Addison Bottleneck Study

1990

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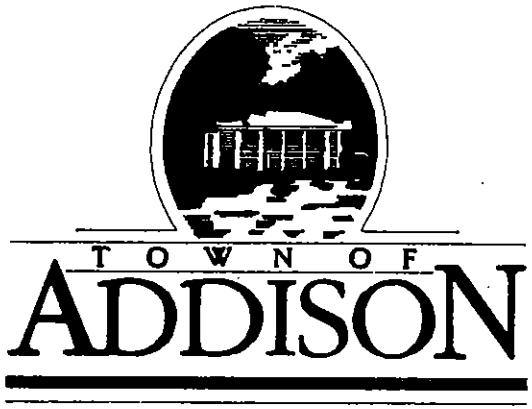
ADDISON BOTTLENECK STUDY

Submitted to



Barton-Aschman Associates, Inc.

ADDISON BOTTLENECK STUDY

FOR

TOWN OF ADDISON

BY

BARTON-ASCHMAN ASSOCIATES, INC.

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INTRODUCTION

Strategically located in northern Dallas County, the Town of Addison has experienced tremendous growth over the past several years. Unlike many of its neighboring cities, however, Addison's growth has been predominantly non-residential. Despite the best efforts of the Town's planner to look forward in time to forecast what transportation facilities would be needed to support the higher trip generation intensity of this non-residential growth, the Town of Addison experiences unacceptable conditions on its roadway system during the peak traffic hours.

The movements of people and goods into, out of, through and around the Town of Addison is largely dependent upon the automobile. Recognizing the need for an efficient and safe roadway system, the Town of Addison retained Barton-Aschman Associates, Inc. to develop recommendations for maximizing the operational efficiency and safety of the town's thoroughfare system.

This report presents the procedures, findings and conclusions of the Addison Bottleneck Study. The report is divided into two sections. Section 1 of this report presents the methodology, analysis, recommendations and conclusions of the study to alleviate traffic congestion and increase safety on Addison thoroughfares. Section 2 presents thoroughfare design guidelines and proposed thoroughfare plans to ensure that future growth in Addison can be accommodated.

SECTION 1

SECTION 1

INTERSECTION IMPROVEMENTS

1.1
PURPOSE AND PROCEDURES

The purpose of this phase of the Addison Bottleneck Study was to develop implementable roadway improvements to alleviate traffic congestion and increase safety on Addison thoroughfares, and to provide a prioritized schedule for implementing the recommended improvements. This report presents the procedures, findings, recommendations, and conclusions of this study to improve traffic conditions in the Town of Addison.

Study Procedures

The analysis of existing conditions and the development of cost effective improvements to alleviate traffic congestion requires that a logical study process be followed. Such a process, as developed, will ensure that problems, and solutions to the problems, are adequately evaluated and documented.

Such a logical process was developed and used in conducting the Addison Bottleneck Study. The study methodology is outlined in the following work tasks.

1. A meeting was held with the Town of Addison staff to formulate goals and objectives for the study, and determine the criteria and guidelines to be used in the selection of study locations.

2. A list of candidate intersection locations on Addison's major thoroughfares was developed and reviewed by Town staff.

3. Available data was assembled on all candidate locations and reviewed.

4. Additional needed data was collected by the Town of Addison staff.

5. A.M. and P.M. peak hour visual observations were conducted at each candidate location.

6. All candidate locations were prioritized based on selected criteria in the order of need for improvement.

7. The highest 60% of the candidate locations were selected for detailed analysis.

8. Recommendations were developed for each intersection to decrease delay and improve safety.

9. The recommended roadway improvements were prioritized to provide a systematic method for implementing improvements.

1.2
SELECTION OF STUDY LOCATIONS

The Addison Bottleneck Study was undertaken as a means of identifying and correcting the most congested roadway intersections in Addison. In order to accomplish this goal in a cost effective manner, a three step approach was developed. The first step was to identify the intersections most needing improvement. This was to be accomplished with a minimal amount of new data collection. Step two was to identify the improvements necessary at the intersections to decrease congestion and increase safety on Addison thoroughfares. Third, the improvements were prioritized to provide a system of implementing the improvements which maximizes the benefits for the citizens of Addison as early in the implementation process as possible. This chapter discusses the methodology used in the selection of the intersections to be included in the detailed analysis.

Candidate Locations

Initially, a list of approximately 33 locations was developed for consideration for detailed analysis. This listing included signalized and unsignalized intersections along major arterials within the Town. This list was reviewed by Town staff and revised to approximately twenty-seven (27) locations based on staff's knowledge of operating conditions at the candidate locations. The candidate locations are shown in Figure 1.1. The detailed study locations would be selected from this candidate list based on the criteria and ranking procedures discussed below.

Criteria

In an effort to minimize any additional data collection, the criteria were selected based upon data which either already exists or was readily available. The criteria set consists of volume/capacity ratios, accident rates, observed peak hour conditions, staff and citizen input, and observations of physical conditions at each candidate location. A brief discussion of each criterion follows.

Volume/capacity ratios. The daily volume of traffic entering an intersection was compared to the daily capacity of that intersection (based on hourly capacities and peak hour percentages) to produce a V/C ratio ranging from 0.00 to 1.00+.

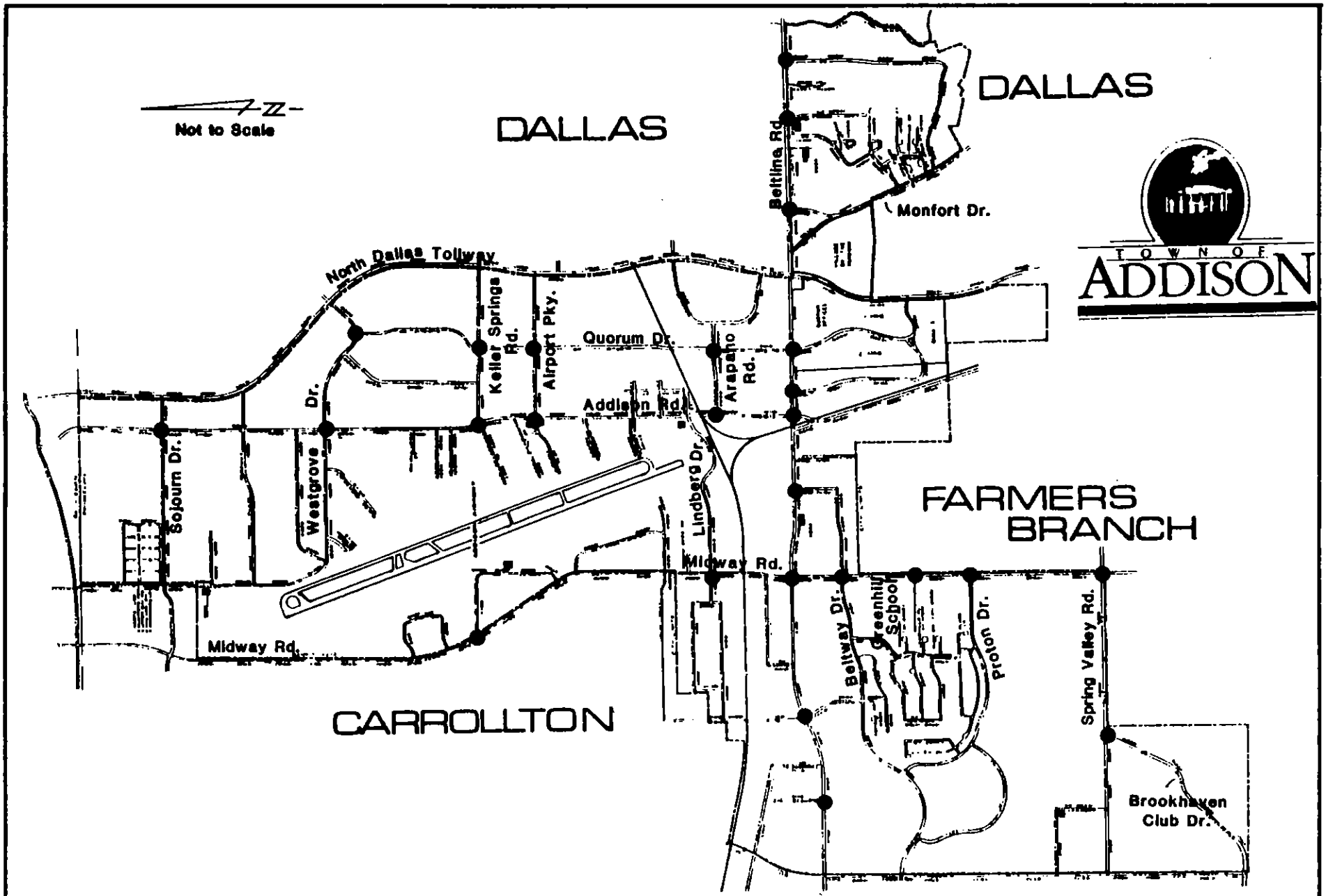


FIGURE 1.1
CANDIDATE STUDY LOCATIONS

Accident rates. The average number of accidents per year reported at an intersection over a period of 3 years was related to the average number of vehicles entering the intersection in a year to produce an accident rate in units of accidents per million entering vehicles (Acc/Mev).

Observed peak hour conditions. A.M. and P.M. peak hour operating conditions were evaluated qualitatively based upon field reconnaissance and perceived level of operation at a location. Factors such as left-or right-turn activity, length of queues, delays, and intersection control were considered in this evaluation.

Staff/citizen input. This criteria was evaluated qualitatively based upon input from Town staff concerning the number and nature of complaints from the citizenry regarding certain locations and other input received by the Town regarding perceived conditions. The Town staff provided these ratings according to the procedure outlined below.

Physical Conditions. These were evaluated qualitatively based upon field reconnaissance and perceived problems at a location with regard to such things as offsets, alignments, sight distance, curb returns, lane widths, driveway conflicts, and visibility of control devices.

Priority Ranking System

The priority ranking system was based upon point values assigned within the criteria weighted by the relative importance and accuracy of each criterion. The scoring distribution and weighted average for the criteria were as follows.

- Volume/capacity ratio - (35%)
  - 0.00 - 0.40 = 0 pt.
  - 0.41 - 0.60 = 1 pt.
  - 0.61 - 0.80 = 2 pt.
  - 0.81 - 1.00 = 3 pt.
  - > 1.00 = 4 pt.

- Observed peak hour conditions (25%)
  - freedom of movement, no apparent problems = 0 pt.
  - movement slowing, but still relatively free = 1 pt.
  - headways become shorter, occasional but short queues = 2 pt.
  - short headways, consistent queues, but still clearing = 3 pt.
  - minimal headways, long queue lengths, queues not clearing = 4 pt.

- Accident rate - (20%)

  0.0 - 0.2 = 0 pt.
  0.3 - 0.5 = 1 pt.
  0.6 - 1.0 = 2 pt.
  1.1 - 1.5 = 3 pt.
  > 1.5 = 4 pt.

- Physical conditions = (10%)
  - good, no problem = 0 pt.
  - fair, minor problems = 1 pt.
  - marginal, minimum standards observed = 2 pt.
  - poor, substandard conditions = 3 pt.
  - severe, hazardous conditions = 4 pt.

- Staff/citizen input - (10%)
  - no input = 0 pt.
  - occasional complaint = 1 pt.
  - frequent complaints = 2 pt.
  - steady, intense complaints = 3 pt.

Study Locations

Table 1.1 shows the results of the ranking procedures outlined above. The highest sixty percent (60%) of the intersections on the list were deemed appropriate for further analysis. These intersections are illustrated in Figure 1.2.

Table 1.1
RESULTS OF CRITERIA RANKING

	CRITERIA												
	VOLUME/CAPACITY			ACCIDENT RATE			PEAK OBSERVATION		STAFF/CITIZEN INPUT		PHYSICAL CONDITIONS		TOTAL
LOCATION	V/C	SCORE	WEIGHTED	RATE	SCORE	WEIGHTED	SCORE	WEIGHTED	SCORE	WEIGHTED	SCORE	WEIGHTED	
Belt Line/Addison	0.85	3	1.05	0.8	2	0.40	4	1.00	0	0.00	2	0.20	2.65
Belt Line/Midway	0.83	3	1.05	0.8	2	0.40	4	1.00	0	0.00	0	0.00	2.45
Belt Line/Quorum	0.87	3	1.05	0.5	1	0.20	4	1.00	0	0.00	2	0.20	2.45
Midway/Spring Valley	0.71	2	0.70	0.3	1	0.20	4	1.00	0	0.00	2	0.20	2.10
Midway/Greenhill School	0.86	3	1.05	0.1	0	0.00	3	0.75	0	0.00	2	0.20	2.00
Midway/Beltway	0.71	2	0.70	0.7	2	0.40	3	0.75	0	0.00	1	0.10	1.95
Addison/Lindberg	0.70	2	0.70	0.8	2	0.40	2	0.50	0	0.00	1	0.10	1.70
Midway/Proton	0.64	2	0.70	0.3	1	0.20	3	0.75	0	0.00	0	0.00	1.65
Belt Line/Montfort	0.72	2	0.70	0.0	0	0.00	3	0.75	0	0.00	1	0.10	1.55
Midway/Lindberg	0.64	2	0.70	1.0	2	0.40	1	0.25	0	0.00	1	0.10	1.45
Spring Valley/Brookhaven	0.51	1	0.35	1.1	3	0.60	1	0.25	0	0.00	2	0.20	1.40
Addison/Westgrove	0.44	1	0.35	0.7	2	0.40	2	0.50	0	0.00	1	0.10	1.35
Quorum/Arapheo	0.24	0	0.00	1.1	3	0.60	3	0.75	0	0.00	0	0.00	1.35
Addison/Keller Springs	0.41	1	0.35	0.7	2	0.40	1	0.25	0	0.00	3	0.30	1.30
Belt Line/Beltway	0.94	3	1.05	0.3	1	0.20	0	0.00	0	0.00	0	0.00	1.25
Addison/Arapaho	0.55	1	0.35	0.5	1	0.20	2	0.50	0	0.00	1	0.10	1.15
Belt Line/Landmark	0.79	2	0.70	0.2	0	0.00	1	0.25	0	0.00	0	0.00	0.95

Table 1.1
RESULTS OF CRITERIA RANKING

	CRITERIA												
	VOLUME/CAPACITY			ACCIDENT RATE			PEAK OBSERVATION		STAFF/CITIZEN INPUT		PHYSICAL CONDITIONS		TOTAL
LOCATION	V/C	SCORE	WEIGHTED	RATE	SCORE	WEIGHTED	SCORE	WEIGHTED	SCORE	WEIGHTED	SCORE	WEIGHTED	
Belt Line/Lake Forest	0.69	2	0.70	0	0	0.00	1	0.25	0	0.00	0	0.00	0.95
Belt Line/Commercial	0.77	2	0.70	0.3	1	0.20	0	0.00	0	0.00	0	0.00	0.90
Quorum/Keller Springs	0.22	0	0.00	1.4	3	0.60	0	0.00	0	0.00	3	0.30	0.90
Belt Line/Surveyor	0.58	1	0.35	0.3	1	0.20	1	0.25	0	0.00	0	0.00	0.80
Belt Line/Winnwood	0.77	2	0.70	0.0	0	0.00	0	0.00	0	0.00	0	0.00	0.70
Midway/Keller Springs	0.51	1	0.35	0.1	0	0.00	1	0.25	0	0.00	1	0.10	0.70
Addison/Airport	0.50	1	0.35	0.3	1	0.20	0	0.00	0	0.00	1	0.10	0.65
Quorum/Westgrove	0.30	0	0.00	0.1	0	0.00	2	0.50	0	0.00	1	0.10	0.60
Addison/Sojourn	0.25	0	0.00	0.6	2	0.40	0	0.00	0	0.00	0	0.00	0.40
Quorum/Airport	0.14	0	0.00	0.6	2	0.40	0	0.00	0	0.00	0	0.00	0.40

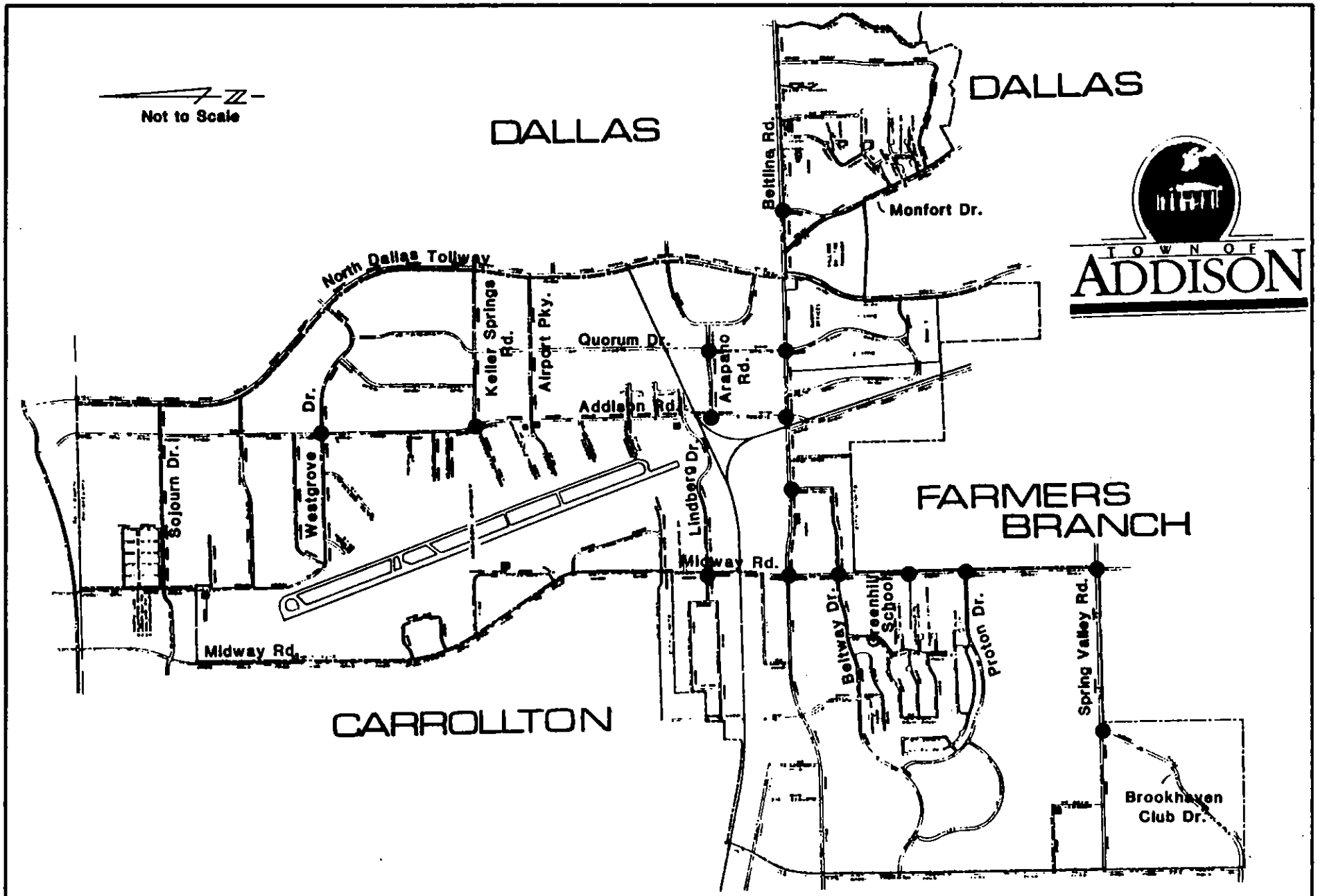


FIGURE 1.2
DETAILED STUDY LOCATIONS

1.3
AREA CHARACTERISTICS

The operating conditions that are experienced on a thoroughfare system are dependent primarily on the amount of traffic present on the system at a given moment (volume), and the characteristics of that traffic. These traffic characteristics are dependent upon many factors, including the types and composition of land-uses served by the roadway system, and the adequacy of the roadway system serving the drivers' needs. The factors can cause traffic characteristics to vary from system to system, and roadway to roadway, and cause similar roadways (i.e., number of lanes, capacity, etc.) to operate differently. This section of the report will discuss the land uses presently existing in Addison and the effects on the current operating conditions on Addison's thoroughfare system.

Land Uses

The Town of Addison's growth has been predominantly commercial, (including many restaurants and office buildings). Surrounded by cities with predominantly residential land uses, the Town of Addison's major thoroughfares are often used by the residents of these surrounding cities.

The Town of Addison experiences sharp increases in traffic volumes during the morning and afternoon peak hours as residents of Addison and surrounding cities travel to and from work in Addison and other areas of the metroplex. For example, Midway Road, a major north/south arterial in Addison experiences approximately 12 percent of its total daily volume during both the A.M. and P.M. peak hours. Belt Line Road, a major east/west arterial experiences an increase in traffic volumes not only during the morning and afternoon peak hours, but also during the noon peak hour as people travel to and from lunch. The thoroughfare system is further impacted by a substantial difference in the direction of travel (directional split) on a particular roadway. Again, using Midway Road as an example, 66 percent of the total traffic during the P.M. peak hour travels north on this roadway. Unlike Midway Road or Addison Road, Belt Line Road does not exhibit a large directional split. This heavy peaking of traffic during the peak hours and the large directional split on some thoroughfares places a heavy impact on Addison's thoroughfare system during the peak hours.

The town also provides employment to several thousand people. Several types of land uses are present which contribute to this employment including light industrial, warehousing/distribution facilities, retail, and office. Of these land uses, the light industrial and warehousing/distribution facilities have a large impact on the efficiency of the Addison thoroughfare system. These facilities, located predominantly along Addison Road; Midway Road; and on Belt Line Road in Carrollton, Texas, generate a large amount of truck traffic. These large trucks exhibit completely different operating characteristics than the normal passenger car. Much slower to accelerate and decelerate it has been estimated that a large truck can be considered the equivalent of up to six passenger cars when calculating the operating conditions at an intersection. The large percentage of truck traffic on some sections of Addison Road, Midway Road and Belt Line Road substantially reduces the operating capacity of these important arterials.

1.4
ANALYSIS AND RECOMMENDATIONS

Once the selection of the detailed study locations was made, additional data was collected for each of the selected intersections including AM and PM peak hour turning movement counts, roadway geometrics, and utility locations. This information was used as the data base for evaluating the current traffic conditions at these locations and developing recommendations for improvements to mitigate any identified deficiencies. The analysis procedures as well as the presentation of the findings and recommendations are discussed in the following paragraphs.

Analysis Procedures

Intersection capacity analyses were performed for the current peak hour traffic conditions to evaluate the current operational level of service for each study location. These analyses were performed utilizing procedures outlined in Chapter 9 of the 1985 Highway Capacity Manual (HCM) for signalized intersections. Level of service is a qualitative measure of identifying how effectively traffic is managed at an intersection and is defined by categories A through F. Table 1.2 provides descriptions for each level of service for signalized intersections. The results of these analyses were then reviewed to identify possible improvements that would relieve congestion, reduce delay and improve the operation and safety of these intersections. Such improvements include the following:

- increased curb return radii,
- increased exclusive-use lane storage,
- additional right- and left-turn lanes,
- signal timing improvements
- intersection signalization,
- improved pavement surface, and
- restriping

Employing various combinations of these improvement types, a set of recommended improvements was then developed for each study location and evaluated again using the 1985 HCM procedures to determine how the traffic conditions might be expected to improve.

General Findings and Recommendations

The findings of this study identified improvements to decrease congestion and increase safety on Addison's thoroughfare system. The traffic engineering

TABLE 1.2
DEFINITION OF LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS

Level of Service	Description
A and B	No delays in intersections with smooth progression of traffic. Uncongested operations; all vehicles clear in a single signal cycle.
C	Moderate delays at intersections with satisfactory to good progression of traffic. Light congestion; occasional back-ups on critical approaches.
D	40 percent probability of delays of one cycle or more at every intersection. Significant congestion on critical approaches, but intersection functional. Vehicles required to wait through more than one cycle during short peaks.
E	Heavy traffic flow condition. Delays of two or more cycles probable. Limit of stable flow. Blockage of intersection may occur if traffic signal does not provide for protected turning movements.
F	Unstable traffic flow. Heavy congestion. Traffic moves in forced flow condition. Three or more cycles to pass through intersection. Stop-and-go operation.

principles used to develop improvements at specific locations, can in some cases, be used to develop general improvements and guidelines to provide the town with the planning tools needed to maintain acceptable service and safety levels of Addison roadways. The traffic engineering principles, as discussed below and in Section 2, include access control and signal timing.

Access Control

Several improvements identified in this study include the closure of access driveways located too close to intersections. The driveways hinder the flow of traffic along the arterial roadways and decrease safety conditions of the intersections.

Driveway access along arterial roadways is a critical issue which must be addressed during the development planning process in order to enhance traffic flow. Each driveway intersection with a street introduces vehicular conflict points into the street's traffic stream, thus decreasing the safety along the roadway. Each driveway also generates "side friction" along a roadway. It has been estimated that for each two percent (2%) increase in driveway frequency, a reduction of one percent (1%) of the roadway capacity results. For these reasons, roadway capacity and safety can be maximized by carefully determining where and how many driveways should be provided following the guidelines provided in Section 2 of this report.

Signal Timing

Traffic signals provide the means for accommodating the conflicting demands of traffic flow at intersections by assigning the right-of-way through the intersection to a particular movement or non-conflicting movements. Traffic signals do, however, reduce a roadway's capacity, and can also present the opportunity for increased accidents. In many cases, traffic accidents will greatly increase following their installation, and the overall vehicle delay is also frequently increased. Nevertheless, no more efficient system has been devised to handle traffic at at-grade intersections.

Efficient timing of traffic signals is essential to minimize the adverse impact that a traffic signal can have on the capacity and safety of a thoroughfare. Modern traffic controllers have the ability to assign the right-of-way to the heaviest movements at an individual intersection, while shortening or eliminating green time for movements with lesser or no traffic volumes. These advances in controller capabilities have provided the opportunity to traffic signal engineers to greatly increase the operational efficiency of individual signalized intersections.

However, when a roadway contains a series of traffic signals, capacity may be further reduced and overall vehicular delay increased substantially if an efficient progressive timing plan is not implemented. A

progressive timing plan allows for the continued movement of through traffic along a thoroughfare without stopping at each of the traffic signals. Without the progressive movement of the through traffic along a thoroughfare, not only is capacity reduced and vehicular delay increased, but pollution and noise along the roadway is also increased. Therefore, as traffic volumes on thoroughfares increase, traffic engineers must ensure that signalized intersections not only work efficiently as isolated intersections, but also that each system of signals provide for the progressive movement of through vehicles.

The Town of Addison has recently undertaken the process of upgrading signal equipment and implementing new timing plans at selected intersections as part of the Dallas County Signalization Project and the SDHPT Traffic Light Synchronization Program. These signal hardware upgrades have provided the Town the opportunity to implement progressive timing plans along some of its major thoroughfares. Significant reductions in vehicular delay can be realized along these thoroughfares as a result of new timing plans.

Within the Dallas County Signalization Project and the SDHPT Traffic Light Synchronization Program was the identification of control areas (grouping of intersections) along the thoroughfares which would be coordinated during the different timing periods which were identified by the study. These control areas are shown in Figure 1.3. These recommended control areas provide the framework necessary to allow the Town to implement progressive timing plans throughout Addison and reduce motorist delay on the town's thoroughfares.

Signal Clearance Intervals

The signal clearance interval is that period of time in a traffic signal cycle that is used to change the right-of-way assignment at an intersection. A clearance interval is characterized by a yellow warning indication on the approach where the green indication is about to be terminated. In many instances, the yellow warning indication is followed by a short red indication on all approaches and movements at the intersection. The Town of Addison currently uses a yellow and all-red interval to make up its signal clearance interval.

An improperly timed clearance interval can be a major cause of accidents at an intersection. Clearance intervals that are too short do not provide adequate time for vehicles to clear the intersection before conflicting vehicle movements are released. If a clearance interval is too long, the number of vehicles entering the intersection during the yellow indication also increases. A correctly timed clearance interval provides an adequate amount of time for an average driver of a vehicle to react to the impending change of the signal and have sufficient distance to safely stop the vehicle.

The lengths of the yellow and all-red indications are calculated separately based on a number of factors.

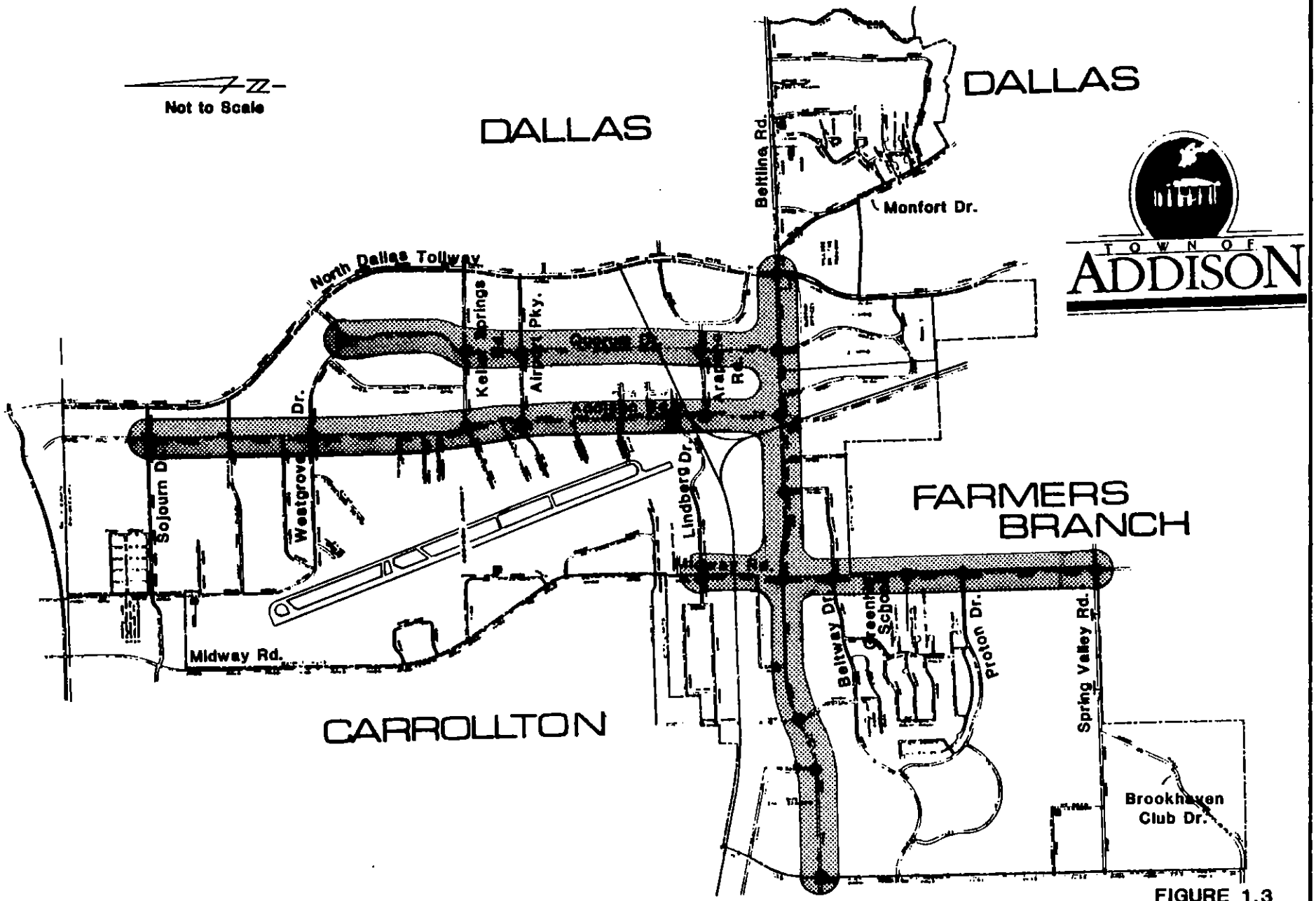


FIGURE 1.3
EXISTING AND RECOMMENDED
TRAFFIC SIGNAL CONTROL AREAS

As recommended in the Institute of Transportation Engineers' (ITE) publication entitled, "Determining Vehicle Change Intervals", the length of the yellow interval is primarily a function of the speed of the approaching vehicle. Other factors that have to be considered include signal head visibility, vehicle mix, grade, and railroad crossings. The formula for determining the yellow interval is:

$$y = \frac{v}{t + 2a + 2Gg}$$

where,

y = length of the yellow interval
t = driver perception/reaction time = 1.0 sec.
v = velocity of approaching vehicle (ft./sec.)
a = deceleration rate = 10 ft./sec.^{2}
G = acceleration due to gravity = 32 ft./sec.^{2}
g = grade of approach (assume as level) = 0%

This equation was used to calculate yellow intervals for various approach speeds. The results are given in Table 1.3.

The all-red duration is a function of the speed of the vehicle through the intersection and the width of the intersection. The all-red time is determined using the formula:

$$r = \frac{W + L}{v}$$

where,

r = duration of all-red interval

W = width of intersection (in feet), measured from the near side stop line to the far edge of the conflicting traffic lane along the actual vehicle path

L = length of vehicle = 20 ft.

v = speed of vehicle through intersection (ft./sec.)

The formula would provide adequate all-red time for a vehicle that enters the intersection at the end of the yellow interval to travel past the conflict area of vehicles about to receive the green indication. To calculate recommended all red times the roadway widths given in Section 2 of this report should be assumed and follow:

Residential Collector (C2U)	= 40'
Commercial Collector (4LU)	= 48'
Minor Arterial (4LD)	= 64'
Major Arterial (6LD)	= 86'

where,

Table 1.3
RECOMMENDED YELLOW INTERVAL DURATIONS

Approach Speed (mph)	Yellow Duration (sec.)
30	3.2
35	3.6
40	3.9
45	4.3
Left turns	2.5

C2U = 2-lane residential collector
4LU = 4-lane commercial roadway
4LD = 4-lane divided roadway
6LD = 6-lane divided roadway

These widths were used to calculate the all-red clearance intervals for the same approach speeds used for the yellow intervals. The results are given in Table 1.4.

The signal clearance interval is a combination of the yellow and all-red directions that fit the intersection type and approach speed of a particular intersection. The times given in the two proceeding tables are guidelines used in determining the total clearance intervals shown in Table 1.5. Other factors, as mentioned earlier, should always be considered when determining the final clearance interval for each approach.

