.217	1.797	6	48	5	6	52	5
13	22	21	1.975	16.366	1.769	43	353	38	41	344	37
14	142	142	1.877	15.628	1.743	267	2227	248	267	2219	248
15	13	13	1.787	14.982	1.720	22	188	22	23	195	22
16	110	111	1.705	14.412	1.699	188	1586	187	189	1600	189
17	37	37	1.629	13.906	1.680	60	510	62	60	515	62
18	200	199	1.558	13.453	1.663	311	2687	332	310	2677	331
19	28	28	1.491	13.046	1.647	42	371	47	42	365	46
20	1,069	1,069	1.427	12.497	1.636	1525	13354	1748	1525	13359	1749
21	150	151	1.377	11.820	1.630	207	1778	245	208	1785	246
22	2,075	2,075	1.331	11.204	1.626	2762	23248	3374	2762	23248	3374
23	1,765	1,765	1.288	10.641	1.622	2273	18779	2863	2273	18781	2863
24	3,821	3,820	1.248	10.126	1.618	4768	38689	6182	4767	38681	6181
25	3,388	3,385	1.212	9.652	1.615	4106	32697	5471	4103	32672	5467
26	2,479	2,477	1.178	9.214	1.613	2920	22842	3999	2918	22823	3995
27	1,933	1,933	1.146	8.810	1.611	2215	17031	3114	2215	17030	3114
28	1,391	1,393	1.116	8.436	1.610	1552	11731	2239	1555	11751	2243
29	635	634	1.088	8.087	1.610	691	5137	1023	690	5127	1021
30	240	239	1.062	7.763	1.610	255	1862	386	254	1855	385
31	928	928	1.037	7.461	1.611	962	6920	1494	962	6924	1495
32	277	278	1.014	7.179	1.612	281	1991	447	282	1996	448
33	23	23	0.992	6.915	1.614	23	158	37	23	159	37
34	9	9	0.971	6.667	1.616	9	62	15	9	60	15
35	0	0	0.951	6.434	1.620	0	0	0	0	0	0
36	0	0	0.932	6.216	1.623	0	0	0	0	0	0
37	0	0	0.914	6.011	1.628	0	0	0	0	0	0
38	0	0	0.897	5.817	1.633	0	0	0	0	0	0
39	0	0	0.881	5.635	1.639	0	0	0	0	0	0
40	0	0	0.866	5.464	1.645	0	0	0	0	0	0
41	0	0	0.851	5.302	1.652	0	0	0	0	0	0
42	0	0	0.837	5.149	1.660	0	0	0	0	0	0
43	0	0	0.823	5.004	1.669	0	0	0	0	0	0
44	0	0	0.810	4.868	1.678	0	0	0	0	0	0
45	0	0	0.798	4.739	1.689	0	0	0	0	0	0
46	0	0	0.786	4.618	1.700	0	0	0	0	0	0
47	0	0	0.774	4.503	1.712	0	0	0	0	0	0
48	0	0	0.763	4.395	1.725	0	0	0	0	0	0
49	0	0	0.760	4.399	1.770	0	0	0	0	0	0
50	0	0	0.756	4.404	1.816	0	0	0	0	0	0
51	0	0	0.753	4.411	1.863	0	0	0	0	0	0
52	0	0	0.750	4.420	1.911	0	0	0	0	0	0
53	0	0	0.748	4.431	1.961	0	0	0	0	0	0
54	0	0	0.745	4.443	2.012	0	0	0	0	0	0
55	0	0	0.743	4.458	2.064	0	0	0	0	0	0
56	0	0	0.752	4.801	2.118	0	0	0	0	0	0
57	0	0	0.762	5.146	2.174	0	0	0	0	0	0
58	0	0	0.772	5.493	2.232	0	0	0	0	0	0
59	0	0	0.782	5.843	2.292	0	0	0	0	0	0
60	0	0	0.792	6.195	2.354	0	0	0	0	0	0
	21,341	21,336									
		-5				27,038	217,080	34,734	27,028	217,004	34,726

