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Considerations in the Application of Collector-Distributor Designs for Improving Mainlane Freeway Operations

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December 1992

METRIC (SI*) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol

LENGTH

Symbol	When You Know	Multiply By	To Find	Symbol
in	inches	2.54	centimetres	cm
ft	feet	0.3048	metres	m
yd	yards	0.914	metres	m
mi	miles	1.61	kilometres	km

AREA

Symbol	When You Know	Multiply By	To Find	Symbol
in^2	square inches	645.2	centimetres squared	cm^2
ft^2	square feet	0.0929	metres squared	m^2
yd^2	square yards	0.836	metres squared	m^2
mi^2	square miles	2.59	kilometres squared	km^2
ac	acres	0.395	hectares	ha

MASS (weight)

Symbol	When You Know	Multiply By	To Find	Symbol
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg

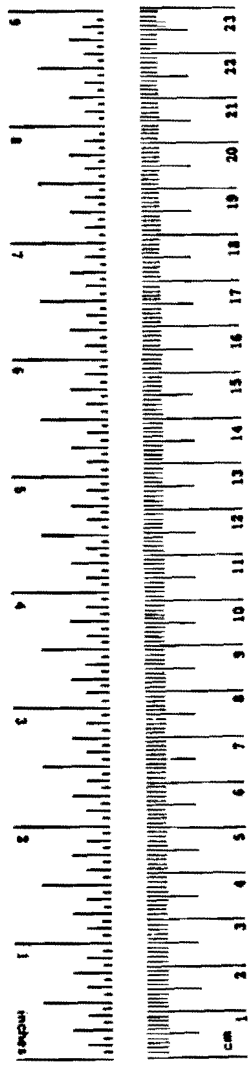
VOLUME

Symbol	When You Know	Multiply By	To Find	Symbol
fl oz	fluid ounces	29.57	millilitres	mL
gal	gallons	3.785	litres	L
ft^3	cubic feet	0.0328	metres cubed	m^3
yd^3	cubic yards	0.0765	metres cubed	m^3

NOTE: Volumes greater than 1000 L shall be shown in m^3.

TEMPERATURE (exact)

Symbol	When You Know	Multiply By	To Find	Symbol
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol

LENGTH

Symbol	When You Know	Multiply By	To Find	Symbol
mm	millimetres	0.039	inches	in
m	metres	3.28	feet	ft
m	metres	1.09	yards	yd
km	kilometres	0.621	miles	mi

AREA

Symbol	When You Know	Multiply By	To Find	Symbol
mm^2	millimetres squared	0.0016	square inches	in^2
m^2	metres squared	10.764	square feet	ft^2
km^2	kilometres squared	0.39	square miles	mi^2
ha	hectores (10 000 m^2)	2.53	acres	ac

MASS (weight)

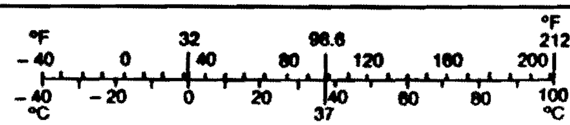
Symbol	When You Know	Multiply By	To Find	Symbol
g	grams	0.0353	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (1 000 kg)	1.103	short tons	T

VOLUME

Symbol	When You Know	Multiply By	To Find	Symbol
mL	millilitres	0.034	fluid ounces	fl oz
L	litres	0.264	gallons	gal
m^3	metres cubed	35.315	cubic feet	ft^3
m^3	metres cubed	1.308	cubic yards	yd^3

TEMPERATURE (exact)

Symbol	When You Know	Multiply By	To Find	Symbol
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



These factors conform to the requirement of FHWA Order 5190.1A.

* SI is the symbol for the International System of Measurements

EXECUTIVE SUMMARY

One alternative for expanding freeway capacity is developing a collector-distributor system. A collector-distributor system provides a buffer for weaving maneuvers between the freeway mainlanes and surface arterial streets. Normally, a collector-distributor system is a three-level system consisting of frontage roads, the collector-distributor facilities, and freeway mainlanes.

A freeway corridor that could be considered a candidate for a collector-distributor system should have:

1) Sufficient right-of-way.
2) Significant separation between major cross streets.
3) Significant through and weaving movement on the existing freeway mainlanes.
4) Adequate intersection geometrics on right-of-way.

Several key design elements are recommended for effective collector-distributor design:

1) Ramp design should encompass one-lane entrances and two-lane exits;
2) Provision should be made for a desirable distance of 3,000 feet between mainlane connector ramps and freeway to freeway interchanges;
3) Ramps should be designed to full freeway standards; and
4) Weaving area on the collector-distributor roadway should be a 1,000 foot minimum length.

A case study freeway corridor was evaluated as an example application of a collector-distributor alternative. An analysis methodology was employed for a complete collector-distributor system illustrating that while improvements were demonstrated for mainlane level-of-service, congestion problems were more prevalent at cross street interchanges.

ABSTRACT

Collector-distributor roadways can be effective as a "buffer" facility with limited access interfacing between mainlanes and frontage road development. However, both transverse and longitudinal space requirements are critical for acceptable implementation. This report summarizes several key aspects of collector-distributor freeway system design considerations and features; and then presents a case study that demonstrates an evaluation methodology.

DISCLAIMER

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INTRODUCTION

Traffic volumes on many freeways in Texas urban areas have reached and exceeded their design volumes long before they reach their design year. Additional capacity, whether in the form of additional lanes, alternative configurations or optimized use of the existing roadways is the method most utilized to alleviate bottlenecks. Some segments of urban freeways have become such problem areas, that entirely new roadway alternatives (geometrics) have been considered. Two prominent design alternatives currently being considered are the use of expresslanes and collector-distributor roadways. This report discusses considerations for the application of collector-distributor roadway systems.