Detailed Findings, Recommendations and Estimated Cost of Improvements

A variety of improvements are recommended to improve traffic operations and safety at the detailed study locations for the Bottleneck Study. These have been arranged into the following four groups:

- Belt Line Road
- Midway Road
- Addison Road, and
- Isolated Locations

For each of these groups, the following information is presented for each intersection in the following format:

- Sheet 1
  - -- Existing conditions by intersection approach
- Sheet 2
  - -- Existing and projected deficiencies
  - -- Recommended improvements
  - -- Expected benefits or disbenefits
  - -- Measures of effectiveness
  - -- Preliminary Construction Cost Estimate
- Sheet 3
  - -- Scaled drawing showing proposed physical improvement configurations.

Table 1.4
RECOMMENDED ALL-RED INTERVAL DURATIONS (sec.)

Speed	C2U	4LU	4LD	6LD
30	1.4	1.5	1.9	2.4
35	1.2	1.3	1.6	2.1
40	1.0	1.2	1.4	1.8
45	0.9	1.0	1.3	1.6
Left turns	0.5	0.7	1.0	1.0

Table 1.5
RECOMMENDED TOTAL CLEARANCE INTERVAL DURATIONS (sec.)

Speed	C2U	4LU	4LD	6LD
30	4.6	4.7	5.1	5.6
35	4.8	4.9	5.2	5.7
40	4.9	5.1	5.3	5.7
45	5.2	5.3	5.6	5.9
Left turns	3.0	3.2	3.5	3.5

BELT LINE ROAD

EXISTING CONDITIONS

Location - Montfort/Belt Line

Street	Montfort	Montfort	Belt Line	Belt Line
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	None	None	West Leg (220')	None
Approach ADT	5,894	6,331	21,198	20,190
Approach Lanes				
Left Turn	1	0	2	2
Through	2	2	4	3
Right Turn	0	0	0	0

Peak Hour Approach Volumes	AM	MID	PM	AM	MID	PM	AM	MID	PM	AM	MID	PM
Left Turn	157	274	163	6	108	110	276	333	269	30	311	195
Through	24	210	230	72	202	142	1759	1069	909	634	1201	1904
Right Turn	87	271	411	12	142	129	22	76	54	25	122	57

Operating Conditions

	Intersection		
	AM	MID	PM
V/C	.68	.90	.92
Average Delay	14.8	42.0	81.0
LOS	B	E	F

Accident History 1987-90*

Accident Rate/MV	.02
Accidents/Year	3

Right Angle	0	Head On	0
Rear End	0	Pedestrian	0
Left Turn	1	Ran Off Road	0
Right Turn	0	Fixed Object	0
Sideswipe	0	Other	0
Total	**1**		

*Includes only accidents reported to the Town of Addison Police

LOCATION: Montfort at Belt Line

EXISTING AND PROJECTED DEFICIENCIES:

1. High left-turn volumes on east approach.
2. No pavement markings on north approach.
3. Heavy volumes producing a large queue on south approach in evening peak.
4. Driveway access to close to intersection on the southeast quadrant.

RECOMMENDED IMPROVEMENTS:

1. Flare north approach to provide a 33' approach with a left lane, through lane, and right lane. Modify existing transition of 75' to 150' on south approach.
2. Stripe north approach.
3. Close access driveway closest to intersection on southeast quadrant.
4. Cut back median nose on Belt Line west approach.
5. Widen south approach to provide dual left turn lanes, a through lane, and a right turn lane.

EXPECTED BENEFITS OR DISBENEFITS:

1. Improve movement/facilitation of south and north approach.
2. Reduce intersection delay during AM and PM peak hours.
3. Improve overall traffic flow, and operation.

MEASURE OF EFFECTIVENESS:

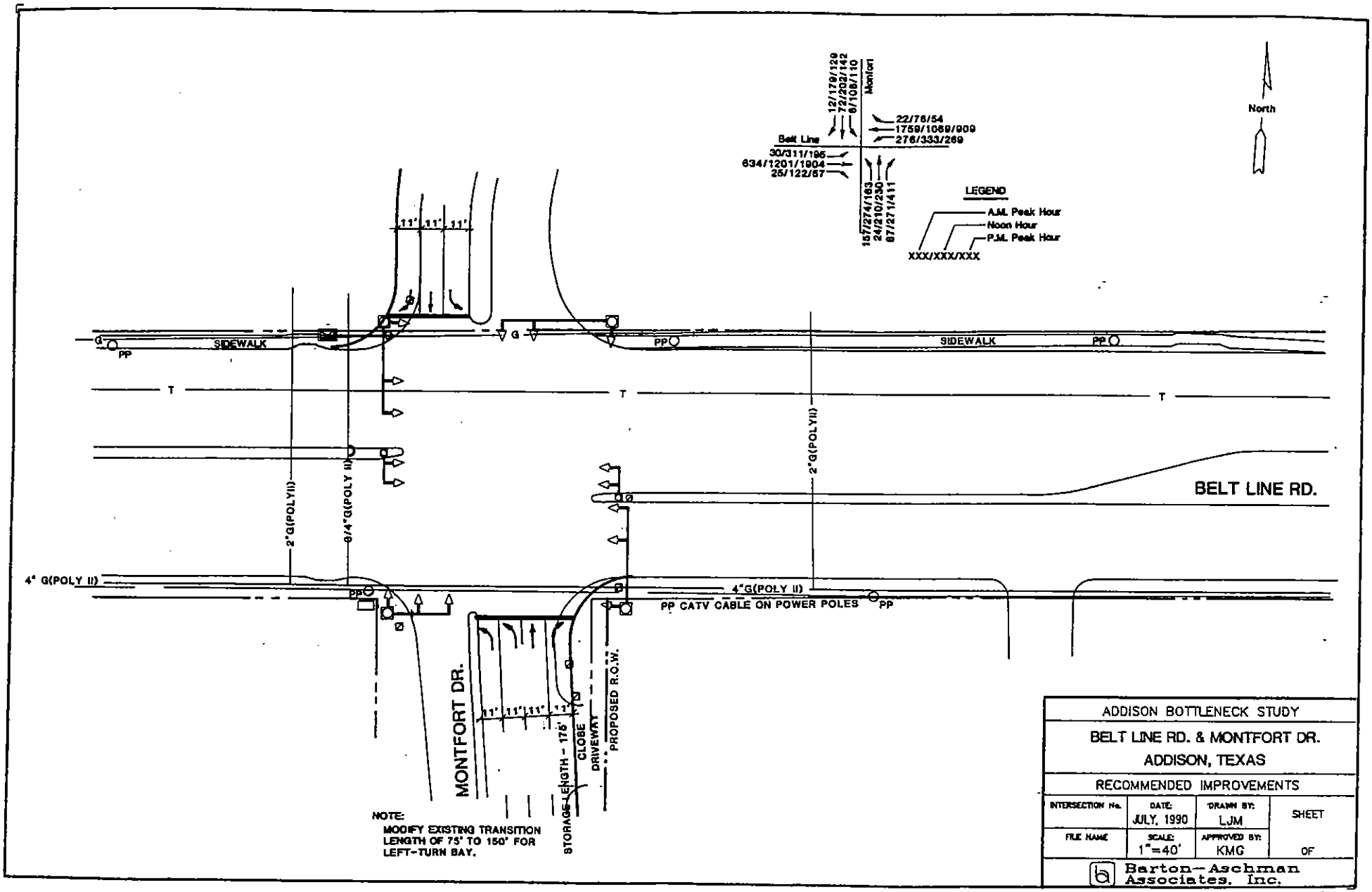
	Level of Service AM MID PM	Average (sec/veh) AM MID PM	Delay Acc. Rate (Acc/MEV)
Existing	B E F	14.8 42.0 81	.02
With Recommended Improvements	B C C	12.9 19.7 24.4	.02

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: BELTLINE AND MONTFORT
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	435	S.Y.	New Pavement (concrete)	24.00	10440.00
	435	S.Y.	Rem. Exist. Pavement	8.00	3480.00
	447	L.F.	New Curb & Gutter	8.00	3576.00
	447	L.F.	Rem. Exist. Curb & Gutter	5.00	2235.00
	10	%	Intersection Signalization	70000.00	7000.00
	0	EA.	Rel. Controller/Fndn.	1664.00	0.00
	0	EA.	Rel. Mastarm Pole/Fndn.	3803.00	0.00
	0	EA.	Rel. Pedstl. Pole/Fndn.	992.00	0.00
	7	EA.	Rel. Pullbox	177.00	1239.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	0	EA.	Rel. Util. Pole @ Inters'n.	6000.00	0.00
	0	EA.	Rel. Util. Pole	2000.00	0.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	0	EA.	Rel. Fire Hydrant	755.00	0.00
	0	EA.	Rel. Water Meter	328.00	0.00
	0	EA.	Adjust Manhole	413.00	0.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	3200	S.F.	Add'l R-O-W (comm./retail)	12.00	38400.00
			Sub-Total		66370.00
		L.S.	Engineering/Contingency Fees	0.15	9955.50
			TOTAL ESTIMATE		76500.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.


Montfort
12/179/129
72/202/142
6/108/110
22/76/54
1759/1069/909
276/333/269
Belt Line
30/311/195
634/1201/1904
25/122/67
157/274/163
24/210/230
87/271/411
LEGEND
A.M. Peak Hour
Noon Hour
P.M. Peak Hour
XXX/XXX/XXX
North
11'
11'
11'
SIDEWALK
PP
T
2"G(POLY II)
3/4"G(POLY II)
BELT LINE RD.
4" G(POLY II)
PP CATV CABLE ON POWER POLES
MONTFORT DR.
STORAGE LENGTH - 175'
CLOSE DRIVEWAY
PROPOSED R.O.W.
NOTE:
MODIFY EXISTING TRANSITION LENGTH OF 75' TO 150' FOR LEFT-TURN BAY.
ADDISON BOTTLENECK STUDY
BELT LINE RD. & MONTFORT DR.
ADDISON, TEXAS
RECOMMENDED IMPROVEMENTS
INTERSECTION No.
DATE: JULY, 1990
DRAWN BY: LJM
SHEET
FILE NAME
SCALE: 1"=40'
APPROVED BY: KMG
OF
Barton-Aschman Associates, Inc.

EXISTING CONDITIONS

Location - Belt Line/Quorum

Street	Quorum	Quorum	Belt Line	Belt Line
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	South leg (62')	North leg (49')	West leg (125') East leg (205')	None
Approach ADT	4,728	3,606	20,598	21,218
Approach Lanes				
Left Turn	0	1	1	1
Through	2	2	3	3
Right Turn	0	0	0	0

Peak Hour Approach Volumes	AM	MID	PM	AM	MID	PM	AM	MID	PM	AM	MID	PM
Left Turn	144	307	307	41	75	93	122	115	87	204	175	152
Through	144	171	312	283	137	148	1571	1314	1423	1017	1491	1912
Right Turn	45	175	101	216	166	216	85	70	75	235	171	266

Operating Conditions

	Intersection		
	AM	MID	PM
V/C	.97	.96	6.39
Average Delay	34.0	35.6	153.9
LOS	D	D	F

Accident History 1987-90

Accident Rate/MV	.46	Right Angle	7	Head On	0
Accidents/Year	8.0	Rear End	11	Pedestrian	0
		Left Turn	4	Ran Off Road	0
		Right Turn	0	Fixed Object	1
		Sideswipe	1	Other	0
		Total	**24**		

LOCATION: Belt Line at Quorum

EXISTING AND PROJECTED DEFICIENCIES:

1. Heavy left turn volumes for west and south approaches.
2. Heavy right turn volumes for north and west approaches.
3. High frequency of rear-end accidents.
4. Unmarked pavement on south approach.
5. Median on west approach extends too far out and impedes traffic operations.
6. Extreme delay incurred by northbound motorist during PM peak.

RECOMMENDED IMPROVEMENTS:

1. Expand the south approach on Quorum to provide dual left turning lanes (75' storage), two through lanes, and a right turning lane (125' storage).
2. Expand the north approach on Quorum to provide a left turning lane (100' storage), two through lanes, and a right turning lane (75' storage).
3. Expand Belt Line on all approaches to provide dual left turn lanes (eastbound - 100' storage and westbound - 200' storage) and three through lanes.
4. Cut back median nose on west approach and north approach.
5. Provide tracking for eastbound and westbound left turn movements.

EXPECTED BENEFITS OR DISBENEFITS:

1. Decrease intersection delay.
2. Increase intersection capacity.
3. Improve operation and traffic flow.

MEASURE OF EFFECTIVENESS:

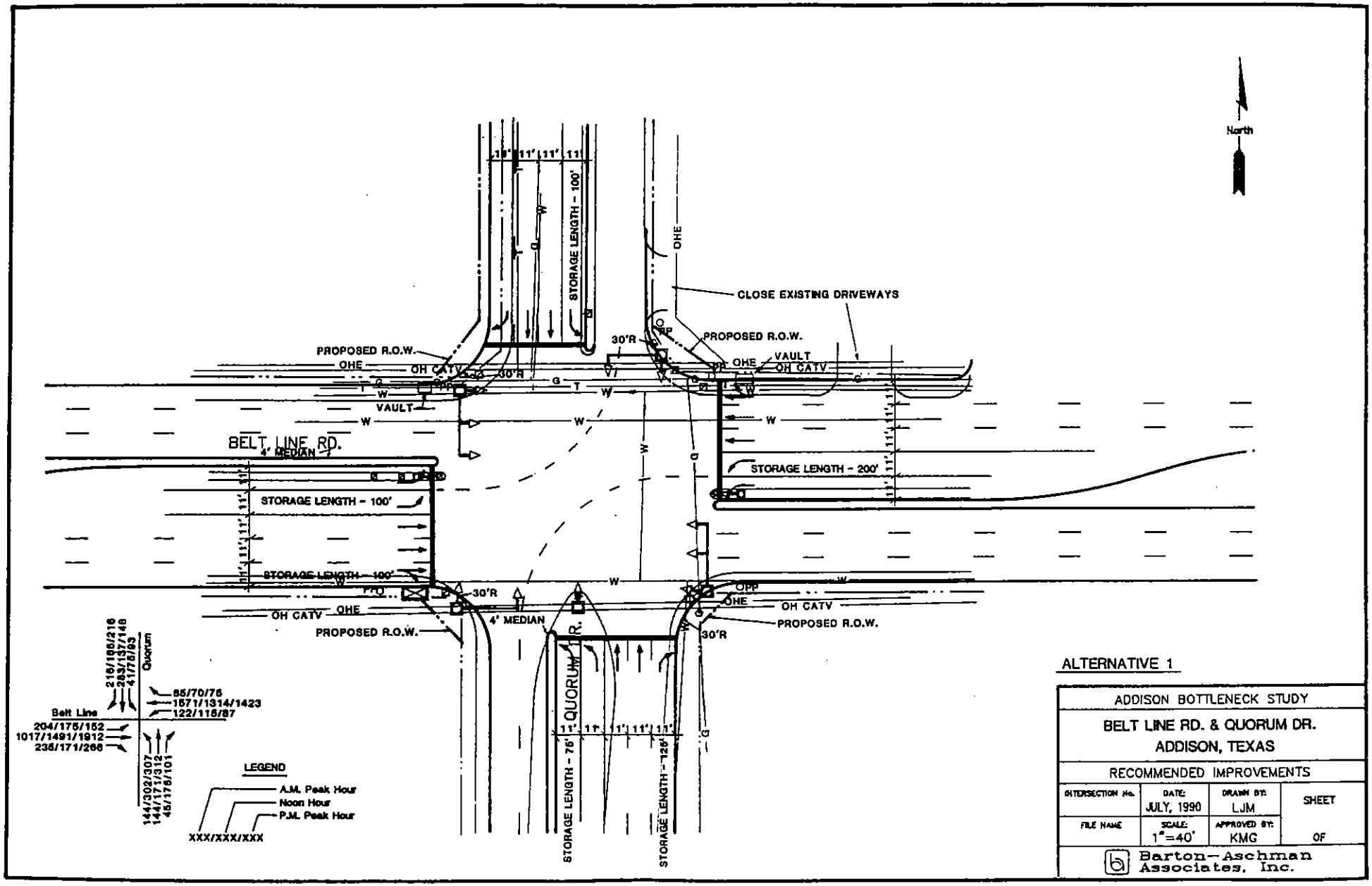
	Level of Service AM MID PM	Average Delay (sec/veh) AM MID PM	Acc. Rate (Acc/MEV)
Existing	D D F	34.0 35.6 153.9	.46
With Recommended Improvements	B B D	14.4 14.8 25.6	.46

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: BELTLINE AND QUORUM ALT. 1
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	3043	S.Y.	New Pavement (concrete)	24.00	73032.00
	1051	S.Y.	Rem. Exist. Pavement	8.00	8408.00
	3195	L.F.	New Curb & Gutter	8.00	25560.00
	3195	L.F.	Rem. Exist. Curb & Gutter	5.00	15975.00
	15	%	Intersection Signalization	70000.00	10500.00
	1	EA.	Rel. Controller/Fndn.	1664.00	1664.00
	3	EA.	Rel. Mastarm Pole/Fndn.	3803.00	11409.00
	3	EA.	Rel. Pedstl. Pole/Fndn.	992.00	2976.00
	6	EA.	Rel. Pullbox	177.00	1062.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	3	EA.	Rel. Util. Pole @ Inters'n.	6000.00	18000.00
	0	EA.	Rel. Util. Pole	2000.00	0.00
	2	EA.	Rel. Util. Vault	10000.00	20000.00
	0	EA.	Rel. Fire Hydrant	755.00	0.00
	0	EA.	Rel. Water Meter	328.00	0.00
	0	EA.	Adjust Manhole	413.00	0.00
	50	S.F.	Add'l R-O-W(northeast quadrant))	18.00	900.00
	4225	S.F.	Add'l R-O-W (comm./retail)	12.00	50700.00
			Sub-Total		240186.00
		L.S.	Engineering/Contingency Fees	0.15	36027.90
			TOTAL ESTIMATE		276500.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.



ALTERNATIVE 1

ADDISON BOTTLENECK STUDY			
BELT LINE RD. & QUORUM DR. ADDISON, TEXAS			
RECOMMENDED IMPROVEMENTS			
INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF
Barton-Aschman Associates, Inc.			

EXISTING CONDITIONS

Location - Belt Line/Quorum

Street	Quorum	Quorum	Belt Line	Belt Line
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	South leg (62')	North leg (49')	West leg (125') East leg (205')	None
Approach ADT	4,728	3,606	20,598	21,218

Approach Lanes

Left Turn	0	1	1	1
Through	2	2	3	3
Right Turn	0	0	0	0

Peak Hour Approach Volumes	AM	MID	PM	AM	MID	PM	AM	MID	PM	AM	MID	PM
Left Turn	144	307	307	41	75	93	122	115	87	204	175	152
Through	144	171	312	283	137	148	1571	1314	1423	1017	1491	1912
Right Turn	45	175	101	216	166	216	85	70	75	235	171	266

Operating Conditions

	Intersection		
	AM	MID	PM
V/C	.97	.96	6.39
Average Delay	34.0	35.6	153.9
LOS	D	D	F

Accident History 1987-90

Accident Rate/MV	.46	Right Angle	7	Head On	0
Accidents/Year	8.0	Rear End	11	Pedestrian	0
		Left Turn	4	Ran Off Road	0
		Right Turn	0	Fixed Object	1
		Sideswipe	1	Other	0
		Total	**24**		

LOCATION: Belt Line at Quorum

EXISTING AND PROJECTED DEFICIENCIES:

1. Heavy left turn volumes for west and south approaches.
2. Heavy right turn volumes for north and west approaches.
3. High frequency of rear-end accidents.
4. Unmarked pavement on south approach.
5. Median on west approach extends too far out and impedes traffic operations.
6. Extreme delay incurred by northbound motorist during PM peak.

RECOMMENDED IMPROVEMENTS:

1. Expand the south approach on Quorum to provide dual left turning lanes (75' storage), two through lanes, and a right turning lane (125' storage).
2. Expand the north approach on Quorum to provide a left turning lane (100' storage), two through lanes, and a right turning lane (75' storage).
3. Expand Belt Line on all approaches to provide dual left turn lanes (eastbound - 100' storage and westbound - 200' storage) and three through lanes.
4. Cut back median nose on west approach and north approach.
5. Provide tracking for eastbound and westbound left turn movements.

EXPECTED BENEFITS OR DISBENEFITS:

1. Decrease intersection delay.
2. Increase intersection capacity.
3. Improve operation and traffic flow.

MEASURE OF EFFECTIVENESS:

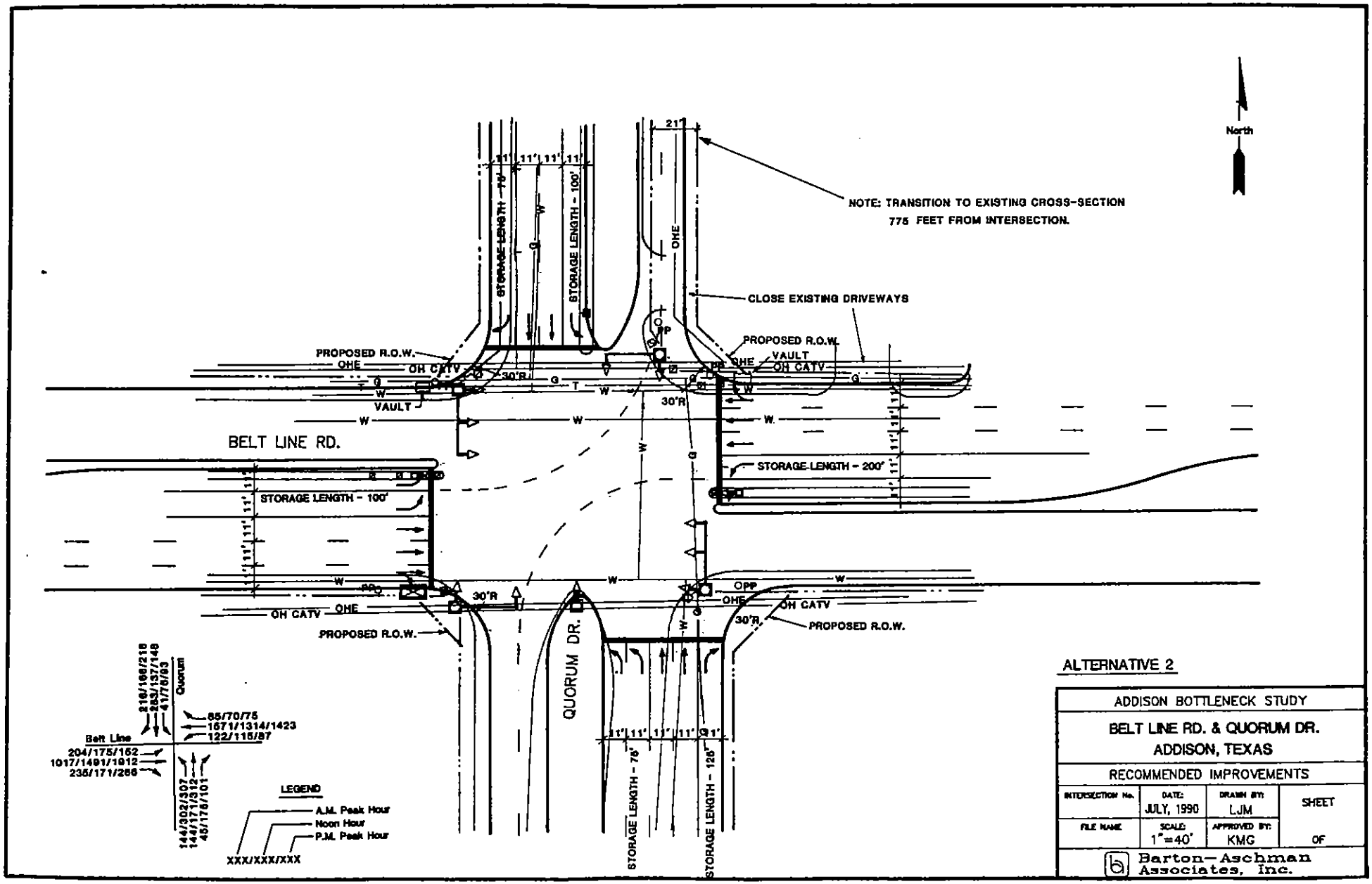
	Level of Service			Average Delay (sec/veh)			Acc. Rate
	AM	MID	PM	AM	MID	PM	(Acc/MEV)
Existing	D	D	F	34.0	35.6	153.9	.46
With Recommended Improvements	B	B	D	14.4	14.8	25.6	.46

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: BELTLINE AND QUORUM ALT. 2
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/06/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	5337	S.Y.	New Pavement (concrete)	24.00	128088.00
	1302	S.Y.	Rem. Exist. Pavement	8.00	10416.00
	4308	L.F.	New Curb & Gutter	8.00	34464.00
	4308	L.F.	Rem. Exist. Curb & Gutter	5.00	21540.00
	15	%	Intersection Signalization	70000.00	10500.00
	1	EA.	Rel. Controller/Fndn.	1664.00	1664.00
	3	EA.	Rel. Mastarm Pole/Fndn.	3803.00	11409.00
	1	EA.	Rel. Pedstl. Pole/Fndn.	992.00	992.00
	6	EA.	Rel. Pullbox	177.00	1062.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	3	EA.	Rel. Util. Pole @ Inters'n.	6000.00	18000.00
	6	EA.	Rel. Util. Pole	2000.00	12000.00
	2	EA.	Rel. Util. Vault	10000.00	20000.00
	0	EA.	Rel. Fire Hydrant	755.00	0.00
	8	EA.	Rel. Water Meter	328.00	2624.00
	1	EA.	Adjust Manhole	413.00	413.00
	2500	S.F.	Add'l R-O-W (northeast corner)	18.00	45000.00
	15005	S.F.	Add'l R-O-W (comm./retail)	12.00	180060.00
			Sub-Total		498232.00
		L.S.	Engineering/Contingency Fees	0.15	74734.80
			TOTAL ESTIMATE		573000.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.



ALTERNATIVE 2

ADDISON BOTTLENECK STUDY			
BELT LINE RD. & QUORUM DR. ADDISON, TEXAS			
RECOMMENDED IMPROVEMENTS			
INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF
Barton-Aschman Associates, Inc.			

EXISTING CONDITIONS

Location - Addison/Belt Line

Street	Addison	Addison	Belt Line	Belt Line
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	None	None	East leg (62')	None
Approach ADT	5,894	6,331	21,198	20,190
Approach Lanes				
Left Turn	1	1	2	2
Through	2	2	3	3
Right Turn	0	0	0	0

Peak Hour Approach Volumes	AM	MID	PM	AM	MID	PM	AM	MID	PM	AM	MID	PM
Left Turn	83	187	321	157	222	128	122	212	200	204	282	383
Through	188	297	710	666	296	407	1571	1473	1703	1017	1653	1942
Right Turn	74	213	243	291	306	282	85	122	75	235	16	6

Operating Conditions

	Intersection		
	AM	MID	PM
V/C	.92	1.0	1.10
Average Delay	40.2	48.4	93.2
LOS	E	E	F

Accident History 1987-90

Accident Rate/MV	.81	Right Angle	4	Head On	0
Accidents/Year	17.6	Rear End	12	Pedestrian	0
		Left Turn	24	Ran Off Road	0
		Right Turn	0	Fixed Object	6
		Sideswipe	4	Other	1
		Total	**52**	Unknown Object	1

LOCATION: Addison at Belt Line

EXISTING AND PROJECTED DEFICIENCIES:

1. High frequency of accidents.
2. High volume of right and left turning volumes on north and south approaches.
3. Curb return radii too small.

RECOMMENDED IMPROVEMENTS:

1. Widen north approach to provide a left turn lane (150'), through lanes, and a right turning lane (150').
2. Widen south approach to provide dual left turning lanes (150'), two through lanes, and a right turning lane (250').
3. Increase curb return radii to 35' on northwest, southwest, and southeast corners.

EXPECTED BENEFITS OR DISBENEFITS:

1. Increase safety.
2. Improve left turn capacity and operation.
3. Improve intersection capacity and flow.
4. Reduce delay.

MEASURE OF EFFECTIVENESS:

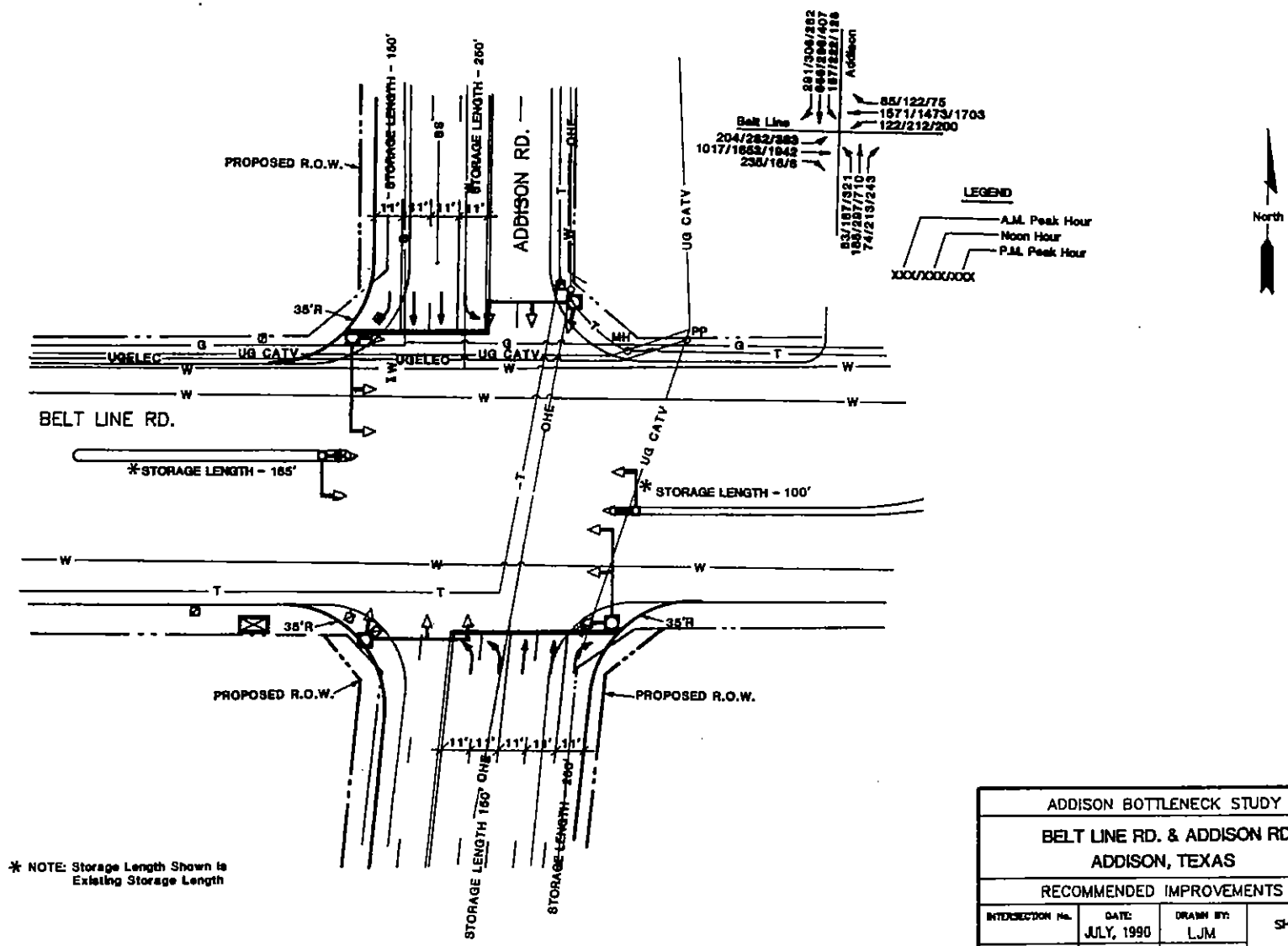
	Level of Service AM MID PM	Average Delay (sec/veh) AM MID PM	Acc. Rate (Acc/MEV)
Existing	E E F	40.2 48.4 93.2	.81
With Recommended Improvements	C D E	21.7 27.9 41.8	.69

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: BELTLINE AND ADDISON
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	1589	S.Y.	New Pavement (concrete)	24.00	38136.00
	0	S.Y.	Rem. Exist. Pavement	8.00	0.00
	1897	L.F.	New Curb & Gutter	8.00	15176.00
	1897	L.F.	Rem. Exist. Curb & Gutter	5.00	9485.00
	10	%	Intersection Signalization	70000.00	7000.00
	0	EA.	Rel. Controller/Fndn.	1664.00	0.00
	3	EA.	Rel. Mastarm Pole/Fndn.	3803.00	11409.00
	0	EA.	Rel. Pedstl. Pole/Fndn.	992.00	0.00
	3	EA.	Rel. Pullbox	177.00	531.00
	0	EA.	Rem. Pullbox	56.00	0.00
	1	EA.	Rel. Drainage Inlet	2300.00	2300.00
	0	EA.	Rel. Util. Pole @ Inters'n.	6000.00	0.00
	0	EA.	Rel. Util. Pole	2000.00	0.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	1	EA.	Rel. Fire Hydrant	755.00	755.00
	0	EA.	Rel. Water Meter	328.00	0.00
	0	EA.	Adjust Manhole	413.00	0.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	4950	S.F.	Add'l R-O-W (comm./retail)	12.00	59400.00
			Sub-Total		144192.00
		L.S.	Engineering/Contingency Fees	0.15	21628.80
			TOTAL ESTIMATE		166000.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.



* NOTE: Storage Length Shown is Existing Storage Length

ADDISON BOTTLENECK STUDY			
BELT LINE RD. & ADDISON RD. ADDISON, TEXAS			
RECOMMENDED IMPROVEMENTS			
INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF
Barton-Aschman Associates, Inc.			