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.030	VOCs =	0.030
CO =	0.239	CO =	0.239
NOx =	0.038	NOx =	0.038

CHANGE FROM BASE TO NEW:	
VOCs =	-0.000
CO =	-0.000
NOx =	-0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 9 – PACE – Subscription Bus Service to Sears

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.982	70.381	3.491	0	0	0	0	0	0
9	0	0	9.139	63.056	3.411	0	0	0	0	0	0
10	0	0	8.443	57.146	3.340	0	0	0	0	0	0
11	0	0	7.855	52.285	3.278	0	0	0	0	0	0
12	0	0	7.349	48.220	3.222	0	0	0	0	0	0
13	0	0	6.906	44.772	3.173	0	0	0	0	0	0
14	0	0	6.514	41.810	3.128	0	0	0	0	0	0
15	0	0	6.162	39.238	3.089	0	0	0	0	0	0
16	0	0	5.842	36.980	3.054	0	0	0	0	0	0
17	0	0	5.550	34.980	3.022	0	0	0	0	0	0
18	0	0	5.279	33.194	2.994	0	0	0	0	0	0
19	0	0	5.027	31.585	2.969	0	0	0	0	0	0
20	0	0	4.822	30.209	2.951	0	0	0	0	0	0
21	0	0	4.670	28.971	2.942	0	0	0	0	0	0
22	0	0	4.531	27.834	2.936	0	0	0	0	0	0
23	0	0	4.401	26.784	2.930	0	0	0	0	0	0
24	0	0	4.281	25.812	2.926	0	0	0	0	0	0
25	0	0	4.168	24.908	2.923	0	0	0	0	0	0
26	0	0	4.063	24.066	2.922	0	0	0	0	0	0
27	0	0	3.964	23.280	2.922	0	0	0	0	0	0
28	0	0	3.872	22.545	2.923	0	0	0	0	0	0
29	0	0	3.784	21.859	2.925	0	0	0	0	0	0
30	0	0	3.702	21.218	2.929	0	0	0	0	0	0
31	135	0	3.624	20.620	2.934	489	2784	396	0	0	0
32	120	0	3.550	20.062	2.939	426	2407	353	0	0	0
33	1034	0	3.481	19.543	2.946	3599	20207	3046	0	0	0
34	69	0	3.415	19.061	2.955	236	1315	204	0	0	0
35	445	0	3.353	18.614	2.964	1492	8283	1319	0	0	0
36	522	0	3.294	18.201	2.975	1719	9501	1553	0	0	0
37	1555	0	3.238	17.820	2.987	5035	27710	4645	0	0	0
38	1740	0	3.186	17.471	3.000	5544	30400	5220	0	0	0
39	3738	0	3.136	17.151	3.015	11722	64110	11270	0	0	0
40	1766	0	3.089	16.859	3.031	5455	29773	5353	0	0	0
41	271	0	3.044	16.595	3.049	825	4497	826	0	0	0
42	115	0	3.002	16.356	3.068	345	1881	353	0	0	0
43	0	0	2.962	16.142	3.089	0	0	0	0	0	0
44	0	0	2.924	15.950	3.113	0	0	0	0	0	0
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	11510	0									
		-11510				36,888	202,869	34,537	0	0	0

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.041	VOCs =	0.000
CO =	0.224	CO =	0.000
NOx =	0.038	NOx =	0.000

CHANGE FROM BASE TO NEW:	
VOCs =	-0.041
CO =	-0.224
NOx =	-0.038

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 10 – PACE – Vanpool Service to Sears

COLUMN #:

