2000-1 Addison Circle

Roundabout Design & Operational Review (Lee Engineering) - 2005

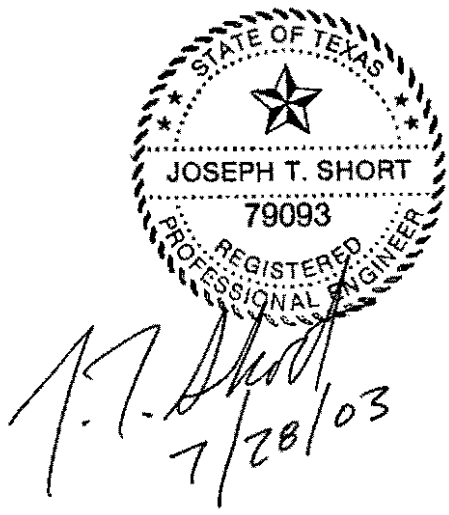
ADDISON CIRCLE

DESIGN, OPERATIONS, AND SAFETY REVIEW

Performed For:
Town of Addison
16801 Westgrove Drive
Addison, TX 75001

Prepared By:
Lee Engineering, L.L.C.
17440 Dallas Parkway, Suite 204
Dallas, TX 75287

July 2003



EXECUTIVE SUMMARY

The Town of Addison constructed one of the first implementations of the modern roundabout in the Dallas/Ft. Worth metropolitan area in the late 1990s. Located at the intersection of Addison Circle and Quorum Drive, the roundabout serves as the focal point of the mixed-use Addison Circle development. The Town of Addison contracted Lee Engineering to evaluate the design, operations, and safety of the Addison Circle roundabout.

Lee Engineering studied the Addison Circle roundabout in May and June of 2003. Traffic counts, design plan review, aerial photography, on-site observation, and crash history data were all used in the assessment of the design, operations, and safety of the Addison Circle Roundabout.

Currently, over 15,000 vehicles travel through the roundabout on a typical workday. Approximately 1,600 vehicles use the roundabout during the 5:00 PM hour, with almost 950 of those vehicles traveling through the roundabout while northbound on Quorum Drive. The roundabout currently has excess capacity and motorists experience very little delay, regardless of the time of day that they use the roundabout.

Very few crash reports are available for the roundabout as most crashes are minor in nature and do not result in the completion of an official police report. On-site observation and conversations with Addison Police Officers reveal that the northbound exit point is a frequent vehicular conflict point on the roundabout.

The Addison Circle roundabout conforms well to modern roundabout geometric guidelines, operates far better than stop or signal control, and is extremely safe as evidenced by the lack of a single injury crash at the roundabout.

Several recommended improvements were identified to address minor operational issues. These improvements include:

- Pedestrian activity was significant in the area; however, many pedestrians do not use the existing crosswalks present on the roundabout approaches. Landscaping improvements could encourage pedestrians to use the existing crosswalks.
- Many warning and guide signs have been obscured by the growth of foliage in the area. The existing pavement markings on the approaches to the roundabout need to be refurbished.
- The northbound and southbound entry points should be marked as two-lane entries to correspond with motorists' existing usage.
- A lane line within the roundabout that corresponds to the northbound through traffic movement along with modifications to the northbound and southbound approach guide signs with suggested lane usage should mitigate the northbound vehicular conflict point.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Project Description

Modern roundabouts have been widely used in several countries for many years and during the past decade have begun to gain acceptance in the United States because they provide an effective means of traffic control. Roundabouts can offer a number of benefits over traditional signal or stop controlled intersections through their safety performance, reduced operation and maintenance costs, and operational enhancements.

In the late 1990s, the Town of Addison constructed a double lane roundabout to control traffic flow through the Quorum Drive and Addison Circle intersection, their first implementation of this device. The roundabout serves a four-lane divided roadway, Quorum Drive, and a two-lane undivided roadway, Addison Circle. The roundabout is the focal point of the Addison Circle mixed-use development.

Lee Engineering was selected to analyze the current roundabout design, operation, and safety in order to investigate any potential improvements for the facility.

1.2 Summary of Tasks Performed

The tasks below summarize the scope of this project:

1. Data Collection – Lee Engineering inventoried and photographed the existing signing and markings on each approach and along the circulating roadway. A recent aerial photograph of the roundabout was acquired for use during the study. Lee collected 24-hour traffic counts on each approach and departure from the circle as well as at one location on the circulating roadway on a typical weekday. Peak period traffic operations were also observed. All crash data available for the roundabout and for each approach to the roundabout was gathered from the Addison Police Department.
2. Design Review – Lee Engineering compared design plans with inventoried roundabout features and aerial photographs. Design features such as approach widths, circulating roadway widths, signing, and pavements markings were compared with recommended practices from the FHWA publication, *Roundabouts: An Informational Guide* and the current *Texas Manual of Uniform Traffic Control Devices*. As part of the design review, we identified the shortest path through the roundabout from each approach. The design speeds along each of these paths was calculated and compared to identify any significant discrepancies in speeds between vehicles entering the roundabout from each approach. Based on this review we identified recommended modifications to the existing signing and markings at the roundabout that may help guide motorists through the roundabout.
3. Operational Analysis – Lee Engineering performed capacity analyses for the peak periods at the roundabout. These analyses focused on each merge point around the roundabout.

4. Safety Analysis – Lee Engineering reviewed crash records for the roundabout. The types, locations, frequencies, and rates of crashes were summarized. The records were also reviewed to identify the cited causes of the crashes.
5. Documentation – This report is the summary of our findings and recommendations as they relate to the Addison Circle roundabout.

2. DATA COLLECTION

2.1 Introduction

Data collection at the Addison Circle roundabout was conducted to provide a benchmark for the performance level of the facility and determine its current design, safety, and operational characteristics. An aerial photograph of the roundabout can be found in ***Figure 1***. Data was collected using procedures outlined in the FHWA publication *Roundabouts: An Informational Guide*.

The following data was collected for use in the analysis:

- 24-Hour Volume counts at all approaches and departures;
- 24-Hour Volume count at one location on the circulatory roadway;
- On-site vehicle observations of driver behavior and truck performance;
- On-site observations of pedestrian and bicycle activity;
- On-site inventory of signing and pavement markings; and
- Crash history

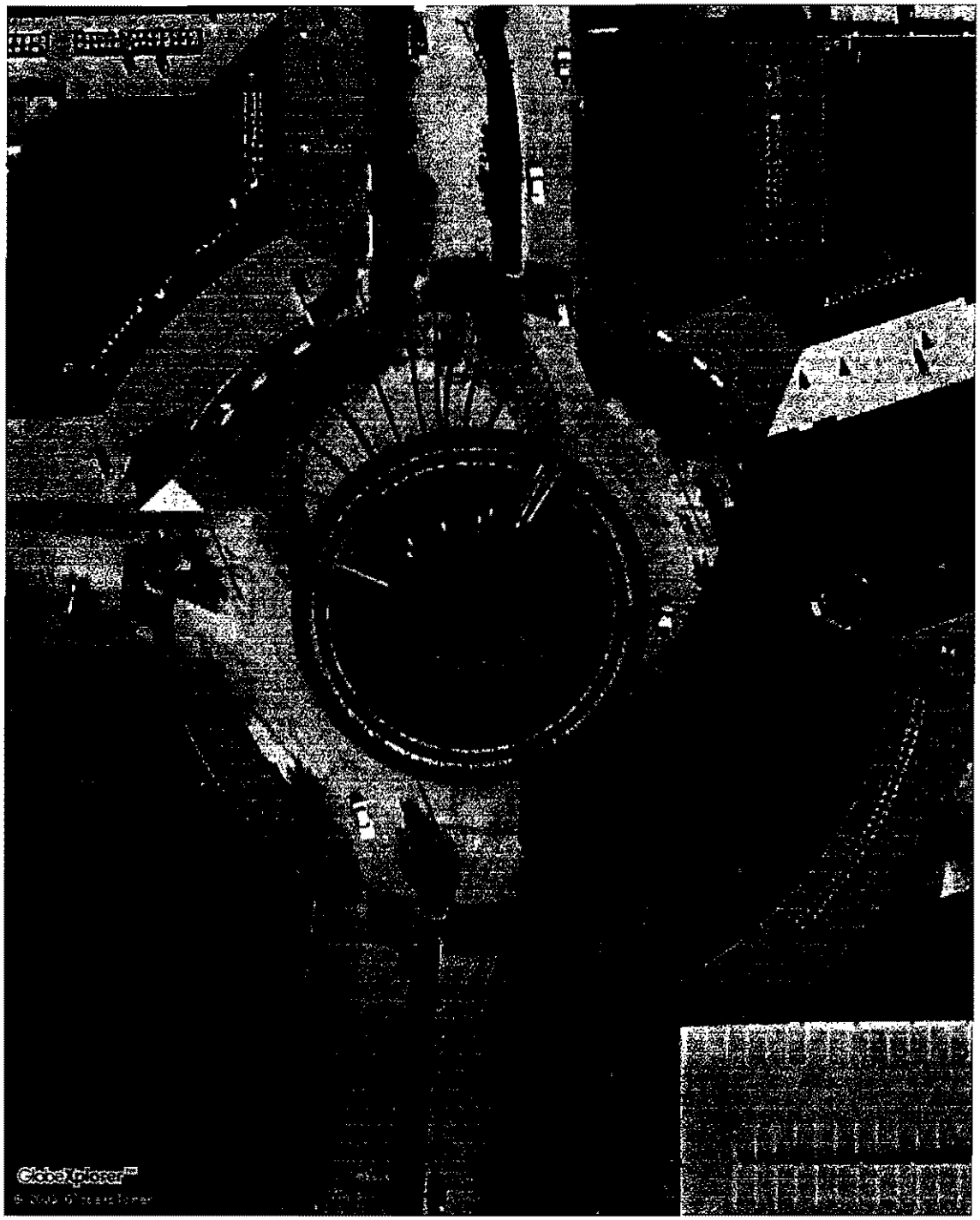
Below is a description of the activities, methodologies, and results obtained for the data collection.

2.2 24-Hour Volume Counts

To determine the volume of traffic using the Addison Circle roundabout, 24-hour traffic counts were performed on the approach and exit legs of the roundabout as well as on the circulatory roadway within the roundabout. The traffic counters were strategically placed so that all conflicting movements could be directly or indirectly obtained for each approach and departure roadway. The interior count was performed adjacent to the splitter island on the northbound approach. The 24-hour counts were performed on Thursday May 22, 2003. ***Figure 2*** presents a diagrammatic representation of the AM peak hour and PM peak hour volumes counted at the roundabout. The peak hours for this roundabout were from 7:45 AM to 8:45 AM in the morning and from 5:00 PM to 6:00 PM in the evening. The collected volumes for the roundabout appear in ***Table 1***.

Observations conducted during this data collection effort identified construction activity adjacent to Addison Circle and Quorum Drive to the southwest of the roundabout. This construction work was confined to off-street areas and was not considered to have a detrimental effect on the volume data being collected.

FIGURE 1:
Aerial View of Addison Circle roundabout



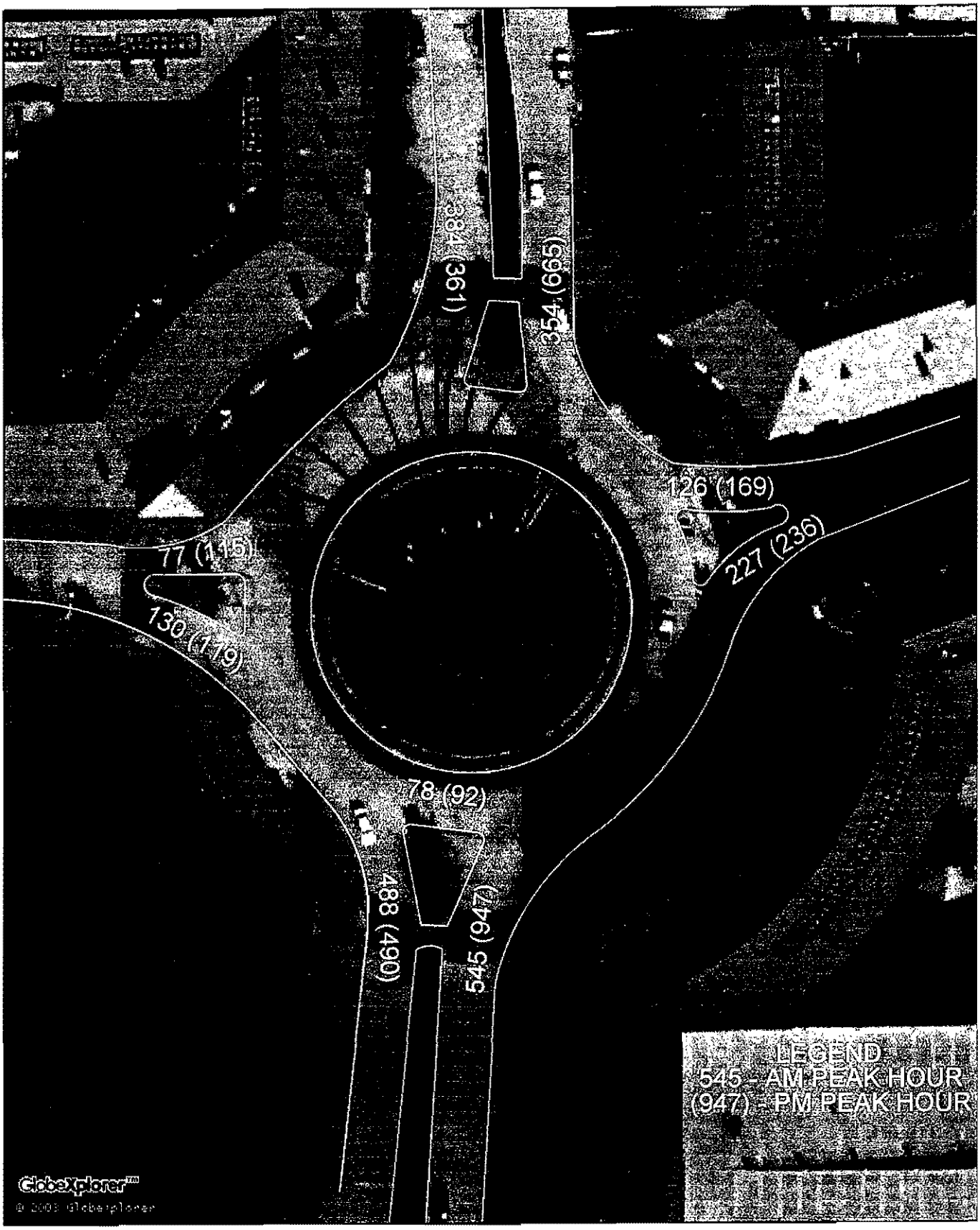


FIGURE 2:
PEAK HOUR VOLUMES

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972-248-3006 FAX 972-248-3855
ENGINEERING
PHOENIX - DALLAS

on the western entry. Crosswalks exist on all approaches and are marked in the form of red brick pavers.

Pedestrians were frequently observed crossing outside the crosswalks, particularly at the nose of splitter islands. Pedestrians were apt to take the fastest path through the area, which often led them to cross at the nose of splitter islands and walk along the sidewalk adjacent to the roundabout (***Figure 3)***. This presents a possible safety issue, as the large red paving stone crosswalks lead the motorist to expect people to cross further back from the roundabout itself. No signage, landscaping, bollards or other channelizing objects direct pedestrians towards the crosswalks.

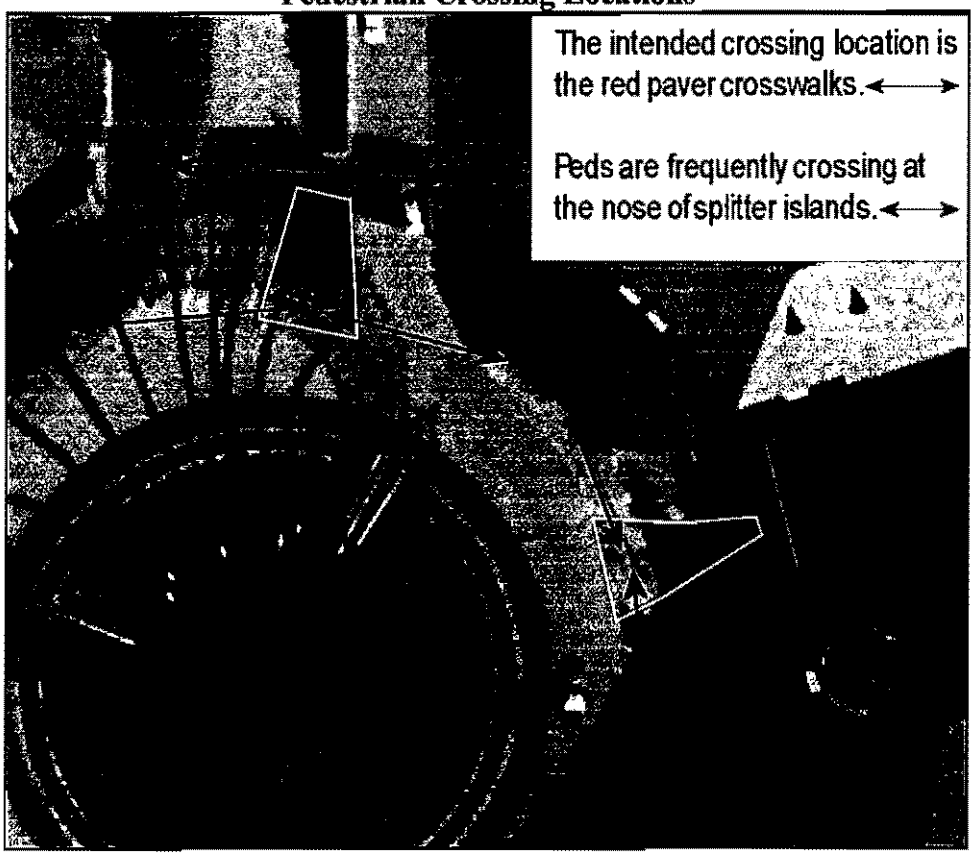
Bicyclists used both the crosswalks and the circulatory roadway as they traveled through or around the roundabout. No bicycle-car conflicts were observed during observation of traffic operations at the Addison Circle roundabout.

2.5 Signing and Pavement Markings

Lee Engineering staff made repeated visits to the study area and documented the traffic control signage that is currently in place on the four approaches and within the roundabout itself. The following observations about signing and pavement markings were made:

- Pavement markings at the entries are faded and worn, and visibility of these markings is significantly reduced from their original form (***Figure 4)***;
- Pavement markings on the northbound and southbound entries divide the roadway into three entering lanes, however most motorists either stay in the outside lanes, or disregard the markings and create two "new" lanes centered on the lane lines;
- Both yield ahead warning signs on the northbound approach and one yield-ahead sign on the southbound approach are obscured by trees. The second yield-ahead sign on the southbound approach will be obscured by uncut tree growth in the coming months (***Figure 5 & Figure 6)***;
- The large green roundabout guide sign on the southbound approach is partially obscured by trees (***Figure 7***);
- The large green roundabout guide signs provide no lane use instructions to motorists approaching the roundabout;
- A yield sign on the westbound approach is obscured by tree growth (***Figure 8***);
- No crosswalk warning signs are present to alert drivers to the crosswalks;
- The yield-ahead sign for the eastbound approach has been placed very low on a no parking sign inside temporary fencing and is missing the "Yield at Roundabout" supplemental plaque present on all other approaches (***Figure 9***);

FIGURE 3:
Pedestrian Crossing Locations



2.6 Crash History Data

Crash data was gathered from the Addison Police Department (APD). Crash data consisted of both dispatch records and Texas Peace Officer's Accident Reports (ST-3). In addition to dispatch records and ST-3 reports, the APD officer assigned to the area was interviewed. Dispatch records reveal 68 crashes in the area in a 45 month period, and ST-3 reports were available for seven of the 49 dispatched crashes in the most recent 29 month period. Crash history is discussed in further detail in the safety analysis segment of this report.