EXISTING CONDITIONS

Location - Belt Line/Beltway

Street	Beltway	Belt Line	Belt Line
Intersection Approach	Northbound	Westbound	Eastbound
Bus Stop Location	None	Far	None
Approach ADT	5,894	21,198	20,190
Approach Lanes			
Left Turn	1	1	1
Through	2	3	3
Right Turn	0	0	0

Peak Hour Approach Volumes	AM	MID	PM	AM	MID	PM	AM	MID	PM
Left Turn	17	50	58	201	214	159	0	0	0
Through	0	0	0	1657	1755	2110	1835	1794	2063
Right Turn	120	271	364	0	0	0	27	57	49

Operating Conditions

	Intersection		
	AM	MID	PM
V/C	.72	.72	.84
Average Delay	16.9	17.5	20.9
LOS	C	C	C

Accident History 1987-90

Accident Rate/MV	.25	Right Angle	0	Head On	0
Accidents/Year	3	Rear End	6	Pedestrian	0
		Left Turn	5	Ran Off Road	0
		Right Turn	0	Fixed Object	0
		Sideswipe	1	Other	0
		Total	**12**		

LOCATION: Belt Line/Beltway

EXISTING AND PROJECTED DEFICIENCIES:

1. Large vehicular volume on Belt Line causes delay to Beltway.

2. High frequency of rear-end and left turn accidents.

RECOMMENDED IMPROVEMENTS:

1. No lane configuration changes.

2. Coordination of signal with other signals on Belt Line.

EXPECTED BENEFITS OR DISBENEFITS:

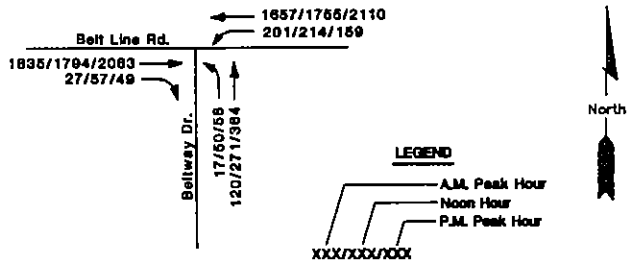
1. Coordination will allow Belt Line traffic to flow with decreased delay.

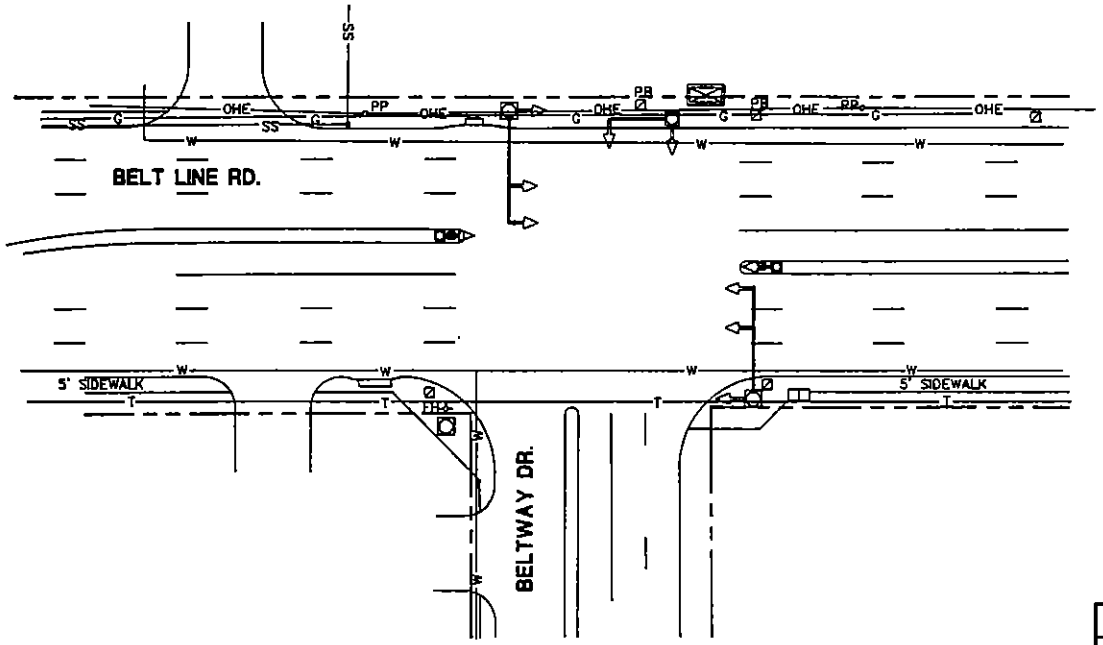
MEASURE OF EFFECTIVENESS:

	Level of Service			Average Delay (sec/veh)			Acc. Rate
	AM	MID	PM	AM	MID	PM	(Acc/MEV)
Existing	C	C	C	16.9	17.5	20.9	.25
With Recommended Improvements	No change			No change			.25

NOTE: No physical changes to the intersection, therefore no preliminary cost estimate is included.

NOTE:
No Recommended Lane
Configuration Improvements





ADDISON BOTTLENECK STUDY			
BELT LINE RD. AND BELTWAY DR. ADDISON, TEXAS			
SIGNAL HEAD & LOOP RECOMMENDATIONS			
INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME: AD10	SCALE: 1"=40'	APPROVED BY: KGM	OF
Barton-Aschman Associates, Inc.			

EXISTING CONDITIONS

Location - Belt Line/Midway

Street	Midway	Midway	Belt Line	Belt Line
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	None	South leg (262')	None	None
Approach ADT	18,113	16,457	19,834	18,448

Approach Lanes

Left Turn	1	1	1	1
Through	3	3	3	3
Right Turn	1	0	0	0

Peak Hour Approach Volumes	AM	MID	PM	AM	MID	PM	AM	MID	PM	AM	MID	PM
Left Turn	113	271	314	221	372	297	296	330	252	116	158	150
Through	629	745	1391	1514	805	936	1037	1102	1262	1242	1007	1330
Right Turn	200	418	392	67	202	117	240	242	236	296	178	143

Operating Conditions

	Intersection		
	AM	MID	PM
V/C	1	.98	1.08
Average Delay	81.6	59.4	116.9
LOS	F	E	F

Accident History 1987-90

Accident Rate/MV .76

Accidents/Year 20.3

Right Angle	13	Head On	0
Rear End	25	Pedestrian	0
Left Turn	15	Ran Off Road	0
Right Turn	0	Fixed Object	7
Sideswipe	1	Other	0
Total	**61**		

LOCATION: Belt Line at Midway

EXISTING AND PROJECTED DEFICIENCIES:

1. High left turn volumes on all approaches.
2. High right turn volumes on east, south, and west approaches.
3. High frequency of accidents from vehicles pushing clearance interval.

RECOMMENDED IMPROVEMENTS:

1. Widen Midway approaches to provide dual left turns, (north approach 150' storage and south approach 100' storage), three through lanes, and a right turn lane (north approach 175' storage and south approach 125' storage).
2. Widen Belt Line west approach to provide dual left turns (75' storage), three through lanes and right turn lane (150' storage).
3. Widen east approach to provide dual left, two through, and a shared right/through lane.
4. Close access driveways closest to intersection on northwest and southwest corners.

EXPECTED BENEFITS OR DISBENEFITS:

1. Better management of left and right turns.
2. Maximize intersection capacity for at-grade intersection.
3. Improve safety.
4. Improve overall operation and traffic flow.

MEASURE OF EFFECTIVENESS:

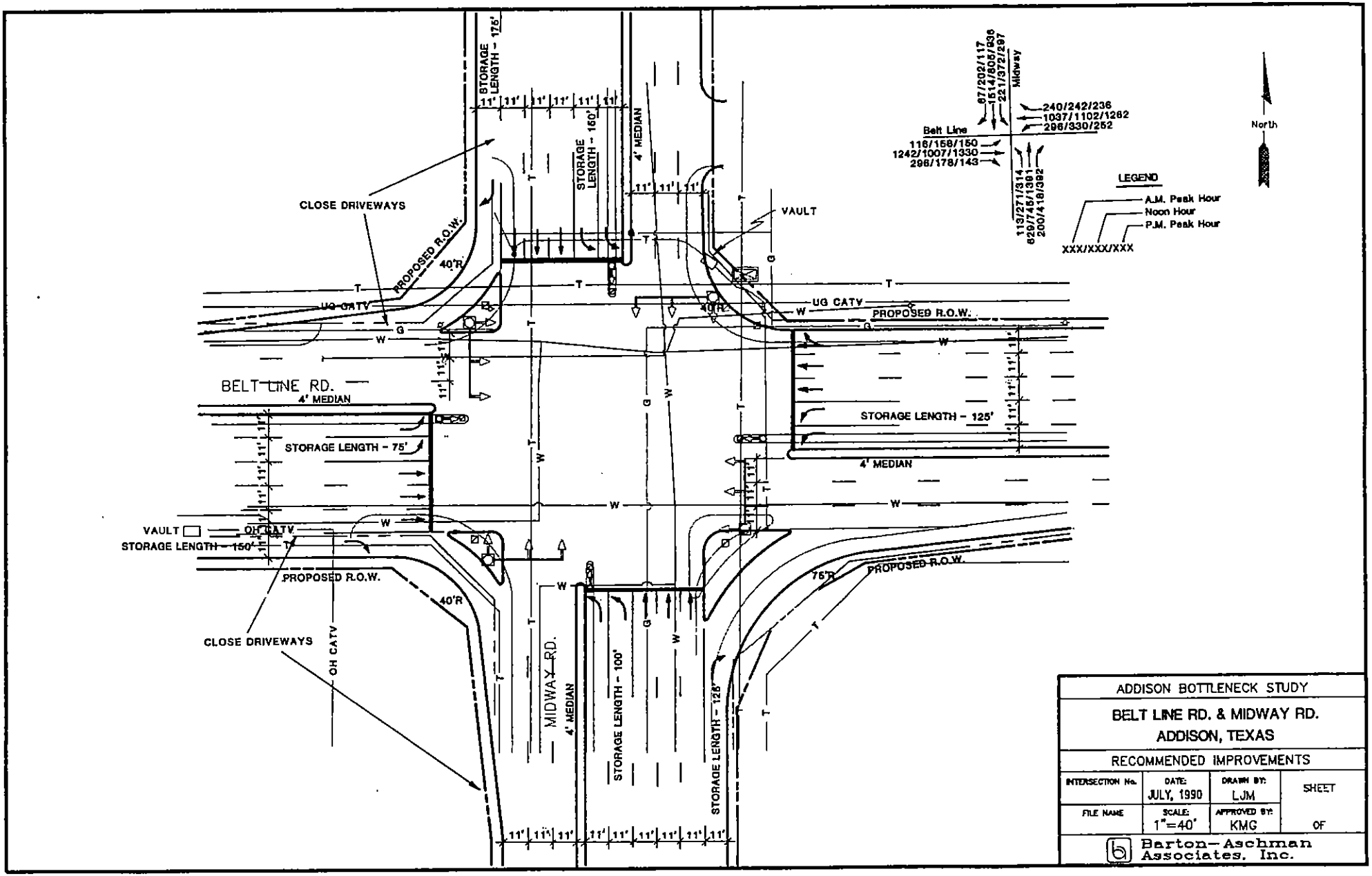
	Level of Service			Average Delay (sec/veh)			Acc. Rate
	AM	MID	PM	AM	MID	PM	(Acc/MEV)
Existing	F	E	F	81.6	59.4	116.9	.76
With Recommended Improvements	D	D	E	29.2	26.3	47.3	.50

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: BELTLINE AND MIDWAY
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	3255	S.Y.	New Pavement (concrete)	24.00	78120.00
	2752	S.Y.	Rem. Exist. Pavement	8.00	22016.00
	4363	L.F.	New Curb & Gutter	8.00	34904.00
	4027	L.F.	Rem. Exist. Curb & Gutter	5.00	20135.00
	50	%	Intersection Signalization	70000.00	35000.00
	0	EA.	Rel. Controller/Fndn.	1664.00	0.00
	2	EA.	Rel. Mastarm Pole/Fndn.	3803.00	7606.00
	4	EA.	Rel. Pedstl. Pole/Fndn.	992.00	3968.00
	6	EA.	Rel. Pullbox	177.00	1062.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	3	EA.	Rel. Util. Pole @ Inters'n.	6000.00	18000.00
	2	EA.	Rel. Util. Pole	2000.00	4000.00
	2	EA.	Rel. Util. Vault	10000.00	20000.00
	1	EA.	Rel. Fire Hydrant	755.00	755.00
	1	EA.	Rel. Water Meter	328.00	328.00
	1	EA.	Adjust Manhole	413.00	413.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	19346	S.F.	Add'l R-O-W (comm./retail)	12.00	232152.00
			Sub-Total		478459.00
		L.S.	Engineering/Contingency Fees	0.15	71768.85
			TOTAL ESTIMATE		550000.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.



ADDISON BOTTLENECK STUDY

BELT LINE RD. & MIDWAY RD.
ADDISON, TEXAS

RECOMMENDED IMPROVEMENTS

INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF

Barton-Aschman Associates, Inc.

MIDWAY ROAD

EXISTING CONDITIONS

Location - Midway/Lindberg

Street	Midway	Midway	Lindberg	Lindberg
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	South leg (50')	North leg (54')	None	None
Approach ADT	12,681	16,457	3,897	2,698
Approach Lanes				
Left Turn	1	1	0	0
Through	3	3	1	1
Right Turn	0	0	0	0

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM	AM	PM
Left Turn	86	73	348	398	87	117	13	81
Through	863	1805	1906	1131	107	41	22	87
Right Turn	90	103	61	26	342	213	17	55

Operating Conditions

	Intersection	
	AM	PM
V/C	.97	.99
Average Delay	35.9	84.4
LOS	D	F

Accident History 1987-90

Accident Rate/MV	1.0	Right Angle	3	Head On	0
Accidents/Year	13	Rear End	12	Pedestrian	0
		Left Turn	8	Ran Off Road	1
		Right Turn	3	Fixed Object	4
		Sideswipe	5	Other	3
		Total	**39**		

LOCATION: Midway at Lindberg

EXISTING AND PROJECTED DEFICIENCIES:

1. Heavy volumes for southbound left turns and eastbound right turns.
2. Curb return radii small for northeast corner and southeast corner.
3. High frequency of accidents.
4. Pavement markings on west approach are not appropriate.

RECOMMENDED IMPROVEMENTS:

1. Expand north approach left turning lanes to 250' storage length; may require closing median upstream.
2. Install pavement markings on east approach to provide a left turn lane, a through lane, and a right turn lane.
3. Install pavement markings on west approach to provide a left turning lane and a through lane.
4. Increase northeast and southeast corner to a 60' curb return radii.

EXPECTED BENEFITS OR DISBENEFITS:

1. Improve overall operation and traffic flow at the intersection.
2. Reduce intersection delay.
3. Increase intersection capacity.
4. Improve safety.
5. Improved truck operation.

MEASURE OF EFFECTIVENESS:

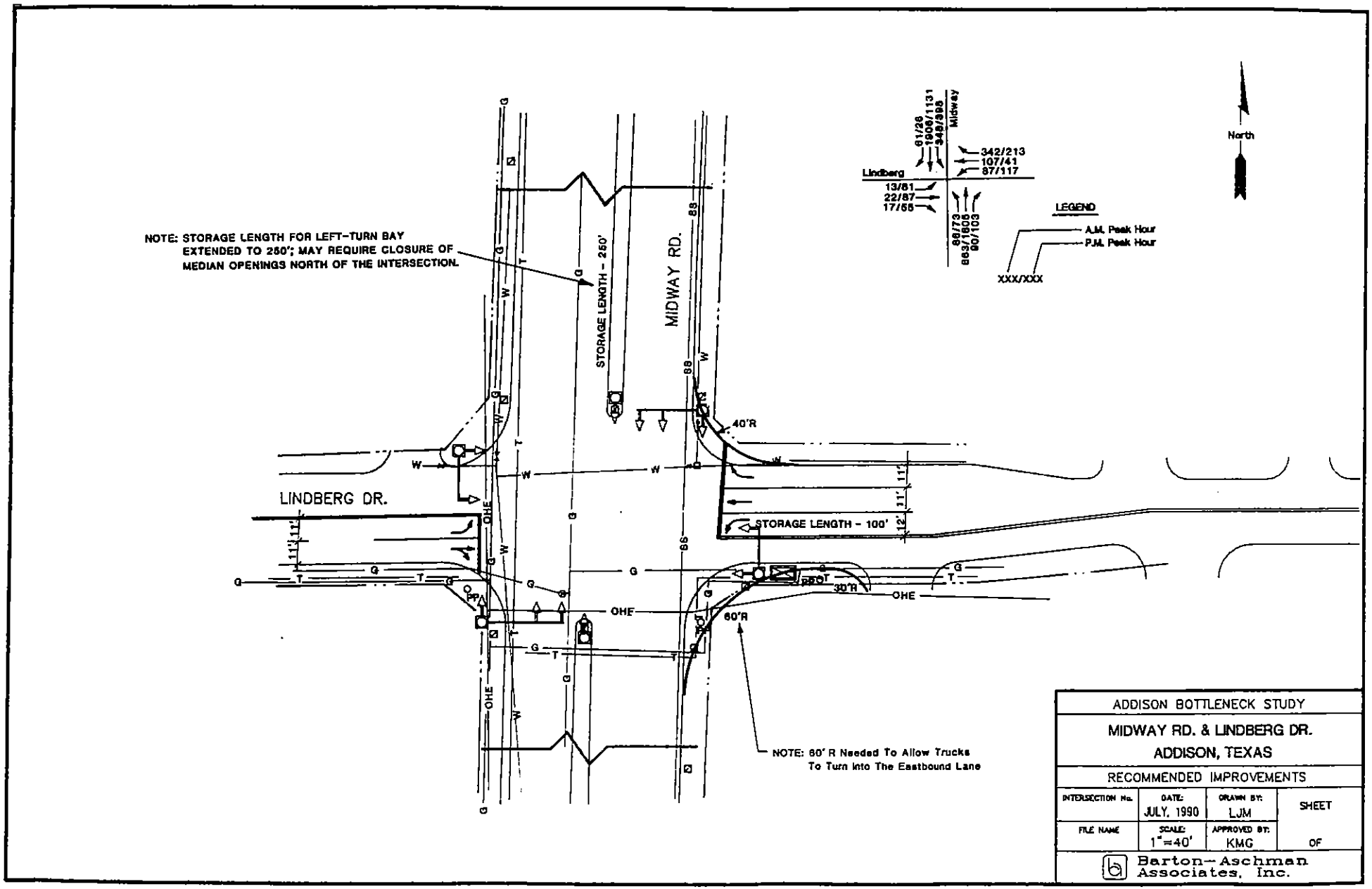
	Level of Service		Average Delay (sec/veh)		
	AM	PM	AM	PM	Acc. Rate (Acc/MEV)
Existing	D	F	35.9	84.4	1.0
With Recommended Improvements	B	D	8.3	25.4	.61

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: MIDWAY AND LINDBERG
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	847	S.Y.	New Pavement (concrete)	24.00	20328.00
	280	S.Y.	Rem. Exist. Pavement	8.00	2240.00
	810	L.F.	New Curb & Gutter	8.00	6480.00
	810	L.F.	Rem. Exist. Curb & Gutter	5.00	4050.00
	10	%	Intersection Signalization	70000.00	7000.00
	1	EA.	Rel. Controller/Fndn.	1664.00	1664.00
	2	EA.	Rel. Mastarm Pole/Fndn.	3803.00	7606.00
	0	EA.	Rel. Pedstl. Pole/Fndn.	992.00	0.00
	2	EA.	Rel. Pullbox	177.00	354.00
	0	EA.	Rem. Pullbox	56.00	0.00
	2	EA.	Rel. Drainage Inlet	2300.00	4600.00
	3	EA.	Rel. Util. Pole @ Inters'n.	6000.00	18000.00
	0	EA.	Rel. Util. Pole	2000.00	0.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	1	EA.	Rel. Fire Hydrant	755.00	755.00
	5	EA.	Rel. Water Meter	328.00	1640.00
	1	EA.	Adjust Manhole	413.00	413.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	1950	S.F.	Add'l R-O-W (comm./retail)	12.00	23400.00
			Sub-Total		98530.00
		L.S.	Engineering/Contingency Fees	0.15	14779.50
			TOTAL ESTIMATE		113500.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.


NOTE: STORAGE LENGTH FOR LEFT-TURN BAY EXTENDED TO 250'; MAY REQUIRE CLOSURE OF MEDIAN OPENINGS NORTH OF THE INTERSECTION.
STORAGE LENGTH - 250'
MIDWAY RD.
LINDBERG DR.
40'R
STORAGE LENGTH - 100'
30'R
60'R
OHE
NOTE: 60' R Needed To Allow Trucks To Turn Into The Eastbound Lane
Midway
Lindberg
61/26
1906/1131
348/398
342/213
107/41
87/117
13/61
22/87
17/55
66/73
863/1606
90/103
North
LEGEND
A.M. Peak Hour
P.M. Peak Hour
XXX/XXX
ADDISON BOTTLENECK STUDY
MIDWAY RD. & LINDBERG DR.
ADDISON, TEXAS
RECOMMENDED IMPROVEMENTS
INTERSECTION No.
DATE: JULY, 1990
DRAWN BY: LJM
SHEET
FILE NAME
SCALE: 1"=40'
APPROVED BY: KMG
OF
Barton-Aschman Associates, Inc.

EXISTING CONDITIONS

Location - Beltway/Midway

Street	Midway	Midway	Beltway	Beltway
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	South leg (204')	None	None	None
Approach ADT	18,795	17,718	1,264	1,835

Approach Lanes

Left Turn	1	1	1	1
Through	3	3	1	1
Right Turn	1	1	0	1

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM	AM	PM
Left Turn	71	176	11	44	179	95	47	28
Through	1020	1949	2224	1371	6	44	63	45
Right Turn	103	195	17	60	12	28	221	78

Operating Conditions

	Intersection	
	AM	PM
V/C	.5	.73
Average Delay	11.9	11.4
LOS	B	B

Accident History 1987-90

Accident Rate/MV .7

Accidents/Year 10.0

Right Angle	2	Head On	0
Rear End	21	Pedestrian	0
Left Turn	1	Ran Off Road	1
Right Turn	0	Fixed Object	2
Sideswipe	3	Other	0
Total	**30**		

LOCATION: Beltway at Midway

EXISTING AND PROJECTED DEFICIENCIES:

1. Pavement markings on eastbound and westbound approaches are needed.

2. Insufficient storage length on south approach.

3. High number of rear-end accidents.

RECOMMENDED IMPROVEMENTS:

1. Intall new pavement markings on east and west approaches.

2. Construct additional storage for right-turn lane (125'), left turn lane (150') on south approach, and left turn lane (75') on west approach and left turn lane (150') on east approach.

EXPECTED BENEFITS OR DISBENEFITS:

1. Increase intersection capacity.

2. Provide better channelization for east and west approach.

MEASURE OF EFFECTIVENESS:

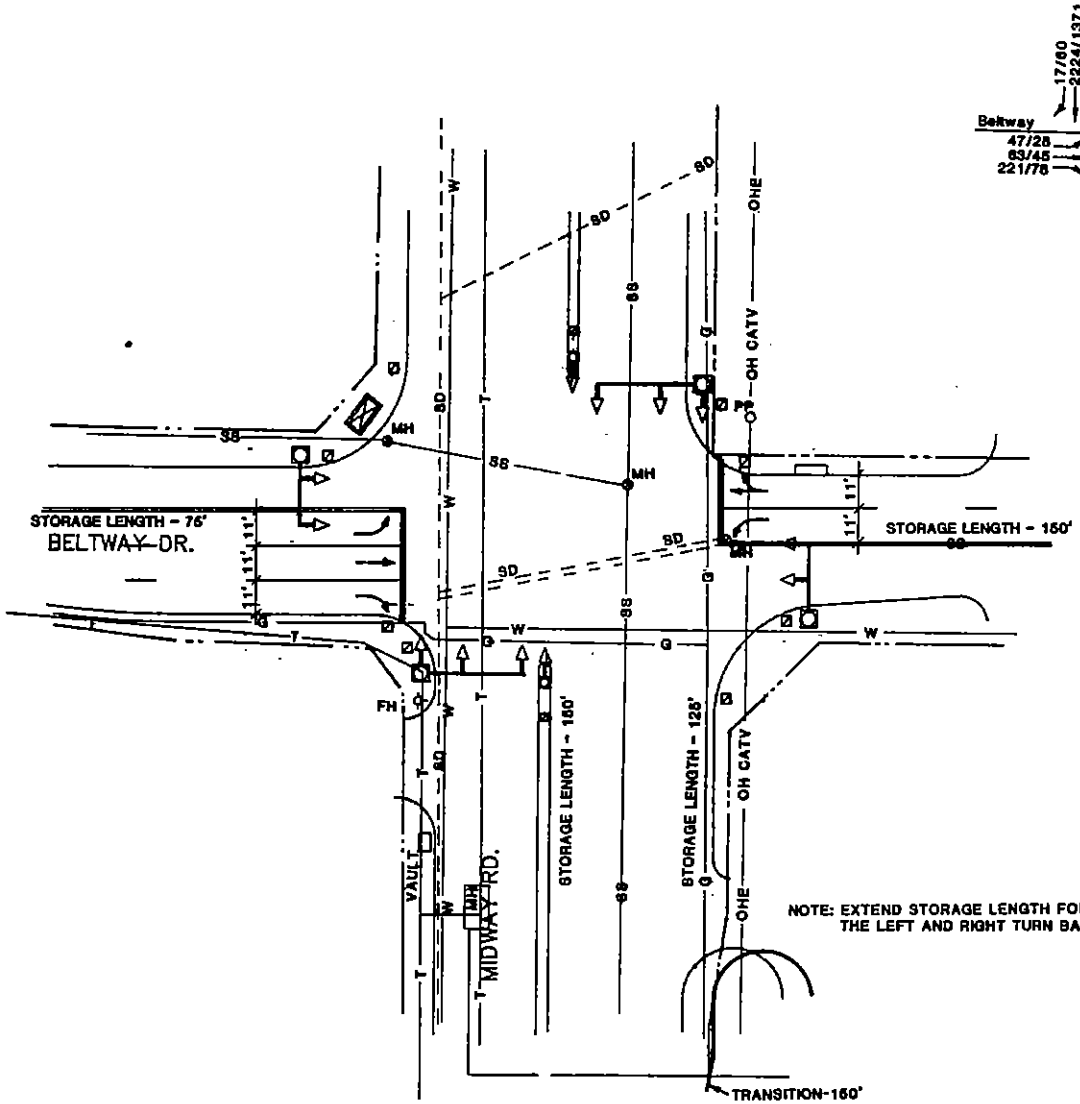
	Level of Service		Average Delay (sec/veh)		Acc. Rate
	AM	PM	AM	PM	(Acc/MEV)
Existing	B	B	11.9	11.4	.70
With Recommended Improvements	B	B	11.9	11.4	.50

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: BELTWAY AND MIDWAY
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	186	S.Y.	New Pavement (concrete)	24.00	4464.00
	186	S.Y.	Rem. Exist. Pavement	8.00	1488.00
	231	L.F.	New Curb & Gutter	8.00	1848.00
	231	L.F.	Rem. Exist. Curb & Gutter	5.00	1155.00
	5	%	Intersection Signalization	70000.00	3500.00
	0	EA.	Rel. Controller/Fndn.	1664.00	0.00
	0	EA.	Rel. Mastarm Pole/Fndn.	3803.00	0.00
	0	EA.	Rel. Pedstl. Pole/Fndn.	992.00	0.00
	0	EA.	Rel. Pullbox	177.00	0.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	0	EA.	Rel. Util. Pole @ Inters'n.	6000.00	0.00
	0	EA.	Rel. Util. Pole	2000.00	0.00
	2	EA.	Rel. Util. Vault	10000.00	20000.00
	0	EA.	Rel. Fire Hydrant	755.00	0.00
	0	EA.	Rel. Water Meter	328.00	0.00
	0	EA.	Adjust Manhole	413.00	0.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	0	S.F.	Add'l R-O-W (comm./retail)	12.00	0.00
			Sub-Total		32455.00
		L.S.	Engineering/Contingency Fees	0.15	4868.25
			TOTAL ESTIMATE		37500.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.



ADDISON BOTTLENECK STUDY

MIDWAY RD. & BELTWAY DR.
ADDISON, TEXAS

RECOMMENDED IMPROVEMENTS

INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF

Barton-Aschman Associates, Inc.

EXISTING CONDITIONS

Location - Midway/Proton

Street	Midway	Midway	Proton	Proton
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	North leg (91')	South leg (83')	None	None
Approach ADT	19,902	18,588	1,978	3,189

Approach Lanes

Left Turn	1	1	0	0
Through	3	3	1	1
Right Turn	0	0	1	1

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM	AM	PM
Left Turn	49	144	187	33	11	47	81	103
Through	1129	1918	1939	1424	19	88	81	7
Right Turn	0	0	103	97	47	138	265	63

Operating Conditions

	Intersection	
	AM	PM
V/C	.68	.72
Average Delay	9	10.2
LOS	B	B

Accident History 1987-90

Accident Rate/MV	.3	Right Angle	1	Head On	0
Accidents/Year	4.3	Rear End	4	Pedestrian	0
		Left Turn	5	Ran Off Road	0
		Right Turn	1	Fixed Object	1
		Sideswipe	1	Other	0
		Total	**13**		

LOCATION: Midway at Proton

EXISTING AND PROJECTED DEFICIENCIES:

1. Unmarked pavement on east and west approaches.

2. Heavy right turn volumes from Proton onto Midway during AM peak.

RECOMMENDED IMPROVEMENTS:

1. Install pavement markings on east and west approaches.

2. Widen west approach to provide dual right turn lanes (storage 75') and a shared left and through lane.

EXPECTED BENEFITS OR DISBENEFITS:

1. Improves operation and flow on Proton.

2. Decrease intersection delay during PM peak.

MEASURE OF EFFECTIVENESS:

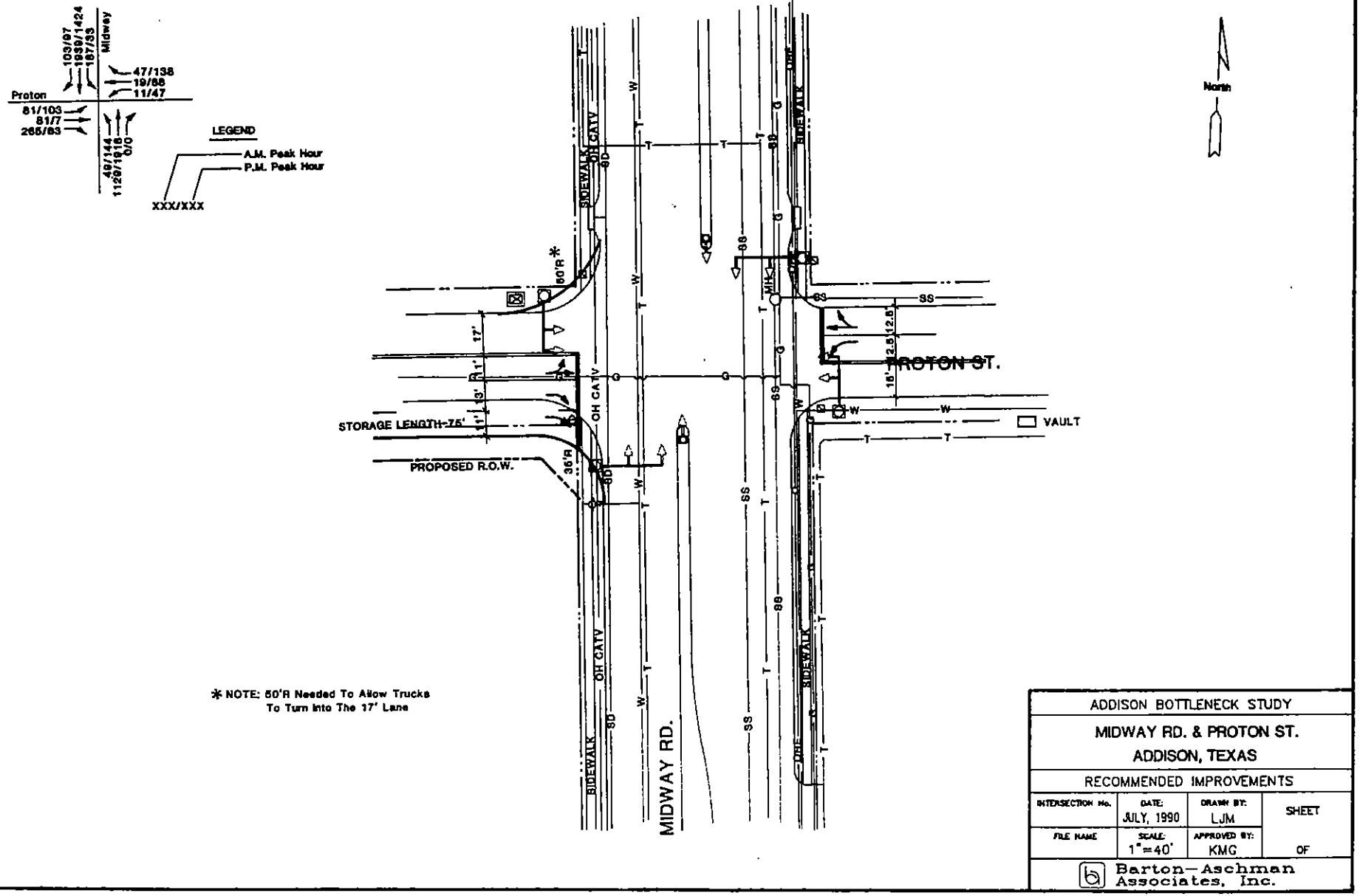
	Level of Service		Average Delay (sec/veh)		
	AM	PM	AM	PM	Acc. Rate (Acc/MEV)
Existing	B	B	9.2	10.2	.3
With Recommended Improvements	B	B	9.0	8.8	.3

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: PROTON AND MIDWAY
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	116	S.Y.	New Pavement (concrete)	24.00	2784.00
	0	S.Y.	Rem. Exist. Pavement	8.00	0.00
	272	L.F.	New Curb & Gutter	8.00	2176.00
	272	L.F.	Rem. Exist. Curb & Gutter	5.00	1360.00
	5	%	Intersection Signalization	70000.00	3500.00
	0	EA.	Rel. Controller/Fndn.	1664.00	0.00
	1	EA.	Rel. Mastarm Pole/Fndn.	3803.00	3803.00
	0	EA.	Rel. Pedstl. Pole/Fndn.	992.00	0.00
	1	EA.	Rel. Pullbox	177.00	177.00
	0	EA.	Rem. Pullbox	56.00	0.00
	1	EA.	Rel. Drainage Inlet	2300.00	2300.00
	0	EA.	Rel. Util. Pole @ Inters'n.	6000.00	0.00
	0	EA.	Rel. Util. Pole	2000.00	0.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	1	EA.	Rel. Fire Hydrant	755.00	755.00
	2	EA.	Rel. Water Meter	328.00	656.00
	0	EA.	Adjust Manhole	413.00	0.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	1350	S.F.	Add'l R-O-W (comm./retail)	12.00	16200.00
			Sub-Total		33711.00
		L.S.	Engineering/Contingency Fees	0.15	5056.65
			TOTAL ESTIMATE		39000.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.