1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.982	70.381	3.491	0	0	0	0	0	0
9	0	0	9.139	63.056	3.411	0	0	0	0	0	0
10	0	0	8.443	57.146	3.340	0	0	0	0	0	0
11	0	0	7.855	52.285	3.278	0	0	0	0	0	0
12	0	0	7.349	48.220	3.222	0	0	0	0	0	0
13	0	0	6.906	44.772	3.173	0	0	0	0	0	0
14	0	0	6.514	41.810	3.128	0	0	0	0	0	0
15	0	0	6.162	39.238	3.089	0	0	0	0	0	0
16	0	0	5.842	36.980	3.054	0	0	0	0	0	0
17	0	0	5.550	34.980	3.022	0	0	0	0	0	0
18	0	0	5.279	33.194	2.994	0	0	0	0	0	0
19	0	0	5.027	31.585	2.969	0	0	0	0	0	0
20	0	0	4.822	30.209	2.951	0	0	0	0	0	0
21	0	0	4.670	28.971	2.942	0	0	0	0	0	0
22	0	0	4.531	27.834	2.936	0	0	0	0	0	0
23	0	0	4.401	26.784	2.930	0	0	0	0	0	0
24	0	0	4.281	25.812	2.926	0	0	0	0	0	0
25	0	0	4.168	24.908	2.923	0	0	0	0	0	0
26	35	0	4.063	24.066	2.922	142	842	102	0	0	0
27	149	0	3.964	23.280	2.922	591	3469	435	0	0	0
28	0	0	3.872	22.545	2.923	0	0	0	0	0	0
29	0	0	3.784	21.859	2.925	0	0	0	0	0	0
30	50	0	3.702	21.218	2.929	185	1061	146	0	0	0
31	146	0	3.624	20.620	2.934	529	3011	428	0	0	0
32	627	0	3.550	20.062	2.939	2226	12579	1843	0	0	0
33	621	0	3.481	19.543	2.946	2162	12136	1829	0	0	0
34	249	0	3.415	19.061	2.955	850	4746	736	0	0	0
35	205	0	3.353	18.614	2.964	687	3816	608	0	0	0
36	472	0	3.294	18.201	2.975	1555	8591	1404	0	0	0
37	427	0	3.238	17.820	2.987	1383	7609	1275	0	0	0
38	653	0	3.186	17.471	3.000	2080	11409	1959	0	0	0
39	1084	0	3.136	17.151	3.015	3399	18592	3268	0	0	0
40	805	0	3.089	16.859	3.031	2487	13571	2440	0	0	0
41	524	0	3.044	16.595	3.049	1595	8696	1598	0	0	0
42	116	0	3.002	16.356	3.068	348	1897	356	0	0	0
43	82	0	2.962	16.142	3.089	243	1324	253	0	0	0
44	0	0	2.924	15.950	3.113	0	0	0	0	0	0
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	6245	0									
		-6245				20,462	113,348	18,682	0	0	0

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.023	VOCs =	0.000
CO =	0.125	CO =	0.000
NOx =	0.021	NOx =	0.000

CHANGE FROM BASE TO NEW:	
VOCs =	-0.023
CO =	-0.125
NOx =	-0.021

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 11 – RTA – Transit Check (Factored to existing use)