Alleviating traffic congestion on urban freeways is one of the major issues that the Texas Department of Transportation (TxDOT) has to contend with. In 1990, TxDOT District 12 asked the Texas Transportation Institute (TTI) to evaluate the feasibility of a collector-distributor freeway system along IH-610W (West Loop). This activity represented an attempt on behalf of TxDOT to quantify the effects of such a design alternative on possibly the most congested corridor in Texas. This project also served as the basis for many of the recommendations found within this report. This particular application was solely site specific, however, the concept of innovative designs to improve traffic operations is a timely concern. This report summarizes several key aspects of collector-distributor freeway system design considerations and features and then presents a case study that demonstrates an evaluation methodology.

COLLECTOR-DISTRIBUTOR SYSTEMS

One alternative for expanding freeway capacity is developing a collector-distributor system. A collector-distributor system provides a buffer for weaving maneuvers between the freeway mainlanes and surface arterial streets. Normally, a collector-distributor system is a three-level system consisting of frontage roads, the collector-distributor facilities, and freeway mainlanes. The mainlanes focus on providing unrestricted through movements, and the collector-distributor facilities provide weaving areas and accommodate short distance trips. Frontage roads primarily serve as the interface between the system and local access points, as well as provide short duration trip circulation.

Collector-distributor systems can improve the operational characteristics of a corridor, however, several key design elements and existing conditions must be present and considered. Past reviews of these systems by TTI (1,2) have shown that if the existing roadway conditions are conducive to a collector-distributor system, this system can improve mobility throughout the entire area. However, if the collector-distributor system is forced into a highway corridor that is not conducive to this type of configuration, the mainlane travel times and delay may be improved, but the collector-distributor facility, frontage roads, or cross-street intersections may operate more poorly than before.

DESIGN CONSIDERATIONS

Before designing a collector-distributor system, several factors must be considered. A freeway corridor that could be considered a candidate for a collector-distributor system should have the following characteristics:

1) Sufficient right-of-way,
2) Significant separation between major cross-streets,
3) Significant through and weaving movements on existing freeway mainlanes,
4) Adequate intersection geometrics on right-of-way for improvements.

Most collector-distributor system configurations for major facilities will require 500 to 600 feet of right-of-way. In areas with restrictive right-of-way, constructing a collector-distributor system requires the elimination of ramps and places acceleration/deceleration areas directly in the weaving areas. Collector-distributor systems should not be considered in locations where obtaining additional right-of-way is cost prohibitive. This severely limits the locations where collector-distributor systems can be utilized in several Texas cities.

Another existing condition required for a collector-distributor system to function properly is sufficient separation between major cross-streets. The ideal distance separating major cross-streets is approximately one mile. Cross-streets at one mile spacings allow designers enough distance to adequately design weaving, ingress, and egress areas. Minor cross-streets may be located at shorter distances; however, careful consideration should be given to whether or not access to these streets is restricted to the frontage road system. Access to the collector-distributor system by numerous minor cross-streets may seriously impair the system's operation.

Suggesting that significant through and weaving movements must exist on the existing system may seem trivial, however, before designing a collector-distributor system designers should have some idea of whether the finished design will solve the existing problem. The purpose of the collector-distributor system is to remove heavy weaving movements from the mainlane traffic stream. It is suggested that traffic data be collected and fully analyzed to determine the effects of a collector-distributor system early in the conceptual design phase. If the problem exists purely because of through traffic movements, other less expensive alternatives, i.e. additional mainlanes, should be considered. Weaving effects should also be carefully examined.

Developing a collector-distributor system requires that the intersection geometrics be sufficient to handle the traffic demands. For many years, improvements to freeways have not been followed up with improvements to the connecting cross-streets. If the cross-street design is inadequate for the existing or projected volumes, the delay throughout the entire collector-distributor system will be affected.

DESIGN FEATURES

During the conceptual and initial design process, several key design element parameters seem necessary for effective collector-distributor design. The design elements that have been identified through previous freeway system analyses conducted by the Texas Transportation Institute (1,2) include the following items:

1) Ramp design should encompass - one-lane freeway entrances and two-lane freeway exits;
2) Provision should be made for a desirable distance of 3,000 feet between mainlane connector ramps and freeway to freeway interchanges;
3) Ramps should be designed to full freeway standards; and
4) Weaving area on the collector-distributor roadway should be a 1,000 foot minimum length.

The primary concern in the design of a collector-distributor system is the weaving areas. Previous analyses have indicated that lane-changes may exceed the number of weaving vehicles by 1.8 times (1). One method of eliminating some of the lane-changes is to construct one-lane freeway entrances and two-lane freeway exits. This configuration provides an auxiliary lane between the entrance and exit while requiring only one lane-change for entering vehicles to continue on the collector-distributor system.

Another major concern is weaving in the vicinity of the interchanges. Again, previous analyses have yielded some useful guidance in this area. Prior studies have shown that ramps located less than 2,000 feet up or down stream of an interchange adversely impact vehicular operations (3). For this reason, it is suggested that connection ramps to the mainlanes should be located a minimum of 2,500 feet and desirably 3,000 feet from freeway to freeway interchanges. With spacings of this magnitude, weaving maneuvers are accommodated with a minimal impact to the mainlane traffic stream.

Full standard ramp design is also preferred. Recently, new standards for freeway ramps in restricted right-of-way have been implemented which include a 30-foot minimum separation distance. This design standard requires a large angle of departure and shorter ramp; both of these factors cause drivers to reduce speed and adversely impact the mainlane traffic stream.