103/97
1939/1424
187/33
Midway
47/138
19/88
11/47
Proton
81/103
81/7
265/83
49/144
1129/1916
0/0
LEGEND
A.M. Peak Hour
P.M. Peak Hour
XXX/XXX
North
PROTON ST.
MIDWAY RD.
STORAGE LENGTH-75'
PROPOSED R.O.W.
VAULT
SIDEWALK
OH CATV
50'R *
36'R
17'
11'
13'
11'
12.5'
12.5'
16'
* NOTE: 50'R Needed To Allow Trucks
To Turn Into The 17' Lane
ADDISON BOTTLENECK STUDY
MIDWAY RD. & PROTON ST.
ADDISON, TEXAS
RECOMMENDED IMPROVEMENTS
INTERSECTION No.
DATE: JULY, 1990
DRAWN BY: LJM
SHEET
FILE NAME
SCALE: 1"=40'
APPROVED BY: KMG
OF
Barton-Aschman Associates, Inc.

EXISTING CONDITIONS

Location - Greenhill School/Midway

Street	Midway	Greenhill School	Midway
Intersection Approach	Southbound	Eastbound	Northbound
Bus Stop Location	None	None	South leg (108')
Approach ADT	22,718	1,820	19,797
Approach Lanes			
Left Turn	0	1	1
Through	3	0	3
Right Turn	0	2	0

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM
Left Turn	0	0	42	35	84	47
Through	1824	1549	0	0	1262	1687
Right Turn	132	16	78	81	0	0

Operating Conditions

	Intersection AM	Intersection PM
V/C	.52	.55
Average Delay	3.3	4.6
LOS	A	A

Accident History 1987-90

Accident Rate/MV .9

Accidents/Year 1.3

Right Angle	2	Head On	0
Rear End	1	Pedestrian	0
Left Turn	0	Ran Off Road	0
Right Turn	0	Fixed Object	1
Sideswipe	0	Other	0
Total	**4**		

LOCATION: Greenhill School at Midway

EXISTING AND PROJECTED DEFICIENCIES:

1. Heavy right-turn volumes on north approach.
2. Median on south approach extends too far into intersection; inhibits the flow and operation of left turns.
3. Median on the west approach impedes operation; eastbound left turning movements, and northbound left turning movements.

RECOMMENDED IMPROVEMENTS:

1. Widen north approach to provide three through lanes, and a right turn lane (225' storage).
2. Cut back median nose on south approach.
3. Modify median nose on west approach to provide more efficient turning movements.

EXPECTED BENEFITS OR DISBENEFITS:

1. Increase intersection capacity.
2. Improve north approach left and right turning movements.
3. Improve safety.
4. Reduce impedance and conflict points to traffic flow.
5. Improve traffic opertion and traffic flow.

MEASURE OF EFFECTIVENESS:

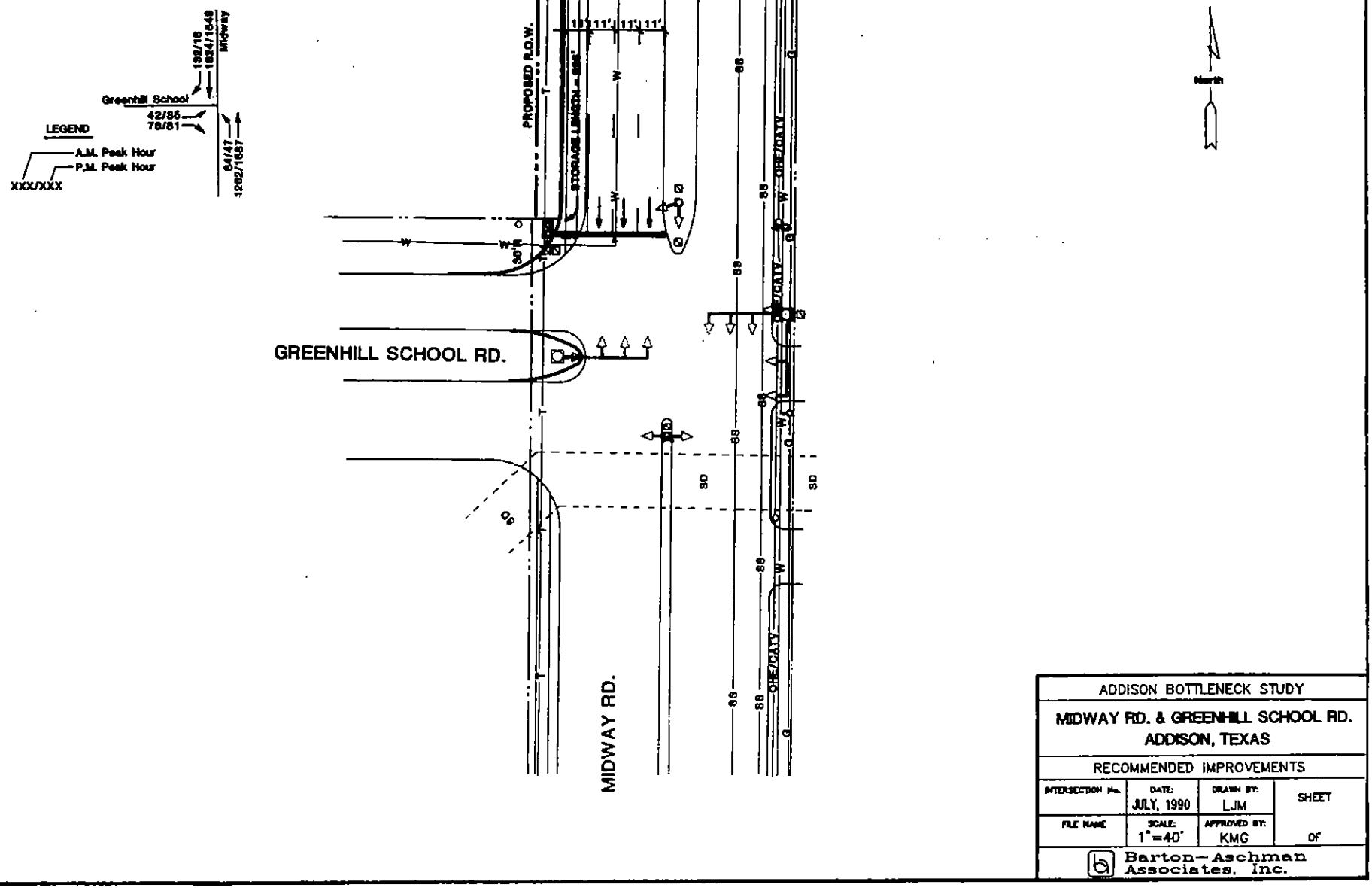
	Level of Service			Average Delay (sec/veh)			Acc. Rate
	AM	MID	PM	AM	MID	PM	(Acc/MEV)
Existing	A	A	A	3.3	3.0	4.6	.9
With Recommended Improvements	A	A	A	3.2	2.9	2.9	.6

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: MIDWAY AND GREENHILL SCHOOL
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	502	S.Y.	New Pavement (concrete)	24.00	12048.00
	0	S.Y.	Rem. Exist. Pavement	8.00	0.00
	480	L.F.	New Curb & Gutter	8.00	3840.00
	492	L.F.	Rem. Exist. Curb & Gutter	5.00	2460.00
	10	%	Intersection Signalization	70000.00	7000.00
	0	EA.	Rel. Controller/Fndn.	1664.00	0.00
	0	EA.	Rel. Mastarm Pole/Fndn.	3803.00	0.00
	1	EA.	Rel. Pedstl. Pole/Fndn.	992.00	992.00
	4	EA.	Rel. Pullbox	177.00	708.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	0	EA.	Rel. Util. Pole @ Inters'n.	6000.00	0.00
	0	EA.	Rel. Util. Pole	2000.00	0.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	0	EA.	Rel. Fire Hydrant	755.00	0.00
	1	EA.	Rel. Water Meter	328.00	328.00
	2	EA.	Adjust Manhole	413.00	826.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	2079	S.F.	Add'l R-O-W (comm./retail)	12.00	24948.00
			Sub-Total		53150.00
		L.S.	Engineering/Contingency Fees	0.15	7972.50
			TOTAL ESTIMATE		62000.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.


192/16
1834/1649
Midway
Greenhill School
42/85
78/81
84/47
1262/1687
LEGEND
A.M. Peak Hour
P.M. Peak Hour
XXX/XXX
PROPOSED R.O.W.
STORAGE LENGTH = 600'
11'
11'
11'
11'
W
30'
GREENHILL SCHOOL RD.
MIDWAY RD.
SD
88
T
Ø
North
ADDISON BOTTLENECK STUDY
MIDWAY RD. & GREENHILL SCHOOL RD.
ADDISON, TEXAS
RECOMMENDED IMPROVEMENTS
INTERSECTION No.
DATE: JULY, 1990
DRAWN BY: LJM
SHEET
FILE NAME
SCALE: 1"=40'
APPROVED BY: KMG
OF
Barton-Aschman Associates, Inc.

EXISTING CONDITIONS

Location - Midway/Spring Valley

Street	Midway	Midway	Spring Valley	Spring Valley
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	North leg (160')	South leg (232')	West leg (260')	West leg (235')
Approach ADT	22,771	19,797	13,056	6,168
Approach Lanes				
Left Turn	1	1	1	1
Through	3	3	3	3
Right Turn	0	1	0	0

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM	AM	PM
Left Turn	103	259	286	245	279	425	204	122
Through	1267	1421	1569	1273	391	814	688	425
Right Turn	373	321	78	270	288	259	291	56

Operating Conditions

	Intersection	
	AM	PM
V/C	1.04	.97
Average Delay	72.6	56.7
LOS	F	E

Accident History 1987-90

Accident Rate/MV	.28	Right Angle	0	Head On	1
Accidents/Year	6.3	Rear End	9	Pedestrian	0
		Left Turn	6	Ran Off Road	0
		Right Turn	0	Fixed Object	1
		Sideswipe	2	Other	0
		Total	**19**		

LOCATION: Midway at Spring Valley

EXISTING AND PROJECTED DEFICIENCIES:

1. Heavy right-turn and left-turn volumes on all approaches.
2. Storage bays for north and south approaches not adequate.
3. High frequency of rear-end and left-turn accidents.

RECOMMENDED IMPROVEMENTS:

1. Widen Midway approaches to provide dual left turns (northbound 150' storage and southbound 175' storage).
2. Widen Spring Valley approaches to provide dual left turns (westbound 150' storage and eastbound 150' storage) as well as right turn lanes (westbound 100' storage and eastbound 100' storage).

EXPECTED BENEFITS OR DISBENEFITS:

1. Decrease intersection delay.
2. Increase intersection capacity.
3. Improve safety; reduce rear-end and left-turn accident potential.
4. Improve overall operation and traffic flow at the intersection.

MEASURE OF EFFECTIVENESS:

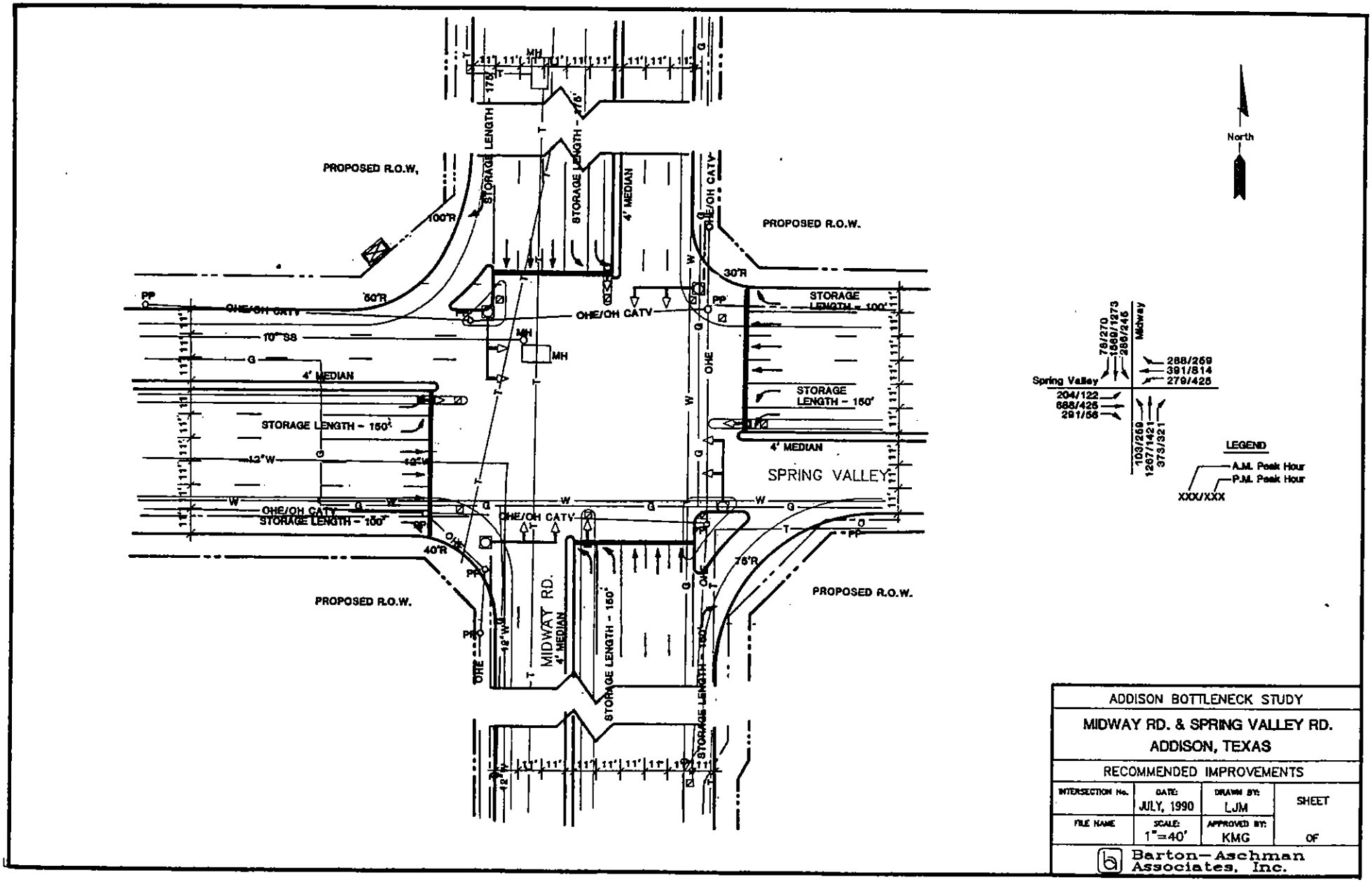
	Level of Service		Average Delay (sec/veh)		Acc. Rate
	AM	PM	AM	PM	(Acc/MEV)
Existing	F	E	72.6	56.7	.28
With Recommended Improvements	D	C	31.7	21.8	.23

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: MIDWAY AND SPRING VALLEY
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	5677	S.Y.	New Pavement (concrete)	24.00	136248.00
	371	S.Y.	Rem. Exist. Pavement	8.00	2968.00
	6638	L.F.	New Curb & Gutter	8.00	53104.00
	6638	L.F.	Rem. Exist. Curb & Gutter	5.00	33190.00
	25	%	Intersection Signalization	70000.00	17500.00
	0	EA.	Rel. Controller/Fndn.	1664.00	0.00
	4	EA.	Rel. Mastarm Pole/Fndn.	3803.00	15212.00
	4	EA.	Rel. Pedstl. Pole/Fndn.	992.00	3968.00
	9	EA.	Rel. Pullbox	177.00	1593.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	6	EA.	Rel. Util. Pole @ Inters'n.	6000.00	36000.00
	0	EA.	Rel. Util. Pole	2000.00	0.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	1	EA.	Rel. Fire Hydrant	755.00	755.00
	0	EA.	Rel. Water Meter	328.00	0.00
	3	EA.	Adjust Manhole	413.00	1239.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	2425	S.F.	Add'l R-O-W (comm./retail)	12.00	29100.00
			Sub-Total		330877.00
		L.S.	Engineering/Contingency Fees	0.15	49631.55
			TOTAL ESTIMATE		381000.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.



ADDISON BOTTLENECK STUDY			
MIDWAY RD. & SPRING VALLEY RD. ADDISON, TEXAS			
RECOMMENDED IMPROVEMENTS			
INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF
Barton—Aschman Associates, Inc.			

ADDISON ROAD

EXISTING CONDITIONS

Location - Addison/Arapaho

Street	Addison	Addison	Arapaho
Intersection Approach	Northbound	Southbound	Westbound
Bus Stop Location	None	None	None
Approach ADT	8,955	7,853	4,184

Approach Lanes

Left Turn	0	1	1
Through	2	2	0
Right Turn	0	0	1

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM
Left Turn	0	0	267	349	229	167
Through	414	904	855	619	0	0
Right Turn	135	277	0	0	239	291

Operating Conditions

	Intersection AM	Intersection PM
V/C	.54	.72
Average Delay	9.5	13.6
LOS	B	B

Accident History 1987-90

Accident Rate/MV	.5	Right Angle	4	Head On	0
Accidents/Year	4.3	Rear End	5	Pedestrian	0
		Left Turn	3	Ran Off Road	0
		Right Turn	0	Fixed Object	0
		Sideswipe	1	Other	0
		Total	**13**		

EXISTING CONDITIONS

Location - Addison Road/Lindberg

Street	Addison	Addison	Lindberg	Lindberg
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	None	None	None	None
Approach ADT	8,955	7,853	2,021	2,698
Approach Lanes				
Left Turn	1	1	0	0
Through	2	2	1	1
Right Turn	0	0	0	1

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM	AM	PM
Left Turn	241	346	4	1	3	14	89	168
Through	313	860	942	466	2	5	1	3
Right Turn	4	12	184	90	0	9	305	351

Operating Conditions

	Intersection	
	AM	PM
V/C	.80	.85
Average Delay	16.2	45.7
LOS	C	E

Accident History 1987-90

Accident Rate/MV	.8	Right Angle	3	Head On	0
Accidents/Year	7	Rear End	9	Pedestrian	0
		Left Turn	0	Ran Off Road	5
		Right Turn	0	Fixed Object	1
		Sideswipe	3	Other	0
		Total	**21**		

LOCATION: Addison, Lindberg and Arapaho

EXISTING AND PROJECTED DEFICIENCIES:

1. Left-turning vehicles queue into north and southbound through lanes during PM peak hour.

2. Access driveways to post office closest to intersection present hazardous conditions.

3. High frequency of rear-end and running off road accidents.

RECOMMENDED IMPROVEMENTS:

1. Widen Addison Road between Lindberg and Arapaho to provide two through lanes and individual left turn lanes for eastbound and westbound vehicles.

2. Close access driveway to post office on Lindberg near intersection.

3. Channelize access driveway on right turns into access driveway of post office.

4. Near Lindberg and Arapaho intersection provide pavement markings to channelize the left-turn movements.

EXPECTED BENEFITS OR DISBENEFITS:

1. Reduce accidents, especially rear-ends and left-turns accidents.

2. Provide enough storage space for left turn lanes on Addison between Lindberg and Arapaho.

3. Improve traffic operation and traffic flow.

MEASURE OF EFFECTIVENESS:

	Level of Service		Average Delay (sec/veh)		
	AM	PM	AM	PM	Acc. Rate (Acc/MEV)
Existing Lindberg	C	E	16.2	45.7	.8
With Recommended Improvements	No Change		No Change		.5

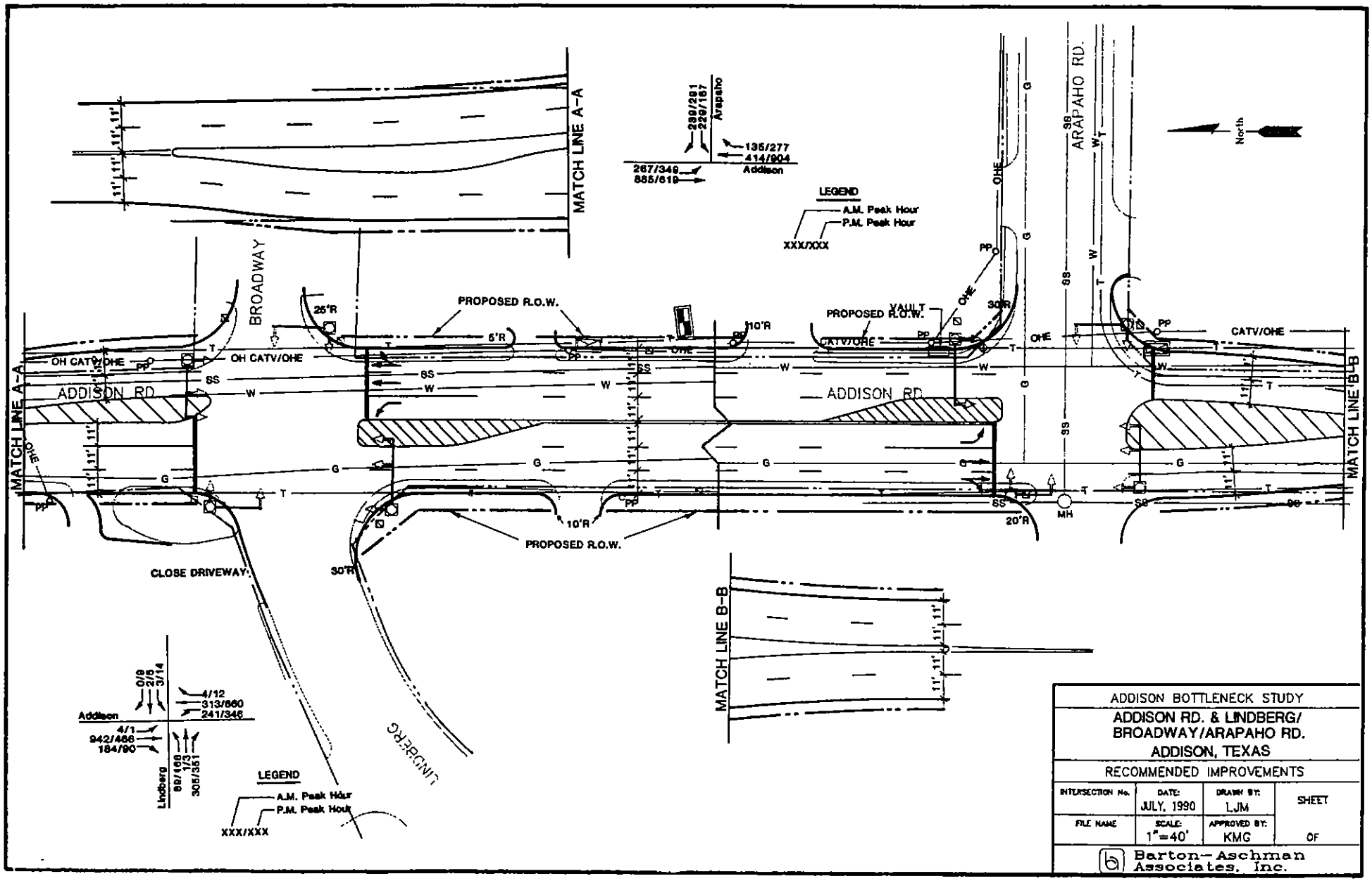
	Level of Service		Average Delay (sec/veh)		
	AM	PM	AM	PM	Acc. Rate (Acc/MEV)
Existing Arapaho	B	B	9.5	13.6	.5
With Recommended Improvements	No Change		No Change		.2

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: ADDISON AT LINDBERG AND ARAPAHO
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	425	S.Y.	New Pavement (concrete)	24.00	10200.00
	0	S.Y.	Rem. Exist. Pavement	8.00	0.00
	778	L.F.	New Curb & Gutter	8.00	6224.00
	778	L.F.	Rem. Exist. Curb & Gutter	5.00	3890.00
	5	%	Intersection Signalization	70000.00	3500.00
	1	EA.	Rel. Controller/Fndn.	1664.00	1664.00
	3	EA.	Rel. Mastarm Pole/Fndn.	3803.00	11409.00
	0	EA.	Rel. Pedstl. Pole/Fndn.	992.00	0.00
	2	EA.	Rel. Pullbox	177.00	354.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	2	EA.	Rel. Util. Pole @ Inters'n.	6000.00	12000.00
	0	EA.	Rel. Util. Pole	2000.00	0.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	0	EA.	Rel. Fire Hydrant	755.00	0.00
	6	EA.	Rel. Water Meter	328.00	1968.00
	0	EA.	Adjust Manhole	413.00	0.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	3402	S.F.	Add'l R-O-W (comm./retail)	10.00	34020.00
			Sub-Total		85229.00
		L.S.	Engineering/Contingency Fees	0.15	12784.35
			TOTAL ESTIMATE		98500.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.



ADDISON BOTTLENECK STUDY

ADDISON RD. & LINDBERG/
BROADWAY/ARAPAHO RD.
ADDISON, TEXAS

RECOMMENDED IMPROVEMENTS

INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF

Barton-Aschman Associates, Inc.

EXISTING CONDITIONS

Location - Westgrove/Addison

Street	Addison	Addison	Westgrove	Westgrove
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	None	None	West leg (240')	West leg (144')
Approach ADT	3,318	3,209	3,321	4,184
Approach Lanes				
Left Turn	1	1	0	0
Through	2	2	2	2
Right Turn	0	0	0	0

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM	AM	PM
Left Turn	97	462	79	80	54	45	4	25
Through	182	550	442	187	116	231	266	168
Right Turn	22	70	12	12	176	113	557	158

Operating Conditions

	Intersection AM	Intersection PM
V/C	.80	.88
Average Delay	24.6	28.7
LOS	C	D

Accident History 1987-90

Accident Rate/MV .7

Accidents/Year 4.6

Right Angle	4	Head On	0
Rear End	4	Pedestrian	0
Left Turn	2	Ran Off Road	2
Right Turn	0	Fixed Object	0
Sideswipe	2	Other	0
Total	**14**		

LOCATION: Westgrove at Addison

EXISTING AND PROJECTED DEFICIENCIES:

1. No pavement markings on east and west approach.
2. Small curb return radii.
3. High right turn volumes on east approach during PM peak.
4. High right turn volumes on west approach during AM peak.
5. High frequency of rear-end and right angle accidents.

RECOMMENDED IMPROVEMENTS:

1. Flare east and west approach to 44' and provide a left turn lane, a through lane, and a right turn lane.
2. Increase curb return radii to 30'.
3. Provide storage of 175' for right turning lanes and 75' for left turning lanes on east and west approaches.
4. Install pavement markings on east and west approaches.

EXPECTED BENEFITS OR DISBENEFITS:

1. Increase intersection capacity and decrease intersection delay.
2. Increase east/west flow across intersection.
3. Decrease rear-end and right angle accidents; improve safety.

MEASURE OF EFFECTIVENESS:

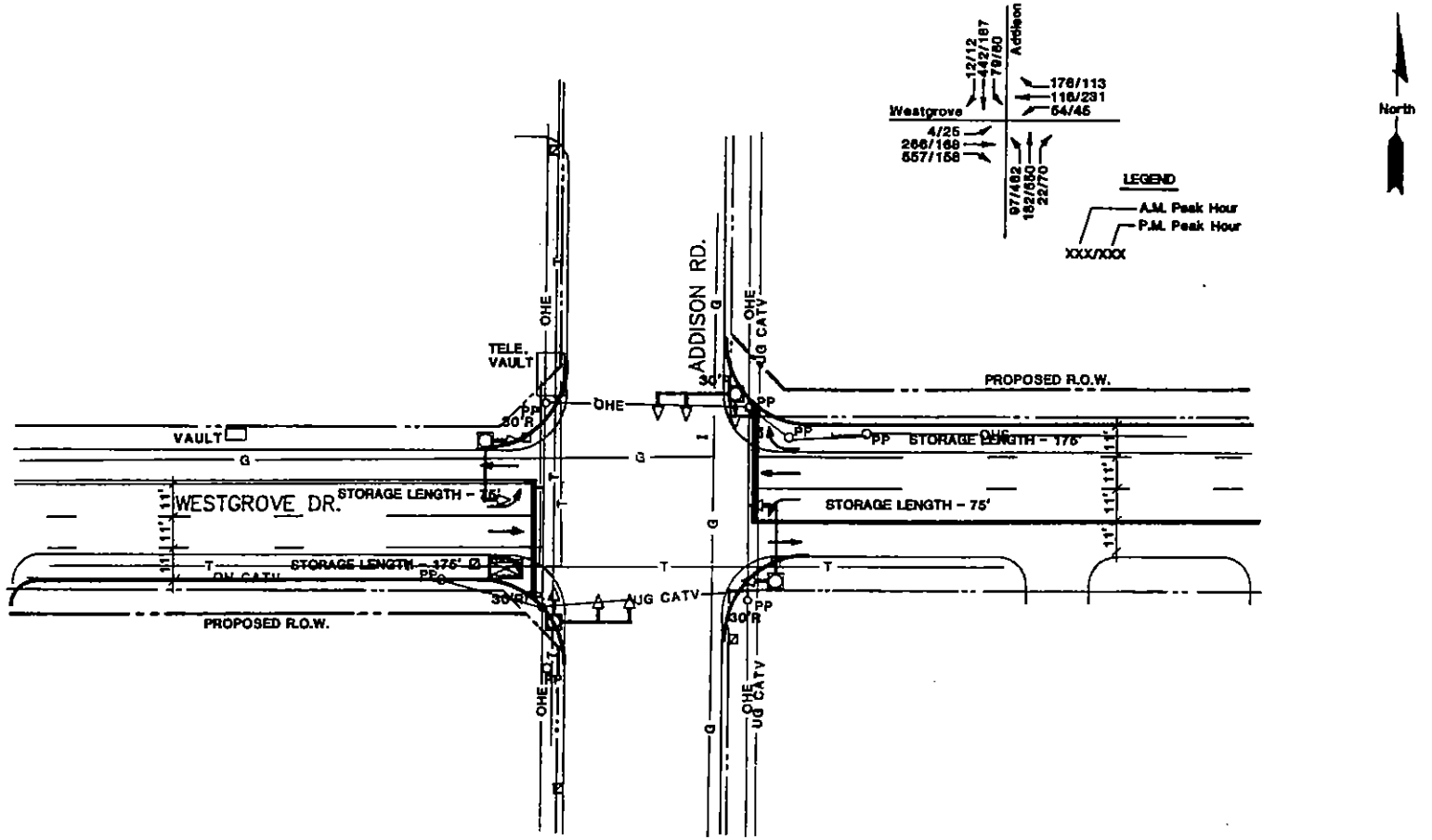
	Level of Service		Average Delay (sec/veh)		Acc. Rate
	AM	PM	AM	PM	(Acc/MEV)
Existing	C	D	24.6	28.7	.7
With Recommended Improvements	B	B	14.2	14.4	.5

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: ADDISON AND WESTGROVE
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	480	S.Y.	New Pavement (concrete)	24.00	11520.00
	0	S.Y.	Rem. Exist. Pavement	8.00	0.00
	693	L.F.	New Curb & Gutter	8.00	5544.00
	693	L.F.	Rem. Exist. Curb & Gutter	5.00	3465.00
	10	%	Intersection Signalization	70000.00	7000.00
	1	EA.	Rel. Controller/Fndn.	1664.00	1664.00
	3	EA.	Rel. Mastarm Pole/Fndn.	3803.00	11409.00
	0	EA.	Rel. Pedstl. Pole/Fndn.	992.00	0.00
	2	EA.	Rel. Pullbox	177.00	354.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	4	EA.	Rel. Util. Pole @ Inters'n.	6000.00	24000.00
	4	EA.	Rel. Util. Pole	2000.00	8000.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	0	EA.	Rel. Fire Hydrant	755.00	0.00
	0	EA.	Rel. Water Meter	328.00	0.00
	0	EA.	Adjust Manhole	413.00	0.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	2100	S.F.	Add'l R-O-W (comm./retail)	10.00	21000.00
			Sub-Total		93956.00
		L.S.	Engineering/Contingency Fees	0.15	14093.40
			TOTAL ESTIMATE		108500.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.



ADDISON BOTTLENECK STUDY			
ADDISON RD. & WESTGROVE DR. ADDISON, TEXAS			
RECOMMENDED IMPROVEMENTS			
INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF
Barton-Aschman Associates, Inc.			

EXISTING CONDITIONS

Location - Keller Springs/Addison

Street	Addison	Addison	Keller Springs	Keller Springs
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	North leg (76')	None	None	East leg (127')
Approach ADT	7,073	7,853	4,092	589
Approach Lanes				
Left Turn	1	1	0	0
Through	2	2	1	1
Right Turn	1	0	1	0

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM	AM	PM
Left Turn	9	14	139	107	330	109	1	23
Through	255	785	830	411	27	9	2	18
Right Turn	69	319	14	3	127	235	3	14

Operating Conditions

	Intersection AM	Intersection PM
V/C	.69	.61
Average Delay	17.8	14.8
LOS	C	B

Accident History 1987-90

Accident Rate/MV	.7	Right Angle	2	Head On	1
Accidents/Year	5	Rear End	6	Pedestrian	0
		Left Turn	2	Ran Off Road	2
		Right Turn	0	Fixed Object	0
		Sideswipe	2	Other	0
		Total	**15**		

LOCATION: Keller Springs/Addison

EXISTING AND PROJECTED DEFICIENCIES:

1. Heavy right-turn volumes east approach.
2. High frequency of rear-end accidents.
3. Through and right-turns conflict on south approach.
4. Northbound left-turns cause hazards on north approach.

RECOMMENDED IMPROVEMENTS:

1. Add channelization median on south approach to separate through lanes and right-turn lane.
2. Add channelization island at the access driveway closest to the intersection on the northwest corner.
3. Increase East approach roadway to provide a right turning lane with storage of 150'.