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.184	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	3	0	0	3	0
7	0	0	11.073	79.678	3.583	0	1	0	0	1	0
8	0	0	9.682	70.381	3.491	0	1	0	0	1	0
9	0	0	9.139	63.056	3.411	1	5	0	1	5	0
10	0	0	8.443	57.146	3.340	3	21	1	3	20	1
11	0	0	7.855	52.285	3.278	4	24	2	4	24	1
12	2	2	7.349	48.220	3.222	15	99	7	15	98	6
13	4	4	6.906	44.772	3.173	27	176	12	27	172	12
14	5	5	6.514	41.810	3.128	30	195	15	30	193	14
15	8	8	6.162	39.238	3.089	47	302	24	46	295	23
16	13	13	5.842	36.980	3.054	76	495	41	76	482	40
17	22	21	5.550	34.980	3.022	119	753	65	117	739	64
18	39	37	5.279	33.194	2.994	204	1284	116	198	1245	112
19	67	65	5.027	31.585	2.969	335	2104	198	326	2048	193
20	117	115	4.822	30.209	2.951	566	3546	348	554	3470	339
21	212	207	4.670	28.971	2.942	990	6140	624	966	5990	608
22	404	391	4.531	27.834	2.936	1830	11243	1166	1773	10891	1149
23	645	624	4.401	26.784	2.930	2839	17278	1890	2745	16708	1828
24	790	763	4.281	25.812	2.926	3384	20403	2313	3268	19705	2234
25	780	755	4.168	24.908	2.923	3250	19422	2279	3145	18797	2206
26	790	761	4.063	24.066	2.922	3208	19000	2307	3091	18308	2223
27	726	703	3.964	23.280	2.922	2879	16909	2122	2788	16384	2054
28	640	620	3.872	22.545	2.923	2478	14428	1870	2402	13989	1814
29	579	563	3.784	21.859	2.925	2193	12667	1695	2130	12303	1648
30	560	565	3.702	21.218	2.929	2148	12309	1699	2092	11990	1655
31	504	493	3.624	20.620	2.934	1827	10394	1479	1787	10170	1447
32	454	444	3.550	20.062	2.939	1610	9099	1333	1577	8911	1305
33	431	424	3.481	19.543	2.948	1499	8417	1269	1475	8281	1248
34	405	400	3.415	19.061	2.955	1383	7717	1196	1367	7632	1183
35	354	350	3.353	18.614	2.964	1185	6581	1048	1175	6522	1039
36	321	319	3.294	18.201	2.975	1056	5838	954	1049	5797	948
37	264	262	3.238	17.820	2.987	854	4698	787	847	4664	782
38	233	232	3.186	17.471	3.000	744	4077	700	739	4052	696
39	190	190	3.136	17.151	3.015	597	3265	574	595	3253	572
40	149	148	3.089	16.859	3.031	460	2510	451	458	2501	450
41	118	118	3.044	16.595	3.049	360	1961	360	358	1954	359
42	88	88	3.002	16.356	3.068	265	1443	271	264	1441	270
43	70	70	2.962	16.142	3.089	209	1136	217	208	1135	217
44	62	62	2.924	15.950	3.113	182	995	194	182	993	194
45	58	57	2.888	15.779	3.138	166	910	181	166	907	180
46	45	45	2.854	15.627	3.165	127	696	141	127	696	141
47	29	29	2.821	15.492	3.195	81	445	92	81	444	92
48	23	23	2.790	15.370	3.228	63	349	73	63	349	73
49	12	12	2.774	15.391	3.334	33	182	39	33	182	39
50	9	9	2.759	15.417	3.443	24	132	30	24	132	30
51	6	6	2.746	15.450	3.554	17	96	22	17	96	22
52	3	3	2.733	15.490	3.668	8	43	10	8	43	10
53	5	5	2.721	15.536	3.784	13	75	18	13	75	18
54	2	2	2.709	15.589	3.903	5	29	7	5	29	7
55	2	2	2.699	15.649	4.025	5	31	8	5	31	8
56	1	1	2.762	16.355	4.150	4	23	5	4	23	5
57	3	3	2.826	21.068	4.279	8	57	12	8	57	12
58	1	1	2.890	23.791	4.411	2	15	3	2	15	3
59	0	0	2.955	26.523	4.547	1	8	1	1	8	1
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	10,263	10,019				39,416	230,031	30,290	38,435	224,233	29,575
		-244									

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.043	VOCs =	0.042
CO =	0.254	CO =	0.247
NOx =	0.033	NOx =	0.033

CHANGE FROM BASE TO NEW:	
VOCs =	-0.001
CO =	-0.006
NOx =	-0.001

NOTE...Multiply by 4 to get tons per day.