FIGURE 4:
Pavement Markings Faded and Worn

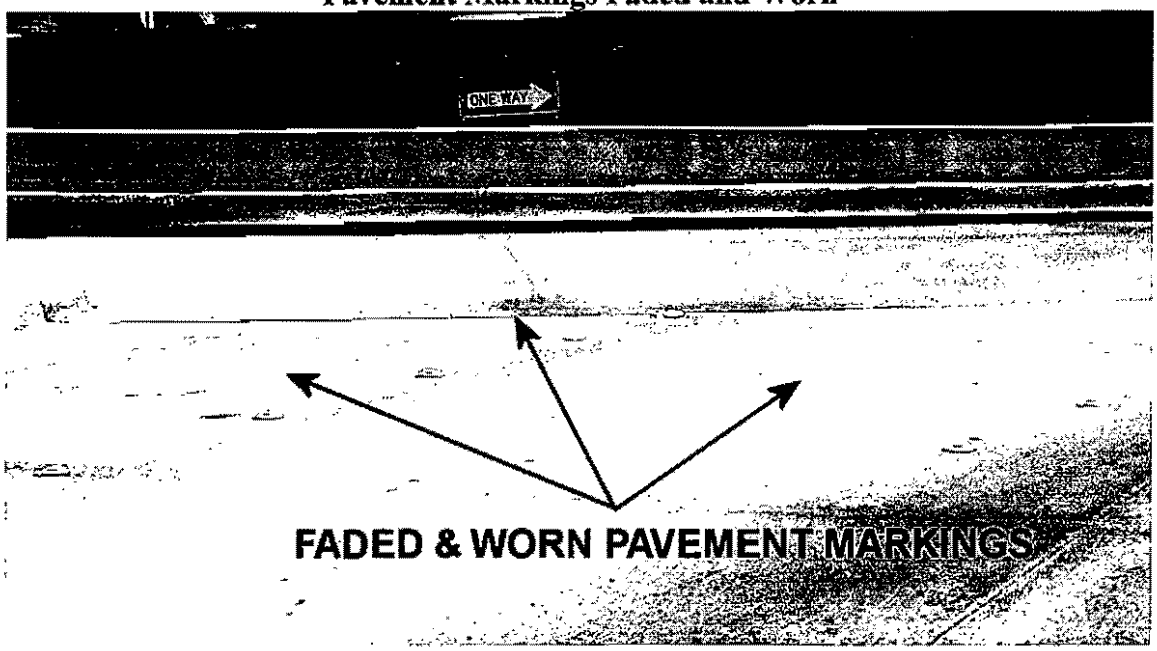


FIGURE 5:
Obscured Yield Ahead Signs, Northbound

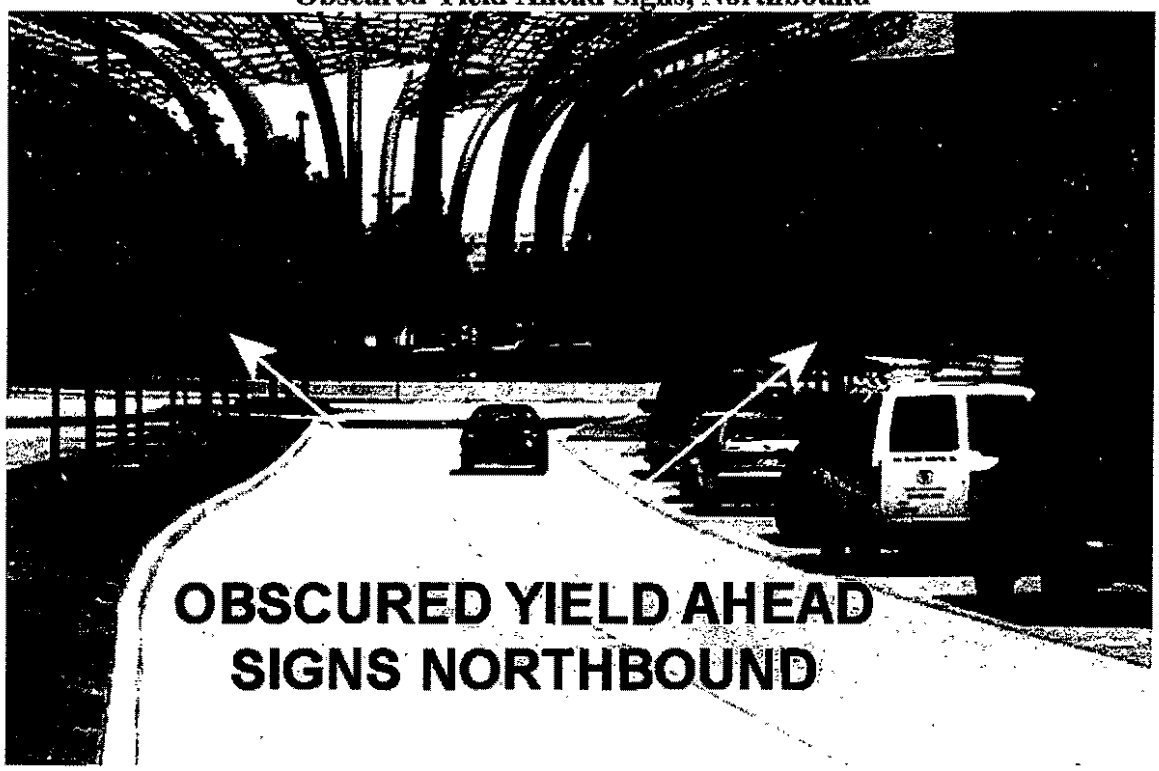


FIGURE 6:
Obscured Yield Ahead Sign, Southbound

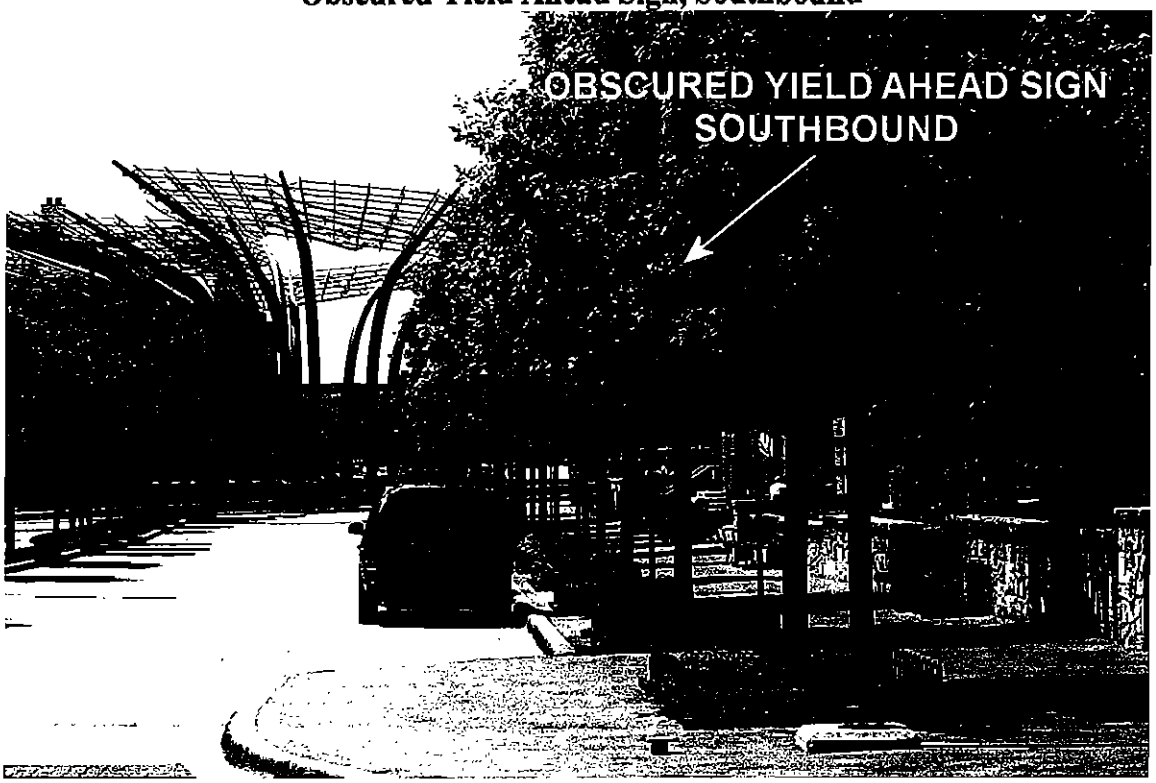


FIGURE 7:
Obscured Guide Sign, Southbound

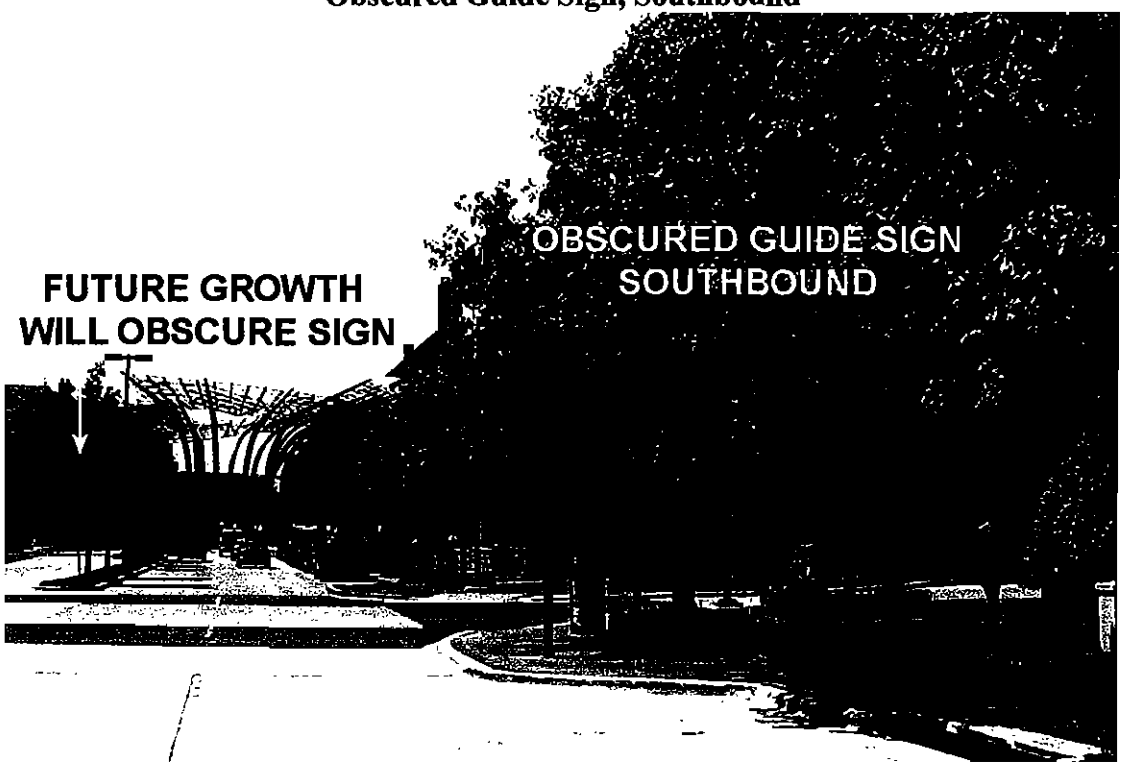
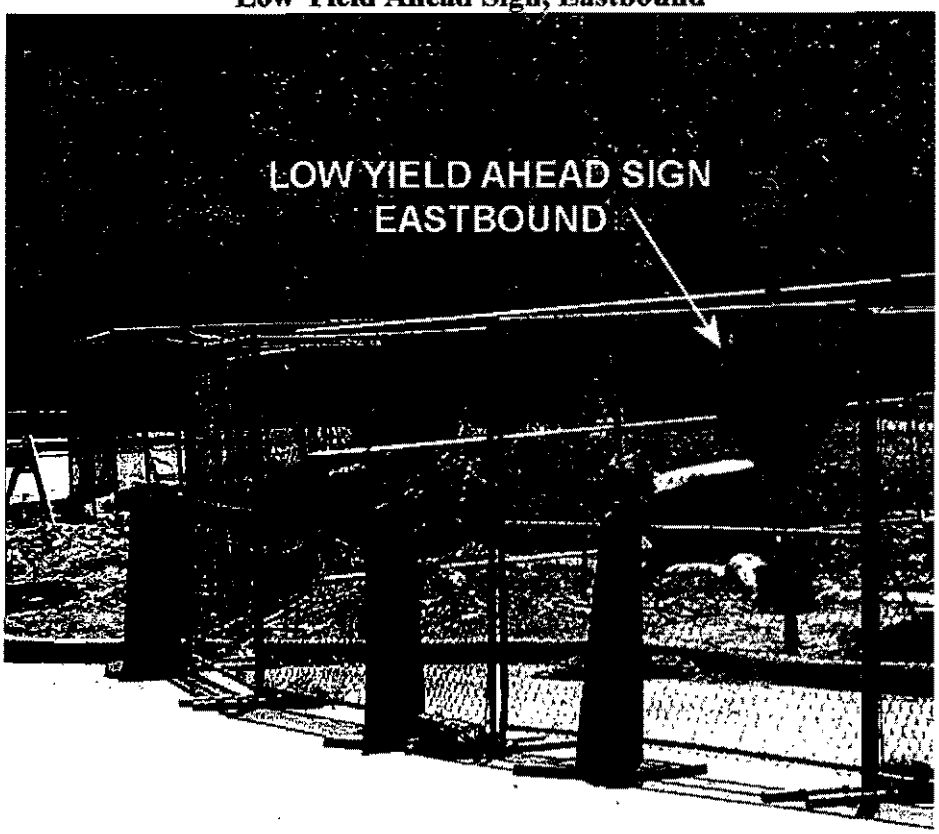


FIGURE 8:
Westbound Obscured Yield Sign

FIGURE 9:
Low Yield Ahead Sign, Eastbound



3. GEOMETRIC LAYOUT EVALUATION

3.1 Original Design

The original design of the roundabout was performed in 1996. The design plans were obtained from Town of Addison records and reviewed to determine any significant differences between the design plans and what is currently in the field. The existing roundabout and associated signing and markings present currently in the field do not differ significantly from what was intended on the design plans.

3.2 Geometric Evaluation

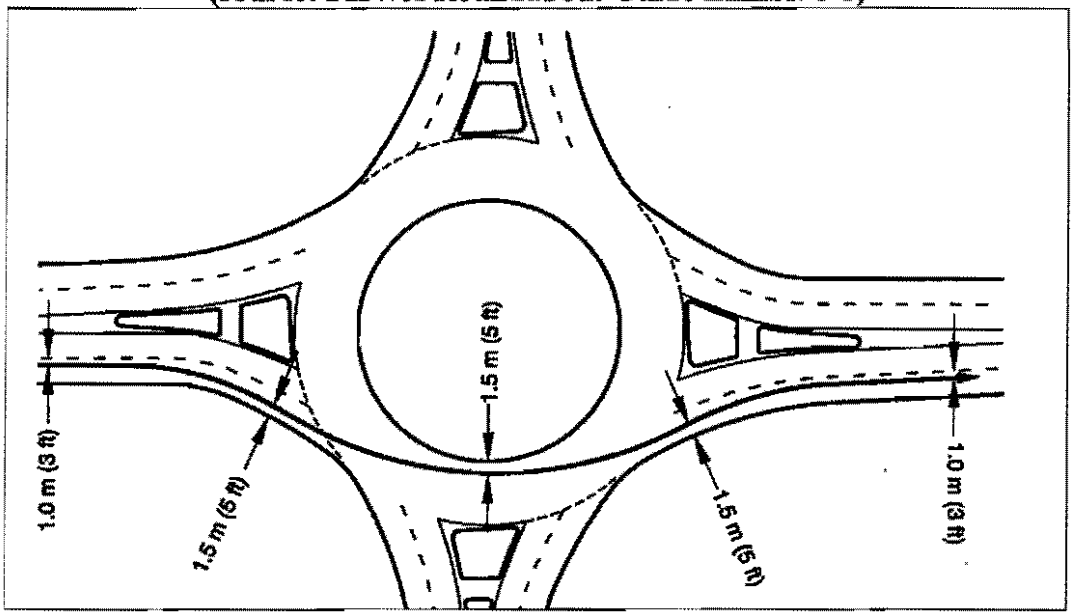
Fundamental principles for the geometric design of roundabouts are detailed in Chapter 6 of the FHWA publication *Roundabouts: An Informational Guide*. Additional guidance is from the research and practices developed in other countries with more roundabout experience than the United States, particularly the United Kingdom and Australia. The Addison Circle roundabout was evaluated in accordance with these design guidelines and principles. This section summarizes the fundamental geometric design principles and provides comments related to the Addison Circle roundabout.

3.2.1 *Design Speed and Speed Consistency*

One of the most critical design objectives is achieving appropriate vehicular speed through the roundabout. Roundabouts operate most safely when their geometry forces traffic to enter and circulate at slow and relatively consistent speeds. To determine the speed of the vehicle at a roundabout, the fastest path allowed by the geometry is drawn. This is the smoothest, flattest path possible for a single vehicle, in the absence of other traffic and ignoring all lane markings. The fastest path is drawn for a vehicle traversing through the entry, around the central island, and out the exit. ***Figure 10*** illustrates how the fastest vehicle path is constructed for a through movement at a typical double-lane roundabout.

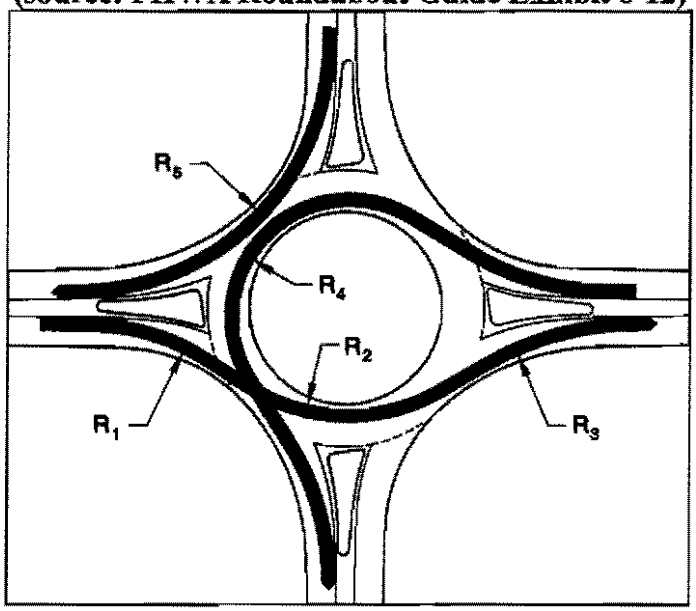
Once the fastest path is drawn, the minimum radius of each curve along the path is measured. The corresponding design speed of each curve along the path is then calculated in accordance with the speed-curve equations in the standard AASHTO reference manual *A Policy on Geometric Design of Highways and Streets*. The recommended maximum design speed for typical single- and double-lane roundabouts in suburban environments is 25 mph. In rural environments, it is often acceptable to allow design speeds up to 30 mph. It is most critical to achieve the target design speed at the roundabout entries. Exit speeds may be greater than the 25 mph target; however, they should generally be kept low to maximize safety for pedestrians.