EXPECTED BENEFITS OR DISBENEFITS:

1. Improve safety.
2. Improve traffic flow on Addison.
3. Decrease intersection delay.

MEASURE OF EFFECTIVENESS:

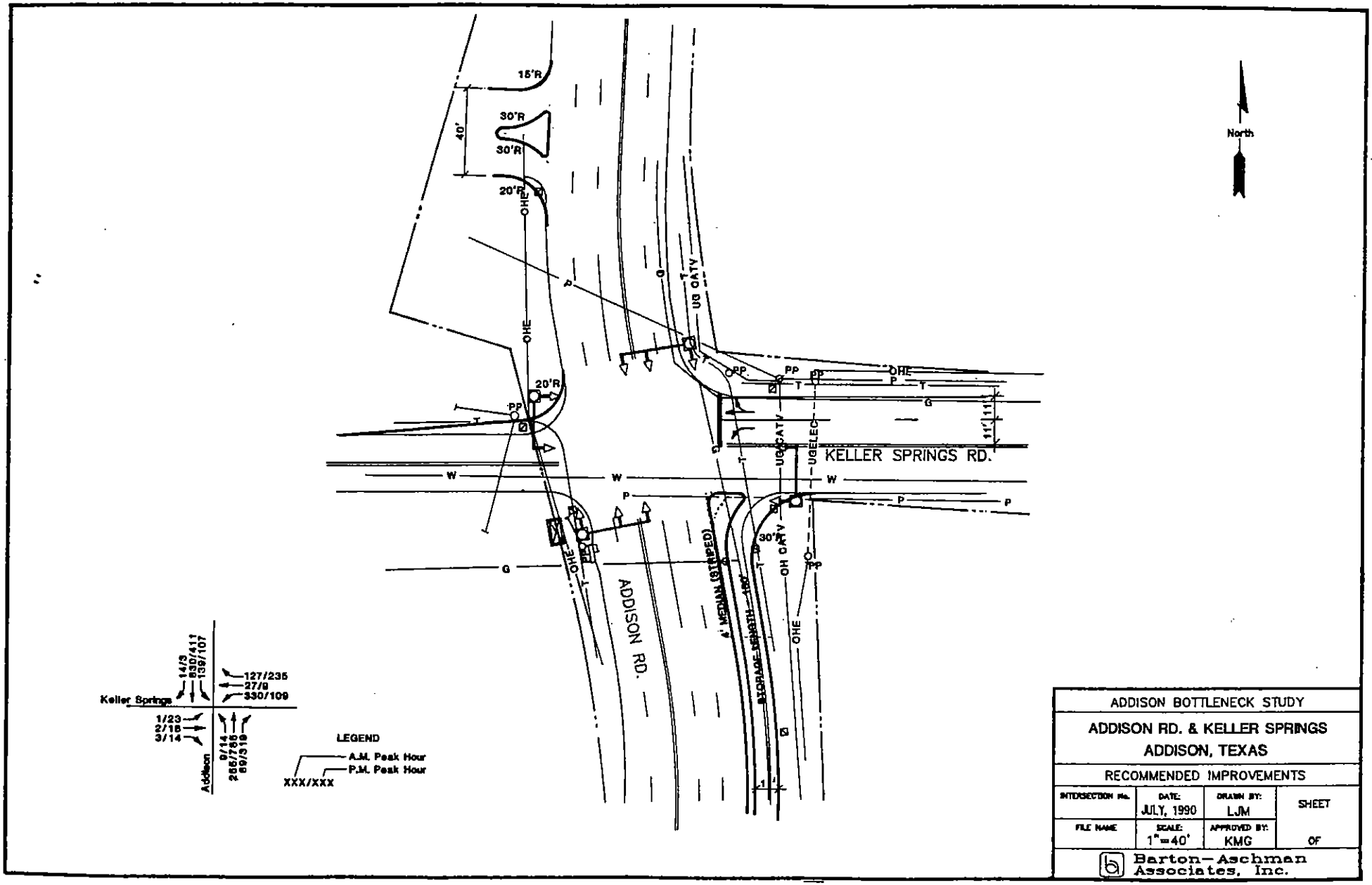
	Level of Service		Average Delay (sec/veh)		Acc. Rate
	AM	PM	AM	PM	(Acc/MEV)
Existing	C	B	17.8	14.8	.7
With Recommended Improvements	B	B	8.5	8.7	.5

Barton–Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: ADDISON AND KELLER SPRINGS
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	384	S.Y.	New Pavement (concrete)	24.00	9216.00
	0	S.Y.	Rem. Exist. Pavement	8.00	0.00
	842	L.F.	New Curb & Gutter	8.00	6736.00
	456	L.F.	Rem. Exist. Curb & Gutter	5.00	2280.00
	5	%	Intersection Signalization	70000.00	3500.00
	0	EA.	Rel. Controller/Fndn.	1664.00	0.00
	2	EA.	Rel. Mastarm Pole/Fndn.	3803.00	7606.00
	0	EA.	Rel. Pedstl. Pole/Fndn.	992.00	0.00
	2	EA.	Rel. Pullbox	177.00	354.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	1	EA.	Rel. Util. Pole @ Inters'n.	6000.00	6000.00
	1	EA.	Rel. Util. Pole	2000.00	2000.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	0	EA.	Rel. Fire Hydrant	755.00	0.00
	0	EA.	Rel. Water Meter	328.00	0.00
	0	EA.	Adjust Manhole	413.00	0.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	1800	S.F.	Add'l R-O-W (comm./retail)	10.00	18000.00
			Sub–Total		55692.00
		L.S.	Engineering/Contingency Fees	0.15	8353.80
			TOTAL ESTIMATE		64500.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.



ADDISON BOTTLENECK STUDY			
ADDISON RD. & KELLER SPRINGS ADDISON, TEXAS			
RECOMMENDED IMPROVEMENTS			
INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF
Barton-Aschman Associates, Inc.			

ISOLATED INTERSECTIONS

EXISTING CONDITIONS

Location - Quorum/Arapaho

Street	Quorum	Quorum	Arapaho	Arapaho
Intersection Approach	Northbound	Southbound	Westbound	Eastbound
Bus Stop Location	None	None	None	East leg (256')
Approach ADT	4,576	1,995	2,021	4,184
Approach Lanes				
Left Turn	1	1	0	0
Through	2	2	2	2
Right Turn	0	0	0	0

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM	AM	PM
Left Turn	75	75	117	29	146	159	11	76
Through	123	278	416	130	452	362	259	533
Right Turn	153	186	55	9	16	121	73	68

Operating Conditions

	Intersection	
	AM	PM
V/C	.68	.74
Average Delay	18.7	44.6
LOS	C	E

Accident History 1987-90

Accident Rate/MV 1.1

Accidents/Year 5.0

Right Angle	4	Head On	0
Rear End	1	Pedestrian	0
Left Turn	1	Ran Off Road	8
Right Turn	0	Fixed Object	1
Sideswipe	0	Other	0
Total	**15**		

LOCATION: Quorum at Arapaho

EXISTING AND PROJECTED DEFICIENCIES:

1. High intersection delay for PM peak hours.
2. Heavy left turning movements on east approach.
3. Unmarked pavement on east and west approach.

RECOMMENDED IMPROVEMENTS:

1. Flare east and west approaches to 55' to provide a left lane, through lane, and right lane.
2. Provide a left storage lane of 125' on the east approach.
3. Provide a left storage lane of 75' on the west approach.
4. Install pavement markings on east and west approaches.

EXPECTED BENEFITS OR DISBENEFITS:

1. Decrease intersection delay.
2. Increase capacity of east and west approaches.
3. Increase traffic flow through intersection.
4. Increase safety.

MEASURE OF EFFECTIVENESS:

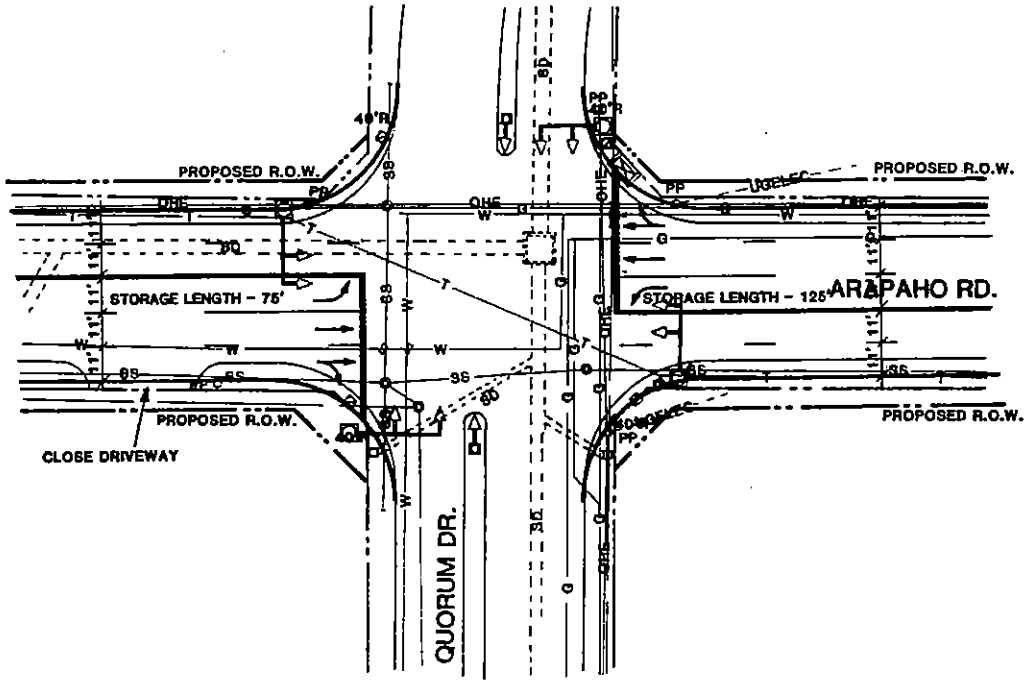
	Level of Service		Average Delay (sec/veh)		Acc. Rate
	AM	PM	AM	PM	(Acc/MEV)
Existing	C	E	18.7	44.6	1.1
With Recommended Improvements	C	C	17.4	18.9	.7

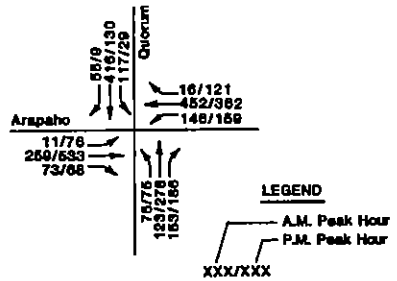
Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

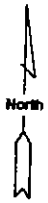
Location: ARAPAHO AND QUORUM
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/22/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	1030	S.Y.	New Pavement (concrete)	24.00	24720.00
	0	S.Y.	Rem. Exist. Pavement	8.00	0.00
	1252	L.F.	New Curb & Gutter	8.00	10016.00
	1252	L.F.	Rem. Exist. Curb & Gutter	5.00	6260.00
	10	%	Intersection Signalization	70000.00	7000.00
	1	EA.	Rel. Controller/Fndn.	1664.00	1664.00
	3	EA.	Rel. Mastarm Pole/Fndn.	3803.00	11409.00
	0	EA.	Rel. Pedstl. Pole/Fndn.	992.00	0.00
	6	EA.	Rel. Pullbox	177.00	1062.00
	0	EA.	Rem. Pullbox	56.00	0.00
	1	EA.	Rel. Drainage Inlet	2300.00	2300.00
	3	EA.	Rel. Util. Pole @ Inters'n.	6000.00	18000.00
	2	EA.	Rel. Util. Pole	2000.00	4000.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	0	EA.	Rel. Fire Hydrant	755.00	0.00
	2	EA.	Rel. Water Meter	328.00	656.00
	3	EA.	Adjust Manhole	413.00	1239.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	6462	S.F.	Add'l R-O-W (comm./retail)	8.00	51696.00
			Sub-Total		140022.00
		L.S.	Engineering/Contingency Fees	0.15	21003.30
			TOTAL ESTIMATE		161500.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.







ADDISON BOTTLENECK STUDY			
ARAPAHO RD & QUORUM DR. ADDISON, TEXAS			
RECOMMENDED IMPROVEMENTS			
INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF
Barton-Aschman Associates, Inc.			

EXISTING CONDITIONS

Location - Spring Valley/Brookhaven

Street	Brookhaven	Spring Valley	Spring Valley
Intersection Approach	Northbound	Westbound	Eastbound
Bus Stop Location	None	East leg (294')	None
Approach ADT	4,185	5,849	7,727

Approach Lanes

Left Turn	1	2	0
Through	0	1	2
Right Turn	1	0	0

Peak Hour Approach Volumes	AM	PM	AM	PM	AM	PM
Left Turn	54	47	182	607	31	108
Through	0	0	221	683	651	342
Right Turn	527	301	0	0	0	0

Operating Conditions

	Intersection AM	Intersection PM
V/C	.59	.52
Average Delay	12.1	8.1
LOS	B	B

Accident History 1987-90

Accident Rate/MV	1.1	Right Angle	3	Head On	0
Accidents/Year	7.0	Rear End	3	Pedestrian	0
		Left Turn	6	Ran Off Road	3
		Right Turn	0	Fixed Object	3
		Sideswipe	4	Other	0
		Total	**22**		

LOCATION: Spring Valley at Brookhaven

EXISTING AND PROJECTED DEFICIENCIES:

1. High frequency of accidents.

RECOMMENDED IMPROVEMENTS:

1. Increase channellization through intersection.
2. Add median on west approach to restrict turns in access driveways near intersection.
3. Provide tracking for northbound left turns.
4. Close driveways on east approach closest to intersection.

EXPECTED BENEFITS OR DISBENEFITS:

1. Improve safety, reduce accidents.

MEASURE OF EFFECTIVENESS:

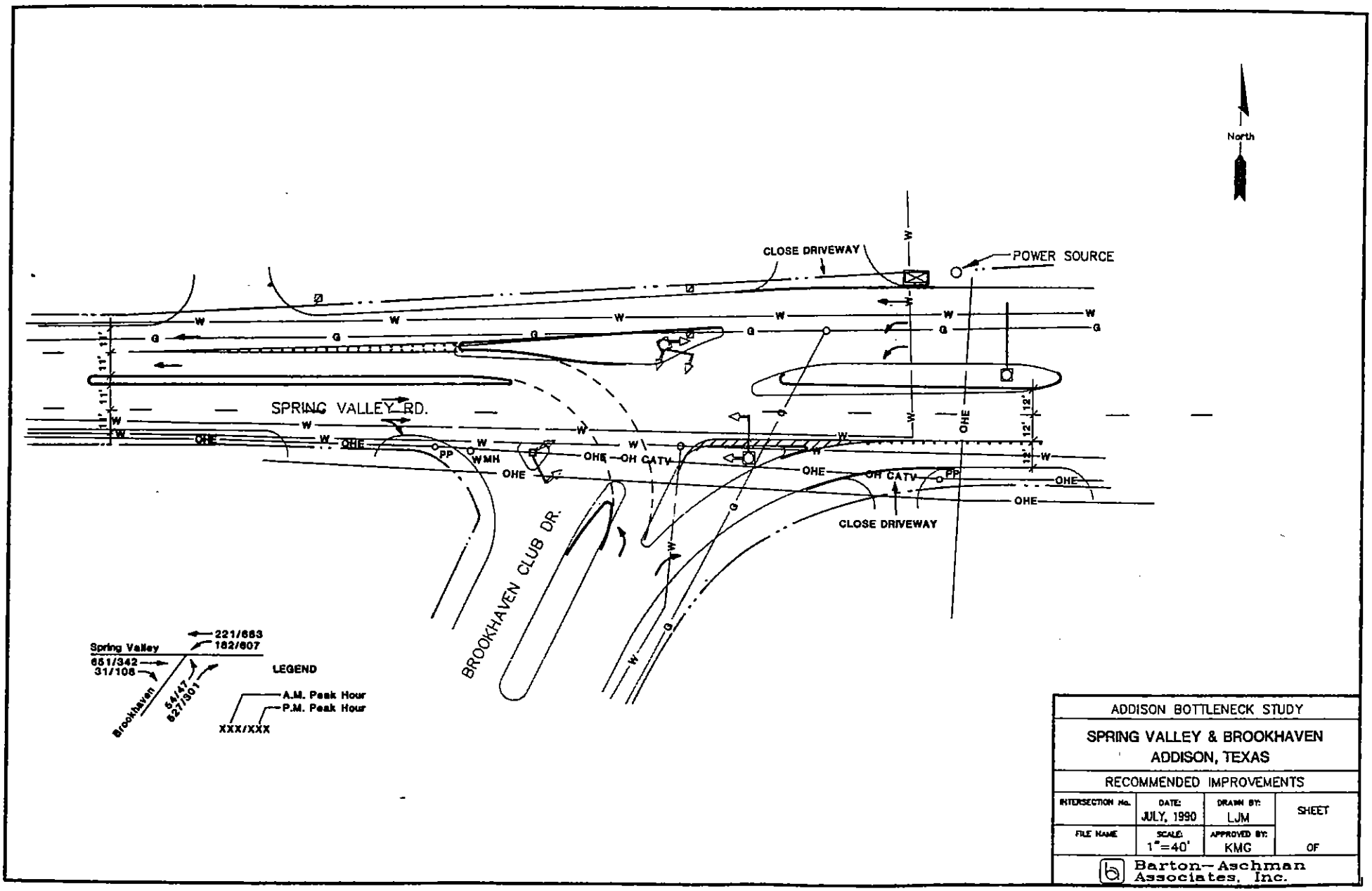
	Level of Service		Average Delay (sec/veh)		Acc. Rate
	AM	PM	AM	PM	(Acc/MEV)
Existing	B	B	12.1	8.1	1.1
With Recommended Improvements	No Change		No Change		.76

Barton-Aschman Associates,Inc.
PRELIMINARY CONSTRUCTION COST ESTIMATE WORKSHEET

Location: SPRING VALLEY AND BROOKHAVEN
Client: Town of Addison
Project: Addison Bottleneck Study
Job #: 1663.08.01
Date: 8/06/90

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
	232	S.Y.	New Pavement (concrete)	24.00	5568.00
	232	S.Y.	Rem. Exist. Pavement	8.00	1856.00
	972	L.F.	New Curb & Gutter	8.00	7776.00
	570	L.F.	Rem. Exist. Curb & Gutter	5.00	2850.00
	0	EA.	Intersection Signalization	70000.00	0.00
	0	EA.	Rel. Controller/Fndn.	1664.00	0.00
	0	EA.	Rel. Mastarm Pole/Fndn.	3803.00	0.00
	0	EA.	Rel. Pedstl. Pole/Fndn.	992.00	0.00
	0	EA.	Rel. Pullbox	177.00	0.00
	0	EA.	Rem. Pullbox	56.00	0.00
	0	EA.	Rel. Drainage Inlet	2300.00	0.00
	0	EA.	Rel. Util. Pole @ Inters'n.	6000.00	0.00
	0	EA.	Rel. Util. Pole	2000.00	0.00
	0	EA.	Rel. Util. Vault	10000.00	0.00
	0	EA.	Rel. Fire Hydrant	755.00	0.00
	0	EA.	Rel. Water Meter	328.00	0.00
	75	LF.	Pavement Marking	6.00	450.00
	0	S.F.	Add'l R-O-W (residential)	4.00	0.00
	0	S.F.	Add'l R-O-W (comm./retail)	8.00	0.00
			Sub-Total		18500.00
		L.S.	Engineering/Contingency Fees	0.15	2775.00
			TOTAL ESTIMATE		21500.00

Note: Preliminary Cost Estimates Do Not Include Landscaping.



ADDISON BOTTLENECK STUDY			
SPRING VALLEY & BROOKHAVEN ADDISON, TEXAS			
RECOMMENDED IMPROVEMENTS			
INTERSECTION No.	DATE: JULY, 1990	DRAWN BY: LJM	SHEET
FILE NAME	SCALE: 1"=40'	APPROVED BY: KMG	OF
Barton-Aschman Associates, Inc.			

1.5
PRIORITIZATION OF IMPROVEMENTS

In order to prioritize the recommended improvements at the detailed study locations, a criteria and ranking system similar to the one used in selecting the study locations was developed. This system, discussed in the following paragraphs, relates the level of improvements at each location to their respective implementation costs.

Criteria

To maintain a level of consistency in comparing the "before" and "after" conditions at each location, the criteria were selected based upon measures of effectiveness common to all of the study locations. The criteria set consists of total delay, accident rates, and determination of each location's relation to a particular corridor system. Each location was evaluated based upon these criteria for both existing and improved conditions. A brief discussion of each criteria follows.

Total Delay. The total delay for the two most peak hours were considered. The number of entering vehicles to the intersection was multiplied by the average delay per vehicle to calculate the total delay. The difference between the existing total delay and proposed total delay was used to rank the intersection.

Accident rates. The average number of accidents per year reported at an intersection over a period of 3 years was related to the average number of vehicles entering the intersection in a year to produce an accident rate in units of accidents per million entering vehicles (Acc/Mev).

Relation to a corridor system. Each study location was assigned a "Y" or "N" designation to identify the improvements at that location as either corridor-related or isolated in nature.

Ranking System

The priority ranking system was based upon point values assigned within the criteria, weighted by the relative importance and accuracy of each criterion. The scoring distribution and weighted average for the criteria was as follows.

- Two most peak hours; total delay difference (25% each)

0 - 1.00	= 0 pt.
1.01- 10.00	= 1 pt.
10.01 - 20.00	= 1.5 pt.
20.01 - 40.00	= 2 pt.
40.01 - 70.00	= 3 pt.
70.01 - 100.00	= 3.5 pt.
100.01 - 200.00	= 4 pt.

- Accident rate - (35%)

0.0 - 0.2 = 0 pt.
0.3 - 0.5 = 1 pt.
0.6 - 1.0 = 2 pt.
1.1 - 1.5 = 3 pt.
> 1.5 = 4 pt.

- Relation to a corridor system - (15%)

Y = 0 pt.
N = 5 pt.

The weighted percents were then applied to the scores for the criteria and added to develop a condition index for each location for both existing and improved conditions. The difference between the existing condition index and the improved condition index (i.e., index change, indicating the level of improvement) was then divided into the cost of the improvements to develop a relative cost per level of improvement. Through this process, locations with a lower relative cost per improvement would receive a higher priority ranking. Table 1.6 shows the results of the prioritization procedures as outlined above.

Table 1.6
RESULTS OF THE PRIORITIZATION

Major Street	Minor Street	Peak Exist LOS	2nd Peak Exist LOS	Exist. Acc. Rate	Peak Imprv. LOS	2nd Peak Imprv. LOS	Imprv. Acc. Rate	Part of System	Index Change	Imprvmt. Cost	Rel. Cost of Imprvmt
Spring Valley	Brookhaven	B	B	1.1	B	B	0.8	N	1.1	21500	19545.45
Addison	Keller Springs	C	B	0.7	B	B	0.5	N	1.4	64500	46071.43
Belt Line	Montfort	E	F	0.02	C	C	0.02	Y	1.4	76500	54642.86
Addison	Westgrove	C	D	0.7	B	B	0.5	N	1.6	108500	67812.50
Midway	Lindberg	D	F	1.0	B	D	0.6	Y	1.3	113500	87307.70
Addison	Lindberg/ Arapaho	C	E	0.8	C	E	0.5	N	1.1	98500	89545.45
Midway	Beltway	B	B	0.7	B	B	0.5	Y	0.4	37500	93750.00
Midway	Greenhill School	A	A	0.9	A	A	0.6	Y	0.6	62000	103333.33
Quorum	Arapaho	C	E	1.1	C	C	0.7	N	1.5	161500	107666.67
Belt Line	Addison	E	F	0.8	C	E	0.7	Y	1.4	166000	118571.43
Midway	Proton	B	B	0.3	B	B	0.3	Y	0.3	39000	130000.00
Belt Line	Quorum Alt. 01	D	F	0.5	B	D	0.5	Y	1.5	276500	184333.33
Midway	Spring Valley	F	E	0.3	D	C	0.2	Y	1.8	381000	211666.67
Belt Line	Midway	F	F	0.8	D	E	0.5	Y	2.2	550000	250000.00
Belt Line	Quorum Alt. 02	D	F	0.5	B	D	0.5	Y	1.5	573000	382000.00

1.6
CONCLUSIONS

The Belt Line Road, Midway Road, and Addison Road corridors along with other secondary corridors in and through the town of Addison provide local and crosstown access for neighborhoods and businesses. With the continued growth of the area and linkage of these corridors with other major arterial roadways and regional highways, traffic demands have continued to increase. During this period of time, safety for adjacent residences and businesses has been reduced, along with that for the non-local roadway user. Delays and congestion have increased at the same time, reducing the quality of life in both similar and different ways for local residents and non-local motorists along these corridors.

The focus of this study has been to identify problem areas of congestion and safety within the Town of Addison and working closely with the Town of Addison staff, to develop workable solutions to current deficiencies. The recommendations presented in this report represent at-grade improvements that will improve traffic flow and safety along the major corridors throughout the Town of Addison. Maximum at-grade capacity has been recommended at a number of the study intersections (such as the intersection of Belt Line and Midway). Even with the recommended lane configurations, delays may occur at these intersections with maximum allowable at-grade capacity. Future considerations may need to be given to grade separation of major intersections.

SECTION 2

SECTION 2

ROADWAY FUNCTIONAL CLASSIFICATION AND DESIGN STANDARDS

2.1
INTRODUCTION

City thoroughfare plans are typically based on a system of functionally classified roadways. These functional classifications are intended to reflect the role or functions of each roadway within the overall thoroughfare system.

The functional classifications describe each roadway's function and reflect a set of characteristics common to all roadways within each classification. Functions range from providing mobility for through traffic and major traffic flows to providing access to specific properties. Characteristics unique to each classification include degree of continuity, general capacity, and traffic control characteristics. Figure 2.1 illustrates the relative roles of each classification to achieve its intended function.

Design standards, as discussed in this section, describe the generalized characteristics of each functional classification. These characteristics are necessary to insure roadways will serve their intended functions without resulting in diversion of traffic to or from these facilities. Maintaining these characteristics allows the roadways to operate as intended, with maximum efficiency and safety.

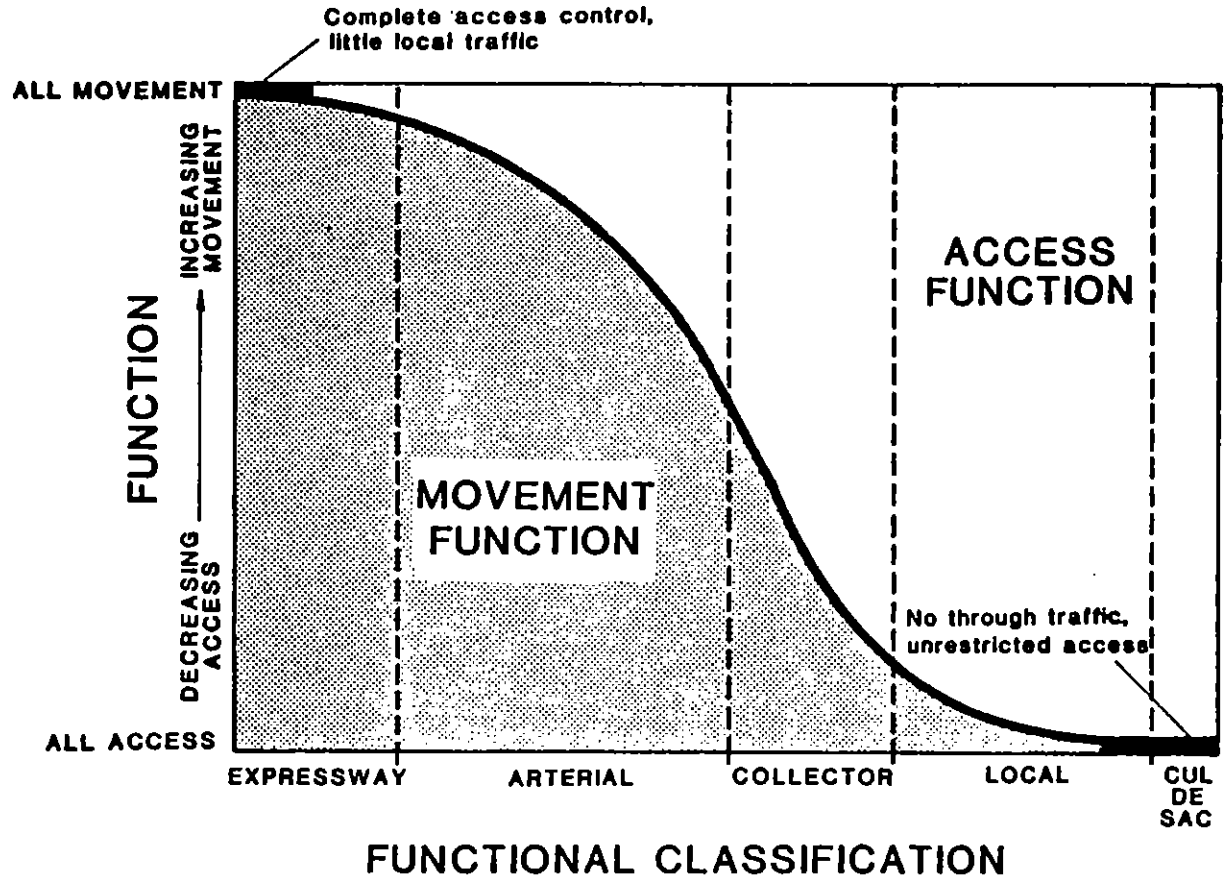


FIGURE 2.1

ROADWAY FUNCTION BY CLASSIFICATION

2.2
FUNCTIONAL CLASSIFICATIONS

Functional classifications for thoroughfare roadways are needed to provide an underlying basis for determining the following:

- Desired degree of continuity
- Capacity level
- Traffic control strategy
- Design speeds and other general design criteria
- Access policy

In order to function properly, streets must not only be designed to provide adequately for the desired function, but must also appear to the driver to be appropriate for the role. Arterial streets typically have four or more lanes, medians, turn lanes at intersections, wider rights-of-way, higher design speeds, higher levels of nighttime illumination, and traffic control which gives them priority at intersections with lower class streets. Local streets have one or two lanes with low design speeds and restricted right-of-way which tend to limit through movement. The functional classification system provides a basis for applying these characteristics to the roadway system. Table 2.1 describes the general characteristics required for each classification to achieve its intended function.

Roadway Classifications

There are four basic functional classifications of roadways. These are:

- *Freeways* - high capacity facilities with controlled access intended to carry high volumes of longer distance trips; high capacity supplement to arterial system.

- *Arterials* - carry through traffic between areas. Relatively high speed, continuous, high capacity roadways with mobility as their priority function. Property access is low priority function.

- *Collectors* - primary function is to link the local streets with the arterial system; function as collector-distributors and provide property access to commercial properties.

- *Locals* - provide access to individual properties. Accommodation of significant through traffic is not an appropriate function.

TABLE 2.1

ROADWAY FUNCTIONAL CLASSIFICATIONS AND GENERAL PLANNING GUIDELINES

Classifications	Function	Continuity	Approx. Spacing (Miles)[1]	Direct Land Access	Minimum roadway Intersection Spacing	Speed Limit (mph)	Parking	Comments
Freeway and Expressway	Traffic Movement	Continuous	4	None	1 mile	45-55	Prohibited	Supplements capacity and arterial street system and provides high speed mobility.
Arterial	Moderate distance intercommunity, intrametro area, traffic movement. Minor function-land access.	Continuous	1/4-1[2]	Restricted- some movements may be prohibited; number and spacing of driveways controlled. May be limited to major generators on regional routes.	1/8 mile 1/4 mile on regional route	35-45	Prohibited	Backbone of street system.
Collector	Primary - collect/ distribute traffic between local streets and arterial system. Secondary - land access. Tertiary - interneighborhood traffic movement.	Not necessarily continuous; may not extend across arterials.	1/4 - 1/2[2]	Safety controls; limited regulation	300 feet	30	Limited	Through traffic should be discouraged
Local	Land Access	None	As needed	safety control only	300 feet	30	Permitted	Through traffic should be discouraged.

NA = Not applicable.

[1]Spacing determination should also include consideration of (travel projections in the area or corridor based on) ultimate anticipated development.
[2]Denser spacing needed for commercial and high density residential districts.

City street systems consist of arterials, collectors, and local streets. Freeways are normally under the jurisdiction of the State Department of Highways and Public Transportation, and are therefore not the responsibility of the municipalities. The remainder of this section, which relates to the city municipal thoroughfare systems, addresses only arterials, collectors, and locals.

The number of traffic lanes required for each roadway should be determined based on projected traffic volumes to be accommodated on each street. The number of lanes may vary from street to street although their functional classification may be the same. Table 2.2 shows the range in moving traffic lanes by functional classification.

Based on the characteristics of the existing street system in the Town of Addison, the following five roadway classifications were established:

- Major arterial
- Minor arterial
- Commercial collector
- Residential collector
- Local

Figure 2.2 illustrates the classifications of each of the roadways which comprise the arterial and collector thoroughfare system within Addison.

TABLE 2.2
ROADWAY LANES BY FUNCTIONAL CLASSIFICATION

Functional Classification	Lanes[1]				
	2	4	5	4D	6D
Arterial - Limited Continuity		X		X	X
Continuous				X	X
High Capacity/Regional					X
Collector - Residential/Commercial		X	X	X	
Local - Residential	X	X			

[1]D - divided roadway with median

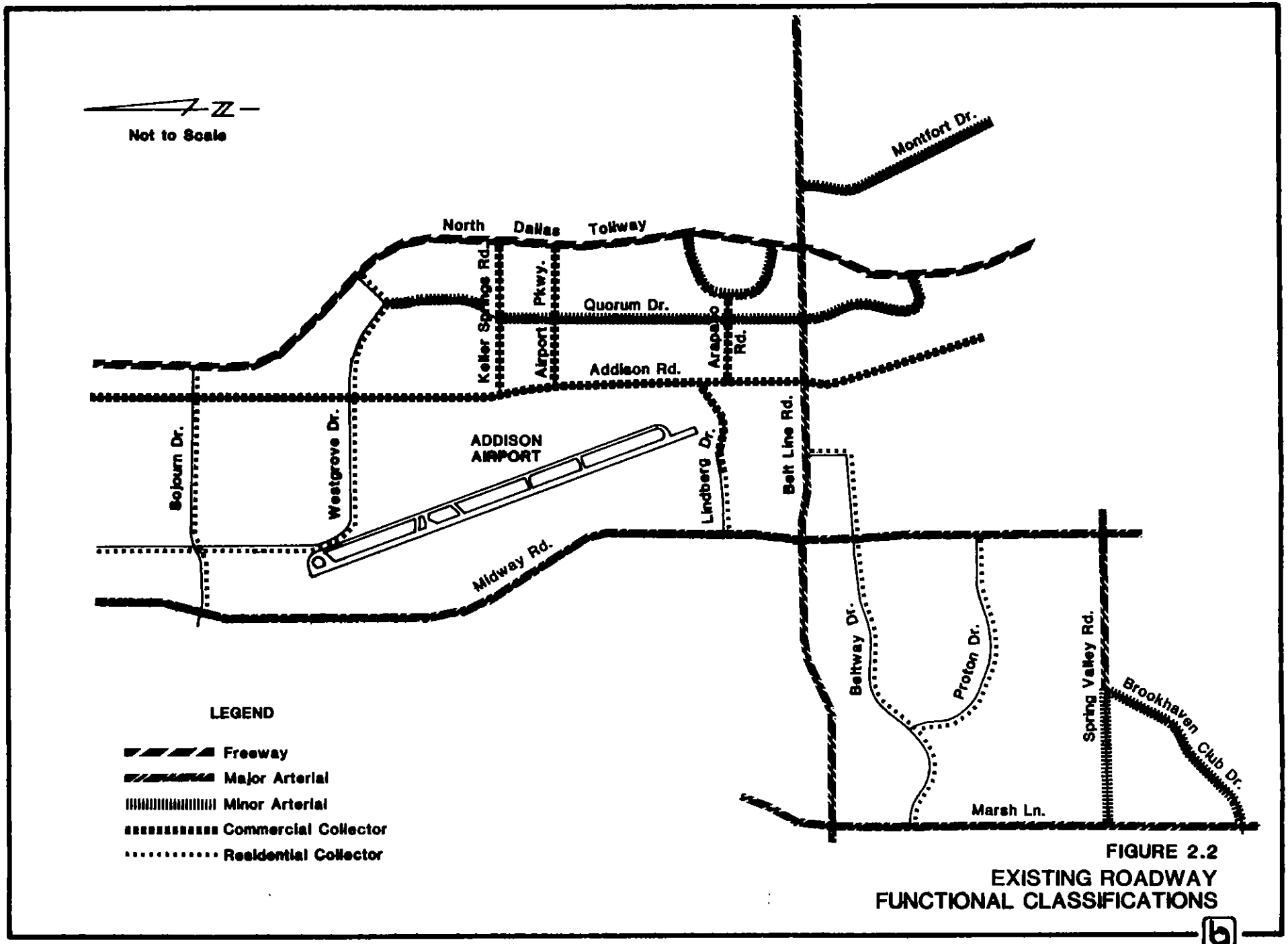


FIGURE 2.2
EXISTING ROADWAY
FUNCTIONAL CLASSIFICATIONS

2.3
THOROUGHFARE DESIGN STANDARDS

For the purposes of this report, design standards include the numbers of lanes by functional classification, standard cross-sections, intersection treatments, and access control. Each of these is described in a separate section below.