CHICAGO 2010 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 11 – RTA – Transit Check (Factored to existing use)

COLUMN #:

1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	6.736	46.190	2.406	0	0	0	0	0	0
4	0	0	4.939	37.032	2.253	0	0	0	0	0	0
5	0	0	3.969	31.365	2.148	0	0	0	0	0	0
6	1	1	3.363	27.519	2.069	3	27	2	3	27	2
7	1	1	2.949	24.668	2.005	3	22	2	3	22	2
8	4	4	2.704	22.515	1.951	12	100	9	12	99	9
9	3	3	2.510	20.789	1.905	7	57	5	7	57	5
10	6	6	2.347	19.381	1.865	14	117	11	14	116	11
11	3	3	2.207	18.208	1.829	8	63	6	8	62	6
12	6	6	2.084	17.217	1.797	13	104	11	12	103	11
13	13	13	1.975	16.366	1.769	26	218	24	26	217	23
14	10	10	1.877	15.628	1.743	19	157	17	19	155	17
15	18	18	1.787	14.982	1.720	32	272	31	32	268	31
16	17	16	1.705	14.412	1.699	28	238	28	28	235	28
17	27	27	1.629	13.906	1.680	44	373	45	43	370	45
18	35	35	1.558	13.453	1.663	55	472	58	54	465	57
19	54	53	1.491	13.046	1.647	81	705	89	80	696	88
20	79	77	1.427	12.497	1.636	112	983	129	110	966	126
21	120	118	1.377	11.820	1.630	165	1419	196	162	1392	192
22	227	222	1.331	11.204	1.626	302	2543	369	295	2487	361
23	374	365	1.288	10.641	1.622	481	3977	606	470	3881	592
24	569	553	1.248	10.126	1.618	710	5758	920	691	5603	895
25	787	787	1.212	9.652	1.615	954	7594	1271	929	7400	1238
26	831	808	1.178	9.214	1.613	979	7855	1340	952	7446	1303
27	807	785	1.148	8.810	1.611	925	7108	1300	900	6918	1265
28	749	730	1.116	8.436	1.610	836	6322	1207	815	6159	1175
29	746	725	1.088	8.087	1.610	811	6030	1200	789	5864	1167
30	762	745	1.062	7.763	1.610	809	5912	1226	792	5787	1200
31	677	661	1.037	7.461	1.611	702	5052	1091	686	4934	1065
32	614	600	1.014	7.179	1.612	623	4411	990	608	4308	967
33	598	586	0.992	6.915	1.614	593	4136	965	581	4050	945
34	579	568	0.971	6.667	1.616	562	3858	935	552	3788	918
35	550	541	0.951	6.434	1.620	523	3539	891	515	3483	877
36	471	465	0.932	6.216	1.623	439	2928	764	433	2888	754
37	407	402	0.914	6.011	1.628	372	2448	663	367	2416	654
38	338	335	0.897	5.817	1.633	303	1968	552	300	1946	546
39	267	264	0.881	5.635	1.639	235	1503	437	232	1485	432
40	215	213	0.866	5.464	1.645	186	1174	353	184	1163	350
41	168	166	0.851	5.302	1.652	143	889	277	142	882	275
42	131	130	0.837	5.149	1.660	109	673	217	109	670	216
43	107	106	0.823	5.004	1.669	88	533	178	87	532	177
44	82	82	0.810	4.868	1.678	66	398	137	66	397	137
45	76	76	0.798	4.739	1.689	61	360	128	60	359	128
46	51	51	0.786	4.618	1.700	40	236	87	40	235	86
47	32	32	0.774	4.503	1.712	25	144	55	25	144	55
48	26	26	0.763	4.395	1.725	20	113	44	20	112	44
49	18	18	0.760	4.399	1.770	14	80	32	14	79	32
50	11	11	0.756	4.404	1.816	9	50	20	9	50	20
51	8	8	0.753	4.411	1.863	6	35	15	6	35	15
52	6	6	0.750	4.420	1.911	5	28	12	5	28	12
53	5	5	0.748	4.431	1.961	4	22	10	4	22	10
54	4	4	0.745	4.443	2.012	3	18	8	3	18	8
55	3	3	0.743	4.458	2.064	2	14	7	2	14	7
56	3	3	0.752	4.801	2.116	2	14	6	2	14	6
57	4	4	0.762	5.146	2.174	3	19	8	3	19	8
58	2	2	0.772	5.493	2.232	2	13	5	2	13	5
59	2	2	0.782	5.843	2.292	2	12	5	2	12	5
60	0	0	0.792	6.195	2.354	0	2	1	0	2	1
	11,703	11,462				12,569	92,698	18,998	12,303	90,893	18,608
		-242									