FIGURE 10:
Construction of Fastest Path through Double-Lane Roundabout
(source: FHWA Roundabout Guide Exhibit 6-6)



In addition to achieving an appropriate design speed for the fastest movements, the relative speeds between consecutive geometric elements comprising the path and conflicting traffic streams should be minimized. The fastest paths are drawn for all movements at all approaches of the roundabout to determine these relative speeds. ***Figure 11*** illustrates the five critical path radii that must be checked at each approach.

FIGURE 11:
Vehicle Path Radii
(source: FHWA Roundabout Guide Exhibit 6-12)



Achieving speed consistency reduces the likelihood of loss-of-control crashes, entering-circulating crashes, and single-vehicle crashes. It is advisable that the speed differentials should be no greater than 12 mph, and preferably less than six mph. In other words, the difference between the design speeds of any two consecutive curves along a path or between two conflicting paths should less than 12 mph and preferably less than six mph.

The fastest paths at the Addison Circle roundabout were sketched in accordance with the guidelines shown in ***Figure 10***. ***Table 2*** summarizes the design speeds of each of the five critical radii at each approach at the west and east roundabouts, respectively. Entry speeds 25 mph or greater are highlighted in bold. ***Figures 12 to 15*** display the fastest path sketches for the Addison Circle roundabout.

TABLE 2:
Roundabout Design Speeds at Addison Circle

Approach	Parameter	R1	R2	R3	R4	R5
Northbound Quorum Drive	Radius	120'	135'	115'	70'	200'
	Speed	22 mph	22 mph	22 mph	16 mph	26 mph
Eastbound Addison Circle	Radius	125'	90'	140'	70'	170'
	Speed	23 mph	18 mph	24 mph	16 mph	24 mph
Southbound Quorum Drive	Radius	160'	150'	120'	70'	160'
	Speed	**25 mph**	23 mph	22 mph	16 mph	23 mph
Westbound Addison Circle	Radius	170'	105'	115'	70'	55'
	Speed	**26 mph**	19 mph	22 mph	16 mph	14 mph

At the Addison Circle roundabout, only the southbound and westbound approaches have design speeds greater than or equal to the target design speed of 25 mph. The circulating design speed (R4) is 16 mph. The westbound right-turn design speed (R5) of 14 mph is the lowest speed within the roundabout. Overall, the consistency between consecutive or conflicting curve radii is good for the Addison Circle roundabout. The majority of consecutive curves fall within the six mph desired maximum differential. The highest speed is the northbound right-turn movement (R5). The 26 mph speed present on the northbound right-turn is also the only speed 12 mph or more above another speed on the roundabout. Minimal impact on safety results from this speed differential though as the paths for these movements do not conflict. The greatest speed differential for crossing/overlapping paths is the eight mph difference between the westbound R5 and northbound R3. This is less than the 12 mph differential identified above.

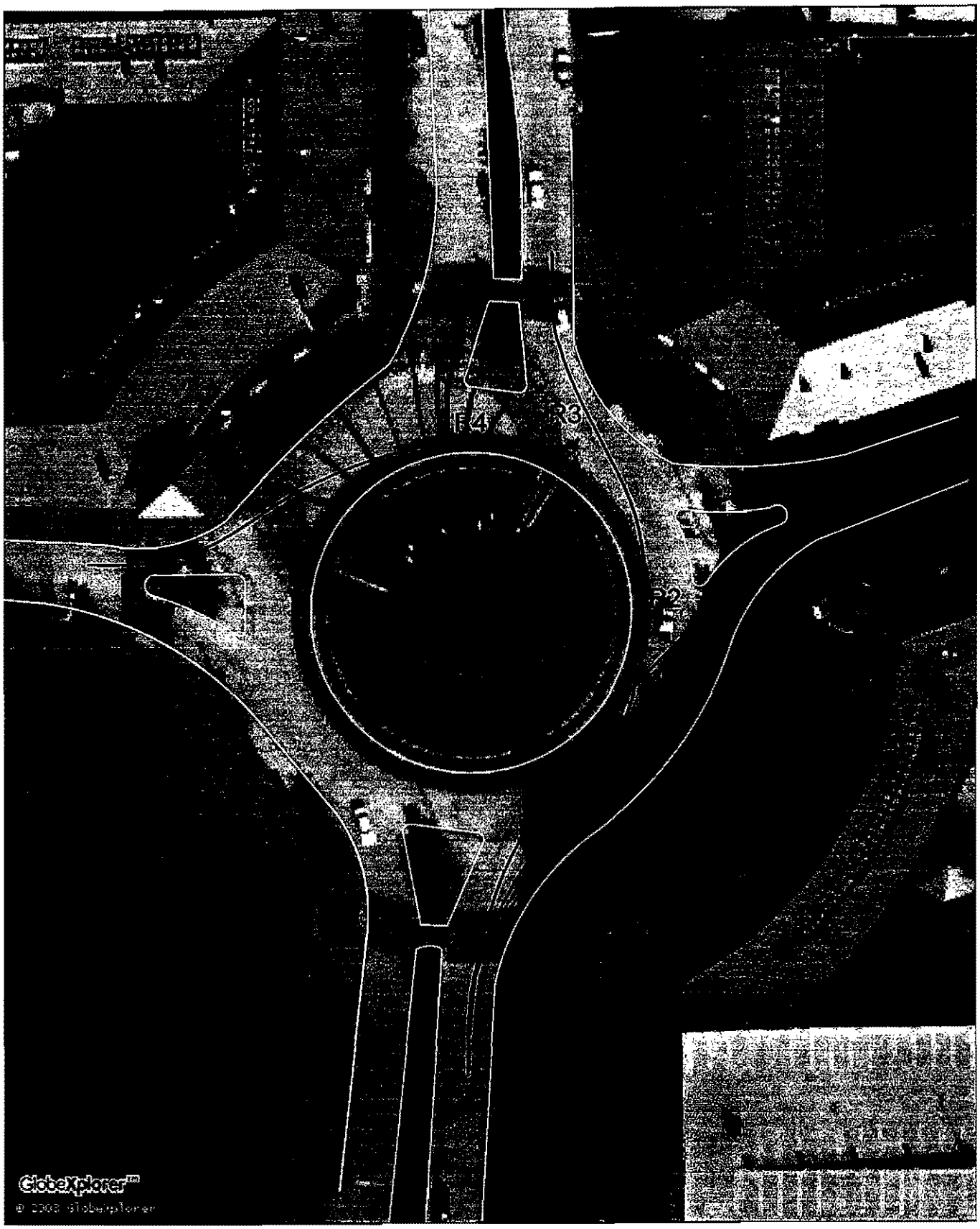


FIGURE 12:
NORTHBOUND ENTRY
FASTEST PATH SKETCH

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972-248-3006 FAX 972-248-3855
LEE ENGINEERING
PHOENIX - DALLAS

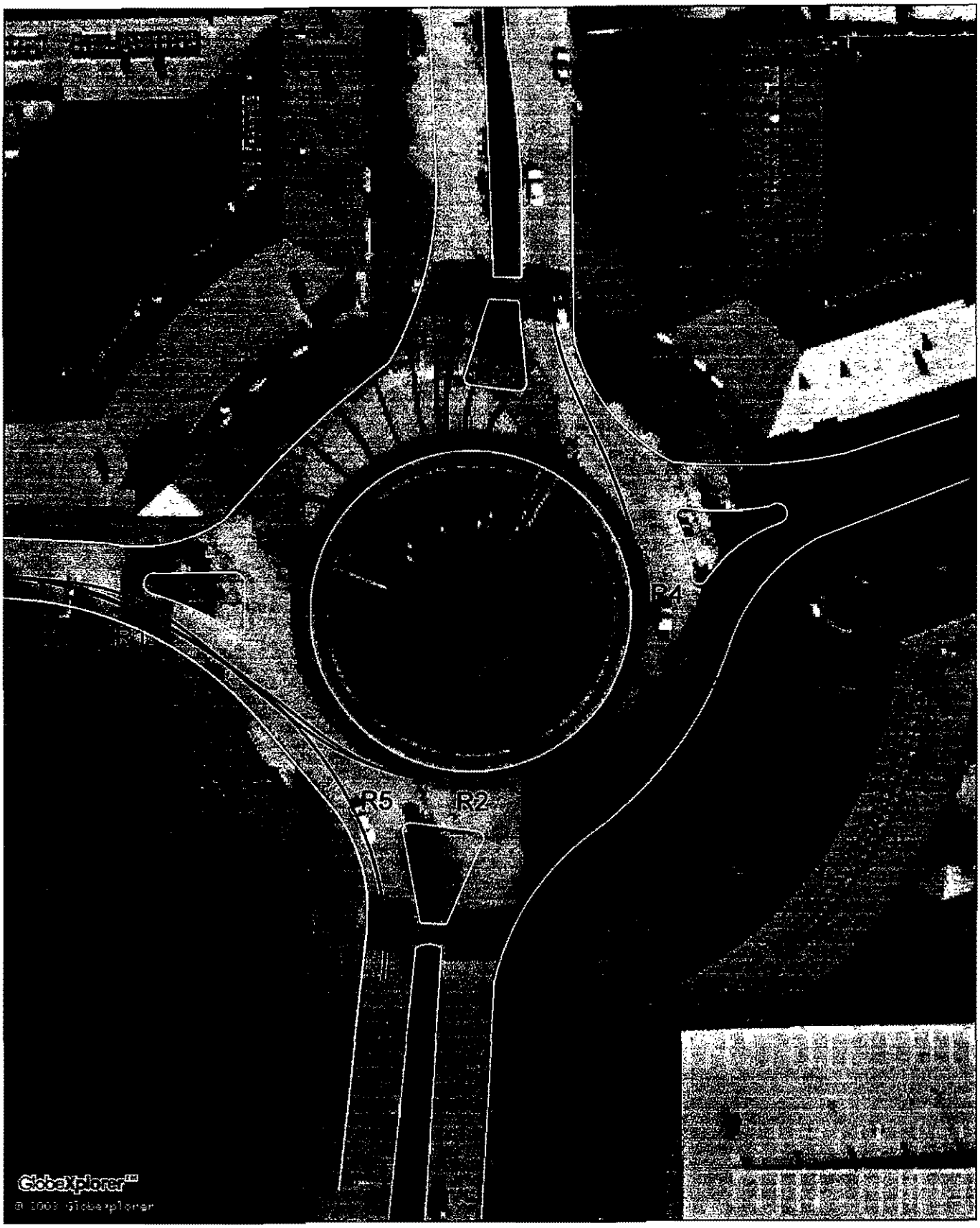


FIGURE 13:
EASTBOUND ENTRY
FASTEST PATH SKETCH

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972-248-3006 FAX 972-248-3855
LEE ENGINEERING
PHOENIX - DALLAS

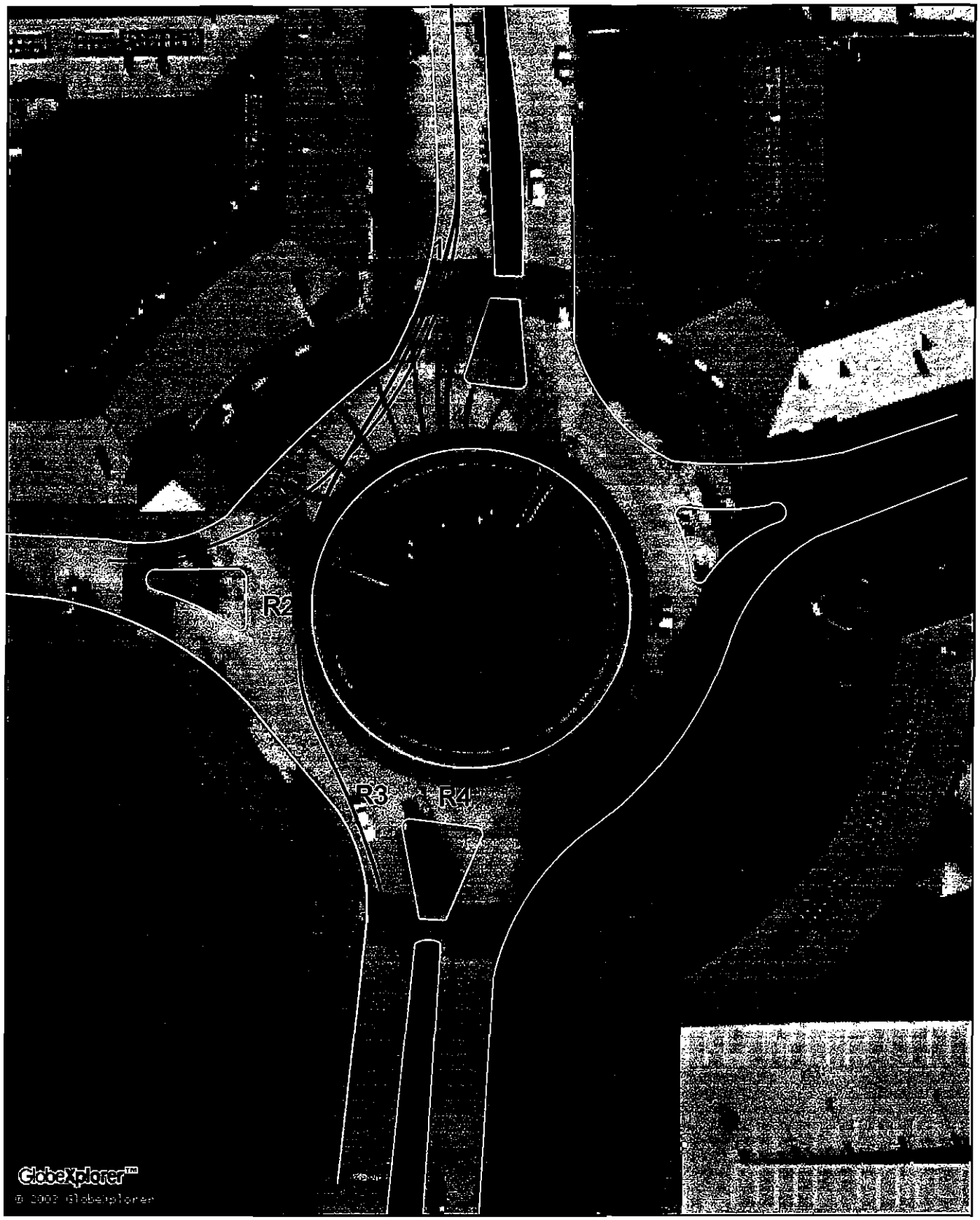


FIGURE 14:
SOUTHBOUND ENTRY
FASTEST PATH SKETCH

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972-248-3D06 FAX 972-248-3855
LEE ENGINEERING PHOENIX - DALLAS

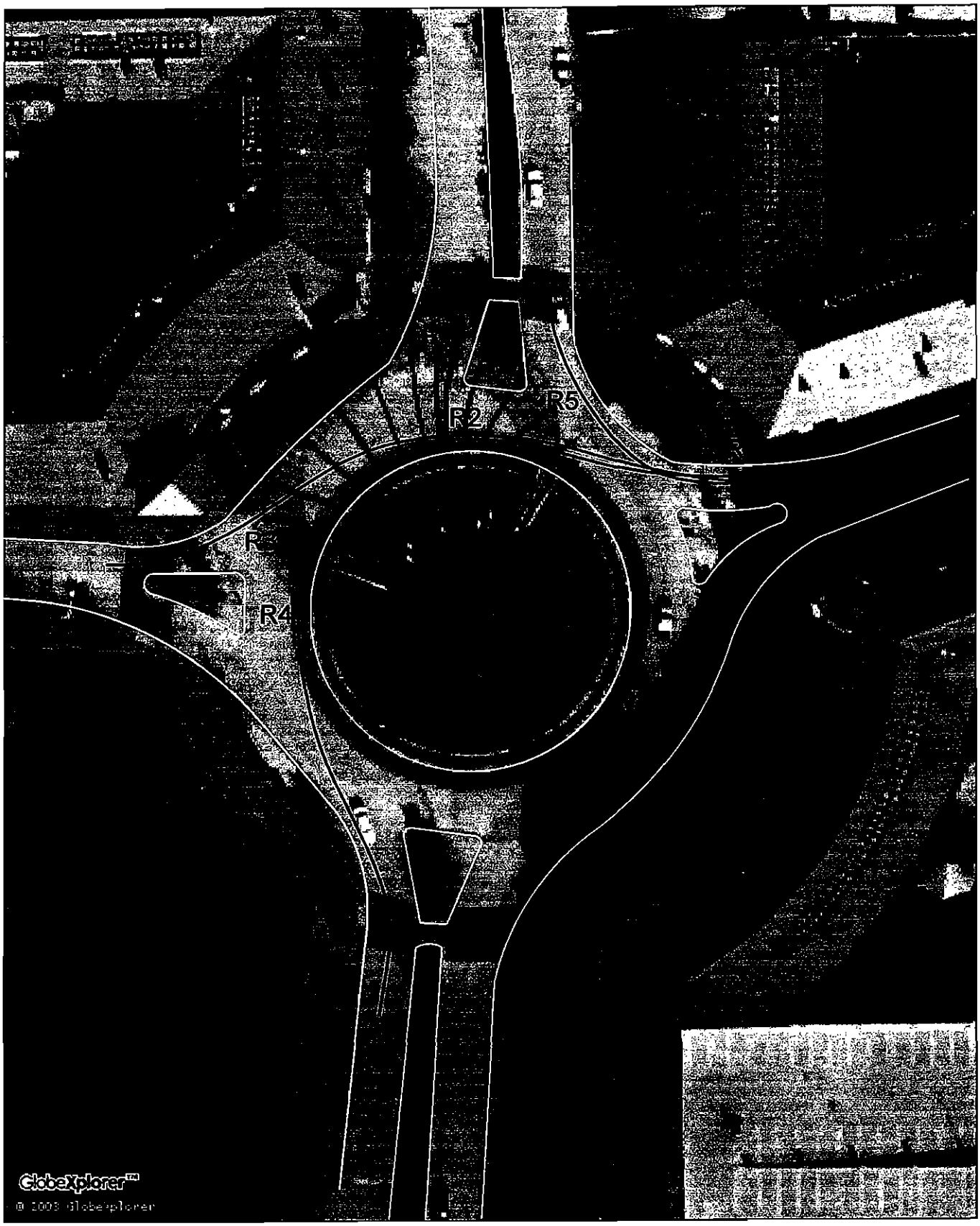


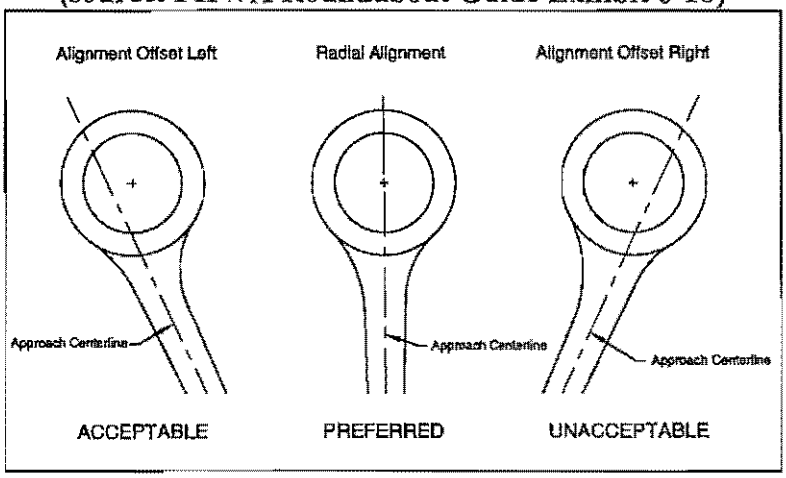
FIGURE 15:
WESTBOUND ENTRY
FASTEST PATH SKETCH

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972-248-3006 FAX 972-248-3855
ENGINEERING
PHOENIX - DALLAS

3.2.2 *Approach Alignment*

Ideally, the centerline of the roundabout approaches should align with the center of the roundabout. However, it is acceptable for the approach to be slightly offset to the left of the center point, since this alignment enhances the deflection of the entry path. If it is aligned too far to the left, the exiting traffic path will be more tangential causing higher exit speeds. If the alignment of the entry is offset to the right, the approach geometry may not provide enough deflection for the entering vehicles. Therefore, approach alignments offset to the right of the roundabout center should be avoided. ***Figure 16*** illustrates the preferred approach alignment for roundabouts in general.