The collector-distributor facility resembles a typical Texas freeway configuration. The Texas frontage roads have the access provided to the collector-distributor system. However, unlike the Texas freeway systems, vehicle speeds on a collector-distributor are usually lower and weaving area much more restrictive. When designing the collector-distributor system, the number of lanes should be demand based but not excessive. A higher number of lanes may cause problems with lane changes and weaving. In addition, weaving areas on the collector-distributor system should be long enough to allow smooth transitions between weaving vehicles. Guidelines have indicated that weaving areas should be a minimum of 1,000 feet (4).

CASE STUDY EVALUATION

A case study was conducted to evaluate the possible effects that a collector-distributor system would have on a site in one of Texas' major urban cities. This particular case study was intended to illustrate the process necessary for analyzing freeway improvements and to highlight possible pitfalls. INTRAS, a microscopic freeway simulation model, was chosen as the analysis tool from which comparisons could be drawn. The microscopic nature of INTRAS lends itself to be the most appropriate model for the evaluation of weaving areas, a main aspect in the design of collector-distributor systems. The car-following and lane-change algorithms that the model employs are the most detailed mathematical representations of vehicular behavior that are available to traffic engineers. A more detailed description of the INTRAS simulation model can be found in a previous study of freeway express lanes (5).

Existing Conditions

The freeway corridor shown in Figure 1 was used to evaluate the effectiveness of the application of a collector-distributor alternative. The case study section is approximately 4 1/2 miles long and includes two fully directional interchanges, two diamond interchanges and several other pairs of ramps. This freeway segment is consistently congested and has been the subject of many traffic analyses in the past (1,3,5). The close spacing of the cross-streets and the fact that the cross-streets are major arterials (high volume generators) result in high weaving volumes. The existing number of lanes and operational level-of-service (LOS), derived from INTRAS simulation output densities, are shown in Figure 2. Table 1 shows some of the system operational characteristics. The volume to capacity ratio (V/C) is based on the highest simulated volume on the mainlanes and a freeway capacity of 2200 vphpl.

Table 1. INTRAS Peak Hour Results for Existing Configuration of Case Study System.

V/C Ratio	Input Volume Veh/Hr.	Vehicle-Miles	Total Delay Veh.-Min.
0.83	36451	59832	31476

Collector-Distributor Alternative Analysis

A collector-distributor alternative was developed for the corridor and the forecasted volumes for 2010 were simulated. The future volumes were calculated using the TxDOT planning model for the area. The collector-distributor system that was developed used the guidelines listed in previous sections, which included: weaving sections on the collector-distributor roadway were a minimum of 1000 ft., one-lane entrance and two-lane exit ramps, full freeway standard ramps, and no mainlane connector ramps within 2500 ft. of the freeway to freeway interchanges. A schematic of the collector-distributor system is shown in Figure 3.