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.014	VOCs =	0.014
CO =	0.102	CO =	0.100
NOx =	0.021	NOx =	0.021

CHANGE FROM BASE TO NEW:	
VOCs =	-0.000
CO =	-0.002
NOx =	-0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 1990 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 12 – Metra – Franklin Pk–Milw West Line
Pedestrian/Auto Grade Separation

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	29.442	169.048	4.194	0	0	0	0	0	0
4	0	0	20.577	132.058	3.977	0	0	0	0	0	0
5	0	0	15.884	108.353	3.817	0	0	0	0	0	0
6	0	0	13.007	91.833	3.689	0	0	0	0	0	0
7	0	0	11.073	79.678	3.583	0	0	0	0	0	0
8	0	0	9.982	70.381	3.491	0	0	0	0	0	0
9	0	0	9.139	63.056	3.411	0	0	0	0	0	0
10	0	0	8.443	57.146	3.340	0	0	0	0	0	0
11	0	0	7.855	52.285	3.278	0	0	0	0	0	0
12	0	0	7.349	48.220	3.222	0	0	0	0	0	0
13	0	0	6.906	44.772	3.173	0	0	0	0	0	0
14	0	0	6.514	41.810	3.128	0	0	0	0	0	0
15	0	0	6.162	39.238	3.089	0	0	0	0	0	0
16	0	0	5.842	36.980	3.054	0	0	0	0	0	0
17	16	16	5.550	34.980	3.022	86	545	47	89	560	48
18	135	135	5.279	33.194	2.994	714	4490	405	713	4481	404
19	283	282	5.027	31.585	2.969	1423	8939	840	1418	8907	837
20	170	170	4.822	30.209	2.951	818	5125	501	820	5136	502
21	123	123	4.670	28.971	2.942	576	3576	363	574	3563	362
22	287	287	4.531	27.834	2.936	1302	8000	844	1300	7988	843
23	313	308	4.401	26.784	2.930	1375	8371	916	1356	8249	902
24	227	226	4.281	25.812	2.926	972	5863	665	968	5834	661
25	290	289	4.168	24.908	2.923	1208	7221	847	1205	7198	845
26	159	159	4.063	24.066	2.922	645	3818	464	646	3826	465
27	18	18	3.964	23.280	2.922	71	418	52	71	419	53
28	17	14	3.872	22.545	2.923	66	382	50	54	316	41
29	49	42	3.784	21.859	2.925	185	1068	143	159	918	123
30	242	210	3.702	21.218	2.929	895	5127	708	777	4456	615
31	234	195	3.624	20.620	2.934	849	4828	687	707	4021	572
32	69	56	3.550	20.062	2.939	244	1380	202	199	1123	165
33	0	0	3.481	19.543	2.946	0	0	0	0	0	0
34	0	0	3.415	19.061	2.955	0	0	0	0	0	0
35	0	0	3.353	18.614	2.964	0	0	0	0	0	0
36	0	0	3.294	18.201	2.975	0	0	0	0	0	0
37	0	0	3.238	17.820	2.987	0	0	0	0	0	0
38	0	0	3.186	17.471	3.000	0	0	0	0	0	0
39	0	0	3.136	17.151	3.015	0	0	0	0	0	0
40	0	0	3.089	16.859	3.031	0	0	0	0	0	0
41	0	0	3.044	16.595	3.049	0	0	0	0	0	0
42	0	0	3.002	16.356	3.068	0	0	0	0	0	0
43	0	0	2.962	16.142	3.089	0	0	0	0	0	0
44	0	0	2.924	15.950	3.113	0	0	0	0	0	0
45	0	0	2.888	15.779	3.138	0	0	0	0	0	0
46	0	0	2.854	15.627	3.165	0	0	0	0	0	0
47	0	0	2.821	15.492	3.195	0	0	0	0	0	0
48	0	0	2.790	15.370	3.228	0	0	0	0	0	0
49	0	0	2.774	15.391	3.334	0	0	0	0	0	0
50	0	0	2.759	15.417	3.443	0	0	0	0	0	0
51	0	0	2.746	15.450	3.554	0	0	0	0	0	0
52	0	0	2.733	15.490	3.668	0	0	0	0	0	0
53	0	0	2.721	15.536	3.784	0	0	0	0	0	0
54	0	0	2.709	15.589	3.903	0	0	0	0	0	0
55	0	0	2.699	15.649	4.025	0	0	0	0	0	0
56	0	0	2.762	18.355	4.150	0	0	0	0	0	0
57	0	0	2.826	21.068	4.279	0	0	0	0	0	0
58	0	0	2.890	23.791	4.411	0	0	0	0	0	0
59	0	0	2.955	26.523	4.547	0	0	0	0	0	0
60	0	0	3.021	29.265	4.687	0	0	0	0	0	0
	2,631	2,530				11,430	69,151	7,733	11,055	66,998	7,437
		−101									