FIGURE 16:
Approach Alignment Guidelines
(source: FHWA Roundabout Guide Exhibit 6-18)



The alignment of all four approaches to the Addison Circle roundabout is very close to the ideal radial alignment that is preferred for a roundabout. This helps contribute to the operational efficiency and speed consistency of this roundabout.

3.2.3 *Lane Balance*

To ensure consistency, the circulatory roadway should be as wide as the widest entry approach. Thus, at roundabouts with two-lane entries, the circulatory roadway should be wide enough for two adjacent traffic streams (although these circulatory lanes may not necessarily be striped). Failure to provide such consistency in the numbers of entry and circulatory lanes can severely hamper the capacity of a roundabout. Furthermore, it may reduce the roundabout's safety as it causes confusion for drivers and can increase the likelihood for sideswipe crashes between adjacent entering traffic streams.

At the Addison Circle roundabout, the northbound and southbound approaches are striped for three-lane entries with widths of approximately 33 feet. However, the width of the circulatory roadway is approximately 27 feet at the splitter islands, thus only wide enough for two lanes. Field observations revealed that the majority of drivers are familiar with the roundabout and choose an entry-lane based on their desired turning movement. Drivers making through or left-turn movements generally use the left-hand entry lane, and

drivers making right-turn movements choose the right-hand lane. Between the northbound entry and eastbound exit, and again between the southbound entry and westbound exit, there is adequate circulatory roadway width for three cars to travel abreast of each other. In the rare event of a three vehicle entry, if the rightmost vehicle intends to proceed through or left, a conflict develops when the vehicles reach the next splitter island and circulatory roadway width can no longer sustain three vehicles abreast. Thus, the roundabout effectively operates as a double-lane roundabout. The three lane entry does not significantly increase the capacity of the Addison Circle roundabout, and due to the inconsistency between the number of entry lanes and circulatory lanes, may increase the likelihood of minor sideswipe crashes within the roundabout.

Because of the familiarity and the overall courtesy of most users, the roundabout is generally operating safely. However, unfamiliar drivers can be caught off-guard by the three-lane entries with no formal lane-use designations. These drivers may find themselves in the right-hand lane, for instance, intending to make a through movement.

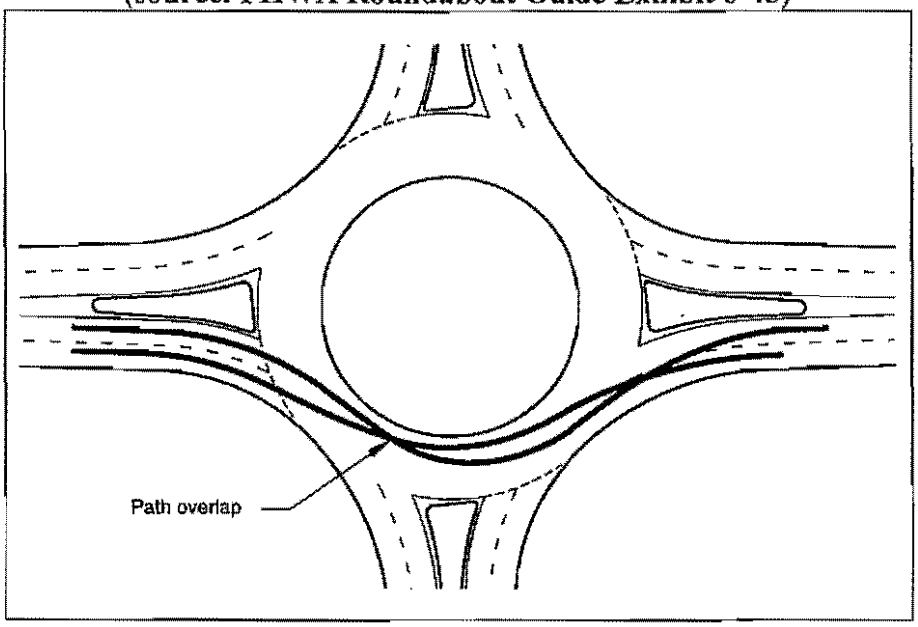
3.2.4 *Angle and Spacing Between Legs*

In addition to the alignment and design speed objectives, it is generally desirable to equally space the distances and angles between the entries. The Addison Circle roundabout is well designed with respect to the angle and spacing between the legs. Three of the four legs are close to one-quarter length around the circle and 90 degrees from each other. The separation between the northern and eastern legs is less than 90 degrees; however, the spacing is such that no operational problems result for the skew angle. This contributes to the efficiency exhibited by the Addison Circle roundabout.

3.2.5 *Path Overlap*

Path overlap exists at multi-lane roundabouts when the natural paths of vehicles in two adjacent traffic lanes cross or overlap one another. It occurs most often at entries, when the geometry causes vehicles in adjacent lanes to naturally travel into the same lane of the circulatory roadway. It may also occur at exits, where the exit geometry tends to cause side-by-side circulating vehicles to exit into the same lane. ***Figure 17*** illustrates path overlap at a typical roundabout.

FIGURE 17:
Path Overlap Example
(source: FHWA Roundabout Guide Exhibit 6-45)



Path overlap can be avoided at entries by ensuring that the geometry orients the natural trajectory of vehicles at the yield line into the appropriate circulatory lane. In other words, vehicles in the left-hand entry lane should be oriented toward the inside circulatory lane, while vehicles in the right-hand entry lane should be oriented toward the outer circulatory lane at the yield line.

At the Addison Circle roundabout, path overlap exists at the northbound and southbound entries due to the three-lane entries. The three-lane entries lead to a two-lane circulatory roadway, resulting in path overlap as vehicles in the right two lanes must compete for the same space within the circulatory roadway should both drivers choose to proceed through the roundabout and not take the first right turn available to them. As most drivers are familiar with the roundabouts, vehicles generally use only two entry lanes to avoid these path overlap conflicts. However, as improvements are considered, they should address the path overlap issues and ensure that the entries and exits are designed to promote clear and safe movements for two lanes of traffic through the roundabout geometry.

4. OPERATIONS/CAPACITY ANALYSIS

4.1 Introduction

The procedure outlined in *Roundabouts: An Informational Guide* was used in evaluating the capacity and operational performance of the Addison Circle roundabout.

The methodology in the FHWA Guide is based on a combination of the British and German roundabout capacity models. The FHWA Guide methodology incorporates

empirical data into its formulations and a maximum volume-to-capacity (V/C) ratio of 0.85 is targeted for roundabout design purposes.

4.2 Analysis of Traffic Volumes

The existing intersection traffic volumes during the weekday AM and PM peak hours were obtained from the tube counts described in the *Data Collection* section. Because an interior count was performed, the conflicting volumes at each entry point could be determined indirectly. Roundabout operations have been evaluated for both the existing weekday AM and weekday PM peak hour traffic conditions. Roundabout operations were also performed to evaluate the effects of altering the Quorum Drive entries to single lane operation.

4.3 FHWA Analysis Methodology

The FHWA publication *Roundabouts: An Informational Guide* provides a methodology for calculating the capacity of single- and double-lane roundabouts. According to the FHWA procedure, the maximum flow rate that can be accommodated at a given roundabout entry depends on two factors: 1) the circulatory flow within the roundabout that conflicts with the entry flow; and 2) the geometric elements of the roundabout.

Even though two of the approaches of the roundabouts have three-lane entries, they were treated as two-lane entries in the FHWA analysis. This was done as a result of observed driver behavior, in which the majority of motorists only utilize two of the three lanes for entering the roundabout.

Table 3 summarizes the results of the existing roundabout analysis based on the FHWA methodology. No volume-to-capacity ratios greater than the 0.85 threshold are present under existing conditions. The full FHWA analysis results are included in the Appendix.

TABLE 3:
Existing Condition FHWA Operational Summary

Approach	Weekday AM Peak Hour			Weekday PM Peak Hour		
	V/C	Control Delay (sec/veh)	95th Percentile Queue (feet)	V/C	Control Delay (sec/veh)	95th Percentile Queue (feet)
Northbound	0.23	2.0	23	0.4	2.6	50
Southbound	0.17	1.9	15	0.16	2.0	15
Eastbound	0.13	4.0	10	0.12	4.0	10
Westbound	0.12	3.8	10	0.18	4.0	18

Legend: V/C = Volume-to-Capacity Ratio

As shown in ***Table 3***, all approaches are currently operating below the 0.85 V/C target threshold by a large margin. Field observations during the weekday AM and PM peak hours confirmed that very little delay and queuing is present at the roundabout as

suggested in the FHWA analysis. On the rare occasion that the heavily platooned northbound flow queued to enter the roundabout, the queues dissipated quickly.

Per discussions with Town staff, the roundabout was analyzed assuming the Quorum Drive approaches were reduced to a single lane in advance of the roundabout, and that the roundabout was functioning as a single lane roundabout. The results for the single lane analysis are presented in ***Table 4***.

TABLE 4:
Single Lane Approach and Roundabout FHWA Operational Summary

	Weekday AM Peak Hour			Weekday PM Peak Hour		
Approach	V/C	Control Delay (sec/veh)	95th Percentile Queue (feet)	V/C	Control Delay (sec/veh)	95th Percentile Queue (feet)
Northbound	0.47	5.7	63	0.82	15.1	243
Southbound	0.34	4.9	38	0.35	5.3	40
Eastbound	0.14	4.4	13	0.13	4.5	10
Westbound	0.13	4.1	10	0.22	5.9	20

Legend: V/C = Volume-to-Capacity Ratio

As evidenced in ***Table 4***, conversion to single lane operation will substantially impact peak hour operations at the Addison Circle roundabout and should not be pursued given the planned 3000+ unit expansion of the Addison Circle development. Geometrics of the lane reduction, impacts of the changes to parking, and the length of roadway necessary to implement a single lane approach properly all make the implementation of a single lane approach scenario less than desirable. Consideration in this analysis was given to the planned expansion of Spectrum Road to the east of Quorum; however, minimal impact on the Addison Circle roundabout volumes is expected from the expansion. Any diversions to Spectrum will likely be offset by volume increases in the area as the Addison Circle development expands. Through motorists traveling on Spectrum Road will be presented with either stop control, or a traffic signal within the Addison Circle development once the Spectrum expansion is complete. Familiar motorists will likely continue to choose the Quorum Drive routing through the roundabout for their north-south trips as this route will result in less delay.

5. SAFETY ANALYSIS

5.1 Collision Analysis

Dispatch records indicate that APD received 67 minor accident calls in the study area between 9/18/1999 and 5/12/2003. In addition, APD officers were initially dispatched to one accident that was initially described as a major accident on Quorum Drive near the

roundabout during the same time period. Table 5 below documents the minor accident dispatch records.

TABLE 5:
Addison Police Department Dispatch Crash History

Time Period	Crash Location Roundabout Approach[1]	Crash Location Circulatory Roadway[2]
9/18/1999 – 12/31/1999	2	1
1/1/2000 – 12/31/2000	12	4
1/1/2001 – 12/31/2001	9	6
1/1/2002 – 12/31/2002	21	4
1/1/2003 – 5/12/2003	8	1

[1] Dispatch record indicated a block number near roundabout on either Quorum Dr. or Addison Cir.

[2] Dispatch record indicated crash at Addison Cir/Quorum Dr.

After examining dispatch records, Lee Engineering physically examined the Peace Officer's Accident Reports (ST-3) maintained by the APD records division. ST-3s were available from January 1, 2001 through May 12, 2003 when the crash analysis was performed. ST-3 analysis revealed that of the 49 total crashes evident on dispatch logs between 1/1/2001 and 5/12/2003, only seven were of a nature severe enough to warrant the completion of an ST-3 accident report.

Of the seven reported crashes for the 29 month period, two were the results of driving while intoxicated, and three were not on the roundabout itself; thus, only two actual roundabout crashes were available for analysis. One of the two crashes that occurred in the roundabout occurred as a motorist failed to yield entering the circle, while the other occurred when a vehicle ran off the road and struck a yield sign. The two DWI crashes and two additional reported crashes on the approaches or circulatory roadway occurred between the hours of 12 AM and 3 AM on a Friday or Saturday. The lack of a single reportable injury accident over the 29 month time period reports was noteworthy.

Dispatch analysis reveals that drivers are having crashes in and around the roundabout; however, very few are severe enough to warrant the APD completing an official crash report. Dispatch records show no instances of an injury-accident within the roundabout or at the entry/exit points in the 45 month period covered by the available records. This likely indicates that the occurrence of injury-accident within the roundabout is extremely low. Reduced crash severity is one of the key advantages of a roundabout intersection configuration over a typical signalized intersection, and the data available does indicate that all damage from crashes in the roundabout intersection is minimal.

Discussions with Addison Police Department officers assigned to the area revealed that the officers feel that the roundabout is very safe. The property damage only crashes reflected in the dispatch logs that do not result in formal reporting are very minor and are often the result of improper maneuvers or failure to yield. The majority of conflicts noted by the APD are concentrated at the northbound Quorum Drive exit point on the

roundabout during the same time period. Table 5 below documents the minor accident dispatch records.

TABLE 5:
Addison Police Department Dispatch Crash History

Time Period	Crash Location Roundabout Approach[1]	Crash Location Circulatory Roadway[2]
9/18/1999 – 12/31/1999	2	1
1/1/2000 – 12/31/2000	12	4
1/1/2001 – 12/31/2001	9	6
1/1/2002 – 12/31/2002	21	4
1/1/2003 – 5/12/2003	8	1

[1] Dispatch record indicated a block number near roundabout on either Quorum Dr. or Addison Cir.

[2] Dispatch record indicated crash at Addison Cir/Quorum Dr.

After examining dispatch records, Lee Engineering physically examined the Peace Officer's Accident Reports (ST-3) maintained by the APD records division. ST-3s were available from January 1, 2001 through May 12, 2003 when the crash analysis was performed. ST-3 analysis revealed that of the 49 total crashes evident on dispatch logs between 1/1/2001 and 5/12/2003, only seven were of a nature severe enough to warrant the completion of an ST-3 accident report.

Of the seven reported crashes for the 29 month period, two were the results of driving while intoxicated, and three were not on the roundabout itself; thus, only two actual roundabout crashes were available for analysis. One of the two crashes that occurred in the roundabout occurred as a motorist failed to yield entering the circle, while the other occurred when a vehicle ran off the road and struck a yield sign. The two DWI crashes and two additional reported crashes on the approaches or circulatory roadway occurred between the hours of 12 AM and 3 AM on a Friday or Saturday. The lack of a single reportable injury accident over the 29 month time period reports was noteworthy.

Dispatch analysis reveals that drivers are having crashes in and around the roundabout; however, very few are severe enough to warrant the APD completing an official crash report. Dispatch records show no instances of an injury-accident within the roundabout or at the entry/exit points in the 45 month period covered by the available records. This likely indicates that the occurrence of injury-accident within the roundabout is extremely low. Reduced crash severity is one of the key advantages of a roundabout intersection configuration over a typical signalized intersection, and the data available does indicate that all damage from crashes in the roundabout intersection is minimal.

Discussions with Addison Police Department officers assigned to the area revealed that the officers feel that the roundabout is very safe. The property damage only crashes reflected in the dispatch logs that do not result in formal reporting are very minor and are often the result of improper maneuvers or failure to yield. The majority of conflicts noted by the APD are concentrated at the northbound Quorum Drive exit point on the

roundabout. With respect to single vehicle accidents, many are concentrated in the early morning hours of the weekend.

6. CONCLUSIONS AND RECOMMENDATIONS

Based on this evaluation of traffic data, traffic operations, design features, and safety, the following conclusions and recommendations are made about the Addison Circle roundabout.

6.1 Geometrics and Operations

- The Addison Circle roundabout geometry operates well as evidenced in the operational efficiency of the roundabout and the very low crash history.
- Design speeds calculated through the fastest path analysis are largely consistent with the design objectives of the modern roundabout.
- The majority of drivers use the three-lane northbound and southbound entry points as two-lane entries because of the inconsistency between the entry width and circulatory roadway width.
- Minimal delays and queues were observed in field observations and were evident in FHWA analysis of the roundabout.
- Conversion to a single lane roundabout, single lane entries, or single lane approaches on Quorum was evaluated and should not be pursued as the area continues to develop.

6.2 Striping and Marking Modifications

- The following improvements are all referenced in ***Figure 18.***
- Remove pavement markings on northbound and southbound entries that indicate a three-lane approach. Reinstall new markings for a two-lane entry to the roundabout. Ensure that markings align with desired position within the roundabout.
- Remove all faded/worn word markings "YIELD" from the pavement on the northbound and southbound approaches as they indicate a three-lane approach. Install new "YIELD" word markings that reflect the striping for a two-lane entry.
- Replace worn "YIELD" markings on the eastbound and westbound entries.
- Broken white line inscribed circle markings should be reinstalled as shown in ***Figure 18*** as they provide a visual cue as to the edge of the circulatory roadway.
- Install white lane markings along center of circulatory roadway to guide traffic entering the roundabout from the south into the proper position for the northbound exit. White lane markings should be of a 5'-15'-5' spacing pattern as shown in ***Figure 18***. Install similar lane markings for southbound through movement.

6.3 Signing Modifications

- Relocate yield-ahead signs so that they are in front of trees that currently obscure them or actively trim all tree growth that currently obscures or threatens to obscure existing signage.
- Trim excessive tree growth that currently obscures westbound yield sign and southbound guide sign.
- Remove the four one-way signs currently present on the center island, leaving the chevron warning signs in place.

- Consider replacing the existing green roundabout guide signs with one that indicates lane use, such as those shown in ***Figure 19***. While the large guide sign may still be aesthetically unpleasing, adding suggested lane use indications will alleviate some concerns that existing signage does not tell the motorist enough about how to drive the roundabout.

6.4 Pedestrian Improvements

- On curb radii and splitter islands between the crosswalk and circulating roadway, planter boxes or other landscaping treatments should be installed to better direct pedestrians to the existing crosswalk facilities. These areas are represented by hatching in ***Figure 20***.

6.5 Additional Recommendations

- Due to the unique nature of roundabout operations, the Town of Addison Public Works Department should request the Town of Addison Police Department to be more aggressive in their reporting of crashes in the vicinity of the Addison Circle roundabout. A full fledged ST-3 is not required for crashes that result in under $1000 damage; however, these minor crashes where motorists frequently exchange information after an officer arrives can be very beneficial in a safety analysis of the roundabout operations. Addison Public Works should request that APD notify them with a simple one or two paragraph synopsis of all crashes that occur at roundabout entry/exits points or on the circulatory roadway regardless of whether or not an official ST-3 is filed.
- The most common conflict evidenced during observation, and in discussions with Town staff and Police Officers was improper lane use while exiting the roundabout to the north. In an effort to better educate motorists in the area, a brief pamphlet describing proper roundabout usage could be prepared by Town staff and mailed to Addison residents in a utility bill and distributed by Post Properties staff to the residents of Addison Circle itself.