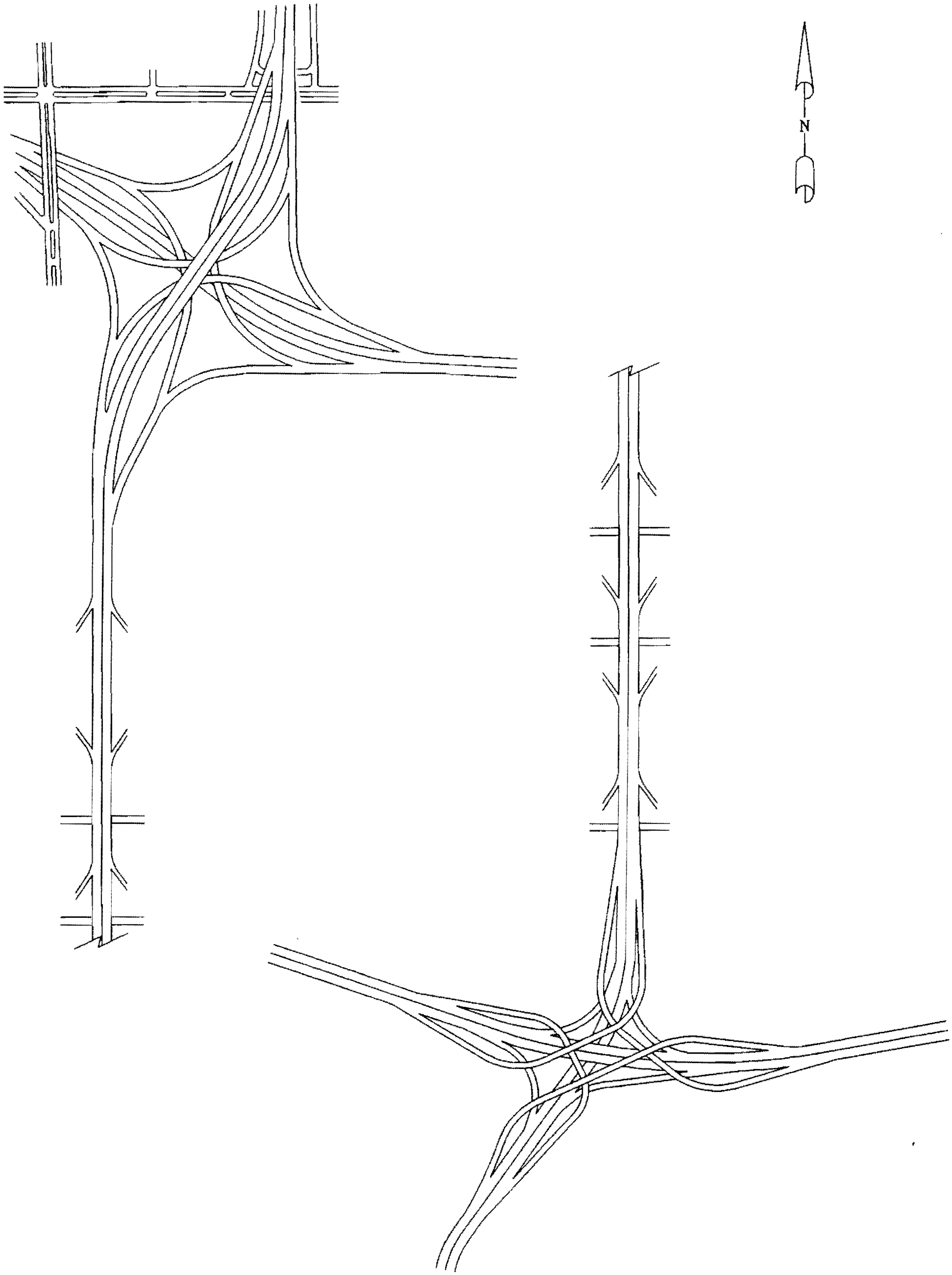

Figure 1. Schematic of Case Study Site

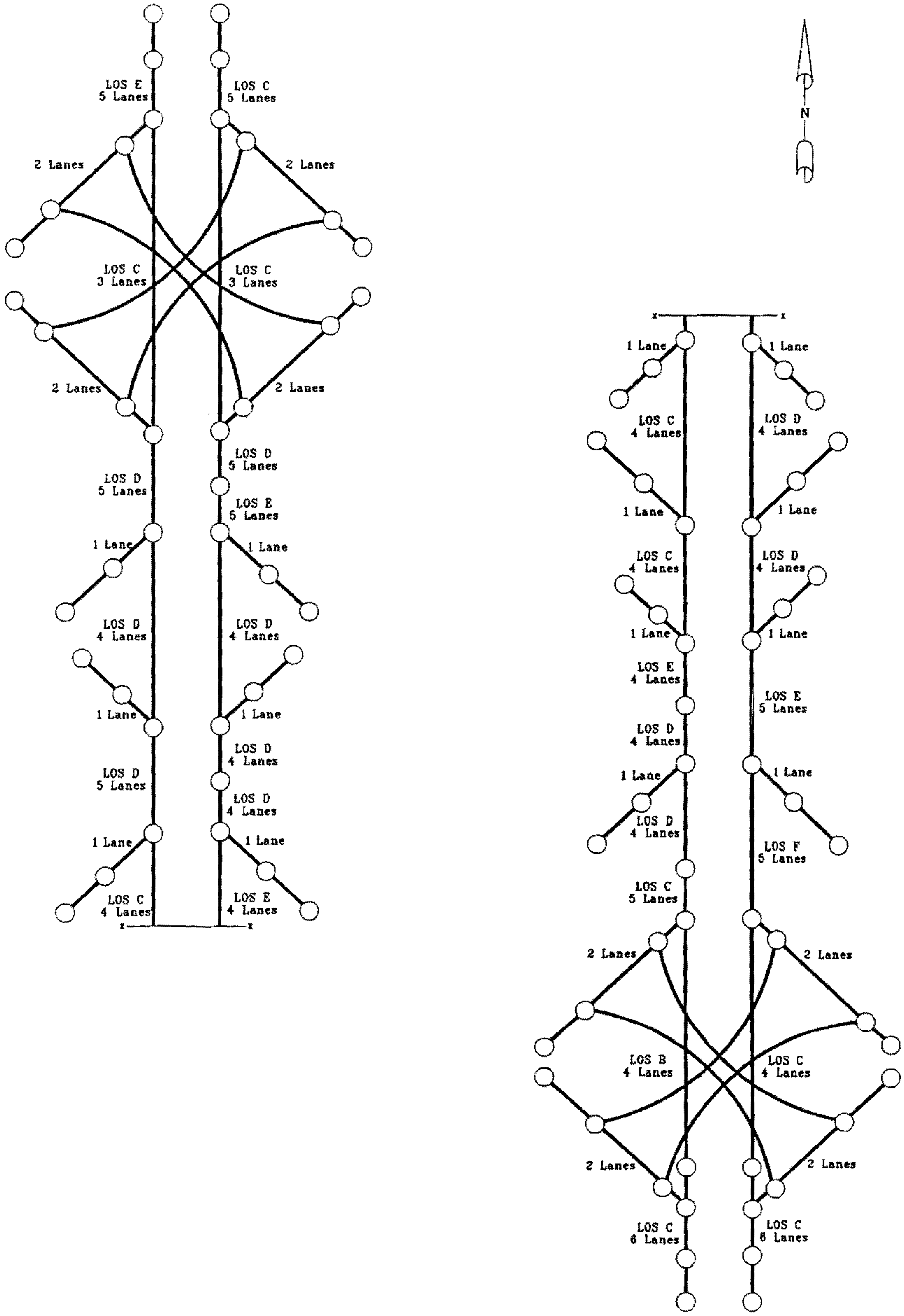

Figure 2. Existing Level of Service and Number of Lanes for Case Study Site

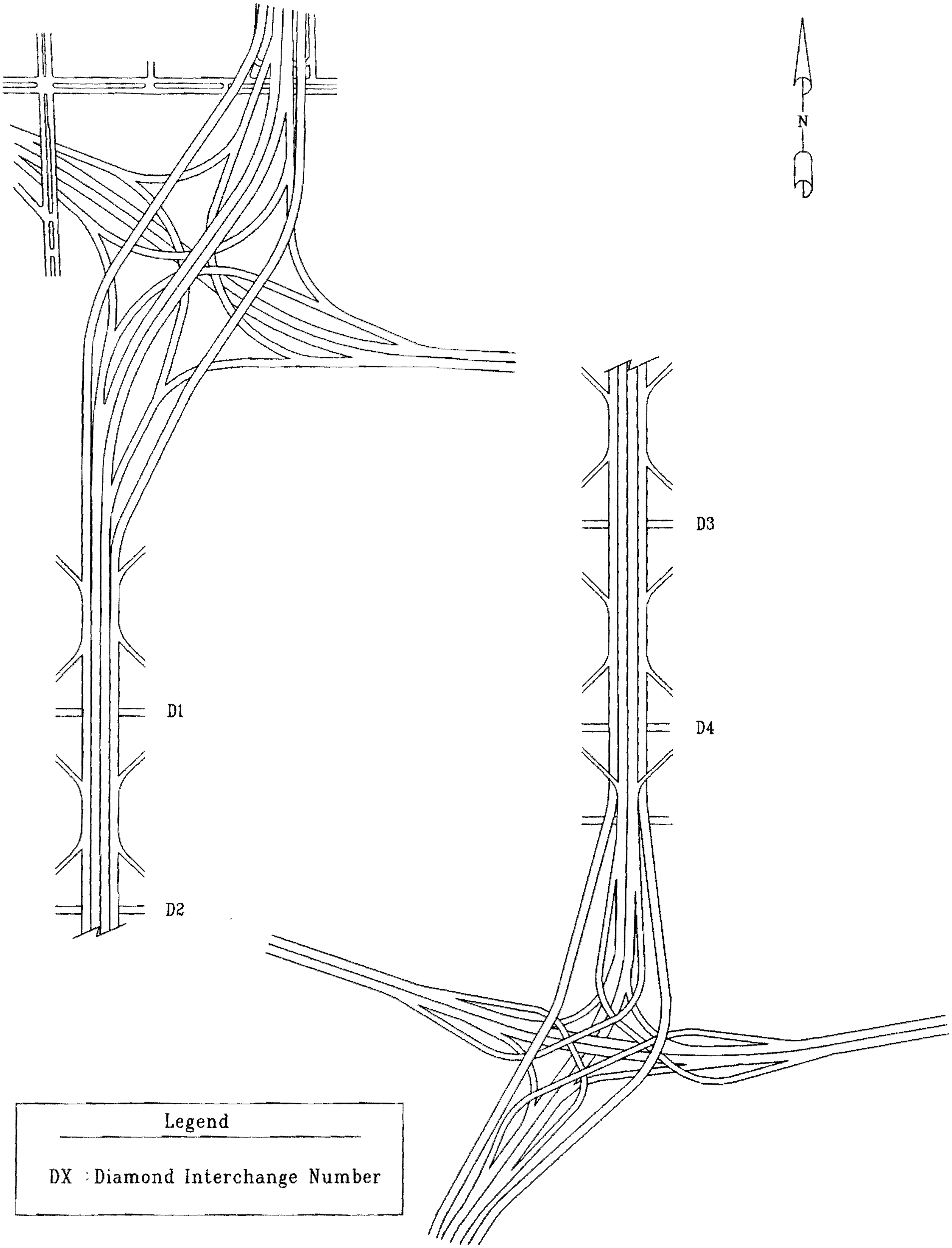

Figure 3. Schematic of Collector-Distributor System
for Case Study Site

At first glance, the application of a C-D system appears to produce operations that are acceptable, as seen in Figure 4 and Table 2. However, when one analyzes the off-freeway system, the cross-street interchanges, the results are not as appealing. PASSER3 was used to optimize the signal timings and signal phasings for the cross-street "diamond" interchanges.

Table 2. INTRAS Peak Hour Results for Collector-Distributor Configuration with Projected Volumes

V/C Ratio	Input Volume Veh/Hr.	Vehicle-Miles	Total Delay Veh.-Min.
0.79	47549	97560	17532

Various geometrics were evaluated until model limits were reached. Specifically, PASSER3 was not capable of analyzing interchange approaches larger than six lanes. The four diamond interchanges (labeled D1-D4) in the case study system were not able to service the projected vehicles that the two-lane exit ramps and high volume cross-streets produced, even with the lane configuration shown in Figure 5. The freeway mainlane and collector-distributor number of lanes, 20 lanes total in most areas, resulted in interchange intersection spacings of approximately 400 feet. The signal timings and phasing patterns were optimized for cycle lengths ranging from 50 to 120 sec. The operations at all four interchanges (D1-D4) ranged from LOS E to LOS F. In order for the diamond interchanges to process the proposed vehicles with an acceptable LOS, the required cross-street lane configuration would be in excess of ten lanes under the mainlane overpass structure. The size of an interchange with cross-street approaches consisting of six lanes, frontage road approaches consisting of five lanes, and ten lanes total internally is an excessive design geometrically and is indequate operationally.