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.013	VOCs =	0.012
CO =	0.076	CO =	0.074
NOx =	0.009	NOx =	0.008

CHANGE FROM BASE TO NEW:	
VOCs =	−0.000
CO =	−0.002
NOx =	−0.000

NOTE...Multiply by 4 to get tons per day.

CHICAGO 2010 TEST SCENARIO: MOBILE5 EMISSION FACTORS (12/4/92 Release) 10-Mar-93
TOTAL EMISSIONS SPREADSHEET
CAMBRIDGE SYSTEMATICS, INC.
ALTERNATIVE: Alternative 12 – Metra – Franklin Pk–Milw West Line
Pedestrian/Auto Grade Separation

COLUMN #: 1	2	3	3	4	5	6	7	8	9	10	11
	VMT:		EMISSION FACTORS (g./mile):			BASE CASE TOTAL GRAMS:			NEW CASE TOTAL GRAMS:		
SPEED	BASE	NEW	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
0	0	0	0.000	0.000	0.000	0	0	0	0	0	0
1	0	0	0.000	0.000	0.000	0	0	0	0	0	0
2	0	0	0.000	0.000	0.000	0	0	0	0	0	0
3	0	0	6.736	46.190	2.406	0	0	0	0	0	0
4	0	0	4.939	37.032	2.253	0	0	0	0	0	0
5	0	0	3.969	31.385	2.148	0	0	0	0	0	0
6	0	0	3.363	27.519	2.069	0	0	0	0	0	0
7	0	0	2.949	24.688	2.005	0	0	0	0	0	0
8	0	0	2.704	22.515	1.951	0	0	0	0	0	0
9	0	0	2.510	20.789	1.905	0	0	0	0	0	0
10	0	0	2.347	19.381	1.865	0	0	0	0	0	0
11	0	0	2.207	18.208	1.829	0	0	0	0	0	0
12	0	0	2.084	17.217	1.797	0	0	0	0	0	0
13	0	0	1.975	16.366	1.769	0	0	0	0	0	0
14	0	0	1.877	15.628	1.743	0	0	0	0	0	0
15	0	0	1.787	14.982	1.720	0	0	0	0	0	0
16	0	0	1.705	14.412	1.699	0	0	0	0	0	0
17	0	0	1.629	13.906	1.680	0	0	0	0	0	0
18	0	0	1.558	13.453	1.663	0	0	0	0	0	0
19	0	0	1.491	13.046	1.647	0	0	0	0	0	0
20	21	21	1.427	12.497	1.636	30	266	35	30	262	34
21	90	91	1.377	11.820	1.630	124	1065	147	125	1076	148
22	112	111	1.331	11.204	1.626	149	1251	182	148	1244	180
23	193	192	1.288	10.641	1.622	248	2050	312	247	2043	311
24	126	124	1.248	10.126	1.618	157	1276	204	155	1256	201
25	135	133	1.212	9.652	1.615	163	1299	217	161	1284	215