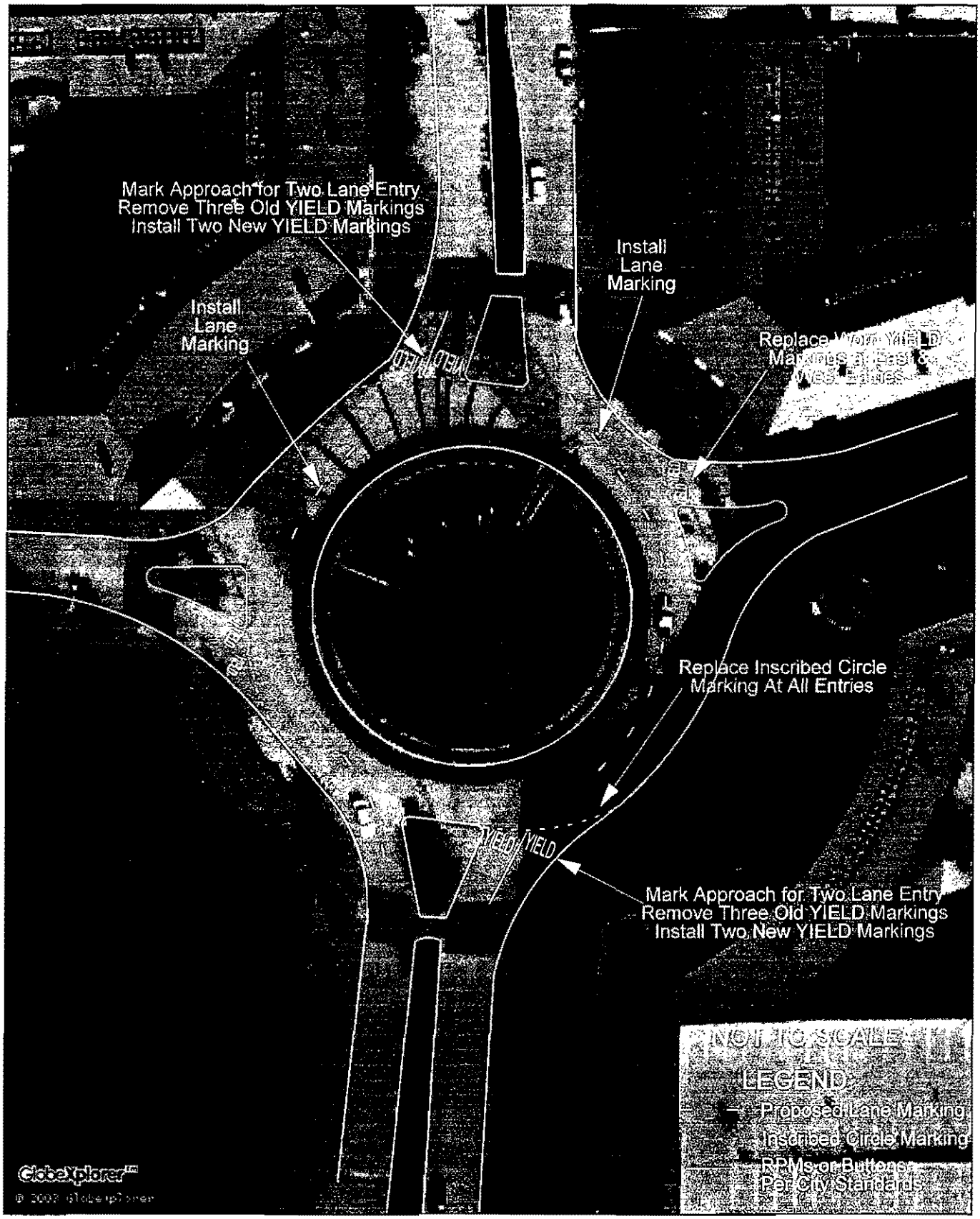
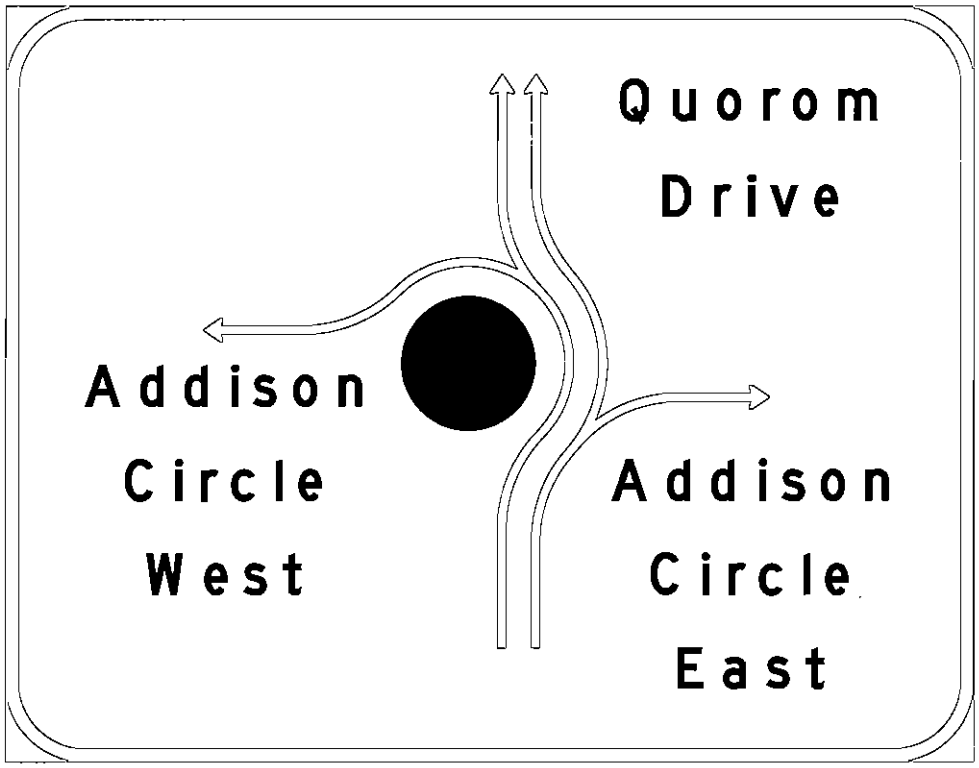
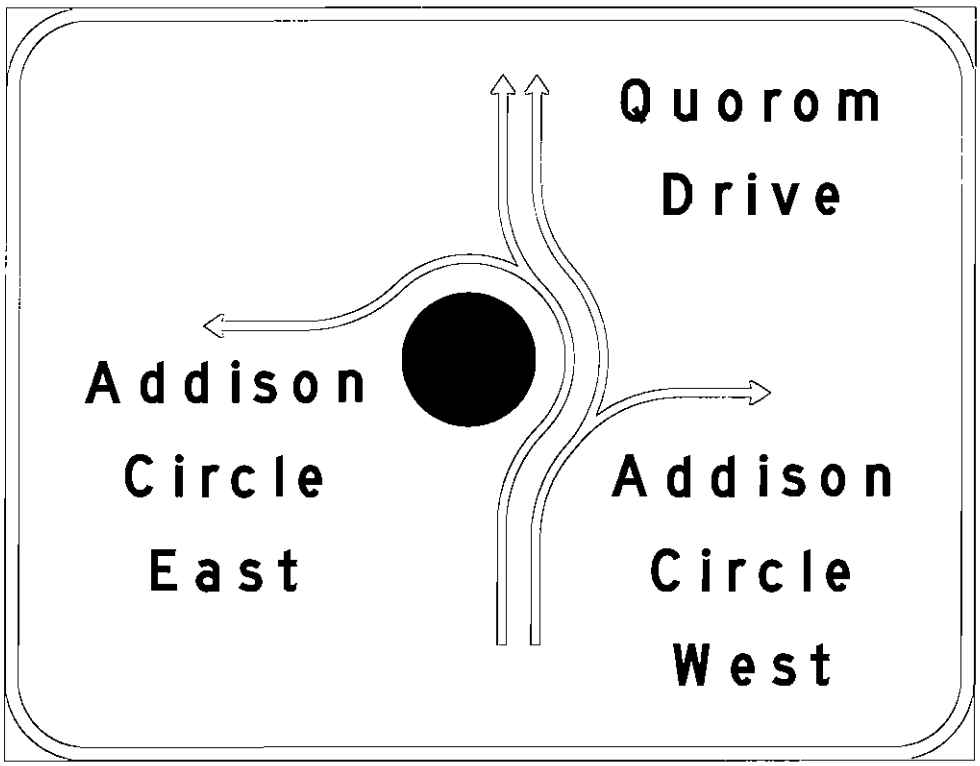


FIGURE 18:
POSSIBLE LANE MARKINGS TO REDUCE CONFLICTS AT NB QUORUM EXIT
5-15-5 LANE LINE

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972-248-3006 FAX 972-248-3855
LEE ENGINEERING
PHOENIX - DALLAS



NORTHBOUND GUIDE SIGN



SOUTHBOUND GUIDE SIGN

FIGURE 19:
SAMPLE GUIDE SIGN
WITH LANE USE

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972-248-3006 FAX 972-248-3855
ENGINEERING
PHOENIX - DALLAS

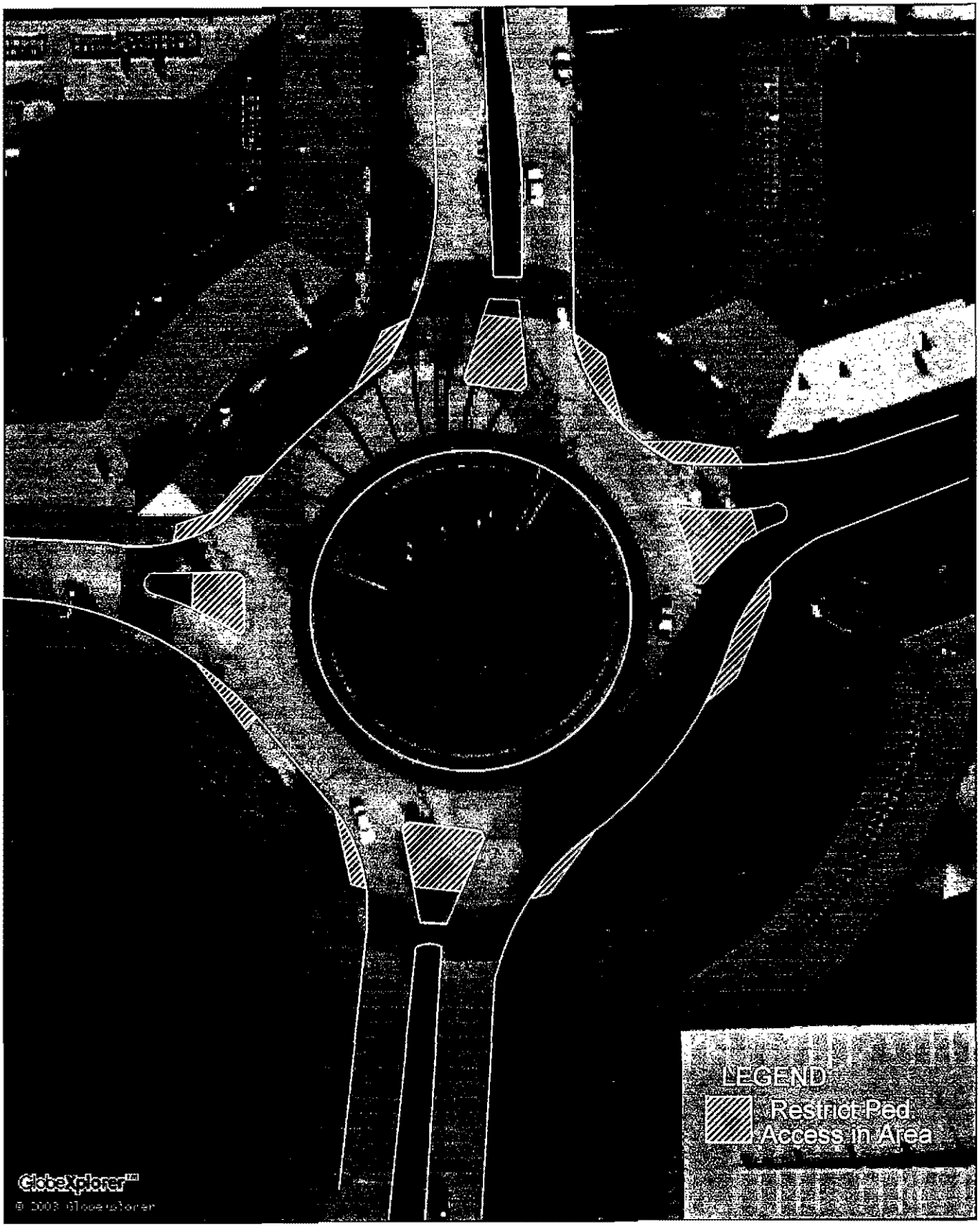


FIGURE 20:
ENCOURAGE CROSSWALK USE THROUGH PEDESTRIAN ACCESS RESTRICTIONS

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972-248-3006 FAX 972-248-3855
LEE ENGINEERING
PHOENIX - DALLAS

APPENDIX

Project	T1145.06
Location	Addison Circle
Scenario	Peak Hour
Analyst	JPD
Date	17-Jun-03

FHWA Double Lane Roundabout Analysis
AM PEAK HOUR
Summary of results:

Approach/entry	NB	SB	EB	WB	Overall
Entering volume (pce)	545	384	130	126	
Conflicting volume (pce)	78	168	475	396	
Adjusted capacity (pce)	2355	2292	1038	1066	
Volume-to-capacity ratio	0.23	0.17	0.13	0.12	
Control delay (sec/veh)	2.0	1.9	4.0	3.8	2.4
Approach average queue (veh)	0.3	0.2	0.1	0.1	
Approach 95%ile queue (veh)	0.9	0.6	0.4	0.4	

FHWA Double Lane Roundabout Analysis
PM PEAK HOUR
Summary of results:

Approach/entry	NB	SB	EB	WB	Overall
Entering volume (pce)	947	361	119	169	
Conflicting volume (pce)	92	307	553	803	
Adjusted capacity (pce)	2346	2195	1011	923	
Volume-to-capacity ratio	0.40	0.16	0.12	0.18	
Control delay (sec/veh)	2.6	2.0	4.0	4.8	2.8
Approach average queue (veh)	0.7	0.2	0.1	0.2	
Approach 95%ile queue (veh)	2.0	0.6	0.4	0.7	

SINGLE LANE ANALYSIS

Project	T1145.06
Location	Addison Circle
Scenario	Peak Hour
Analyst	JPD
Date	17-Jun-03

FHWA Single Lane Roundabout Analysis
AM PEAK HOUR
Summary of results:

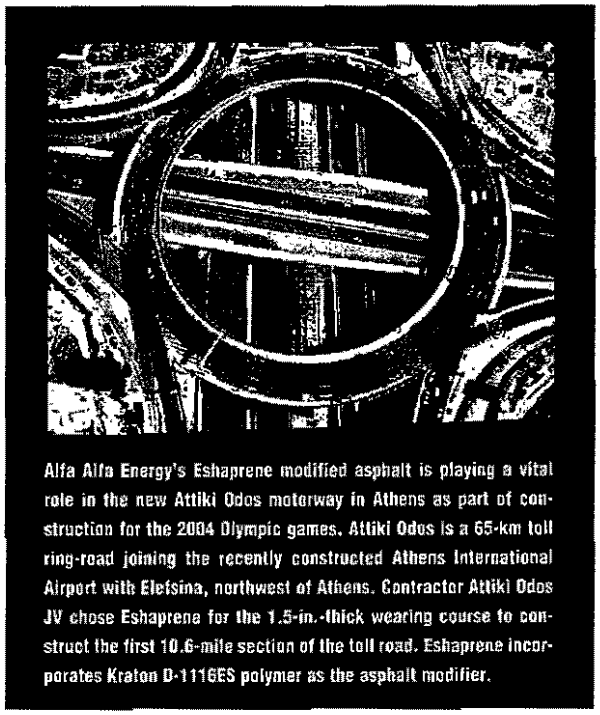
Approach/entry	NB	SB	EB	WB	Overall
Entering volume (pce)	545	384	130	126	
Conflicting volume (pce)	78	168	475	396	
Adjusted capacity (pce)	1169	1120	953	996	
Volume-to-capacity ratio	0.47	0.34	0.14	0.13	
Control delay (sec/veh)	5.7	4.9	4.4	4.1	5.1
Approach average queue (veh)	0.9	0.5	0.2	0.1	
Approach 95%ile queue (veh)	2.5	1.5	0.5	0.4	

FHWA Single Lane Roundabout Analysis
PM PEAK HOUR
Summary of results:

Approach/entry	NB	SB	EB	WB	Overall
Entering volume (pce)	947	361	119	169	
Conflicting volume (pce)	92	307	553	803	
Adjusted capacity (pce)	1161	1044	910	774	
Volume-to-capacity ratio	0.82	0.35	0.13	0.22	
Control delay (sec/veh)	15.1	5.3	4.5	5.9	11.1
Approach average queue (veh)	4.0	0.5	0.2	0.3	
Approach 95%ile queue (veh)	9.7	1.6	0.4	0.8	

8-8-05

Nancy Hart
Lee Ensign
Report on
Alumni Circle



Alfa Alfa Energy's Eshaprene modified asphalt is playing a vital role in the new Attiki Odos motorway in Athens as part of construction for the 2004 Olympic games. Attiki Odos is a 65-km toll ring-road joining the recently constructed Athens International Airport with Elefsina, northwest of Athens. Contractor Attiki Odos JV chose Eshaprene for the 1.5-in.-thick wearing course to construct the first 10.6-mile section of the toll road. Eshaprene incorporates Kraton D-1116ES polymer as the asphalt modifier.

Our Next Roundabout
WWW.ROADSBRIDGES.COM

RECEIVED
NOV 2 3 2004
CITY MANAGER

Jim,
I love this!
Ron

Ron- This is what we need at Belt Line and the Toll Road

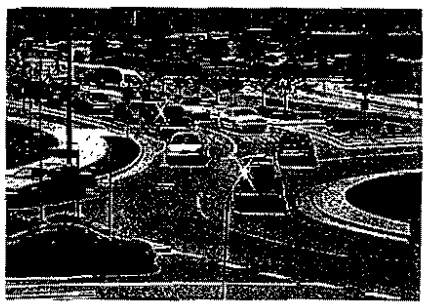
Just Kidding

Jim

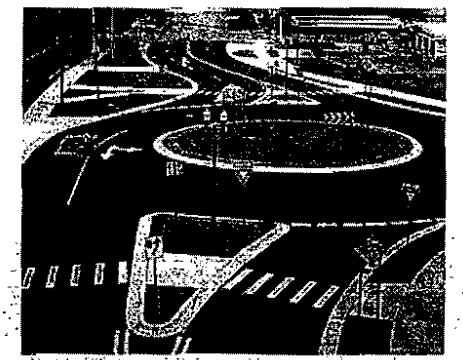
road manager by Ruth W. Stidger, Editor-in-Chief

Roundabout Designs That Work

Intersection locations, rural or urban areas, and other criteria determine the best criteria to use when designing roundabouts.



Dual-lane roundabout.



Markings guide vehicle drivers.

Islands at entries guide, too.

Roundabouts are especially useful to slow traffic and move it smoothly through city intersections. Usually these are single-roundabout designs.

Double-roundabout interchanges have begun appearing along freeways as a substitute for traditional diamond-design interchanges. The double roundabout eliminates traffic signals, some costs, and delays resulting from the signals.

Roundabout size is another key factor in successful design — and generally smaller is considered better.

Setting goals

Intersection designers pick modern roundabouts to help control delays and congestion. Improved safety is another goal, since about half of injury-related crashes and 20% of all fatality crashes happen at intersections.

In some cases software helps prove that roundabouts would do the job better than more conventional designs.

In a study, *Guidelines for Preliminary Selection of Optimum Interchange Type for Specific Locations*, N.J. Garber and M.D. Fontaine compared diamond interchanges with roundabouts at ramp terminals — but only in regard to traffic delays.

British software, which helps design roundabouts, predicts crashes and traffic flow, and is used to estimate delay and queuing for single-island roundabouts.