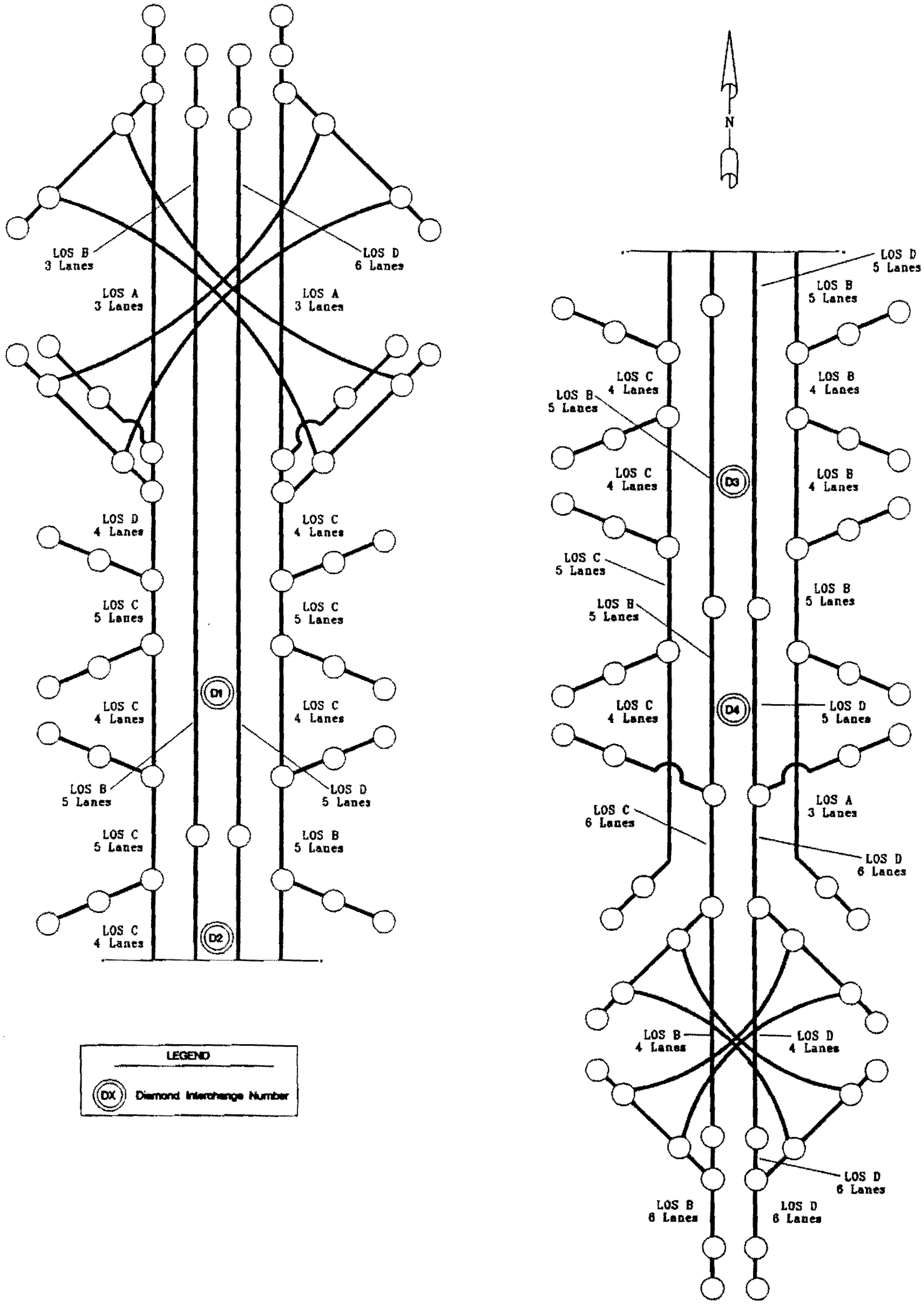

Figure 4. Level of Service and Number of Lanes for Collector-Distributor System at Case Study Site

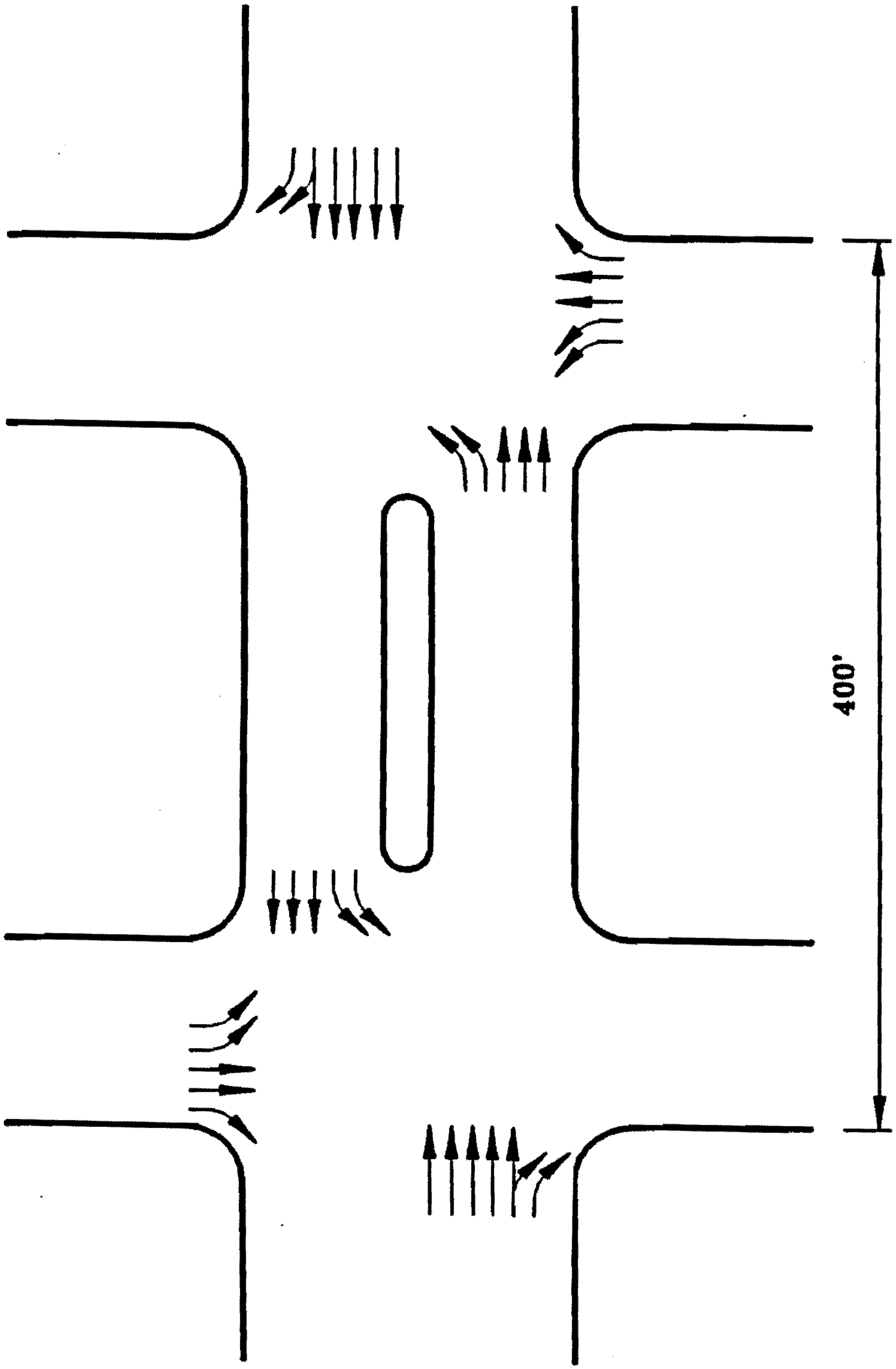

Figure 5. Schematic of Diamond Interchanges D1-D4.