26	204	205	1.178	9.214	1.613	241	1882	330	241	1889	331
27	194	194	1.146	8.810	1.611	222	1710	313	222	1709	313
28	291	292	1.116	8.436	1.610	325	2459	469	326	2463	470
29	152	131	1.088	8.087	1.610	166	1232	245	143	1059	211
30	247	201	1.062	7.763	1.610	262	1915	397	213	1560	324
31	192	169	1.037	7.461	1.611	199	1429	309	175	1261	272
32	155	138	1.014	7.179	1.612	157	1114	250	140	991	222
33	86	78	0.992	6.915	1.614	85	592	138	77	539	126
34	0	0	0.971	6.667	1.616	0	0	0	0	0	0
35	12	12	0.951	6.434	1.620	12	80	20	11	77	19
36	0	0	0.932	6.216	1.623	0	0	0	0	0	0
37	0	0	0.914	6.011	1.628	0	0	0	0	0	0
38	0	0	0.897	5.817	1.633	0	0	0	0	0	0
39	0	0	0.881	5.635	1.639	0	0	0	0	0	0
40	0	0	0.866	5.464	1.645	0	0	0	0	0	0
41	0	0	0.851	5.302	1.652	0	0	0	0	0	0
42	0	0	0.837	5.149	1.660	0	0	0	0	0	0
43	0	0	0.823	5.004	1.669	0	0	0	0	0	0
44	0	0	0.810	4.868	1.678	0	0	0	0	0	0
45	0	0	0.798	4.739	1.689	0	0	0	0	0	0
46	0	0	0.786	4.618	1.700	0	0	0	0	0	0
47	0	0	0.774	4.503	1.712	0	0	0	0	0	0
48	0	0	0.763	4.395	1.725	0	0	0	0	0	0
49	0	0	0.760	4.399	1.770	0	0	0	0	0	0
50	0	0	0.756	4.404	1.816	0	0	0	0	0	0
51	0	0	0.753	4.411	1.863	0	0	0	0	0	0
52	0	0	0.750	4.420	1.911	0	0	0	0	0	0
53	0	0	0.748	4.431	1.961	0	0	0	0	0	0
54	0	0	0.745	4.443	2.012	0	0	0	0	0	0
55	0	0	0.743	4.458	2.064	0	0	0	0	0	0
56	0	0	0.752	4.801	2.118	0	0	0	0	0	0
57	0	0	0.762	5.146	2.174	0	0	0	0	0	0
58	0	0	0.772	5.493	2.232	0	0	0	0	0	0
59	0	0	0.782	5.843	2.292	0	0	0	0	0	0
60	0	0	0.792	6.195	2.354	0	0	0	0	0	0
	2,210	2,092									
		−118				2,540	19,618	3,568	2,416	18,713	3,378

TOTAL TONS (Base):		TOTAL TONS (New):	
VOCs =	0.003	VOCs =	0.003
CO =	0.022	CO =	0.021
NOx =	0.004	NOx =	0.004

CHANGE FROM BASE TO NEW:	
VOCs =	−0.000
CO =	−0.001
NOx =	−0.000

NOTE...Multiply by 4 to get tons per day.