Texas Transportation Institute software, Passer III, is used to determine diamond interchange cycle length, optimum signal timing, and possible delays.

The Federal Highway Administration's Corridor Simulation software looks at alternative intersection designs.

Roundabout size is another key factor in successful design.

According to a report by FHWA's Joe Bared and University of Maryland's Evangelos Kaiser, three specific cases for two-lane roundabouts and one case for a single-lane roundabout were included in the study.

Diamond, double-roundabout, and single-roundabout designs were examined.

Not included in the FHWA study, but worth noting, is the New York State Department of

Transportation's software, RODEL, an interactive program to design roundabouts.

Study findings

During off-peak and weekends, scenarios including roundabouts save up to 30 seconds of delay per vehicle, according to the FHWA study.

Until intersection vehicle throughput passed 5,000 per hour, both double- and single-roundabout intersection designs offered fewer delays than diamond designs.

Using Maryland State Highway Administration traffic trends, the FHWA study projects that in a year a double roundabout (compared to a diamond design) could save 35,000 vehicle hours for a single intersection with a throughput of 30,000 vehicles per day.

The study also shows increased safety with the use of roundabouts, partly due to the lower speeds at which vehicles enter the intersection.

Designs in place

European roundabouts have a long history, and the United States is beginning to move in the same direction.

Eric Teitelman, P.E., city engineer for Nashua, New Hampshire says that the city's Broad Street roundabout offers many benefits over use of conventional intersections with traffic signals.

Roundabout Signing and Marking Are Critical

While agencies increased their use of roundabouts, the *Manual for Uniform Traffic Control Devices'* directions for including proper roundabout signing and marking are minimal to say the least.

Single-lane roundabouts require less direction — yet still need signs and markings indicating entry points, travel paths, and exit points.

Multi-lane roundabouts create more complex signing and marking needs, says Christopher Kinzel, traffic engineer with HDR Incorporated, Kansas City, Missouri.

A two-lane roundabout, he says, requires:

- Yield signs and direction signs at each entrance point.
- Markings on entry and exit lanes.
- Yield lines and signs at exit points.
- Lane markings and exit path markings within the roundabout.

In multiple-lane roundabouts, generally left-turn exits may only be made from the inside or left lane, Kinzel says, while right-turn exits may only be made from the outside or right lane.

Solid-line markings can be used in heavy-traffic roundabouts to discourage lane changing, except at entrances and exits where dotted striping provides movement guidance, according to Kinzel. Not all designers agree with this concept.

Many roundabouts feature directional signs that combine street names. These may be variations of standard MUTCD destination signage.

Pavement arrows, adapted into a fishhook design, help prevent confusion for on-the-pavement markings or signage.

Redesign and signing

Mark Johnson at the Wisconsin DOT provided us with comments from Leif Ourston explaining the signing and marking used on Clearwater, Florida's very successful roundabout redesign by Barry Crown. The original design used in Clearwater had many problems.

Crown's crash reduction achievements show how well his redesign works. The roundabout had 522 fewer crashes per year, or a 99.6% reduction rate, compared to the original design.

Ourston, Ourston Roundabout Engineering, Santa Barbara, California, who has been in highway engineering for 44 years, calls Barry Crown the best roundabout engineer in the world. Crown redesigned hundreds of roundabouts in England and redesigned the badly performing roundabout in Clearwater.

Signing, striping, and marking make a big difference. Crown uses signs and stripes applicable to specific sites and sometimes realigns outer curbs a few feet for best results.

Spiral striping, rather than other less-effective signing such as a full-circle line and exit blisters (both part of the original, faulty design), is a key feature of the successfully redesigned Clearwater roundabout, Ourston says.

Ourston, whose *Roundabout Design Guidelines* is available at *www.amazon.com*, says that when roundabouts don't work well, it is never the fault of the driver, the city, or the country. "It is always the design."

city traffic engineer. Only 400 feet away is a major signalized intersection with 35,000 ADT.

After six years of use, there have been no injury crashes (including vehicles, pedestrians, and bicycles) on the roundabout.

The roundabout gave easier access to businesses previously affected by left-turn restrictions, and also provided better traffic flow and higher traffic capacity.

In Wisconsin, a roundabout at South Church Street in Watertown replaced a conventional intersection with heavy congestion and poor side-street business access, says Mark Johnson, P.E., transportation engineer with the Wisconsin Department of Transportation.

The roundabout improved business access and traffic flow, improved safety, and provided beautification opportunities.

Maintenance costs will be from $2,500 to $4,000 less per year than costs to maintain a signalized intersection.

In Colorado, a roundabout at Interstate 70 and the Main-Vail Diamond Interchange cost $3 million compared to $20 million for an improved conventional intersection — when it was first built nine years ago.

This roundabout reduced all crashes for the intersection by about 50%. Injury crashes were reduced by about 80%.

Traffic delays were also reduced and good business access was maintained.

In Pittsburgh, a roundabout project is underway at the intersection of Route 9 and York Road.

Roundabout construction cost will be about $110,000. Maintenance costs will be from $2,500 to $4,000 less per year than costs to maintain a signalized intersection.

The design will slow traffic entering the roundabout to about 20 miles per hour, says Don Adams with Sear Brown. BR

3033 N. 44TH STREET
SUITE 375
PHOENIX, ARIZONA 85018
602/955-7206 FAX 602/955-7349
ENGINEERING

July 10, 2003

Invoice Number: 15900

Town of Addison
16801 Westgrove Drive
Addison, TX 75001-9010

Attn: Mr. Jim Pierce

Re: Job T1145.06
Addison Circle Design Review

Consulting Services from May 24, 2003 through June 20, 2003

Billing Group: 001

		Contract Maximum:	$8,700.00
		Previous Billings Against Maximum:	$3,413.30
		Current Billings Against Maximum:	$5,286.70
		Balance After This Invoice:	$0.00
Engineering Designer	49.50 hrs. @	$75.00 /hr.	$3,712.50
Project Engineer	6.50 hrs. @	$100.00 /hr.	$650.00
Project Manager	19.00 hrs. @	$130.00 /hr.	$2,470.00
	TOTAL LABOR		$6,832.50

Outside Services

Outside Service/Subconsultants	$677.52
TOTAL OUTSIDE SERVICES	$677.52

Billing Group 001 Totals:

Billing Group Subtotal:	$7,510.02
Billing Adj.--Cost Plus to Max	-$2,223.32
TOTAL AMOUNT DUE	$5,286.70

Project Totals:

Project Subtotal:	$7,510.02

Fees:	-$2,223.32
Billing Total:	$5,286.70
*** Total Project Invoice Amount	$5,286.70

Aged Receivables:

CURRENT	31-60 DAYS	61-90 DAYS	91-120 DAYS	+120 DAYS
$ 5,286.70	$ 0.00	$ 0.00	$ 0.00	$ 0.00

All invoices are due upon receipt. A late charge of 1.5% will be added to any unpaid balance after 30 days.

OK to Pay

Approved: _____

8-15-03

Addison Circle Mtg w CM & ACM 8-12-03

Operation / Signage / Lee Engineering Report

Hired Lee Engineering – Recommended improvements. Signage & traffic flow

Morris ~~ave~~ ave entry & Quorum bad (sight dist.

Restriping proposed

Ron likes the Traffic Flow sign

We want to avoid sign clutter

Ron likes pavement markings too

JP

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972/248-3006 FAX 972/248-3855

LEE ENGINEERING

cc Robin
Mike (3) copies
JCP.

LETTER OF TRANSMITTAL

TO:	Date: 07/28/03 — Job No. T1145.06
Jim Pierce, P.E.	
Town of Addison.	RE: Addison Circle Final Report
16801 Westgrove Road	
Addison, TX 75001	

WE ARE SENDING YOU:

✔ Attached ___ Under Separate Cover via _____ the following items:

___ Drawing ___ Prints ___ Plans ___ Samples ___ Specifications

___ Copy of letter ___ Change order ___

Copies	Date	NO.	Description
5	07/28/03		Addison Circle Final Report.

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 _____ copy for file

___ For review and comment ___ Other

___ FOR BIDS DUE ___ Prints returned after loan to us

Remarks:

Please find enclosed the five copies of the Final Addison Circle Operations, Design, and Safety Review. All requested changes have been made in this document. The edge of pavement on the southwestern corner of the roundabout has been modified slightly to better reflect curb location. Based on our discussion we reviewed the design plans and the aerial photography and modified our edge of pavement line to best reflect the current location of the curb. Please call Jody Short at (972)248-3006 if you have any questions or comments.

Copy to _____

Signed John Denholm III, EIT

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

3033 N. 44TH STREET
SUITE 375
PHOENIX, ARIZONA 85018
602/955-7206 FAX 602/955-7349

ENGINEERING

June 10, 2003

Invoice Number: 15842

Town of Addison
16801 Westgrove Drive
Addison, TX 75001-9010

Attn: Mr. Jim Pierce

Re: Job T1145.06
Addison Circle Design Review

Consulting Services from May 08, 2003 through May 23, 2003

Billing Group: 001

		Contract Maximum:	$8,700.00
		Previous Billings Against Maximum:	$0.00
		Current Billings Against Maximum:	$3,413.30
		Balance After This Invoice:	$5,286.70
Engineering Designer	23.50 hrs. @	$75.00 /hr.	$1,762.50
Project Manager	10.00 hrs. @	$130.00 /hr.	$1,300.00
	TOTAL LABOR		$3,062.50

Reimbursables

Copies	$32.48
Engineering Supplies	$290.21
Mileage	$28.11
TOTAL REIMBURSABLES	$350.80
TOTAL AMOUNT DUE	$3,413.30

Aged Receivables:

CURRENT	31-60 DAYS	61-90 DAYS	91-120 DAYS	+120 DAYS
$ 3,413.30	$ 0.00	$ 0.00	$ 0.00	$ 0.00

OK to pay
Jim Pierce
6-16-03

LETTER OF TRANSMITTAL

TOWN OF ADDISON

Public Works / Engineering
16801 Westgrove • P.O. Box 9010
Addison, Texas 75001
Telephone: (972) 450-2871 • Fax: (972) 450-2837

DATE 5-6-03	JOB NO.
ATTENTION	
RE: Addison Circle	

TO Joseph T. Short, P.E.
Lee Engineering

GENTLEMAN:

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			Addison Circle Design Review & Operational Analysis

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 Please consider this your notice to proceed.

COPY TO _____

SIGNED: _____

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

LETTER OF TRANSMITTAL

TOWN OF ADDISON

Public Works / Engineering
16801 Westgrove • P.O. Box 9010
Addison, Texas 75001
Telephone: (972) 450-2871 • Fax: (972) 450-2837

DATE 5-6-03	JOB NO.
ATTENTION	
RE: Addison Circle	

TO Carmen Moran
Town Hall

GENTLEMAN:

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			Signed Proposal from Lee Engineering for Addison Circle Design Review and Operational Analysis

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 _____

COPY TO _____

SIGNED: _____

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

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972/248-3006 FAX 972/248-3855

LEE ENGINEERING

May 1, 2003

Mr. Jim C. Pierce, P.E.
Assistant City Engineer
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001-9010

Re: Addison Circle Design Review and Operational Analysis

Dear Mr. Pierce:

Lee Engineering (LEE) is pleased to submit this letter of agreement to perform traffic engineering services for the Town of Addison. Per your request we have prepared the following scope of services to perform a thorough review of the design features and current operating characteristics of the roundabout known as the Addison Circle located at the intersection of Quorum Drive and Addison Circle. The anticipated product of the effort will be a letter report documenting the results of the review.

SCOPE OF SERVICES

The Scope of Service outlined below illustrates our approach to this project:

Task 1 Data Collection - LEE will gather and review available studies, reports and graphics prepared as part of the design of the Addison Circle. The existing signing and markings on each approach and along the circulating roadway will be inventoried and photographed. A recent aerial photograph of the roundabout will also be acquired. We will also collect 24-hour traffic counts on each approach and departure from the circle as well as at one location on the circulating roadway on a typical weekday. Peak period traffic operations will be observed. All crash data available for the roundabout and for each approach to the roundabout will be gathered from the Addison Police Department.

Task 2 Design Review - LEE will begin our review of the roundabout design features by comparing design plans with inventoried roundabout features and aerial photographs. Design features such as approach widths, circulating roadway widths, signing, and pavements markings will be compared with recommended practices from the FHWA publication, Roundabouts: An Informational Guide and the new Federal Manual of Uniform Traffic Control Devices. Compliance with design practices from other states with extensive

experience designing and operation roundabouts will also be reviewed. As part of the design review, we will also identify the shortest path through the roundabout from each approach. The design speeds along each of these paths will be calculated. The design speeds will be compared to identify any significant expected discrepancies in speeds between vehicles entering the roundabout from each approach. Based on this review we will identify any recommended modifications or enhancements to the existing signing and markings at the roundabout that may help guide motorists through the roundabout. We will also identify any significant design deficiencies of the roundabout.

Task 3 Operational Analysis - LEE will perform capacity analyses for the peak periods at the roundabout. These analyses will focus on each merge point around the roundabout. Based on these analyses we will identify any significant modifications to the roundabout that are needed to enhance the operating characteristics or increase the capacity of the roundabout.

Task 4 Safety Analysis - LEE will review crash records for the roundabout. The types, locations, frequencies, and rates of crashes will be summarized. The records will also be reviewed to identify the cited causes of the crashes. Based on this review we will identify any significant modifications to the roundabout that are needed to enhance the safety of the roundabout.

Task 5 Documentation - LEE will prepare a brief draft report summarizing our findings and recommendations as they relate to the Addison Circle. This report will be submitted to the City staff for review and comment. A final report will be prepared based on these comments.

SCHEDULE AND FEE

The draft report identified in Task 5 will be completed within four weeks of receiving authorization to proceed with this study. The fee for our services will be billed on an hourly basis according to the attached terms and conditions and will not exceed $8,700 without your approval.

If you have any questions, please contact me at (972) 248-3006. We appreciate the opportunity to provide these services and look forward to working with you on this project. Please sign and return a copy of this letter as a notice to proceed.

Sincerely,

Joseph T. Short, P.E.
Vice President

Accepted

5-6-03
Date

Lee Engineering
Terms and Conditions
April 15, 2002

Additional services as authorized by you will be performed at the following rates:

Principal	$165.00/per hour
Project Manager	$130.00/per hour
Project Engineer	$100.00/per hour
Sr. Engineering Designer	$ 90.00/per hour
Engineering Designer	$ 75.00/per hour
Technician	$ 45.00/per hour
Administrative Assistant	$ 60.00/per hour
Secretarial	$ 50.00/per hour
Highway travel	$0.365/mile
Meals, lodging, air fares,	out-of-pocket costs
Reproduction	$0.10/copy

TERMS AND CONDITIONS:

1. Invoices will be submitted monthly.
2. Invoices are due and payable when received.
3. Interest at the rate of 1.5% per month will be applied to invoices not paid within 30 days of initial billing date.
4. We reserve the right to cease work on delinquent accounts.
5. Contracting party is responsible for paying all fees and expenses associated with all activities related to an engagement. Credit will be given for payments received directly from clients of the contracting party or from others.
6. The retainer fee will be credited against fee.
7. In addition to invoices rendered and interest thereon, contracting party agrees to pay any and all legal fees and costs incurred in collecting overdue accounts.
8. Rates are subject to change annually. Work performed in subsequent years will be charged at the adjusted rates.
9. Extra copies of reports will be billed at $10.00 per copy.

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972/248-3006 FAX 972/248-3855
LEE ENGINEERING

Looks good to me RJ

Robin
Please review & comment
Jim

May 1, 2003

Mr. Jim C. Pierce, P.E.
Assistant City Engineer
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001-9010

Re: Addison Circle Design Review and Operational Analysis

Dear Mr. Pierce:

Lee Engineering (LEE) is pleased to submit this letter of agreement to perform traffic engineering services for the Town of Addison. Per your request we have prepared the following scope of services to perform a thorough review of the design features and current operating characteristics of the roundabout known as the Addison Circle located at the intersection of Quorum Drive and Addison Circle. The anticipated product of the effort will be a letter report documenting the results of the review.

SCOPE OF SERVICES

The Scope of Service outlined below illustrates our approach to this project:

Task 1 Data Collection - LEE will gather and review available studies, reports and graphics prepared as part of the design of the Addison Circle. The existing signing and markings on each approach and along the circulating roadway will be inventoried and photographed. A recent aerial photograph of the roundabout will also be acquired. We will also collect 24-hour traffic counts on each approach and departure from the circle as well as at one location on the circulating roadway on a typical weekday. Peak period traffic operations will be observed. All crash data available for the roundabout and for each approach to the roundabout will be gathered from the Addison Police Department.

Task 2 Design Review - LEE will begin our review of the roundabout design features by comparing design plans with inventoried roundabout features and aerial photographs. Design features such as approach widths, circulating roadway widths, signing, and pavements markings will be compared with recommended practices from the FHWA publication, Roundabouts: An Informational Guide and the new Federal Manual of Uniform Traffic Control Devices. Compliance with design practices from other states with extensive

experience designing and operation roundabouts will also be reviewed. As part of the design review, we will also identify the shortest path through the roundabout from each approach. The design speeds along each of these paths will be calculated. The design speeds will be compared to identify any significant expected discrepancies in speeds between vehicles entering the roundabout from each approach. Based on this review we will identify any recommended modifications or enhancements to the existing signing and markings at the roundabout that may help guide motorists through the roundabout. We will also identify any significant design deficiencies of the roundabout.

Task 3 Operational Analysis - LEE will perform capacity analyses for the peak periods at the roundabout. These analyses will focus on each merge point around the roundabout. Based on these analyses we will identify any significant modifications to the roundabout that are needed to enhance the operating characteristics or increase the capacity of the roundabout.

Task 4 Safety Analysis - LEE will review crash records for the roundabout. The types, locations, frequencies, and rates of crashes will be summarized. The records will also be reviewed to identify the cited causes of the crashes. Based on this review we will identify any significant modifications to the roundabout that are needed to enhance the safety of the roundabout.

Task 5 Documentation - LEE will prepare a brief draft report summarizing our findings and recommendations as they relate to the Addison Circle. This report will be submitted to the City staff for review and comment. A final report will be prepared based on these comments.

SCHEDULE AND FEE

The draft report identified in Task 5 will be completed within four weeks of receiving authorization to proceed with this study. The fee for our services will be billed on an hourly basis according to the attached terms and conditions and will not exceed $8,700 without your approval.

If you have any questions, please contact me at (972) 248-3006. We appreciate the opportunity to provide these services and look forward to working with you on this project. Please sign and return a copy of this letter as a notice to proceed.

Sincerely,

Joseph T. Short, P.E.
Vice President

Accepted

---------- ----------
Date

Lee Engineering
Terms and Conditions
April 15, 2002

Additional services as authorized by you will be performed at the following rates:

Principal	$165.00/per hour
Project Manager	$130.00/per hour
Project Engineer	$100.00/per hour
Sr. Engineering Designer	$ 90.00/per hour
Engineering Designer	$ 75.00/per hour
Technician	$ 45.00/per hour
Administrative Assistant	$ 60.00/per hour
Secretarial	$ 50.00/per hour
Highway travel	$0.365/mile
Meals, lodging, air fares,	out-of-pocket costs
Reproduction	$0.10/copy

TERMS AND CONDITIONS:

1. Invoices will be submitted monthly.
2. Invoices are due and payable when received.
3. Interest at the rate of 1.5% per month will be applied to invoices not paid within 30 days of initial billing date.
4. We reserve the right to cease work on delinquent accounts.
5. Contracting party is responsible for paying all fees and expenses associated with all activities related to an engagement. Credit will be given for payments received directly from clients of the contracting party or from others.
6. The retainer fee will be credited against fee.
7. In addition to invoices rendered and interest thereon, contracting party agrees to pay any and all legal fees and costs incurred in collecting overdue accounts.
8. Rates are subject to change annually. Work performed in subsequent years will be charged at the adjusted rates.
9. Extra copies of reports will be billed at $10.00 per copy.