CONCLUSIONS

Traffic volumes have increased dramatically on many of Texas' urban freeways and innovative approaches are constantly being considered to relieve the resulting congestion. One alternative that has sparked recent interest is the application of a collector-distributor system. Collector-distributor roadways provide a buffer region for weaving maneuvers between freeway mainlanes and the facilities with direct access (typically frontage roads).

Certain site specific characteristics must pre-exist for a collector-distributor system to be considered as a viable alternative. These include:

1) Sufficient right-of-way.
2) Significant separation between major cross-streets.
3) Significant through and weaving movements on the existing freeway mainlanes.
4) Adequate intersection geometries for improvements.

The physical design of a collector-distributor freeway system should include the following elements:

1) Ramp design should encompass one-lane entrances and two-lane exits;
2) Provision should be made for a desirable distance of 3000 feet between mainlane connector ramps and freeway-to-freeway interchanges;
3) Mainlane to collector-distributor ramps should be designed to full freeway standards; and
4) Weaving areas on the collector-distributor roadway should be 1,000 feet, minimum length.

Collector-distributor roadways can be effective as a "third-tier" facility with limited access interfacing between freeway mainlanes and frontage road development. However, both transverse and longitudinal space requirements are critical for acceptable implementation. These requirements are prohibitive to most freeway capacity improvements, including the application of collector-distributor designs.

The case study that was presented demonstrates the methodology that should be used when evaluating freeway alternatives (i.e. collector-distributor systems). This case study revealed the importance of the proper selection of the extent of the study region. Alleviating congestion and improving level-of-service in freeway weaving sections may be achieved with the use of collector-distributor roadways. However, traffic demand many times, will be shifted to loading and unloading points, such as cross street interchanges, creating more extensive problems.

REFERENCES

1. IH-610 (West Loop) Analyses, Technical Memorandum, State Department of Highways and Public Transportation, District 12 (Houston), June, 1987.

2. IH-10W (Katy Freeway) Collector-Distributor Alternative Study, Technical Memorandum, Texas Transportation Institute, 1988.

3. Interchange Computer Simulation, Harris County, Texas, Technical Memorandum, Texas Transportation Institute, 1991.

4. A Policy on Geometric Design of Streets and Highways, American Association of State Highway and Transportation Officials, 1990.

5. Evaluation of Express Lane Effectiveness in Freeway to Freeway Interchanges, Report No. 1232-14, Texas Department of Transportation, 1992.

After pressing ***Enter*** to proceed at the screens giving information about each selection chosen, you will encounter the following two screens before you actually start your revisions:

```
     Please notice that the changes you are going to make will be ignored
unless you save them later on by choosing the  "Save All Revisions"  option
in the main menu.

     Also, please keep in mind that the changes you are going to make will
modify the template file reserved for that project type once you save them.
Therefore, each time the scheduling procedure is run for a specific project
later on, the new values will be utilized.  The changes will be permanent
until the Revision Feature is activated again for future modifications.

                 PROCEED WITH INSTRUCTIONS ON HOW TO REVISE

                         GO BACK TO THE MAIN MENU
```

After choosing *PROCEED WITH INSTRUCTIONS ON HOW TO REVISE* at the above screen:

```
     In the upcoming table, move the cursor to the cell that you would
like to edit, type in the new entry, and then move the cursor to another
cell.  Follow this process without hitting "Enter" until you complete all
the changes you wish to make.  When finished with all changes, hit "Enter"
to go back to the main menu.

     Please edit only those cells which are related to the option you have
selected.  DO NOT attempt to change anything else on the spreadsheet file.

                              START REVISING

                 GO BACK TO THE MAIN MENU WITHOUT REVISING
```

If *SAVE ALL REVISIONS* is chosen from the main menu:

```
        REMINDER:  If you choose to save the revisions you have
made, the template file reserved for that project type will be
modified.  A new file containing the revisions will be substituted
for the old one.  In other words, changes will be permanent until
the revising feature is activated again for future modifications.


                GO BACK TO THE MAIN MENU WITHOUT SAVING

                             SAVE ANYHOW
```

If EXIT TO DOS is chosen from the main menu:

```
                              REMINDER:

               Have you saved the revisions you have made ?


                        GO BACK TO THE MAIN MENU

                             EXIT ANYHOW
```

APPENDIX F - Answers to Questions That Might Arise in the User's Mind

APPENDIX F - Answers to Questions That Might Arise in the User's Mind

Question: How come I have to hit Enter each time I input a quantity of work item to the system, and yet I am not supposed to hit Enter when making modifications on some default values until all my changes are done?

Answer: When inputting quantities, the cursor leads you to the cells that require an input on the spreadsheet, and makes sure no activity is skipped. Each time you enter a quantity, the system checks if it is syntatically-acceptable, and does not move on if not so. The possibility of making an error is minimized this way. In case of inputting information in the form of changes, however, the common spreadsheet principle of editing applies. That is the system will accept the entry if the cursor is simply moved away from that cell after typing that entry.