Standard Cross Sections

Roadway cross sections are composed of a total right-of-way width, pavement widths, median widths, and parkway widths. Figure 2.3 shows the recommended standard roadway cross-sections for the identified roadway classifications. Design elements are discussed below.

Lane Widths

These cross sections have been developed in accordance with the following lane width: (1) 12-foot curb lanes, (2) 11-foot interior lanes, (3) 11-foot single left-turn and right-turn lanes and 22-foot double left-turn lanes.

Sidewalks

It is recommended that sidewalks be constructed to a minimum width of 4 feet. Sidewalks should be 5 feet or more in width in non-residential areas or where sidewalks are next to the curb. As an alternative, sidewalks may be considered for public easements adjacent to the right-of-way or on private property adjacent to the buildings which generate the pedestrian activity. Barrier free ramps should be provided at all intersections.

Median Widths

Median widths on divided roadways should maintain a minimum width of sixteen (16) feet. This width provides for a five (5') foot median island width adjacent to left-turn lanes. A five (5') foot median width is recommended on all new roadways; a four (4') foot minimum median width is recommended on reconstruction of existing roadways.

Parkways

The recommended minimum parkway width is ten feet to accommodate sidewalks and driveway curb-returns within the roadway right-of-way.

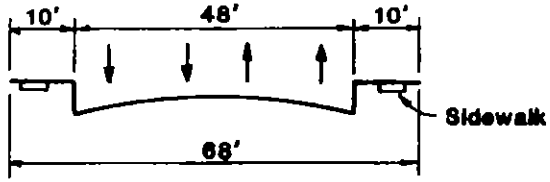
LEGEND

↓ – MOVING TRAFFIC LANE

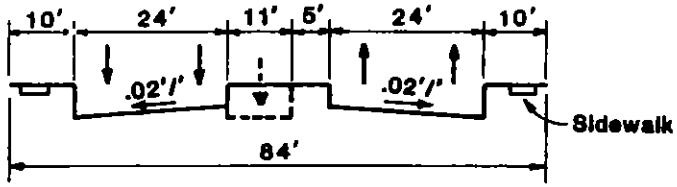
⇣ – TURN LANE AT INTERSECTION

P – PARKING LANE

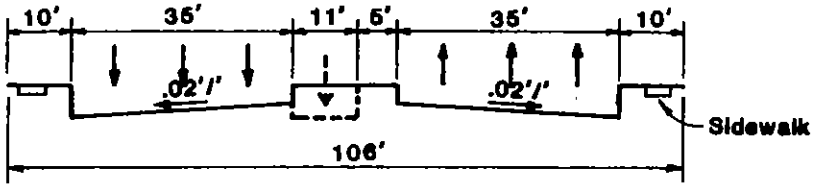
Commercial/Industrial Collector



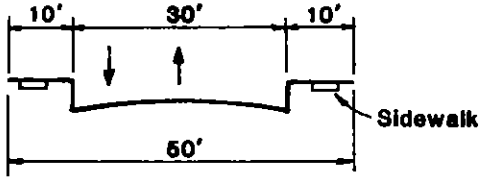
Minor Arterial



Major Arterial



Residential Local



Residential Collector

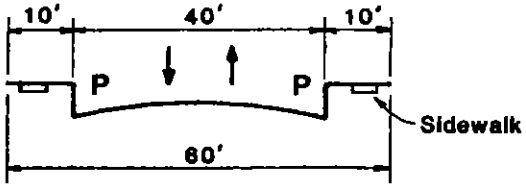


FIGURE 2.3

RECOMMENDED STANDARD
ROADWAY CROSS SECTIONS

Parking

Parking should only be allowed on local residential and residential collector streets. On these streets, parking widths should be eight (8) feet to allow for parallel parking only.

The cross sections shown in Figure 2.3 represent mid-block conditions. In some instances (discussed under intersection treatments) the cross sections will vary in the vicinity of intersections.

Intersection Treatments

At intersections between arterial streets or at locations with at least 200 turning movements per hour, special treatments should be considered to provide sufficient capacity to accommodate existing or projected volumes. These treatments may include left-turn lanes, right-turn lanes, double left-turn lanes, bus turn outs, or a combination thereof. Each intersection treatment should be designed based on the specific needs of that location.

It is appropriate and advisable to reserve sufficient right-of-way to accommodate probable eventual intersection improvements. Figures 2.4 through 2.6 show the additional right-of-way necessary to accommodate several combinations of typical intersection treatments.

Design Speed

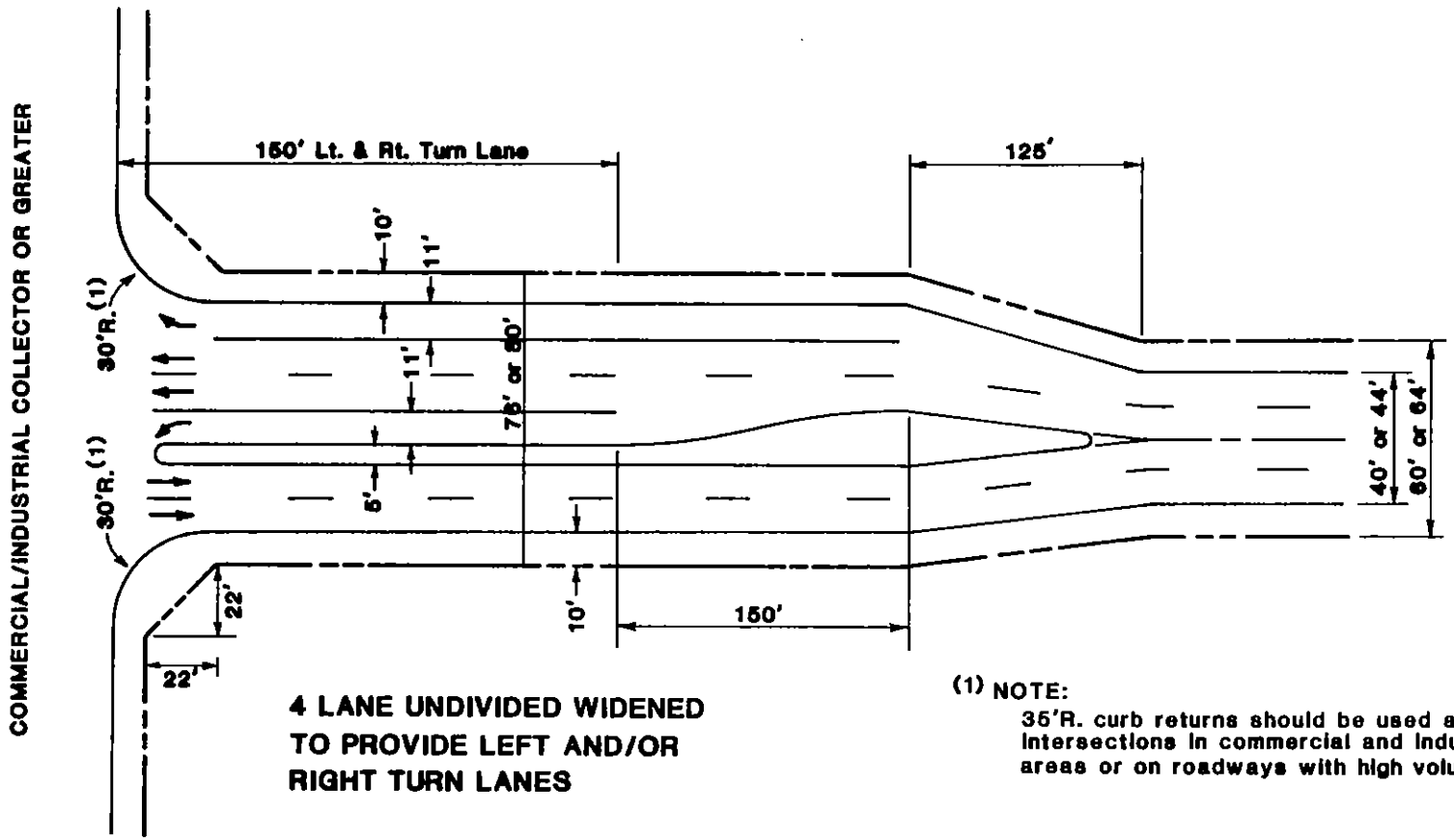
The design speed for a roadway is the maximum safe speed that can be maintained over a specified segment of roadway when conditions are so favorably that design features of the roadway govern. Design speeds determine the physical characteristics of the roadway (i.e. minimum horizontal centerline radius, stopping sight distance, etc.). The recommended design speed for each roadway classification is given below:

Roadway Classification	Design Speed
Major arterial	45
Minor arterial	40
Commercial collector	40
Residential collector	35
Local	30

It should be noted that the physical characteristics of an arterial or collector is generally not the governing factor in restricting speeds. Traffic volumes during peak hours, cross traffic, and traffic controls are examples of factors that must be considered when determining speed limits.

Horizontal Curvature

The minimum centerline radius for curving roadways is determined based on the design speed, friction factor,



(1) NOTE:
35'R. curb returns should be used at intersections in commercial and industrial areas or on roadways with high volumes of trucks.

FIGURE 2.4

INTERSECTION R.O.W. REQUIREMENTS
RESIDENTIAL/INDUSTRIAL COLLECTORS

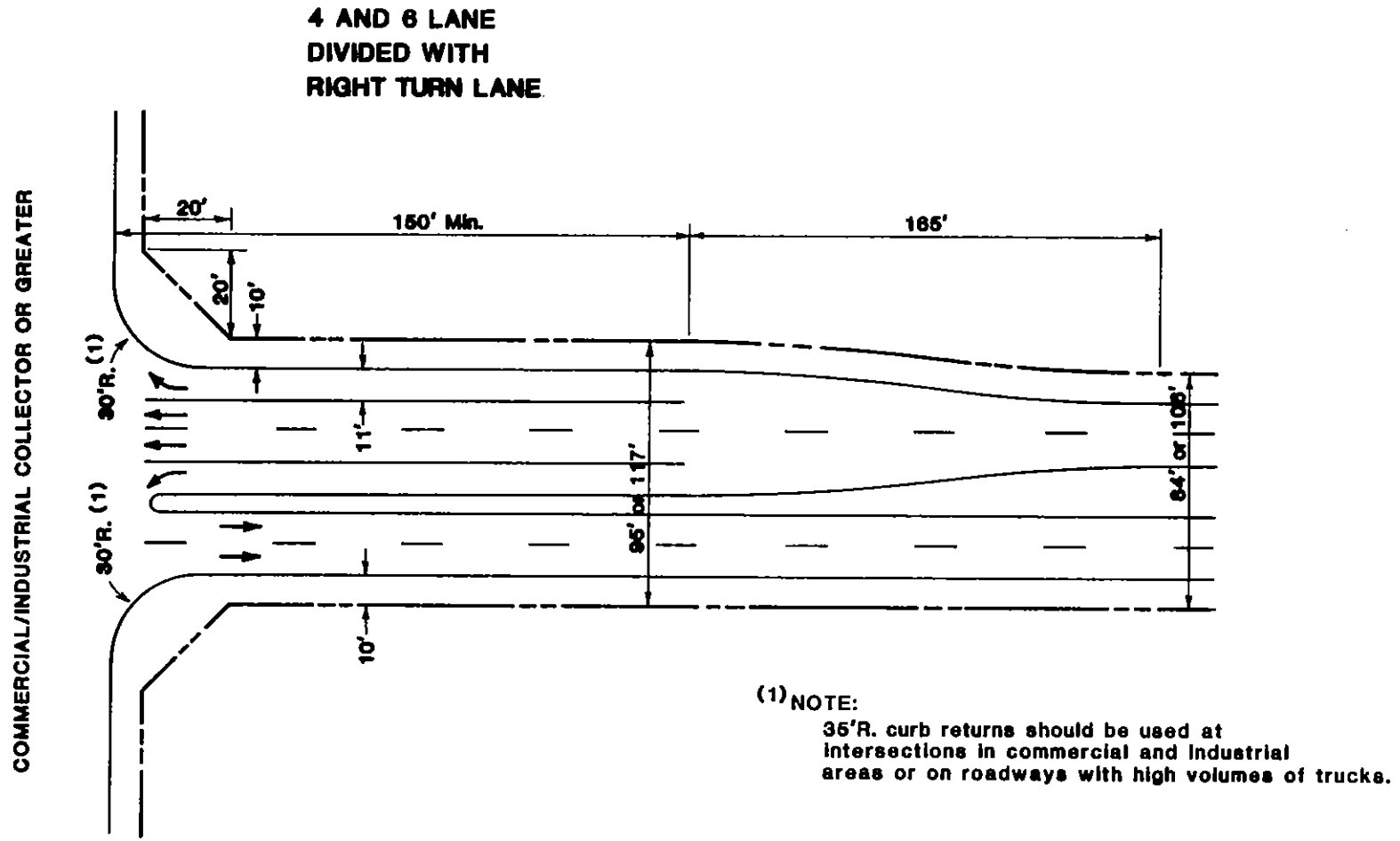
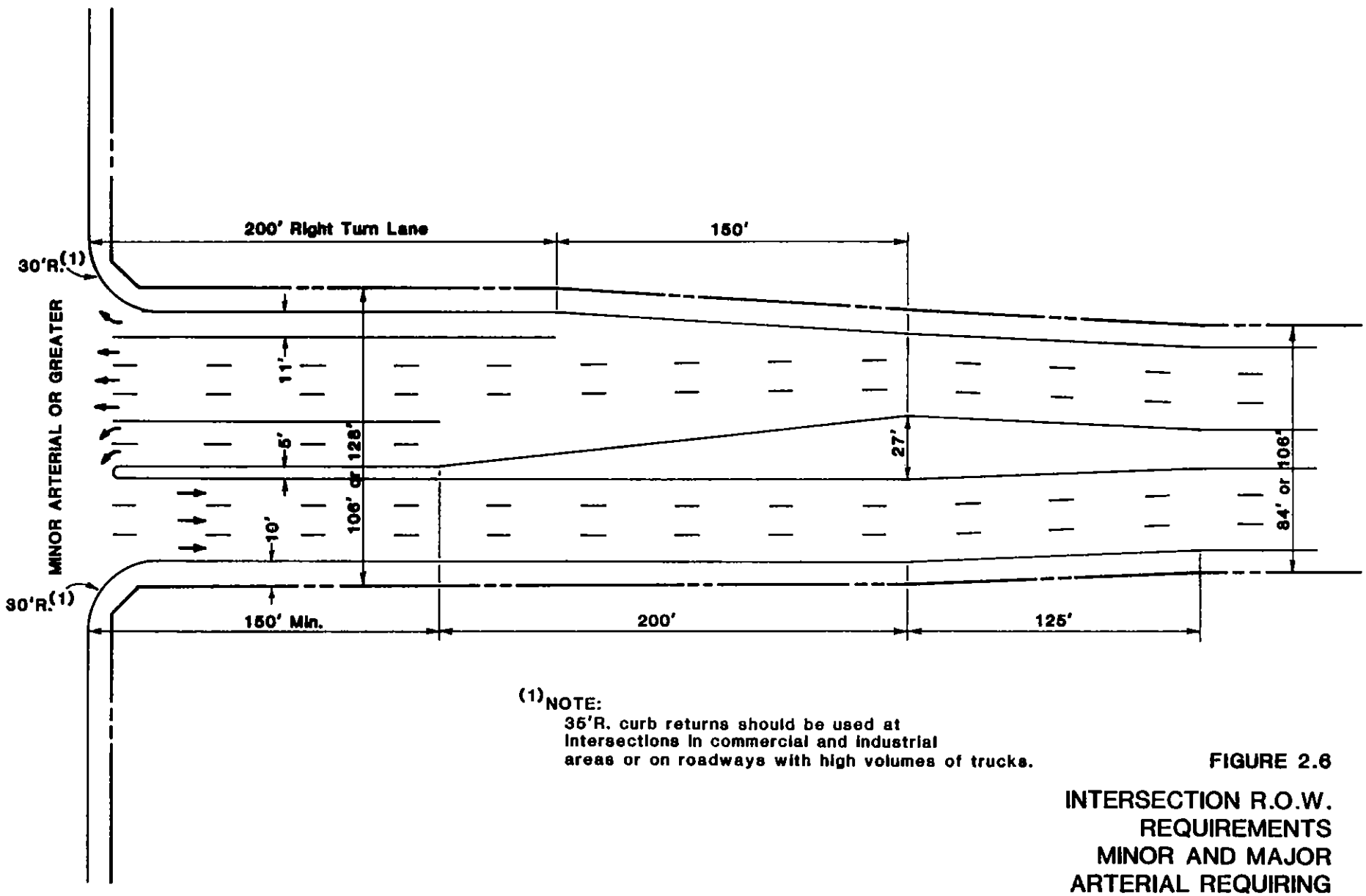


FIGURE 2.5

INTERSECTION R.O.W. REQUIREMENTS
MINOR ARTERIAL



(1) NOTE:
35'R. curb returns should be used at intersections in commercial and industrial areas or on roadways with high volumes of trucks.

FIGURE 2.6

INTERSECTION R.O.W. REQUIREMENTS MINOR AND MAJOR ARTERIAL REQUIRING LEFT-TURN LANES

and rate of super elevation (cross slope) roadway of the roadway. The minimum centerline radius is determined by the following equation:

$$R = \frac{V^2}{15\ (e+f)}$$

where:

R = radius of centerline curve (ft.)
V = roadway design speed (mph)
f = roadway side friction factor (for wet pavement)
e = rate of super elevation (ft./ft.)

Table 2.3 presents the recommended minimum horizontal centerline radius for the Town of Addison Roadway Classification.

Vertical Curvature

Crest and sag vertical curves should be designed based on recommended standards contained in the 1990 edition of A Policy on Geometric Design for Highways and Streets published by the American Association of State Highway and Transportation Officials (AASHTO).

Intersection Sight Triangle

Adequate sight distance at a driveway must be ensured. The operator of the vehicle attempting to cross a thoroughfare should have an unobstructed viewed of the entire intersection and a sufficient length of the thoroughfare to be crossed.

The minimum sight distance is based upon the perception/reaction time of the driver, vehicle operating speeds, and roadway geometry. Adequate sight distance must be ensured for four cases. Figure 2.7 shows the four conditions which are: vehicles crossing an arterial from a driveway, vehicles turning left onto an arterial from a driveway, vehicles turning right onto an arterial from a driveway and a vehicle entering a driveway by making a left turn from the arterial.

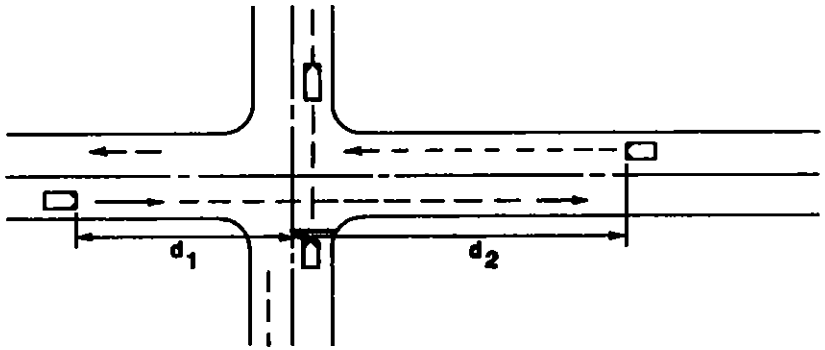
The sight distance requirements for passenger cars is based upon an eye height of 3.5 feet to the top of an object 4.25 feet above the pavement. AASHTO standards should be checked for compliance to ensure that the safe sight distance is available at a drive. Table 2.4 shows sight distances for Case A for three roadway functional classifications for 2, 4, 6, and 8 lane roadways based upon design speed.

Tables 2.5 and 2.6 shows safe sight distances for passenger cars for Cases B and C (turning left and right onto a roadway), developed by applying AASHTO standards. (Reference 1)

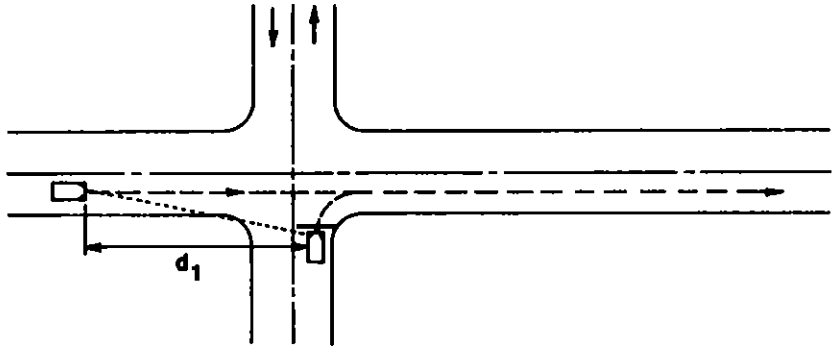
Table 2.3
MINIMUM HORIZONTAL CENTERLINE RADIUS (R)

Design Speed	f[1]	e	R Calculated	R Rounded
30	.22	-.02	300	300
35	.19	-.02	480.39	500
40	.15	-.02	820.51	850
45	.15	-.02	1038.46	1050

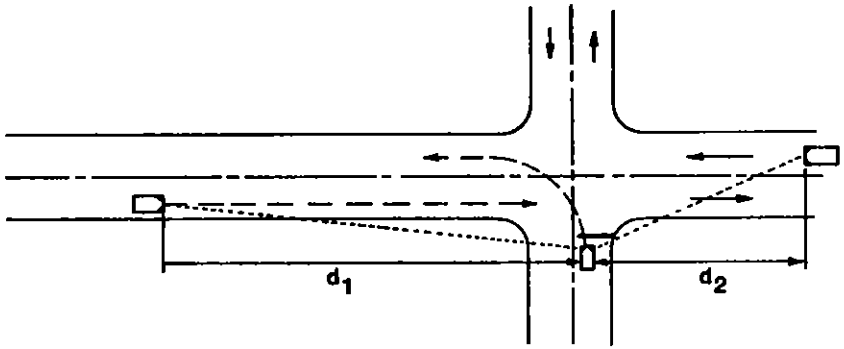
[1] Side friction factor



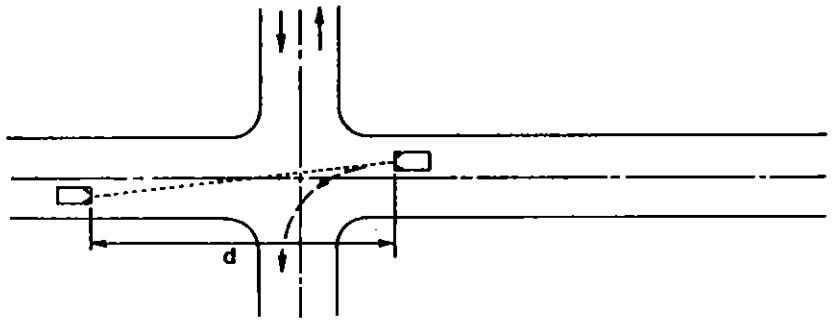
CASE A
STOPPED VEHICLE CROSSING AN ARTERIAL



CASE C
STOPPED VEHICLE TURNING RIGHT ONTO ARTERIAL



CASE B
STOPPED VEHICLE TURNING LEFT ONTO ARTERIAL



CASE D
LEFT TURNING VEHICLE ENTERING DRIVEWAY

d= sight distance

FIGURE 2.7
SIGHT DISTANCES

Table 2.4
SAFE SIGHT DISTANCE FOR PASSENGER CARS CROSSING A ROADWAY - CASE A

Functional Classification	Safe Sight Distance to the Left (d_1), Ft.				Safe Sight Distance to the Right (d_2), Ft.			
	2 Lane	4 Lane	6 Lane	8 Lane	2 Lane	4 Lane	6 Lane	8 Lane
Arterial	415[1]	450	485	525	475[1]	550	625	675
Collector	325	350	NA	NA	350	450	NA	NA
Local	225	250	NA	NA	325	375	NA	NA

[1]Applies to existing arterials not improved to standard or to transition areas.

Table 2.5
SAFE SIGHT DISTANCE FOR PASSENGER CARS TURNING LEFT ONTO A ROADWAY - CASE B

Functional Classification	Safe Sight Distance for Vehicle Turning Left	
	to the left (d_1), feet	to the right (d_2), feet
Arterial	625	950
Collector	500	570
Local	350	350

Table 2.6
SAFE SIGHT DISTANCE FOR PASSENGER CARS TURNING RIGHT ONTO A ROADWAY - CASE C

Functional Classification	Safe Sight Distance to the Left (d_1), feet
Arterial	950
Collector	570
Local	350

Tables 2.7 and 2.8 should be used to determine safe sight distances for passenger cars and semi-trailers for Case D.

The sight distances shown in Tables 2.4 to 2.8 apply when street grades are zero to 3%. When grades are greater than 3% adjustments must be made to compensate for the different distances required to reach the design speed. Table 2.9 shows adjustment to be made to sight distances based on driveway vertical grades.

Care should be taken to examine all sight obstructions and vertical curves in assessing available sight distances. Existing and proposed landscaping should be reviewed for its impact on visibility and sight lines.

Table 2.7
SAFE SIGHT DISTANCES FOR PASSENGER CARS ENTERING DRIVEWAYS BY LEFT TURNS - CASE D

Functional Classification	Safe Sight Distance in Feet[1]			
	2 Lane	4 Lane	6 Lane	8 Lane
Arterial	440	470	500	530
Collector	300	320	NA	NA
Local	190	205	NA	NA

[1]Measured from the point where a left-turning vehicle stops in the left-turn lane (Reference 12)

Table 2.8
SAFE SIGHT DISTANCES FOR SEMI-TRAILERS ENTERING DRIVEWAYS BY LEFT TURNS - CASE D

Functional Classification	Safe Sight Distance in Feet			
	2 Lane	4 Lane	6 Lane	8 Lane
Arterial	690	750	810	870
Collector	485	530	NA	NA
Local	333	360	NA	NA

[1]Measured from the point where a left-turning vehicle stops in the left-turn lane.

Table 2.9
SIGHT DISTANCE ADJUSTMENTS DUE TO GRADE[1]

Functional Classification	Upgrades (Decrease)			Downgrades (Increase)		
	3	6	10	3	6	10
Arterial	25	30	-	25	50	-
Collector	15	20	-	15	25	-
Local	10	15	20	10	20	30

Grades - Percent
Adjustments - Feet
[1]Developed by using City of Dallas standards. (Reference 3)

2.4
ACCESS CONTROL POLICY

Driveway access is a critical issue which requires a well-defined policy with proper enforcement of the guidelines to enhance traffic safety and preserve maximum available capacity on arterial roadways. Because the Town of Addison has a large percentage of its thoroughfares which carry large volumes of traffic and limited opportunity for additional roadway capacity increases, this requirement is of particular importance.

The purpose of an access control policy is to provide guidelines which apply to driveway location, driveway geometric design, the spacing of driveways for various types of roadway facilities, median opening spacing, and median opening geometric design in the Town of Addison. The majority of driveway design guidelines are the same regardless of functional classification. Elements that do warrant differing criteria by functional roadway classification are properly defined.

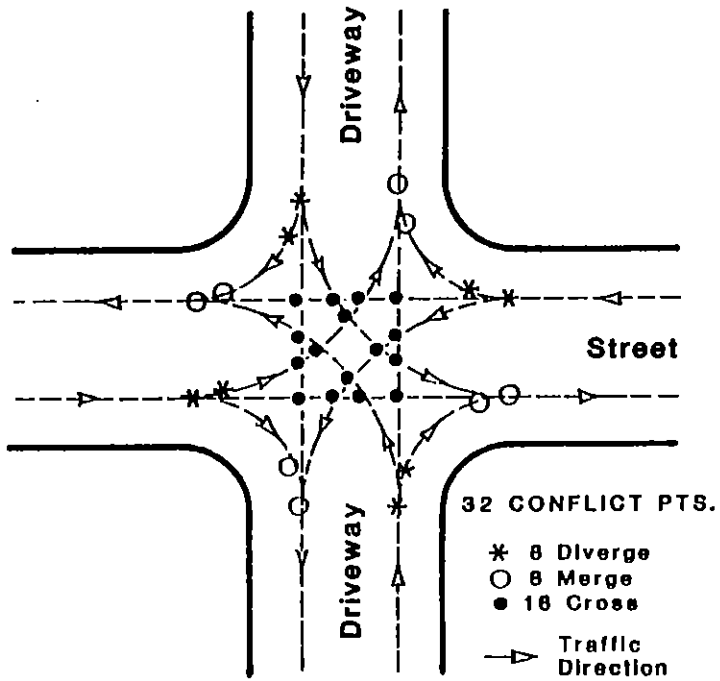
This access policy proposes to preserve the integrity of existing and future arterial roadways. Proper driveway design with enforced access control will help maintain the safe and steady flow of traffic that is so critical to achieve maximum effectiveness of the existing arterial roadway system.

Background

These guidelines have been based on existing and proposed area policies enhanced by national research findings, and recommended standards and practices of national transportation organizations as applied to conditions which do or are likely to exist in the Town of Addison.

Each driveway intersection with any street introduces conflict points into the street's traffic stream (see Figure 2.8). Research has shown conclusively that accident frequency is closely correlated with the number of conflicts in a roadway section. For this reason, driveways should be properly located in accordance with actual need and ability to provide safe roadway operation and, if necessary, proper traffic control.

Each driveway also generates "side friction" along a roadway. It has been estimated that for each two percent increase in driveway frequency, a reduction of one percent of roadway capacity results. Hence,



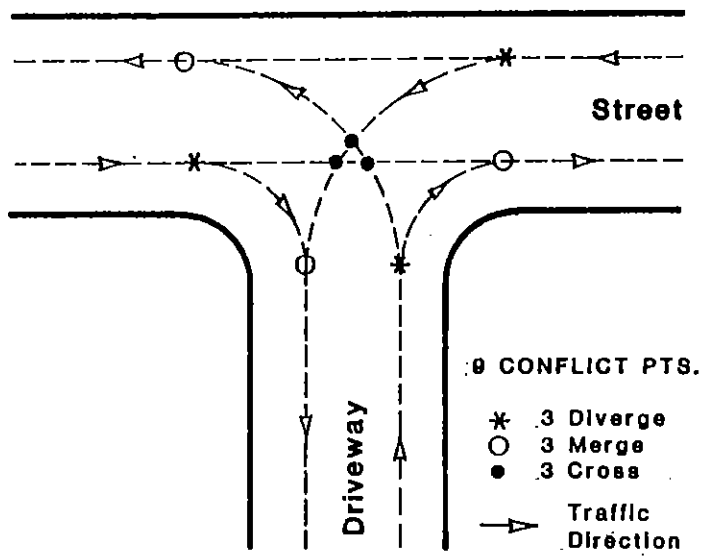


FIGURE 2.8

INTERSECTION CONFLICT POINTS DRIVEWAY/STREET

roadway capacity can be maximized by carefully determining where and how many driveways should be provided.

This recommended roadway access policy is directed toward providing both adequate property access and efficient, safe roadway operation.

Driveway Classification

Access to properties is completed through a driveway. Driveways are classified by the land use of the property and the intensity of that land use. For purposes of this Access Policy three categories of drives may be used; residential, commercial, and industrial.

Residential drives will serve all single-family land uses including duplexes, townhouses, and small multi-family complexes of up to eight units.

Commercial drives will serve all retail, office and other land uses commonly referred to as a commercial. Driveways serving multi-family complexes of more than eight units should conform to commercial rather than residential driveway standards.

Industrial driveways will serve truck traffic,and will be applied to manufacturing and truck access points at high volume commercial land uses (i.e., shopping malls).

General Driveway Access Principles

This section covers five specific areas of access policy. These are:

a. Property Access
b. Number of Access Points
c. Number of Ingress Lanes
d. Number of Egress Lanes
e. One-way Access

Within these areas the critical access and design issues are addressed.

Property Access

The number of access points to any property should be limited to one, unless it can be shown that the property will generate sufficient volumes to require two points of access that are necessary for safe internal operation on the property. Should an additional access point be needed, joint access should be sought with adjacent property owners.

Number of Access Points

Each parcel should be permitted one access point either contained wholly within the property frontage or as part of a joint access with an adjacent property. Additional points of access may be considered if adequate driveway spacing can be maintained (see

section on driveway locations) and the following conditions apply:

1. The average daily driveway volume is expected to exceed 5000 vpd (reference 8), or

2. The expected peak hour driveway volume would exceed the capacity of a stop sign controlled intersection in accordance with the 1985 Highway Capacity Manual, or

3. A professionally competent traffic analysis shows that more than one access point is needed to properly and safely serve the property.