17440 DALLAS PARKWAY
SUITE 204
DALLAS, TEXAS 75287
972/248-3006 FAX 972/248-3855

LEE ENGINEERING

Mike - for your review & comment. Looks OK to me

Gus Mi Jr

cc Robin

May 1, 2003

Mr. Jim C. Pierce, P.E.
Assistant City Engineer
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001-9010

Re: Addison Circle Design Review and Operational Analysis

Dear Mr. Pierce:

Lee Engineering (LEE) is pleased to submit this letter of agreement to perform traffic engineering services for the Town of Addison. Per your request we have prepared the following scope of services to perform a thorough review of the design features and current operating characteristics of the roundabout known as the Addison Circle located at the intersection of Quorum Drive and Addison Circle. The anticipated product of the effort will be a letter report documenting the results of the review.

SCOPE OF SERVICES

The Scope of Service outlined below illustrates our approach to this project:

Task 1 Data Collection - LEE will gather and review available studies, reports and graphics prepared as part of the design of the Addison Circle. The existing signing and markings on each approach and along the circulating roadway will be inventoried and photographed. A recent aerial photograph of the roundabout will also be acquired. We will also collect 24-hour traffic counts on each approach and departure from the circle as well as at one location on the circulating roadway on a typical weekday. Peak period traffic operations will be observed. All crash data available for the roundabout and for each approach to the roundabout will be gathered from the Addison Police Department.

Task 2 Design Review - LEE will begin our review of the roundabout design features by comparing design plans with inventoried roundabout features and aerial photographs. Design features such as approach widths, circulating roadway widths, signing, and pavements markings will be compared with recommended practices from the FHWA publication, Roundabouts: An Informational Guide and the new Federal Manual of Uniform Traffic Control Devices. Compliance with design practices from other states with extensive

experience designing and operation roundabouts will also be reviewed. As part of the design review, we will also identify the shortest path through the roundabout from each approach. The design speeds along each of these paths will be calculated. The design speeds will be compared to identify any significant expected discrepancies in speeds between vehicles entering the roundabout from each approach. Based on this review we will identify any recommended modifications or enhancements to the existing signing and markings at the roundabout that may help guide motorists through the roundabout. We will also identify any significant design deficiencies of the roundabout.

Task 3 Operational Analysis - LEE will perform capacity analyses for the peak periods at the roundabout. These analyses will focus on each merge point around the roundabout. Based on these analyses we will identify any significant modifications to the roundabout that are needed to enhance the operating characteristics or increase the capacity of the roundabout.

Task 4 Safety Analysis - LEE will review crash records for the roundabout. The types, locations, frequencies, and rates of crashes will be summarized. The records will also be reviewed to identify the cited causes of the crashes. Based on this review we will identify any significant modifications to the roundabout that are needed to enhance the safety of the roundabout.

Task 5 Documentation - LEE will prepare a brief draft report summarizing our findings and recommendations as they relate to the Addison Circle. This report will be submitted to the City staff for review and comment. A final report will be prepared based on these comments.

SCHEDULE AND FEE

The draft report identified in Task 5 will be completed within four weeks of receiving authorization to proceed with this study. The fee for our services will be billed on an hourly basis according to the attached terms and conditions and will not exceed $8,700 without your approval.

If you have any questions, please contact me at (972) 248-3006. We appreciate the opportunity to provide these services and look forward to working with you on this project. Please sign and return a copy of this letter as a notice to proceed.

Sincerely,

Joseph T. Short, P.E.
Vice President

Accepted

Date

Lee Engineering
Terms and Conditions
April 15, 2002

Additional services as authorized by you will be performed at the following rates:

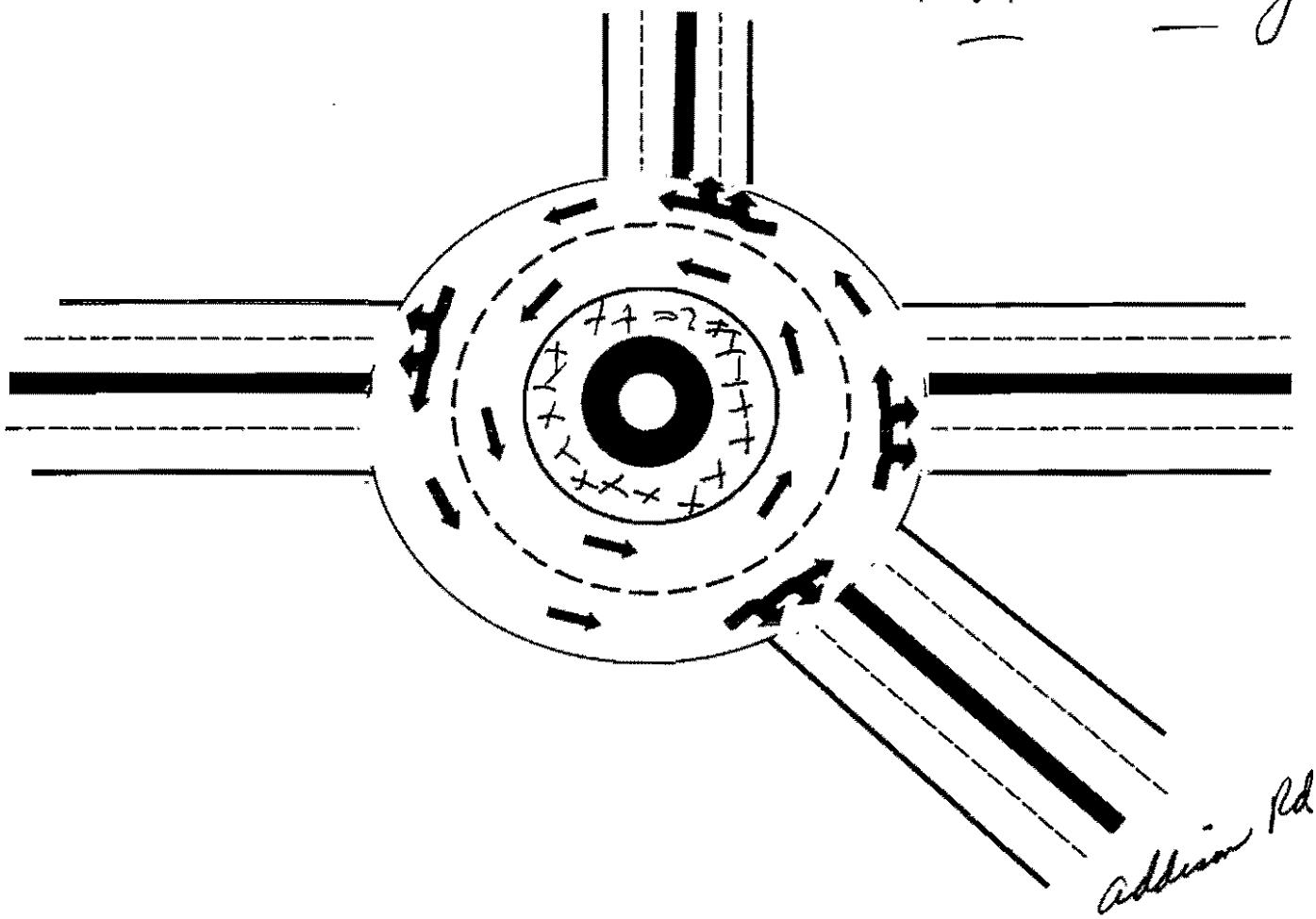
Principal	$165.00/per hour
Project Manager	$130.00/per hour
Project Engineer	$100.00/per hour
Sr. Engineering Designer	$ 90.00/per hour
Engineering Designer	$ 75.00/per hour
Technician	$ 45.00/per hour
Administrative Assistant	$ 60.00/per hour
Secretarial	$ 50.00/per hour
Highway travel	$0.365/mile
Meals, lodging, air fares,	out-of-pocket costs
Reproduction	$0.10/copy

TERMS AND CONDITIONS:

1. Invoices will be submitted monthly.
2. Invoices are due and payable when received.
3. Interest at the rate of 1.5% per month will be applied to invoices not paid within 30 days of initial billing date.
4. We reserve the right to cease work on delinquent accounts.
5. Contracting party is responsible for paying all fees and expenses associated with all activities related to an engagement. Credit will be given for payments received directly from clients of the contracting party or from others.
6. The retainer fee will be credited against fee.
7. In addition to invoices rendered and interest thereon, contracting party agrees to pay any and all legal fees and costs incurred in collecting overdue accounts.
8. Rates are subject to change annually. Work performed in subsequent years will be charged at the adjusted rates.
9. Extra copies of reports will be billed at $10.00 per copy.

Tollway

Ms. Hartley



Addison Circle

- Repaint ***Yield*** in bright, reflective color on pavement at entries.
- Add an ***Exit from Right Lane Only*** sign under yield signs at entries (on same poles).
- Paint lane markings for right vs. left lane division.
- Paint combination exit/straight arrows on pavement in right lane at exits.
- Paint left lane with straight arrows.
- Paint solid white line around center bricks.

4-14-03±

Donna Hartley's proposed Solution to the Addison Circle Roundabout traffic flow

972-248-8754

JMP

cc Mike
Robin

PROJECT OF THE YEAR: STRUCTURES MORE THAN $10 MILLION

The Centre of Elgin

Managing Agency:
City of Elgin, Illinois

Primary Contractor:
Gilbane Building Co.

Primary Consultant:
Williams Architects

Nominated By:
APWA Chicago Metro Chapter

The Centre of Elgin located in the core of Elgin's revitalized downtown Cultural District is the largest municipally-owned family recreation center in the nation. The project consists of a new, 398-car parking structure, a 184,712 gsf Recreation Center, and roadway and streetscape improvements surrounding the site. The City of Elgin's commitment to public recreation, co-generational community activities and urban revitalization is evident throughout this project.

The multi-level design of the Recreational Center is sensitive to the surrounding urban context with a design that seamlessly integrates the natural topography of the site and compliments the dynamics of interior activity. The first level features a secure preschool wing and four themed classrooms, childcare, outdoor play area, leisure pools, eight-lane competition pool, therapy pool, triple court gymnasium, arts and crafts, racquetball courts, multipurpose banquet room, meeting rooms, teaching kitchen, seniors center, 35-foot climbing wall, lounges with a café, and a wellness center.

Visitors are welcomed to the second level activity space featuring a "club" atmosphere health and fitness, three-lane running track with views to the gymnasium and indoor pools, enclosed pedestrian bridge to a multi-level parking structure, teen center, dance and aerobics, and administrative offices.

Because of the owner's expressed desire to include the best possible materials and quality in the construction of the Centre, the contractor developed a comprehensive quality plan to ensure all materials and workmanship met the requirements contained in the contract documents. This quality plan included first inspections of materials delivered to the project for the first time to ensure the selected materials were being used and met the requirements of the submittals.

Several mockups were constructed to work out installation "bugs" and serve as the quality standard for the actual installation. Mockups were made of the exterior walls, architectural concrete, precise panels with integrally cast brick veneer, colored concrete (pool deck), architectural pressed concrete sidewalks, and various architectural finishes. Quality deficiencies noted during construction were noted on a "Rolling Completion List" and distributed to trade contractors at the weekly superintendent's meeting to ensure non-conforming items were corrected before they could be concealed by later work and before substantial completion of the building/compilation of the architect's punchlist. The process was embraced by the contractors as they recognized the benefits of a smaller punchlist and fewer mobilizations to complete their work.

The project accomplished the City of Elgin's goals set forth in their master plan, and contributed to the economic revival of downtown Elgin.

110th Street and Lamar Avenue Roundabout Improvements

Managing Agency:
City of Overland Park, Kansas

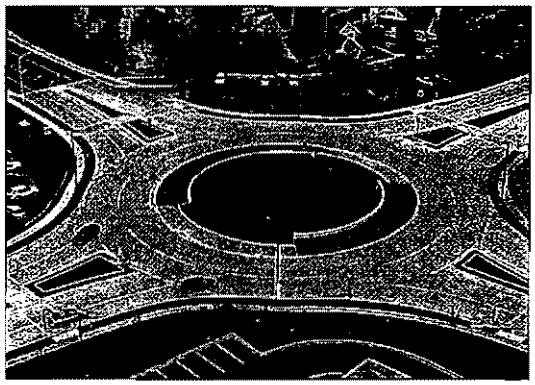
Primary Contractor:
Pyramid Contractors, Inc.

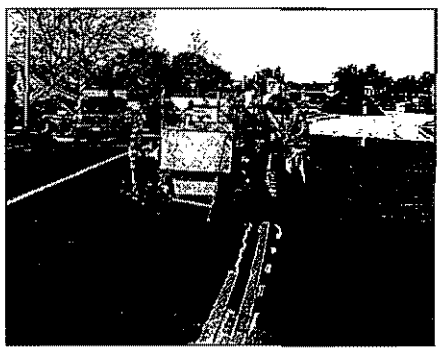
Primary Consultant:
Olsson Associates

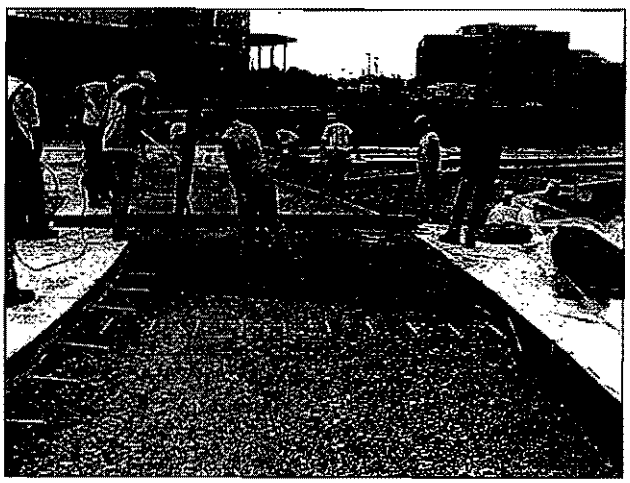
Nominated By:
APWA Kansas City Metro Chapter

The 110th Street and Lamar Avenue Roundabout Improvement Project is the first two-lane modern roundabout in the City of Overland Park, Kansas. Being located adjacent to the newly-constructed Overland Park Hotel and Convention Center Complex, this project had very high visibility. It was paramount that the project be completed and open to traffic prior to the opening of the Convention Center facility. The project required substantial cooperation and coordination with the contractor of the Convention Center due to the construction activities along the common areas of 110th Street and Lamar Avenue.

The pavement in the roundabout, including the flared approaches between the circulating lanes and the entry nose of the splitter islands, is 240 mm of concrete placed on 120 mm of drainable aggregate base course and 200 mm of fly ash treated base. The tangent approaches prior to the splitter islands are constructed of 255 mm of asphaltic concrete on 200 mm of fly ash treated base. An underdrain pipe system was installed to convey subsurface water from under the pavement to an enclosed storm drainage system consisting of curb inlets to remove surface water runoff.







The project also included 600 mm wide concrete curb and gutter with 100 mm curb height, 1.5 m sidewalk and wheelchair ramps constructed of 100 mm and 150 mm thick concrete respectively, 150 mm thick concrete drive entrances, and concrete curbing for splitter islands and central island. The splitter islands and central island are constructed with concrete paver stones or limestone pavers on a concrete base with a raised concrete edge curb to retain the soil in the landscaped planting areas.

The landscaping in the central island consists of two large earthen berms behind two decorative retaining walls. The retaining walls are constructed of structurally reinforced concrete with limestone facing and raised bronze lettering attached to the face. The plantings are a variety of annual flowers, perennial wild flowers and ornamental grasses. An irrigation system with quick hose couplers was installed to supply water to the landscape planting areas. In addition to a streetlighting system for roadway lighting, low voltage aesthetic lighting was constructed in the central island with varying color filters to accent the planting materials. Proper pavement markings and permanent signing were installed to provide the appropriate guidance to the traveling public.

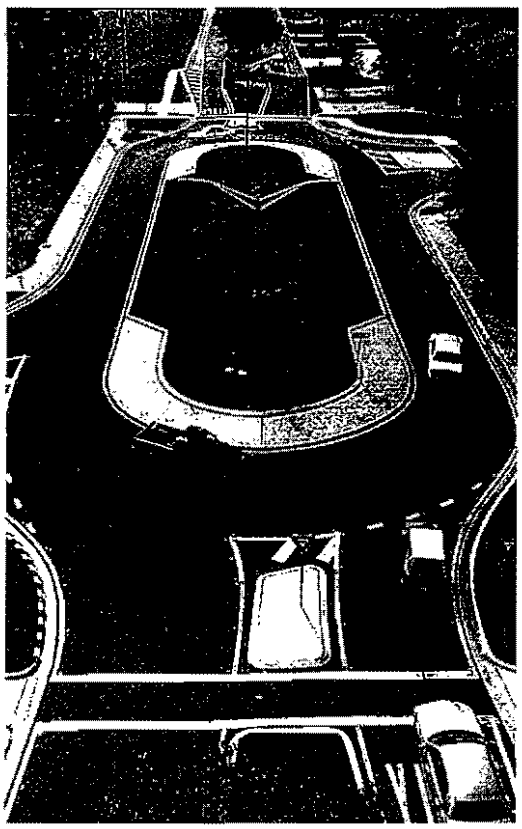
The project was completed ahead of schedule, within budget, and with no lost time accidents in spite of utility conflicts, coordination issues, and material delivery problems.

road manager by Ruth W. Stidger, Editor-in-Chief

Can America Handle Roundabouts?

Designs and applications show that we're beginning to follow Europe's example by using roundabouts to speed traffic and prevent intersection crashes.

Forty states now use or are experimenting with roundabouts. According to the *Seattle Times,* there are more than 600 in the United States today. But, don't confuse them with traffic circles, the experts say.



Conversion to a roundabout reduced crashes to zero.

Roundabouts, properly designed, reduce crashes 50 to 90% when compared to two- and four-way stop control or signalized intersections, says Michael Wallwork, P.E. Roundabouts avoid problems with old-design traffic circles too.

When crashes do occur, Wallwork, a roundabout designer, says, severity is greatly reduced. The reason, according to this engineer, often called Mr. Roundabout, is that normal intersections have 32 vehicle-to-vehicle conflict points. Roundabouts have only eight vehicle-to-vehicle conflict points.

Pedestrian safety is improved, too. Normal intersections have 24 vehicle-to-pedestrian conflict points; roundabouts have only eight.

Design matters

Many agencies confuse roundabouts with traffic circles and are hesitant to try them. The designs are quite different. A traffic circle is often very large, traffic enters and exits at a high speed, and complex entry and exit points can lead to more crashes rather than less.

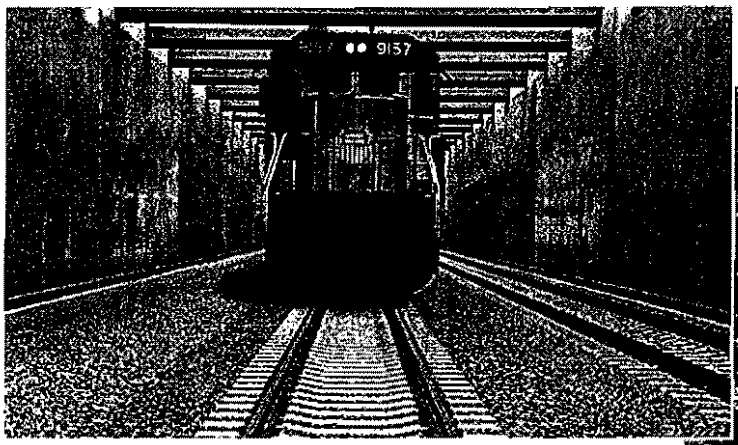
Modern roundabouts, mostly developed in the United Kingdom from the 60s onward, provide many advantages over these old, outmoded traffic circle designs. Roundabout design reduces circle size and slows vehicle entry and exit speeds.