Question: What happens if a syntatically-unacceptable input is given the system, i.e. an alpha-numeric character when a pure number is required?

Answer: In the quantities/production rates/durations table, the system will detect the syntatically-wrong entries, and ask the user to correct them. In general, in case of undetected errors, the system would assume 0 (zero) duration for an activity that seems to have a nonsense duration. Also, it would assume a Finish-to-Start type of a relationship with no lag time if the user enters a syntatically wrong input while editing a relationship between two activities.

Question: In the quantities/production rates/durations table, if I change the duration of an activity with a production rate, does it automatically calculate the new production rate given the quantity remains constant?

Answer: No, it does not. The system is designed to calculate durations from production rates given a quantity, not vice versa. Therefore, for those activities that a production rate is displayed (those that are not lump-sum), it is recommended to change the production rate up or down to see the effect on the duration until the desired duration is obtained through trial-and-error. Only durations of the lump-sum activities should be changed directly if needed.

Question: In the quantities/production rates/durations table, if I change the production rate of an activity, does it also automatically change the rate displayed back under the *Proposed Rate* column in the table where also the low, average, and high rates are displayed?

Answer: No, it does not. Therefore in such a case, the proposed rate and the actual rate used would be different, and it would show different in the two tables mentioned. On the other hand, if you make a change in the proposed rate in the table where low, average and high values are also displayed, that will be automatically transferred to the quantities/production rates/durations table, but it does not work backwards.

Question: Why do some of the proposed production rates have a few decimal digits after the point?

Answer: When the five factors come into account in proposing production rates to the user, their multipliers may change the base production rates, which are almost all whole numbers, to numbers with some decimal points. They are not rounded off because some of the activities have production rates that are very small in numbers like *Major Traffic Signals* having a base rate of 0.4. For those activities, rounding off the proposed production rates would make a lot of difference, so in general proposed rates are not rounded off. The user, however, can go through rates that have unnecessary decimal digits, and round them off as desired.

Question: How come those activities that I have entered 0 (zero) as their quantities still appear in the schedule even though I have specified that they do not exist in my project?

Answer: Those activities for which a quantity of 0 (zero) have been input by the user still appear in the schedule obtained in SuperProject. They appear to seem like milestones in the bar chart. Although they may seem like they are redundant, in reality it is just the opposite. They play a cruical role in the network of activities in that project type. They are used in defining the sequencing of all the activities. If they were taken out of the project, some other activities would lose their status in the pre-established logical sequencing of work. The only exception to this is the first three activities of *Bridge Structures* which are *Erect Temp. Bridge*, *Bridge Demolition*, and *Cofferdams*. The user can delete these three activities in case they all have a duration of 0 (zero) by pressing the delete button in SuperProject which is ***F5***. Deletion of these activities only would not affect the sequencing of the rest of the project.

Question: Especially in bigger projects, a message saying *Optimizing Dependency Links* appears after an operation in SuperProject. What does this mean, and should I wait for the software to complete this process, or should I press ***Ctrl-Break*** to stop it as written as my other option on the screen?

Answer: As the project gets bigger and contains more and more activities, the bar chart gets more complicated for the software to produce. *Optimizing Depencency Links* message appears when SuperProject is trying to draw the bar chart in the most efficient way, e.g., by eliminating redundant relationship arrows. Therefore, it might be better to wait for the software to finish this process in order to obtain a bar chart that looks a little neater. Especially if this happens while merging different phases together into one project, it is recommended not to stop this process, for it will also stop the process of merging, and there may be some phases left out without having been included into the main project.

APPENDIX G - Index of Useful Commands to Remember for CTDS

APPENDIX G - Index of Useful Commands to Remember for CTDS

Commands To Be Used at a DOS Prompt:

Alt-Home : Hot key in Flash-Up to activate its menu. The Home key in the Numeric keypad that shares the same key with the number "7" should be used.

Alt-T : To start the Scheduling Procedure of CTDS. (Requires the library *SCHEDULE.WIN*)

Alt-Y : To start the Edit Feature of CTDS. (Requires the library *SCHEDULE.WIN*)

Alt-R : To start the Revision Feature of CTDS. (Requires the library *REVISION.WIN*)

Commands To Be Used in SuperProject:

Ctrl-F5 : To activate the menu designed specially for CTDS. This menu has the following options in it:

Save the current project
Go to Lotus 123 to edit project
Go to Lotus 123 to work on another phase of the project
Merge phases into one project
Quit the menu

Ctrl-F7 : To activate the process of inclusion of a pre-set calendar into the current project schedule.

F3 : To create an activity, or
To create a holiday (in the *Calendars* screen only).

F5 : To delete an activity, or
to delete a holiday (in the *Calendars* screen only).

F4 : To link two activities.

F2 : To unlink two activities.

Ctrl-R : To reduce the size (time scale) of the bar chart.

Ctrl-E : To enlarge the size (time scale) of the bar chart.

Ctrl-Right: To see what is to the right of the currently displayed part of the bar chart - that is the next portion in the time scale (the cursor has to be on the bar chart).

Ctrl-Left: To see what is to the left of the currently displayed part of the bar chart - that is the previous portion in the time scale (the cursor has to be on the bar chart).

Shift-Up : To position the activity that the cursor is on up in the list of activity names (the cursor has to be in the *Heading/Task* column).

Shift-Down : To position the activity that the cursor is on down in the list of activity names (the cursor has to be in the *Heading/Task* column).

Shift-Left : To promote an activity in the Work Breakdown Structure (the cursor has to be either in the *Heading/Task* column or on the bar chart).

Shift-Right : To demote an activity in the Work Breakdown Structure (the cursor has to be either in the *Heading/Task* column or on the bar chart).