4. Corner lots may have access points on more than on one street if warranted by a traffic analysis, subject to the defined corner clearance criteria.

Number of Ingress Lanes

At medium to high volume driveways exceeding 1000 vpd and 40 right turn ingress movements during the peak hour, it may be desirable to provide an additional ingress lane thereby widening the effective width of the throat to facilitate simultaneous left turn and right turn ingress movements.

Should a high volume driveway have two left turn ingress lanes the receiving length at the drive entrance must be a minimum of 30 feet.

Number of Egress Lanes

The number of lanes required to serve the exiting movements at a driveway location is a function of the number of vehicles expected to exit from the land use served by the driveway. Driveways should be designed with more than one egress lane if any of the following conditions are expected to be present.

1. The average daily egress traffic volume exceeds 1000 vehicles (reference 8).

2. If more than 100 vph are expected to turn left from the driveway during any hour (reference 4) and there are more than 500 vehicles on street being entered (reference 8).

One-Way Access

Access design of a one-way pair of driveways should be considered and is desirable if any of the following conditions are present or expected:

1. Roadway ADT should be greater than 10,000 vpd (reference 8).

2. The left turn volume into the driveway is

expected to exceed 40 vph and the property frontage exceeds 200 feet in length (reference 7).

Driveways

Driveways provide the link from the thoroughfare to a land use. Several design specific elements of driveways and median openings along thoroughfares are shown in Figure 2.9 and detail the applicable standards shown.

Driveway Location

Driveway location is perhaps the most critical issue pertaining to access management. Driveways spaced too closely together or to close to adjacent intersections will result in reduced capacity and increased accidents regardless of their individual design standards. A discussion of the critical drive location elements follow:

Driveway Spacing

Driveways should be spaced at distances sufficient to ensure that conflicting movements at adjacent driveways do not overlap. Adequate driveway spacing should not be difficult to maintain if property frontage is several hundred feet in length. Adjacent driveways should be spaced as far apart as access and on-site circulation needs will permit. Table 2.10 shows the minimum safe driveway spacing as a function of roadway functional classification. This spacing should be maintained to ensure safe stopping distances. Local residential street driveway spacing is based upon a 10' minimum curb return at back-to-back driveways.

Corner Clearances

Spacing between the cross-street and an access driveway should be adequate to avoid having driveway conflict areas within the intersection of the two streets.

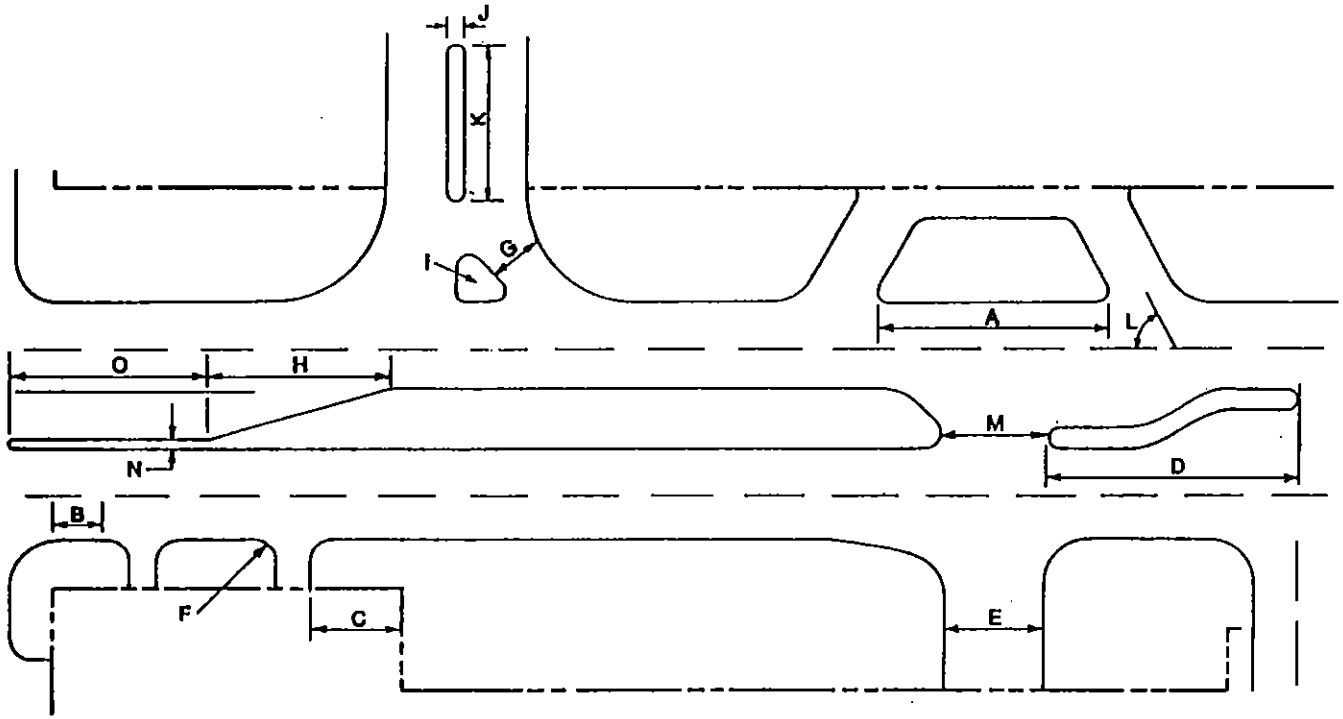
The corner clearance required is a function of the type of streets which intersect. Table 2.11 shows minimum corner clearances for arterials and collectors.

Driveways Adjacent to Right-turn Lanes

Driveways should not be permitted to exit into auxiliary turn lanes because of the difficulty in performing the weaving movement to cross the right turning vehicles. If permitted, they should be located as far from the intersection as possible.

Property Clearance

Property clearance is the distance between the property line of a parcel and the nearest edge of the nearest driveway. The minimum property clearance distance should ideally be one-half of the driveway spacing requirement to ensure proper spacing. Should



A - DRIVEWAY SPACING
B - CORNER CLEARANCE
C - PROPERTY CLEARANCE
D - MEDIAN OPENING SPACING
E - DRIVEWAY WIDTH
F - CURB RETURN RADIUS
G - TURNING ROADWAY WIDTH
H - TAPER LENGTH
I - ISLAND SIZE
J - ELONGATED ISLAND WIDTH
K - ELONGATED ISLAND LENGTH
L - DRIVEWAY ANGLE
M - MEDIAN OPENING LENGTH
N - NARROWED MEDIAN END WIDTH
O - LEFT TURN STORAGE AREA

FIGURE 2.9

DRIVEWAY DESIGN ELEMENTS

Table 2.10
MINIMUM DRIVEWAY SPACING - TWO-WAY DRIVEWAYS[1]

Functional Classification	Minimum Spacing[1]
Arterial (Major)	200
Arterial (Minor)	200
Collector (Non-Residential)	150
Collector (Residential)	20
Local (Residential)	20

[1] The two-way driveway distance given in Table 1 may be reduced to one-half the distance for adjacent one-way driveway with the inbound drive upstream from the downstream drive, excepting local residential streets. (Reference 7).

Table 2.11
CORNER CLEARANCE

Functional Classification	Intersecting With	Clearance, [1,2] (ft.)
Arterial (major and minor)	Arterial, Collector, Local	200, 125, 50
Collector (residential and commercial)	all	50
Local	all	50

[1] Corner clearance is measured from the ultimate near cross-street curb to the near driveway curb (see Figure 2.7)
[2] If the property line is less than the necessary distance from the corner to meet minimum requirements, the driveway must be located within 10' of the property line away from the corner.

a property not be of sufficient frontage to provide this distance, joint access with an adjacent property should be pursued.

The minimum property clearance should be shown in Table 2.12.

Driveway Design

Driveway Grades

The normal driveway grade within the street right-of-way is set at one-quarter inch per foot rise above the top of curb at the property line. The minimum elevation of a driveway at the right-of-way line is two inches above the top of curb. Barrier free sidewalk construction requires a maximum driveway grade as measured from the gutter of eight (8) percent. Driveways should be profiled for a distance of at least twenty feet outside the right-of-way to insure adequate replacement design.

Due to state laws requiring barrier free construction of sidewalks, steps or other abrupt changes in sidewalk, grades are prohibited at driveways.

Figure 2.10 shows the acceptable range of grades outside the right-of-way which should be maintained for a minimum of 20 feet.

Width and Curb Return Radius

Driveway width and curb return interact to affect vehicle speed and path. The selection of an appropriate width must be coordinated with curb return radii selection to achieve safe and efficient driveway operation.

Use of narrow width in combination with a short curb return radius should be avoided. Generally, if the width must be reduced, the curb return radius should be increased and vice versa.

Table 2.13 should be used to determine the curb return radius and driveway width combination that should be used for differing driveways based upon driveway classification and functional classification of the arterial roadway.

Some additional considerations regarding driveway width and curb return radii are presented below:

1. The width of the street right-of-way should not be a limiting factor in selecting the appropriate curb return radii. Curb returns should extend into private property if necessary.

2. If a commercial development is serviced by moderate truck traffic (i.e., delivery trucks), it may be desirable to provide one well-designed

Table 2.12
PROPERTY CLEARANCE REQUIREMENTS[1]

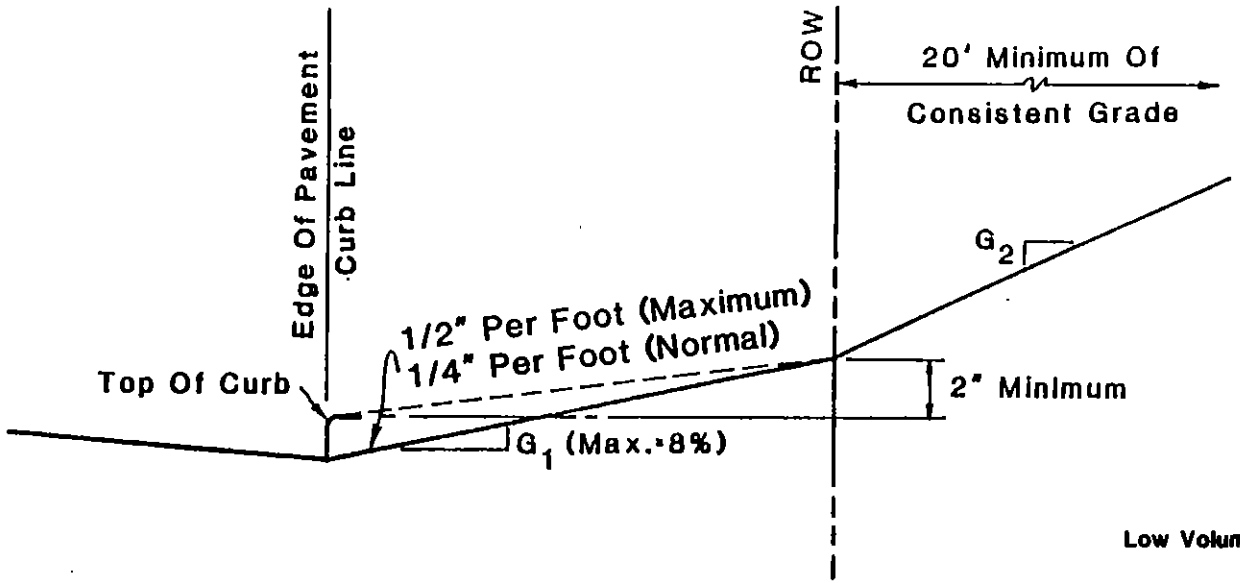
Functional Classification	Property Clearance (feet)
Arterial (major and minor)	100
Commercial/Industrial Collector	75
Residential Collector	10
Local Residential	10

[1] For single-family, duplex, and townhouse residential land uses, lots should be platted so as not to provide direct access to arterial streets.

Table 2.13
CURB RETURN RADIUS AND DRIVEWAY ENTRY WIDTH COMBINATIONS[1]

Land-Use	Design Vehicle[3]	Short Radius		Narrow Width	
		Radius	Associated Entry Width[2]	Entry Width[2]	Associated Radius
Industrial	WB-50	15′	42	20	45′
Commercial and Large MF Residential	SU	15′	26	15	35′
SF and Small MF Residential	P	10′	15	12	15′

[1] For a driveway angle of 90 degrees.
[2] Entry width should be one-half total width for two-way access points.
[3] Design vehicles
WB-50 - large semi-trailer truck
SU - single unit truck
P - passenger car



Low Volume Driveway–less than 100 veh. during peak hour in peak direction

High Volume Driveway–more than 100 veh. during peak hour in peak direction

	G_2 Maximum Range
1. Low Volume Driveway On Local Street	−10% To +14%
2. Low Volume Driveway On Collector Streets	−4% To +8%
3. High Volume Driveway Or Low Volume Driveway On Arterial Streets	−1% To +5%

FIGURE 2.10

DRIVEWAY VERTICAL GRADES

"industrial" driveway for these vehicles and prohibit their use of the other "commercial" driveways within the development.

3. At high volume industrial driveways, the use of compound curves in the curb returns is recommended by AASHTO (reference 1).

Driveway Angle

The angle at which a driveway intersects the street should be 90 degrees. If the site conditions (e.g., terrain, lot size, and shape, etc.) will not permit a 90 degree approach, the angle may be reduced to the following minimums.

Two-way:

1. 70 degrees for large multi-family complex, commercial, and industrial driveways.

2. 60 degrees for single family, duplex, townhouse, and small multi-family complex residential driveways.

One-way:

45 degrees for all driveways.

Channelization Islands And Median Dividers

Turning Roadway Width

To facilitate the ingress and egress movements on high speed arterials, islands separating right-turn movements may be used provided the pavement width is sufficient to allow the vehicle to negotiate the turns at the proper design speed (see Table 2.14). The pavement should be widened to permit the outer and inner wheel tracks of the selected design vehicle to clear the pavement gores by about 2 feet on each side.

Driveways with island separated right-turn ingress movements that will have more than 10% trucks should be designed for single-unit trucks while industrial or commercial delivery driveways should be designed for WB-50 vehicles.

Island Size

Islands should be constructed so as to be easily seen and make obvious the proper course of travel. Islands should only be constructed if they will exceed 75 square feet in area. Islands of a minimum 100 square feet are preferred.

Elongated Driveway Island Width Plus Length

When an elongated island is used as a driveway divider way, that island should have the following

Table 2.14
PAVEMENT WIDTHS FOR TURNING ROADWAYS[1]

Radius on Inner Edge of Pavement	Pavement Width (feet) for Design Vehicle		
R (feet)	Passenger Car	Single-Unit	WB-50
50	13	18	26
75	13	17	2

[1] Developed from Reference 1.

minimum dimensions.

1. Minimum island width = 5 feet
2. Minimum island length = 20 feet

This will ensure adequate island visibility and width on which traffic signs can be installed while providing adequate lateral clearance. Any island landscaping heights and densities shall be as specified in the visual obstruction regulations.

Throat Length

The required length of throat for storage will depend on two factors. These are the parking facility egress control, if any, and the gap availability on the street being entered. Egress control should be considered as a site design prerogative of the developer and normally does not impact street operations. Gap availability, if not considered in establishing driveway throat length, can result in request for police traffic control or unwarranted signalization. Police control should not be permitted as a solution to inadequate throat length.

Egress driveway lanes should be designed to accommodate outbound traffic during the most demanding peak hour condition (site outbound or street peak). Differing land uses will have differing peak parking movement distributions. These distributions affect the rate at which vehicles exit the parking locations and therefore directly affect the length of storage required to hold the vehicles until they receive an acceptable gap to enter the roadway. Table 2.15 presents the required storage for exiting driveway lanes as a function of land use and the number of total site parking spaces divided by the number of exit lanes.

Deceleration/Acceleration Lanes

Right-Turn Deceleration Lanes

Deceleration lanes for right turns into driveways may greatly ease the negative impact a drive will have on the flow of traffic on an arterial. Such a provision will enable right-turning traffic to slow to turn without risk of rear end accidents or causing following traffic to slow down.

A deceleration lane should be considered on arterials with average operating speeds of at least 35 mph or more if the following conditions apply:

1. The average peak hour inbound right turn volume is at least 120 vehicles.

2. Where several successive driveways meet condition 1 and driveway spacing is not adequate to avoid encroachment of the right-turn lane on another driveway, a continuous right-turn lane should be used.

TABLE 2.15
ON-SITE DRIVEWAY VEHICLE STORAGE LENGTHS[1]

Parking Spaces/Outbound Driveway Lane	Storage Required (feet)[2]			
	MF Residential	Retail[3]	Office	Industrial
0 - 200	25	25	25	50
200 - 400	25	50	100	150
400 - 600	50	150	200	more lanes
> 600	100	200	more lanes	more lanes

[1] Developed from Reference 7.
[2] Measured from property line.
[3] More than 700 spaces/lane will require additional outbound driveway lanes.

3. A continuous right-turn lane should be considered in a section where 20 percent of the directional volume on the arterial makes right turns.

For signalized driveway intersections, lane requirements should be based on a capacity analysis.

Right-Turn Lane Length

Deceleration lanes should be of adequate length to permit safe deceleration from the design speed to a stop within the deceleration lane. Traffic may be assumed to leave the through lane at 15 mph below the design speed. Total deceleration lane length includes length of taper. Table 2.16 shows the desired length for various design speeds.

The recommended taper lengths for left or right turns is given in Table 2.17. The transition should be accomplished using reverse curve geometry.

Table 2.16
RIGHT TURN LANE LENGTH

Functional Classification	Deceleration Lane Length Including Taper (feet)
Arterial	350
Collector	250
Local	200

Table 2.17
TRANSITION DISTANCE FOR DECELERATION

Functional Classification	Length (feet)
Arterial	150
Collector	150
Local	100

2.5
MEDIAN OPENINGS

Median Opening Spacing

The location of openings in a median to allow left-turn ingress and egress movements at a driveway or local street is a function of the type and operating speed of the roadway, volume of traffic expected to make the left-turn movements, and the location relative to other intersecting streets, driveways, and median openings.

Median openings may be permitted on divided thoroughfares at intersections with public streets and/or driveways.

The order of priority to be utilized to determine where median openings should be located is at intersections with:

1. First priority - Designated Thoroughfares
2. Second Priority - Minor Streets
3. Third Priority - Driveways

Median openings will be provided at all intersections with designated arterials and collectors. Median openings will normally be permitted at all intersections with minor streets. Priority will be given to minor streets that serve collector functions. No median opening will be permitted at a minor street or driveway if specific conditions create an unsafe intersection. Vertical and horizontal sight distance must meet minimum standards as specified in Section 2.3.

No median opening will be allowed to serve either alleys or emergency access easements and the minimum distance of an opening to an intersecting public street will be governed by the combined left-turn lane design requirements for that intersection and the median opening, as well as the functional classification of the two intersecting streets.

Median openings should not be granted unless all of the following conditions exist:

1. The property to be served has a driveway at the median opening and is a significant traffic generator with demonstrated or projected trip generation of not less than 100 left-turn ingress or 100 egress vehicles during the peak hour. (reference 7)

2. The median width is sufficient to permit construction of a left-turn storage lane.

3. The median is sufficiently long so that should exclusive left-turn lanes be needed at both ends of a median, sufficient distance will be available to properly design deceleration taper and sufficient storage lanes as shown in Table 2.18 given the recommended median length.

Median Opening Design

Median Opening Length

The nose-to-nose length of median openings is a function of turning angles and left turning radius (based on the expected traffic volume vehicle mixture, i.e., passenger cars, single unit trucks, semi-trailers, etc.). Median openings that will be expected to handle a large number of trucks should be designed to accommodate a design vehicles appropriate for the driveway. The minimum median opening length should be 60 feet.

Median End Treatment

Median noses should be of the type illustrated in Figure 2.11, with a nose end radius of 2'6" and transition radii from the full width median to the nose end radius ranging from a minimum of 50 feet to a maximum of 75 feet, depending on the design vehicle turning radius to be accommodated. The median nose should have a minimum of a 15 foot setback from the cross-street curb line for single left turn lanes and 18 feet for dual left-turn lanes.

Median Left-Turn Lane Width

Each median opening where a left-turn or U-turn movement will be permitted should be designed with a left-turn lane of sufficient storage and taper distance. Left-turn lanes constructed in the median should be a minimum width of 11 feet wide.

Left Turn Storage Requirements

The length required for left-turn storage in the median left-turn lane is a function of the number of left-turn movements, opposing through movements and, if the intersection is signalized, the cycle length and green time. Figure 2.12 shows the required storage length for various left turn and through movement conflicts at unsignalized intersections.

Table 2.18
LENGTH OF MEDIAN

Functional Classification	Cross-Street Functional Classification	Minimum Median [1] Length (feet)
Special Arterial	Residential Areas[2]	1000[5]
	Non-Residential Areas	500
Arterial	Freeway	500
	Arterial	500
	Collector	400
	Local	300
	Driveway - less than 40 ft. in width[3]	300
	- 40 ft. or more in width[4]	350
Collector	Freeway	500
	Arterial	400
	Collector	400
	Local	300
	Driveway - less than 40 ft. in width[3]	300
	- 40 ft. or more in width[4]	350

[1] Measured from end to end.
[2] Frontage consists of at least 50 percent residential on each side of street.
[3] 2-way driveway; 1-way driveway less than 20 feet in width.
[4] 2-way driveway; 1-way driveway 20 feet or more in width.
[5] Opening for left turns from the special arterial to a driveway may be permitted with a minimum median length of 500 feet; no outbound left turns from driveways will be permitted at such locations.

MEDIAN BULLET NOSE DETAIL

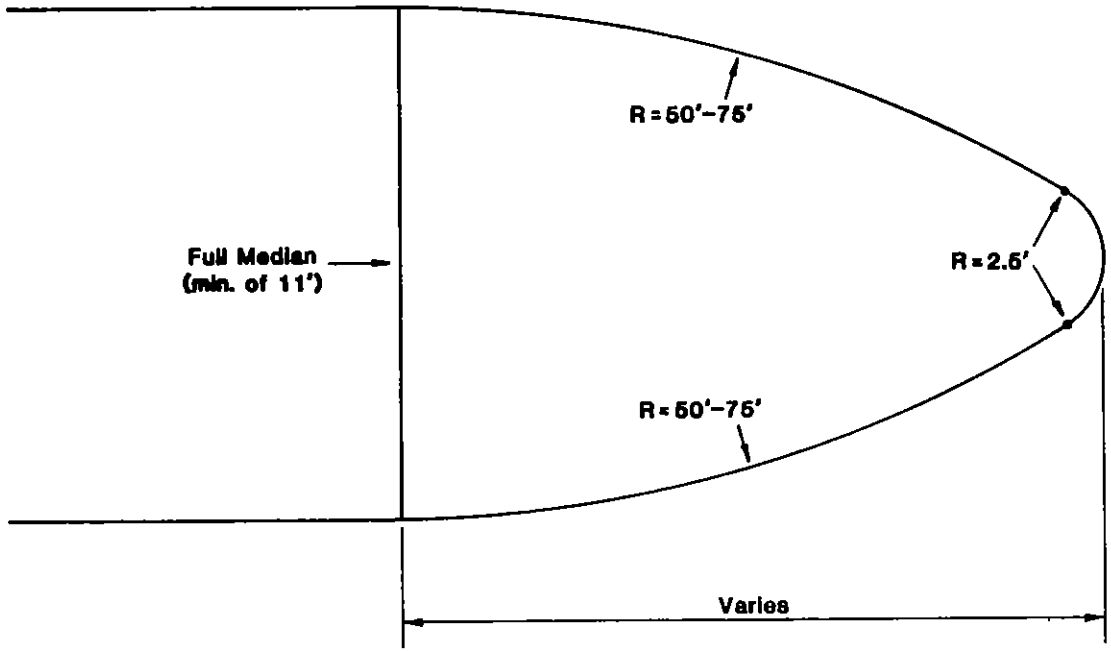


FIGURE 2.11

MEDIAN END TREATMENT

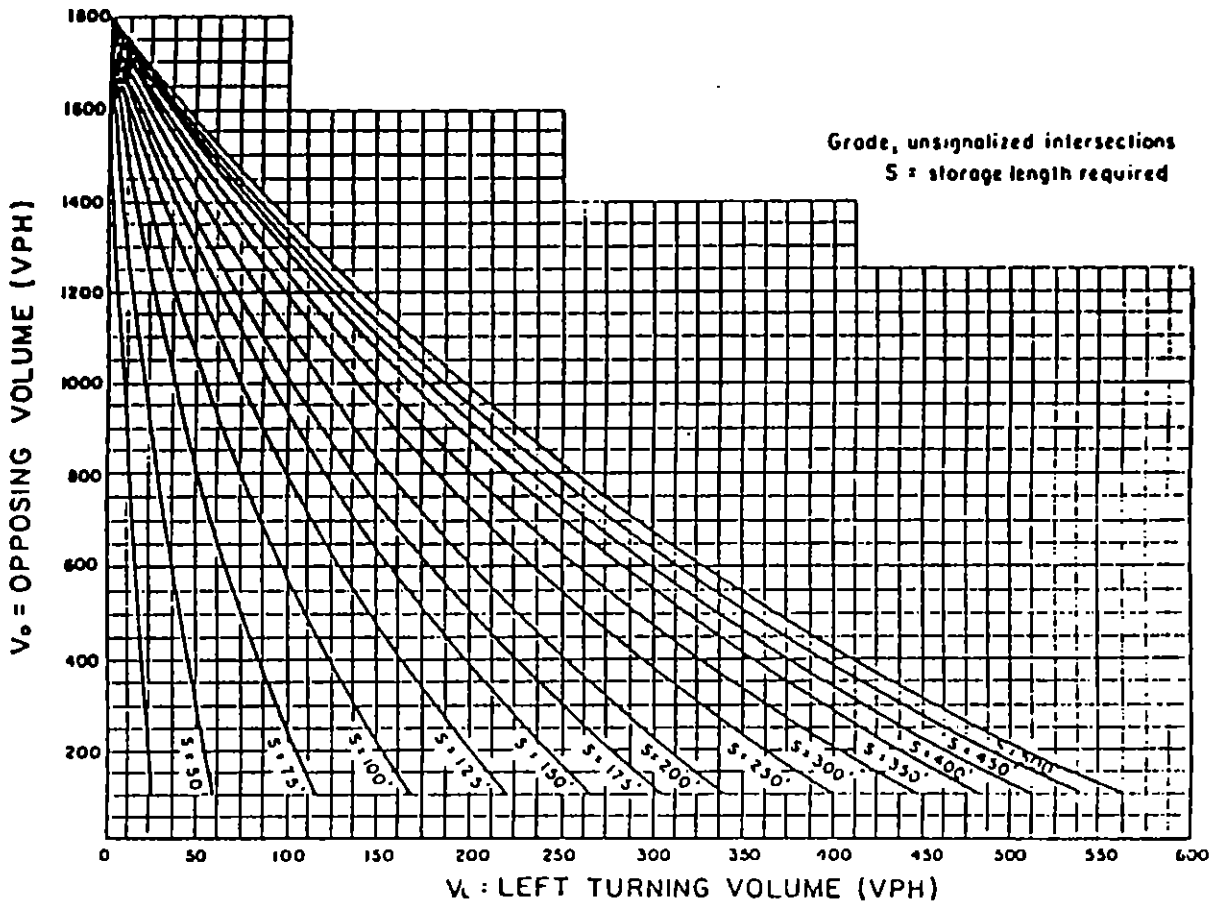


FIGURE 2.12

STORAGE LENGTH REQUIRED FOR UNSIGNALIZED LEFT-TURN LANES

2.6
TRAFFIC SIGNAL SPACING

The primary function of an arterial street is to move a large volume of through traffic as quickly, efficiently, and safely as possible. For major roadways with at-grade intersections this can best be done by providing progressive signal operation. Signal spacing and timing are two of the limiting factors in providing such operation.

Standard procedure in signal timing is to attempt to establish offsets, cycle lengths, and phasings for given conditions, as determined by existing intersection spacings. More efficient operation, however, can be obtained if the intersections are uniformly spaced within a certain optimum range. By providing for proper intersection spacing during the development of an area or, in some cases, modifying existing intersection or signal spacings, a high degree of efficiency in operation of the major roadway and flexibility of adaptation to daily volume fluctuations can be realized.

Subject to the constraints of providing reasonable access to the arterial, and avoiding excessive circuity of travel for crossing traffic, a procedure has been developed (reference 14) to define the "optimum" range of intersection spacings.

Table 2.19 gives desirable intersection spacings for different combinations of cycle lengths and speeds of progression; the numbers in parentheses are for a simultaneous system.

Table 2.19
INTERSECTION SPACING CORRESPONDENCE TO GIVEN SPEEDS AND CYCLE LENGTHS FOR THE SIGNAL ALTERNATE SIGNAL SYSTEM*

	INTERSECTION SPACING (FT) FOR CYCLE LENGTH OF:								
Speed (mph)	40 sec	50 sec	60 sec	70 sec	80 sec	90 sec	100 sec	110 sec	120 sec
25	735 (1470)	919 (1838)	1103 (2205)	1286 (2573)	1470 (2940)	1654 (3308)	1838 (3675)	2021 (4043)	2180 (4360)
30	882 (1764)	1103 (2205	1323 (2646)	1544 (3087)	1764 (1528)	1985 (3969)	2205 (4410)	2426 (4851)	2616 (5232)
35	1029 (2058)	1286 (2573)	1544 (3087)	1801 (3602)	2058 (4116)	2315 (4631)	2573 (5145)	2830 (5660)	3052 (5232)
40	1176 (2352)	1470 (2940)	1764 (3528)	2058 (4116)	2352 (4704)	2646 (5292)	2940 (5880)	3234 (6468)	3488 (6976)
45	1323 (2646)	1654 (3308)	1985 (3969)	2315 (4631)	2646 (5292)	2977 (5954)	3308 (6615)	3638 (7277)	3924 (7848)
50	1470 (2940)	1838 (3675)	2205 (4410)	2573 (5145)	2940 (5880)	3308 (6615)	3775 (7550)	4153 (8305)	4360 (8720)
55	1617 (3234)	2021 (4043)	2426 (4851)	2830 (5660)	3234 (6468)	3638 (7277)	4153 (8305)	4447 (8894)	4796 (9592)

* Numbers in parentheses are for a simultaneous system.

SECTION 3

SECTION 3

FUTURE THOROUGHFARE NEEDS

3.1
FUTURE THOROUGHFARE NEEDS

The preceding sections of this report identify roadway improvements for alleviating existing traffic congestion and provide recommended design and access control guidelines. These recommendations will allow the Town to maximize the efficiency of the existing and future thoroughfare system. However, as Addison and the surrounding area grows, the existing thoroughfare system that serves the Town must be expanded to accommodate the increased traffic volumes in an acceptable manner.

Maximize Existing System Efficiency

In order to minimize the need for costly new roadways within Addison, the efficiency and capacity of the existing roadway system must be maximized. Section 1 of this report identified specific intersection improvements to meet the demand placed on the roadway system by existing traffic volumes and travel characteristics. These intersection improvements generally provide additional lane capacity at the intersection approaches for turning vehicles. Implementation of these improvements will increase the capacity and efficiency of the intersection operation, thereby improving the capacity and efficiency of the roadway system itself.

Section 2 of this report presents recommended design and access control guidelines to aid the Town in preserving thoroughfare capacity. As vacant parcels adjacent to existing thoroughfares develop, new driveways will generate new conflict points along the roadways, reducing the capacity of the roadway. As stated in Section 2, a two percent (2%) increase in driveway volumes can result in a one percent (1%) decrease in the adjacent roadway capacity. By adhering to the access control guidelines recommended, adequate access to adjacent properties can be provided while minimizing the impact on the roadway system capacity.

In addition to the recommendations contained in this report, efficient signal timing plans should be maintained at all Addison signalized intersections. Timing plans for the Town are currently being upgraded as part of the Dallas County Signalization Project and the SDHPT Traffic Light Synchronization Program. These upgraded timing plans will provide increased efficiency on the roadway system by reducing vehicle stops and delays. As travel patterns and volumes change, these new timing plans will require updating in the future in order to maintain optimum signal timing plans.

Future Roadway Needs

In addition to maximizing existing roadway system efficiency, new roadways will be needed to meet future traffic demands. These new roadways could be constructed on new right-of-way (ROW) and alignments or could be the widening of existing facilities. Two short-term needs for new roadways currently exist within the Town of Addison. These include additional east/west capacity to relieve Belt Line Road, and additional access to and from the Quorum area, south of Belt Line. These needs are discussed separately below.

East/West Capacity

Traffic volumes on Belt Line Road currently exceed capacity during several time periods on any given day. Significant intersection improvements have been recommended along Belt Line Road to increase the capacity of this regional arterial. However, additional capacity is also needed to meet future demands.

The extension and realignment of Arapaho Road from the Dallas North Tollway (DNT) to Marsh Lane will provide additional capacity within the east/west corridor. Arapaho Road currently exists as a six-lane divided arterial from the DNT eastward past U.S. 75 (Central Expressway). For most of its length in this area, Arapaho Road generally parallels Belt Line Road. From the DNT west, Arapaho Road exists as a four-lane divided (minor arterial) roadway to Addison Road where it terminates. The current alignment and traffic controls (i.e. stop sign) of the roadway in this area severely constrains its capacity. By realigning and extending Arapaho Road westward to Marsh Lane, significant additional capacity can be added to this important corridor. Figure 3.1 illustrates the proposed alignment of this new roadway. Preliminary cost estimates for this extension are $4,852,000 for ROW acquisition and $5,511,800 for design and construction.

Quorum Area

The Quorum Area, located in the southwest quadrant of the Belt Line Road/DNT intersection is comprised of mainly mid-rise office buildings. Access to the area is currently provided from Belt Line Road via Landmark and Quorum Drives, and the southbound DNT frontage road, via Quorum Drive. The Quorum Drive intersections with Belt Line Road and the DNT provide the only signalized access to the area.

Currently during the PM peak hour, severe congestion occurs at the two signalized exits from the Quorum area, causing long delays for Quorum area employees. Additional exits are needed to alleviate this problem and provide additional capacity for future development within the area. Figure 3.2 illustrates one proposed recommendation for providing this additional roadway capacity. Preliminary estimated costs for this roadway are $1,386,000 for ROW acquisition and

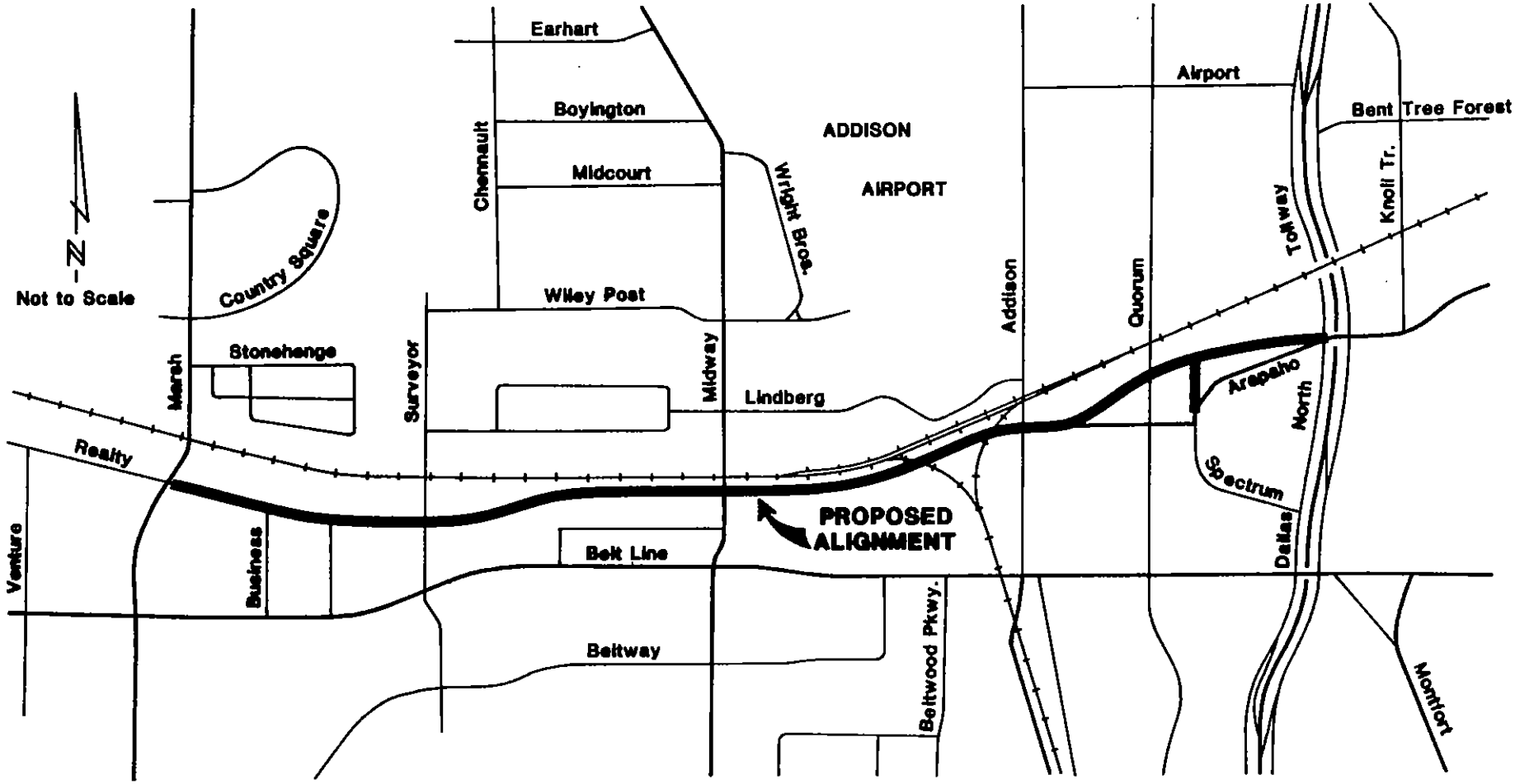


FIGURE 3.1

PROPOSED ARAPAHO ROAD
EXTENSION

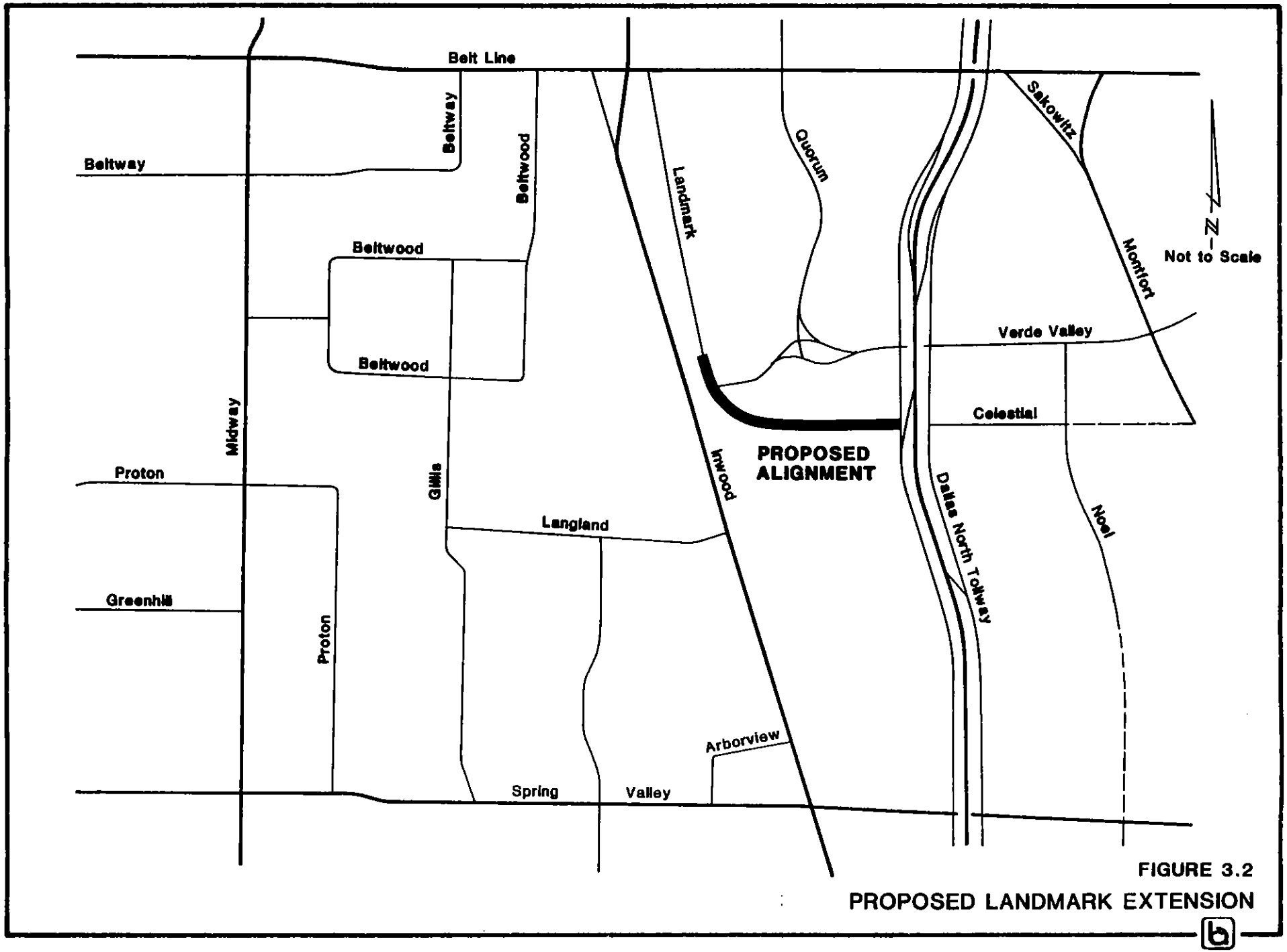


FIGURE 3.2

PROPOSED LANDMARK EXTENSION

$400,000 for design and construction.

To further distribute exiting traffic from the Quorum area, additional access should be considered to Inwood Road. Unused capacity is currently available on Inwood Road to accommodate increased demand from the Quorum area.

Town Thoroughfare Plan

The new roadways described above address immediate needs for new roadways in Addison. Longer-term needs should also be studied to determine ultimate roadway needs for the Town. Based on this study, a Thoroughfare Plan should be adopted by the Town Council to provide the mechanism for reserving ROW for these future needs. This Thoroughfare Plan should also be reviewed periodically to ensure its continued ability to efficiently meet the needs of the Town of Addison.

Additional Safety Improvements

As an additional recommendation, Figure 3.3 illustrates the proposed realignment of Quorum Drive at Keller Springs Road to provide the minimum horizontal curvature as recommended in Section 2 and increase the operational efficiency of this roadway. ROW and construction costs for this improvement are estimated to total $483,000.

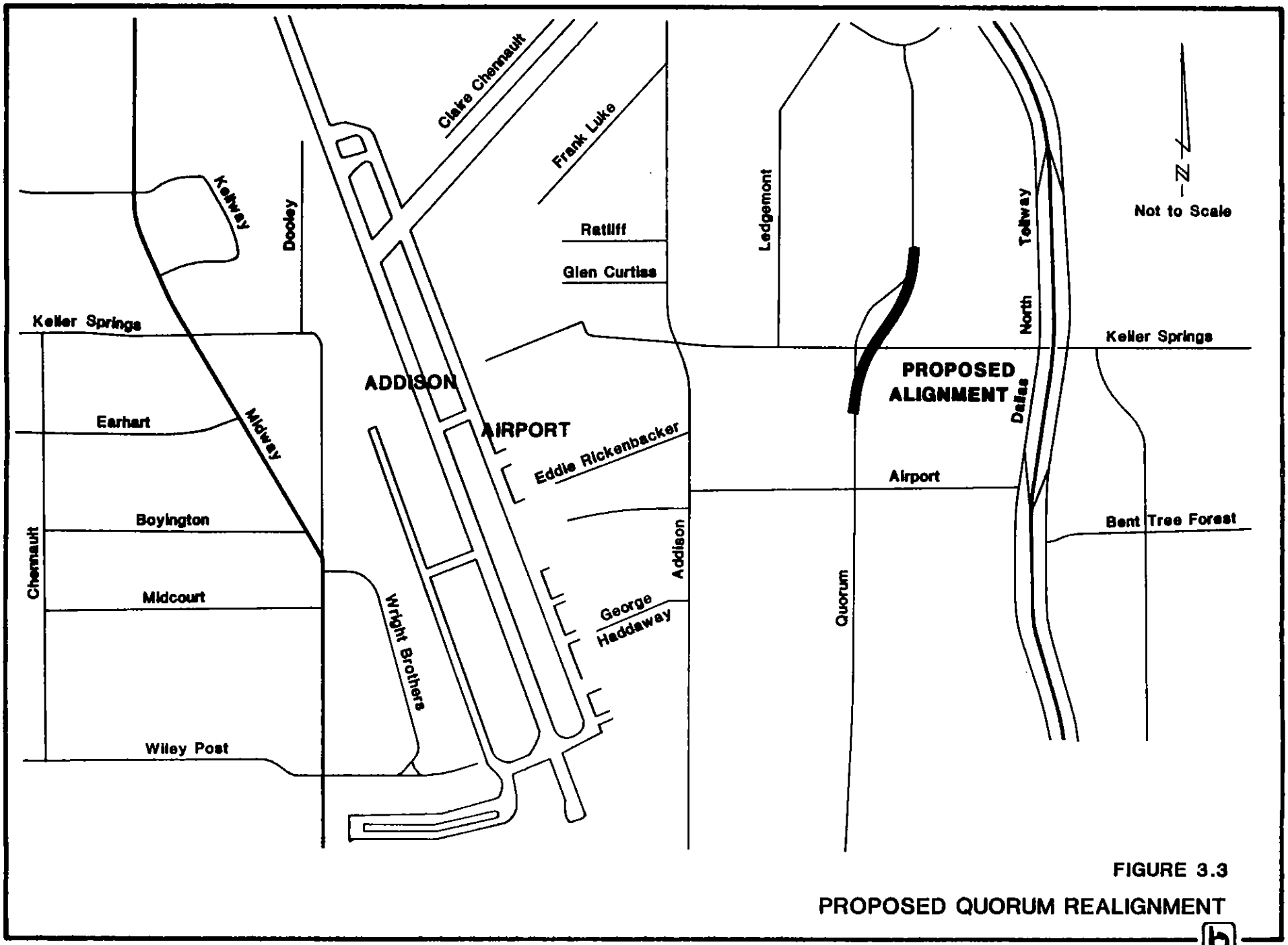


FIGURE 3.3

PROPOSED QUORUM REALIGNMENT

REFERENCES

1. American Association of State Highway and Transportation Officials. A Policy on Geometric Design of Highways and Streets, 1990, AASHTO, Washington, D.C.; 1990.

2. Arterial Driveway Access Guidelines for Glendale Heights, Barton-Aschman Associates, Inc., Evanston, Illinois, 1979.

3. Bochner, Brian S. "Regulation of Driveway Access to Arterial Streets", Evanston, Illinois: Compendium of Technical Papers, Institute of Transportation Engineers, 1978.

4. City of Dallas, Texas. Paving Design Manual, Dallas, Texas: Department of Public Works.

5. City of Dallas, Texas. Guidelines for Driveway Design and Operation, Draft.

6. City of Lakewood, Colorado. Transportation Engineering Design Standards, Lakewood, Colorado, 1985.

7. Crommelin, Robert W., Entrance-Exit Design and Control For Major Parking Facilities, "Seminar '72" Los Angeles Parking Association; Los Angeles, California, 1972.

8. Federal Highway Administration. Access Management for Streets and Highways, National Technical Information Service, Springfield, Virginia, 1982.

9. Federal Highway Administration. Evaluation of Techniques for the Control of Direct Access to Arterial Highways, Final Report. National Technical Information Service, Springfield, Virginia, 1975.

10. Federal Highway Administration. Technical Guidelines for the Control of Direct Access to Arterial Highways, Volume I: General Framework for Implementating Access Control Techniques. National Technical Information Service, Springfield, Virginia, 1975.

11. Federal Highway Administration. Technical Guidelines for the Control of Direct Access to Arterial Highways, Volume II: Detailed Description of Access Control Techniques. National Technical Information Service, Springfield, Virginia, 1975.

12. Institute of Transportation Engineers. Guidelines for Driveway Design and Location, Institute of Transportation Engineers, Washington, D.C., 1985.

13. Institute of Transportation Engineers. Guidelines for Urban Major Street Design, A Recommended Practice, Institute of Transportation Engineers, Washington, D.C., 1984.

14. Highway Research Board. National Cooperative Highway Research Program Report 93, Guidelines for Medial and Marginal Access Control on Major Roadways, Highway Research Board, Washington, D.C., 1970.

mail

LETTER OF TRANSMITTAL

BARTON-ASCHMAN ASSOCIATES, INC.
5485 Belt Line Road, Suite 199
Dallas, Texas 75240
(214) 991-1900

DATE	04 | 22 | 91
JOB NO.	9181.50.01
ATTENTION	John Baumgartner
RE:	Addison Thoroughfare Plan Detailed Fee Estimate

TO Town of Addison
16801 Westgrove Dr.
Addison, Tx 75001

GENTLEMEN:

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1			Detailed Fee Estimate
1			Proposed Schedule

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS Call if you have questions

COPY TO _____

SIGNED: [signature]

If enclosures are not as noted, kindly notify us at once.

TOWN OF ADDISON THOROGHFARE PLAN
FEE ESTIMATE (PERSON-HOURS)
04/15/91

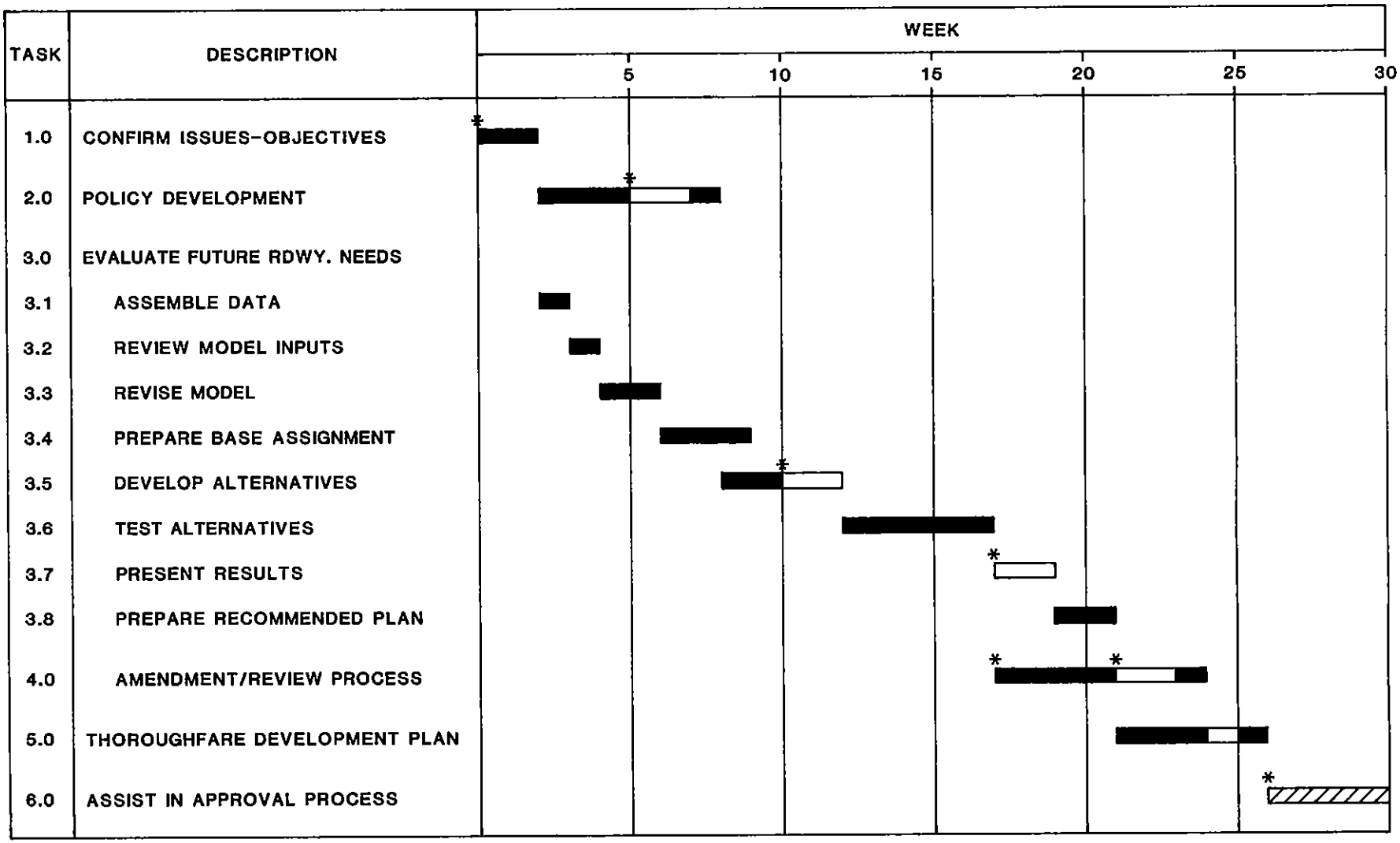
TASK	DESCRIPTION	GDJ	RCW	KMG	TECH	CLER	TOTAL HOURS
1.0	ISSUES AND OBJECTIVES	12	12	4		4	32
2.0	POLICY DEVELOPMENT						
2.1	EXISTING POLICIES	1	2	4			7
2.2	IDENTIFY NEW POLICIES	3	6				9
2.3	PREPARE MEMORANDUM	0	6	2		4	12
2.4	TOWN COUNCIL APPROVA	2	2	2			6
3.0	EVAL. FUTURE RDWY NEEDS						
3.1	ASSEMBLE DATA			16			16
3.2	REVIEW MODEL INPUTS		8	8			16
3.3	REVISE MODEL		8	40			48
3.4	EVAL. 1990 ASSIGNMENT	2	4	8			14
3.5	DEVELOP ALTERNATIVES	6	8	8			22
3.6	TEST ALTERNATIVES	4	6	12			22
3.7	PRESENT RESULTS	2	2	4			8
3.8	REVISE PREFERRED PLAN	2	4	8		4	18
4.0	AMENDMENT/REVIEW PROCESS						
4.1	MEET WITH TOWN STAFF	2	2	2			6
4.2	DRAFT AMEND. PROCESS	4	16	10			30
4.3	REVISE AS NEEDED	2	4	4		4	14
5.0	THOR. DEVELOPMENT PLAN						
5.1	ASSEMBLE RESULTS	2	4	8			14
5.2	SUBMIT DRAFT PLAN	6	8	10			24
5.3	PREPARE MAP	2	4	24	24	8	62
6.0	APPROVAL PROCESS						
6.1	PREPARE PRESENTATION	4	4	4	26	4	42
6.2	MAKE PRESENTATIONS	4	4	4			12
		60	114	182	50	28	434

TOTAL ESTIMATED FEE

LABOR	32000.56
NCTCOG	5000.00
DIRECT EXPENSES	500.00
	37500.56

ESTIMATED FEE PER TASK	LABOR	NCTCOG	EXPENSE	TOTAL
TASK 1: ISSUES AND OBJECTIVES	2808.36		50.00	2858.36
TASK 2: POLICY DEVELOPMENT	2808.34		50.00	2858.34
TASK 3: EVALUATE FUTURE ROADWAY NEEDS	11970.40	5000.00	150.00	17120.40
TASK 4: THOROUGHFARE AMENDMENT/REVIEW PROCE	4080.44		100.00	4180.44
TASK 5: THOROUGHFARE DEVELOPMENT PLAN	6706.66		100.00	6806.66
TASK 6: ASSIST IN APPROVAL PROCESS	3626.36		50.00	3676.36
	32000.56	5000.00	500.00	37500.56

TOWN OF ADDISON
THOROUGHFARE PLAN STUDY
PROPOSED PROJECT SCHEDULE



LEGEND

* Staff and/or Steering Comm. Mtg.

▭ Review by Staff and/or Steering Comm.

Barton-Aschman Associates, Inc.

5485 Belt Line Road, Suite 199
Dallas, Texas 75240
USA

Phone: (214) 991-1900
Fax: (214) 490-9261
Metro: 263-9138

March 6, 1991

Mr. Robin Jones
Director of Streets
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

RE: Proposal to Prepare Town of Addison Thoroughfare Plan

Dear Mr. Jones:

Barton-Aschman Associates, Inc. is pleased to submit this proposal to provide professional engineering services in connection with the preparation for a Thoroughfare Development Plan for the Town of Addison, Texas. Such a plan will provide Town staff with the information required to develop the transportation system necessary to accommodate future travel demands within the Town.

During its forty year history, Barton-Aschman has conducted hundreds of thoroughfare plan studies similar to the proposed Town of Addison Study. Our experience ranges from large cities such as Dallas to small, suburban cities such as Coppell. The project staff proposed for this project has worked with all of the cities which surround Addison and are very familiar with their thoroughfare systems. Barton-Aschman will be assisted on this project by the North Central Texas Council of Governments (NCTCOG). The NCTCOG brings to this study the Dallas-Fort Worth Regional, and specific North Dallas area travel demand forecasting capabilities and expertise which will be necessary to accurately forecast future travel demand within the Town.

This letter presents our approach, proposed work program, and fee estimate for the development of a thoroughfare plan for the Town of Addison. If accepted, this letter will become an agreement between the Town of Addison and Barton-Aschman Associates, Inc. to provide the services outlined in the work program.

APPROACH

The approach we propose for preparation of the Town of Addison's Thoroughfare Plan has worked successfully for our clients elsewhere. Our approach uses a base of relevant issues to be addressed, and sound, technical analysis to develop a plan that will provide the transportation system to meet the Town's goals.

Our approach is straightforward, and involves the following steps:

1. Search out all real and perceived issues related to the thoroughfare plan, the planning process, and its implementation.

2. Utilize an objective, understandable, logical, and responsive planning process and highly qualified, credible staff with prior success to prepare the plan and interface with Town staff and decision makers.

3. Involve the Town staff (and Town Council members and other representatives, if desired) to help maximize knowledge of the process and credibility with the public.

4. Prepare a set of policies and plans which clearly meet local objectives, respond to specific concerns, and can be justified technically.

We have found that this type of process is effective.

Technically, our approach is based on the following process:

1. Maximize the use of information assembled as part of the Addison Bottleneck study.

2. Prepare a set of (draft, and later, final) policies which will guide the development of the thoroughfare plan. For example, a policy might be able to "maximize use of TSM measures in any area or corridor before considering major capital improvements".

3. Build from both processes and the extensive data base that the NCTCOG has developed over the years to provide relevant analysis tools.

4. Conduct the detailed technical analyses which will support the development of the actual plan (map, standards, and implementation policies and guidelines) and review it at strategic points with the Town staff and public decision makers.

5. Develop mechanisms of maintaining flexibility, assessing impacts of development and thoroughfare plan changes, and maintaining or increasing plan and system effectiveness.

WORK PROGRAM

Based upon our understanding of the needs of this project, and our extensive experience as conducting similar studies, we have prepared a work program which comprehensively evaluates the future roadway needs of the Town. Our proposed work program is contained in the following six distinct tasks:

Task 1:	Confirm Issues and Objectives
Task 2:	Develop Policies
Task 3:	Evaluate Future Roadway Needs
Task 4:	Develop Thoroughfare Amendment and Review Process
Task 5:	Prepare Thoroughfare Development Plan
Task 6:	Assist in Approval Process

Each of these tasks is discussed in the following paragraphs:

TASK 1: CONFIRM ISSUES AND OBJECTIVES

Purpose: To identify specific issues to be addressed in the study and develop goals and objectives for the thoroughfare development plan.

Activities:

1.1 Meet with Town staff and key persons selected by staff (i.e. Town Council members, neighborhood association representatives, local developers, etc.) to discuss specific issues (i.e. areas of concern) to be addressed during the study. During this meeting the goals of objectives of the thoroughfare plan will be discussed.

NOTE: This group could serve as a steering committee throughout the study. Periodic presentations to and feedback from this group could greatly enhance the success of the final plan.

1.2 Review results of the Addison Bottleneck study with the steering committee. Specific study results to be discussed are assessment of existing thoroughfare system, recommended improvements, and roadway design and access control standards.

1.3 Prepare and submit memorandum outlining goals and objectives to address issues.

TASK 2: POLICY DEVELOPMENT

Purpose: To assess the effectiveness of current written or unwritten roadway planning polices, develop new policies if necessary, and prepare planning policies issue paper.

Activities:

2.1 Develop, in conjunction with Town staff, a tabulation of policies and procedures which are currently being applied in the thoroughfare planning decision making process.

2.2 Determine the basis or reason of application of these policies, as well as any problems or opportunities associated with them. Identify additional policies and modifications to existing policies necessary to address goals and objectives identified in Task 1.

2.3 Prepare and submit issues paper documenting results of investigations of present policies with recommendations for new or revised policies.

2.4 Following review by Town staff (and/or steering committee), incorporate new and revised policies into appropriate formats and submit to Town Council for approval.

NOTE: Legal review of proposed policies will be necessary prior to approval by the Town Council.

TASK 3: EVALUATE FUTURE ROADWAY NEEDS

Purpose: To identify future thoroughfare needs and evaluate alternative roadway systems to satisfy these needs.

Activities:

3.1 Assemble existing and projected input data to NCTCOG travel forecasting models.

3.2 Review existing and projected population and employment data, model zone structure, and roadways networks. Identify planning horizon year.

3.3 Revise model input data where appropriate to meet specific Town needs.

3.4 Calibrate 1990 base model for use in evaluating future thoroughfare alternatives.

3.5 Develop thoroughfare alternatives to meet specific issues and/or subarea needs (i.e. Quorum area). Three alternative networks will be modeled. Two additional model runs are proposed to evaluate specific refinements after each model run, results will be discussed with staff for selected horizon year.

3.6 Test and evaluate results of each thoroughfare alternative.

3.7 Prepare and present to steering committee results of evaluation and recommended plan.

3.8 Revise recommended plan, as appropriate, based on steering committee comments.

TASK 4: THOROUGHFARE AMENDMENT AND REVIEW PROCESS

Purpose: To provide necessary procedures and analytical tools to assist staff in the continuing process of plan review and amendment.

Activities:

4.1 Meet with Town staff to discuss amendment process and present typical procedures and analytical tools for evaluating requested changes.

4.2 Based on discussions in Task 4.1, prepare and submit draft thoroughfare amendment process and technical analysis procedures.

4.3 Meet with staff to discuss comments and revise procedures.

TASK 5: THOROUGHFARE DEVELOPMENT PLAN

Purpose: To prepare thoroughfare development plan document for approved.

Activities:

5.1 Assemble results of study into final transportation development plan document. Information will include:

- thoroughfare planning policies
- roadway classification system
- roadway design standards
- access control guidelines
- recommended thoroughfare plan
- thoroughfare amendment procedures

5.2 Submit to Town staff for review (NOTE: it is anticipated that this review will be for format only. All elements in the thoroughfare plan will have been previously reviewed by Town staff and/or steering committee.

5.3 In addition to plan document, prepare and submit large scale thoroughfare plan map, in reproducible form, to staff.

TASK 6: ASSIST IN APPROVAL PROCESS

Purpose: To present study procedures, findings, recommendations and conclusions to aid in approval of the plan.

Activities:

6.1 Prepare presentation of study procedures, findings, and recommendation.

6.2 Make presentations, as directed by Town staff, to interested groups.

FEE ESTIMATE

Our fee for completing the Scope of Services outlined above will be based on our hourly rates current at the time of performance, for staff services rendered. Based on our experience in studies of this type, we estimate that the fee for completion of tasks 1 through 6 will be $37,500. We will not exceed this fee without receiving your prior authorization. If the need for extra services should arise, we will seek your authorization and, before proceeding and if requested, we will supply you with our estimate of the fee to be incurred.

Direct reimbursement for out-of-pocket expenses such as travel, reproduction, etc., will be billed at cost and will be added to staff time costs incurred on the project.

Billing for services will be submitted monthly and will be due and payable upon receipt. Billings which are not paid within 30 days will bear interest at the rate of 1.5 percent per month.

AUTHORIZATION AND SCHEDULE

We will initiate work on this project immediately upon receipt of a signed copy of this letter of agreement. We estimate that the Thoroughfare Development Plan can be completed within eighteen (18) weeks of the notice to proceed. The proposed project schedule is attached.

We sincerely appreciate the opportunity to provide this proposal and look forward to working with the Town of Addison staff on this project. If you have any questions regarding this proposal, please do not hesitate to call.

Sincerely,

BARTON-ASCHMAN ASSOCIATES, INC.

Gary D. Jost, P.E.
Principal Associate

Robert C. Wunderlich, P.E.
Senior Associate

GDJ/RCW:tdb

ACCEPTED AND APPROVED BY:

_____
(Signature)

_____
(Printed or Typed Name)

_____
(Title)

AUTHORIZED TO EXECUTE AGREEMENTS FOR:

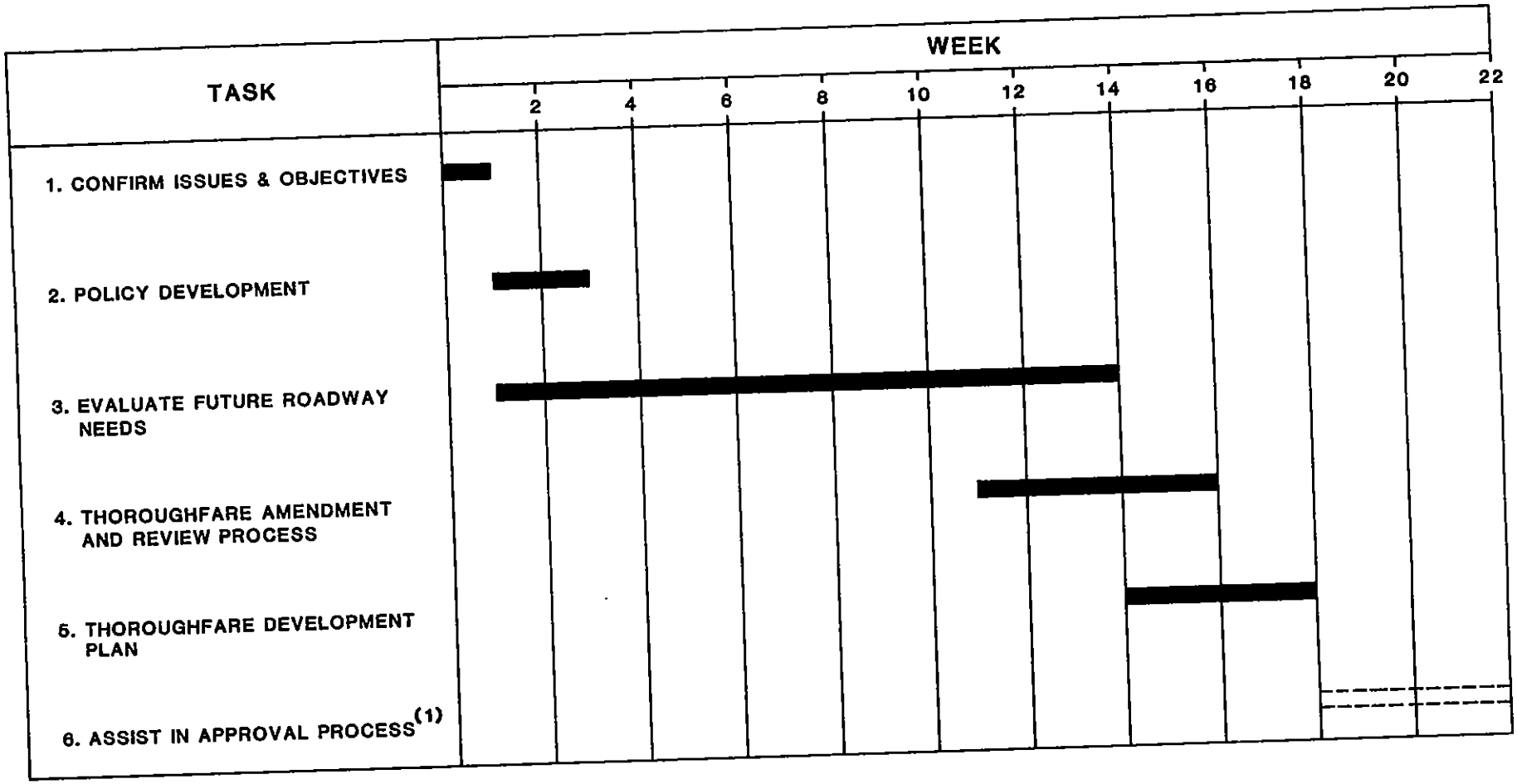
_____
(Organization)

Date:_____

_____
(Title)

TOWN OF ADDISON
THOROUGHFARE PLAN STUDY

PROPOSED PROJECT SCHEDULE



(1) AS REQUESTED BY TOWN STAFF