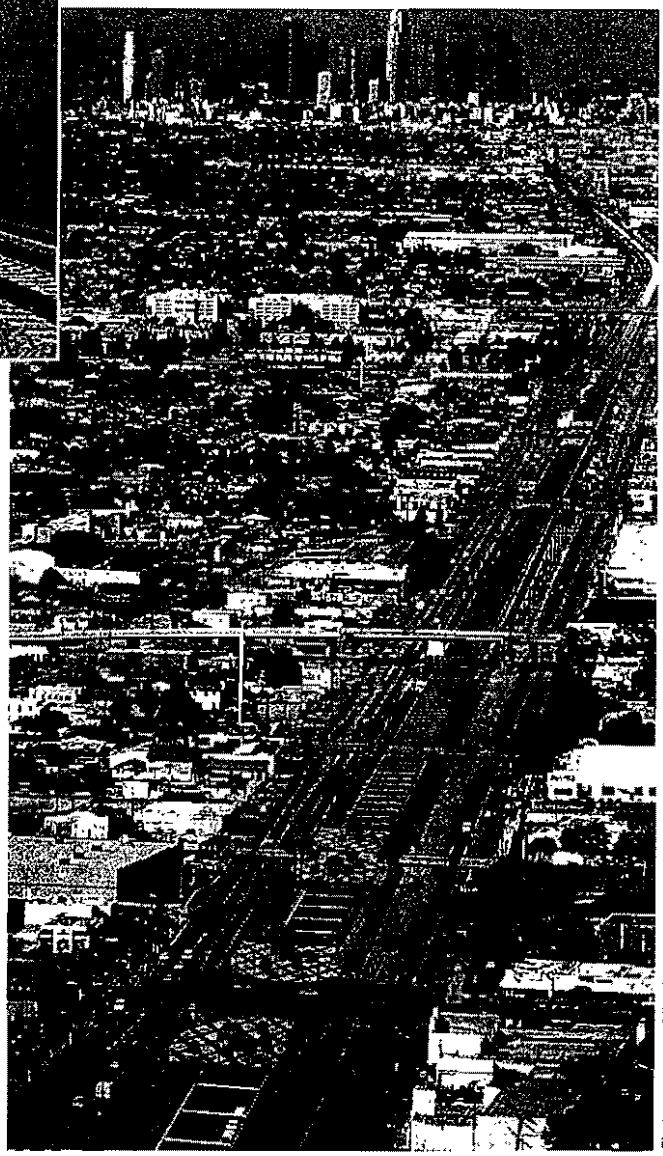
Each roundabout has a central island, 15 feet or larger in diameter.

Each roundabout has a central island, 15 feet or larger in diameter. The island may be round, square, or some other shape.

Each entry/exit point has a splitter island that is triangular. This keeps drivers from entering the exit area and gives pedestrians a safe haven as they cross.

Vehicles enter and exit by turning right at a slow speed of 12 to





Photos courtesy of the Alameda Corridor Transportation Authority.

fully talks about how 'Brown' allowed him to get rid of his warehouses.

Manufacturing inventory turnover ratios increased by 20% during the 1990's, a reflection of decreased cycle times and improved efficiency at the factory level. That means supplies and materials in transit at the front end of the process arriving in time to meet production schedules. It means finished goods in transit at the back end of the process arriving in time to meet sales demand. JIT depends on reliable and predictable freight movement.

NAFTA has spurred a significant rise in incoming trucks from both Canada and Mexico. Canadian border truck crossings grew 22% to just over 7 million in 2000 from 1977; Mexican border truck crossings grew 30% to 4.5 million in the same period.

Internet business in the U.S. hit $524 billion in 1999, according to a University of Texas study. Estimates from ActivMedia say 2002 could have generated $1.2 trillion of business via the Internet. Virtually all of this business relies on our highway system in whole or part to deliver goods to customers.

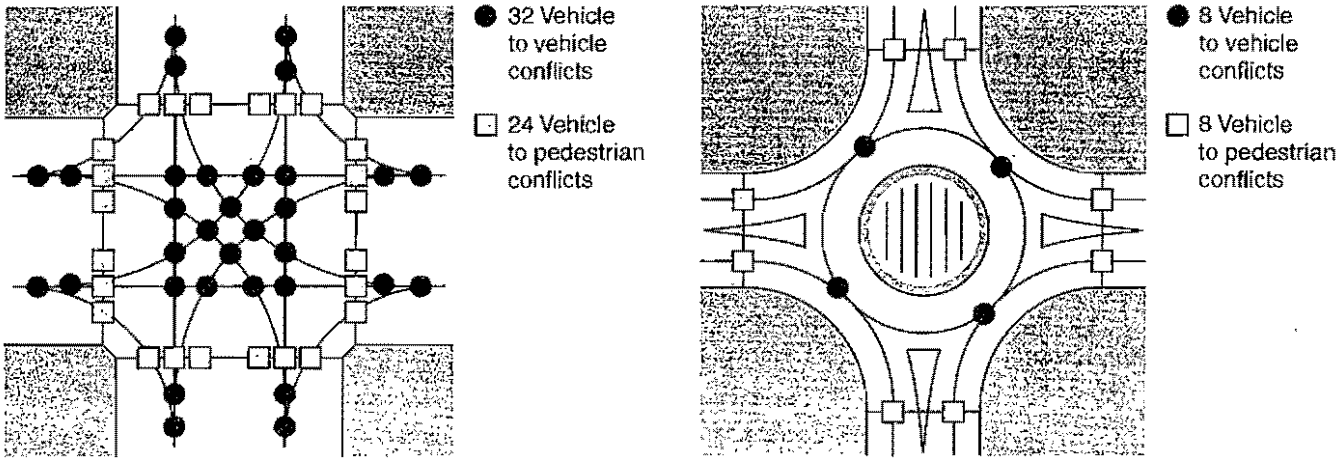
These changes have put more pressure, and more cargo, on our highway system. Some of this represents a shift from other modes. Also, problems or heavy congestion in one particular mode often shift freight to other modes, highways in particular.

AASHTO estimates that minimal investment and no growth in the freight rail industry between now and 2020 would shift almost 900-million tons of freight and 31-billion truck miles onto the highways. The costs over 20 years would be staggering — $326 billion for shippers; $492 billion in added travel time, operating, and accident costs for highway users; $21 billion in added maintenance costs for highway departments.

Sufficient capacity in all freight modes — air, water, rail, and highway — and in the links that connect them, are vital to future growth. Added highway capacity is the lynchpin component because of the significant role highways and trucks play in the overall movement of freight. BR

Linkage and capacity of transportation modes are becoming increasingly important in the fight against congestion, especially in moving freight. The 20-mile, $2.4-billion Alameda Corridor project, shown in an aerial view, celebrated "substantial completion" last year. The intermodal project will create a faster, more efficient way to move freight in the southern California area by connecting the ports of Los Angeles and Long Beach to the transcontinental rail network in downtown Los Angeles. The project also will improve traffic flow and ease congestion in the area it eliminates or minimizes conflicts are 200 at-grade railroad crossings. A signature feature of the project is a 10-mile, 33-foot-deep freight train trench (see inset photo) in the mid-corridor section. The project includes substantial bridge construction (29 trench crossings alone) and road work (widening, repaving, and signaling). Financing was a unique mixture of bond revenues, grants, and loans.

How Roundabouts Reduce Vehicle Conflicts

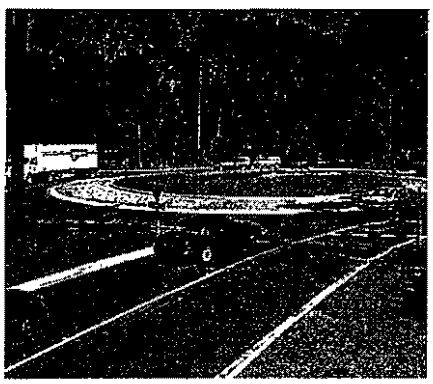


25 miles per hour, depending on the type of street.

Local streets should have central islands of about 15-foot diameter, Wallwork says. Collector road roundabout islands can be 30 to 40 feet. Arterial road central islands begin at 60 feet. Freeway or major intersection islands are 120 to 180 feet.

Design for use

A Web site sponsored by Lounsbury and Associates, *www.alaskaroundabouts.com*, gives roundabout myths and facts, with special focus on design and use.



Hilton Head, South Carolina roundabout reduced crashes by more than 50%.

One myth, the roundabout design company reports, is that roundabouts are difficult to maneuver. In fact, using a roundabout is much the same as making a right turn on red.

At a traffic signal, a right-turning driver stops at the stop bar, looks for conflicting traffic coming from the left, chooses an acceptable gap in the traffic flow, and then turns right onto the cross street.

At a modern roundabout, the oncoming driver approaches the yield line, looks for conflicting traffic coming from the left, chooses an acceptable gap in the traffic flow, and then enters the roundabout with a right turn at the yield sign.

Once inside the roundabout, a driver continues circling counterclockwise until reaching the desired exit. Exit maneuvers are also right turns.

Modern roundabouts work better if drivers signal their intention to turn.

Roundabouts keep traffic moving, since vehicles aren't stopped for several minutes waiting for a signal to change.

The costs

Roundabouts cost less than signalized intersections to build and they don't need electricity or signal parts replacement. When the power goes out, no-one needs to worry about nonfunctionality of the traffic control measure.

How much can roundabouts save? In Anchorage, maintaining a signal costs about $15,000 per year. With at least four signals at each intersection, this means a savings of at least $60,000 per year per intersection.

The Alaska Department of Transportation reports that it expects to save about $1 million in reduced construction costs and associated lighting costs by building two teardrop-shaped roundabouts at Dowling Road and the New Seward Highway in Anchorage.

Safety

Roundabouts improve safety. A study conducted by the Ryerson Polytechnic University, the Insurance Institute for Highway Safety, and the University of Maine found that changing from a signalized intersection to a roundabout decreased crashes 39% and

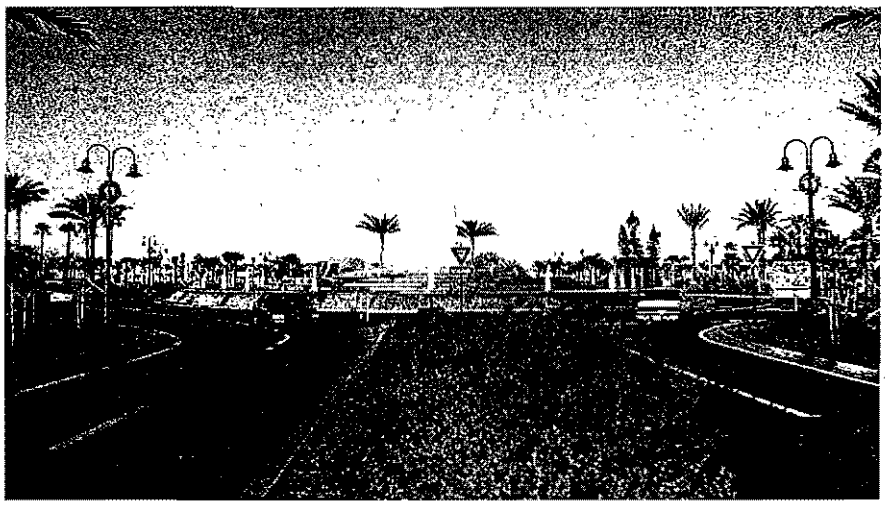
Utah is one of the leaders with more than 40 roundabouts in use and more on the drawing board.

decreased injury-producing crashes by 76%. Fatalities fell by 90%. Delays in traffic were reduced by up to 75%.

A National Cooperative Highway Research Program study found that single-lane roundabouts are the safest. These cut total crashes by 51% and injury-producing crashes by 73%.

Michael Wallwork cites some specific sites. In a two-lane South Carolina roundabout carrying up to 2,500 vehicles per hour, crashes were reduced by 81%. Injury crashes were eliminated.

At a Clearwater, Florida roundabout, all crashes severe enough to be reported were eliminated.

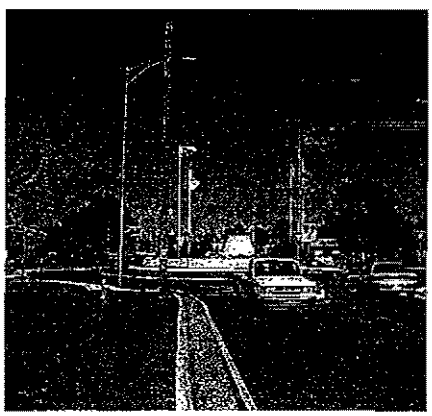


Center island provides beautification as well as increased safety.

Roundabouts in use

Almost everybody's doing it — building roundabouts. Utah is one of the leaders with more than 40 roundabouts in use and more on the drawing board. Some of these were implemented to help keep traffic moving when Salt Lake City hosted the Olympic Games.

The Alaska DOT makes good use of roundabouts, too, especially in larger urban areas such as Anchorage. New York, Florida, Colorado, Hawaii, Texas, Kansas, Vermont, South Carolina, Maryland, Delaware, Washington, Montana, and Illinois DOTs are some of the other leaders.



Beach entrance roundabout cut crashes to zero even though traffic increased 40%.

Michael Wallwork says the greatest roundabout ever built in the U.S. carries up to 58,000 vehicles per day and 8,000 pedestrians each day. It's located in Clearwater, Florida.

At the large, two-lane roundabout, minor property crashes have still occurred, but no reportable crashes. Prior to the roundabout, there were about 35 reported crashes per year. Many of these were injury crashes. There have been no pedestrian or bicycle crashes in the roundabout despite an average of four a year before the roundabout was built.

In Maryland, accident data collected before and after the Lisbon Roundabout in Howard County was built shows a 74% reduction in annual accidents and a 91% reduction in annual injury accidents.

Alaska's DOT projects include the Southport Roundabout. It replaced an accident-prone intersection where drivers habitually sped through. As traffic increased in the area, so did accident rates. Since the intersection was on a curve in the road, blind spots intensified the problems.

The DOT used Lounsbury and Associates to design a roundabout to replace the conventional intersection.

The Alaska DOT makes good use of roundabouts, too, especially in larger urban areas such as Anchorage.

The final design used tapers at the entrances on Southport Drive and an enlarged central island to deflect traffic.

A higher curb at the truck apron prevented snow and ice from compromising the value of the central island during the winter.

Exit radii were increased for truck mobility and to help balance speed.

In Kingston, New York an old traffic circle with a diameter of 600 feet was replaced with a 200-foot roundabout. Accident rates dropped markedly and traffic delays were decreased. BR

Jim Pierce

From: Chris Terry
Sent: Tuesday, April 03, 2001 2:19 PM
To: Michael Murphy; Don Franklin; Jim Pierce
Subject: FW: Roundabouts Reduce Injury Crashes By 76 Percent

FYI -
See, I knew they were safe!
Chris
-----Original Message-----
From: Bill Shipp
Sent: Tuesday, April 03, 2001 1:27 PM
To: Ron Whitehead; Chris Terry; Lea Dunn
Subject: FW: Roundabouts Reduce Injury Crashes By 76 Percent

-----Original Message-----
From: HCBtex@aol.com [mailto:HCBtex@aol.com]
Sent: Tuesday, April 03, 2001 12:15 PM
To: cmoran@ci.addison.tx.us
Cc: bshipp@ci.addison.tx.us
Subject: Roundabouts Reduce Injury Crashes By 76 Percent

Carmen, thought you might find this of interest.
Brad Bradbury

from American Journal of Public Health: April 2001 Highlights

Roundabouts Reduce Injury Crashes By 76 Percent
Compared to intersections with traffic lights and stop signs, roundabouts were found to reduce automobile accidents by 38 percent and crashes involving injury by 76 percent. Fatal and incapacitating crashes fell by some 90 percent. Twenty-four intersections in eight states were converted to modern roundabouts between 1992 and 1997. The authors conclude that roundabouts were safer because cars slow down when entering them, and they reduce problems such as drivers making left turns against opposing or oncoming traffic and front-to-rear accidents such as where a lead vehicle stops at a traffic signal. [From: "Crash and Injury Reduction Following Installation of Roundabouts in the United States." Contact: Richard Retting, MS, Insurance Institute for Highway Safety.]

Gardner Systems
Transportation Systems Engineering

Post-it® Fax Note 7671	Date 8-25	# of pages ▶ 8
To Mike	From Bill S.	
Co./Dept.	Co.	
Phone #	Phone #	
Fax #	Fax #	

FAX COVER SHEET

TO: Mr Bill Shipp

OF: Town of Addison

FAX NO.: (972) 450-7043

RE: Addison Circle District Transportation Issues

FROM: Gary D. Jost

DATE: August 24, 2000

TOTAL NUMBER OF PAGES (including this cover sheet): 8

COMMENTS:

Bill,

Here is the first draft of the memorandum to address the current transportation issues in the Addison Circle District. I have made some recommendations but, most are intended to create discussions on solutions to meet short and long term needs.

Give me a call if you want to get together to discuss.

Thanks,
Gary D. Jost

708 St. Johns Drive, Mansfield, TX 76063, USA • Voice: (817) 477-3002 • Fax: (817) 473-7075 • gjost@gardnersys.com

Gardner Systems
Transportation Systems Engineering

MEMORANDUM

DRAFT

TO: Mr. Michael Murphy, P.E.
Town of Addison

FROM: Gary D. Jost, P.E.

DATE: August 24, 2000

SUBJECT: Addison Circle Transportation Issues - Draft

The success of the Addison Circle Development has identified several new transportation related issues related to the movement of people and goods in and around the existing and future development. Recognizing the need to comprehensively address these issues to create a transportation system that serves the needs of its citizens, the Town of Addison has retained the services of Gardner Systems to provide analysis and recommendations to meet both the existing and long-term transportation needs of the area.

This memorandum identifies the current transportation issues facing the Addison Circle area. Alternatives are identified that could, either individually or in combination, provide solutions to these issues. Those alternatives that are felt best provide the opportunity to meet the transportation goals of the Town are recommended for further analysis or implementation.

GOALS

The Town of Addison has established the following goals related to the transportation system serving the Addison Circle District:

- Provide a safe and efficient transportation system
- Serve the residents and businesses of the district
- Support the District's aesthetics
- Provide an acceptable level of mobility in, around, and through the district

CURRENT ISSUES

The current transportation related issues facing the Town of Addison in the Addison Circle District include the following:

Gardner Systems
Transportation Systems Engineering

- Valet Parking
- Speed on Quorum Drive
- Delivery vehicles
- Surface parking

It is difficult to discuss solutions to any of these issues individually. Each is related to the other and to achieving the goals of the transportation system. A total solution to any single issue could have negative impacts on the others. Recommendations contained in this memorandum are intended to provide a collective solution to these issues.

BACKGROUND

The Addison Circle District (ACD) is centered on the modern roundabout constructed at the intersection of Quorum Drive and Addison Circle. Quorum Drive provides the major access to the District. Addison Circle provides circulation within the district. The future construction of Spectrum Drive between Arapaho Road and Airport will provide additional access to the District.

ROADWAY FUNCTIONALITY

Roadway planning has historically classified roads based on their ability to carry traffic. The classifications (freeway, major arterial, minor arterial, collector, residential, etc.) typically have attached to them certain design standards such as design speed, number of lanes, access control, etc. The standards are intended to safely accommodate the volume of vehicular traffic predicted on a particular roadway classification.

Quorum Drive is classified as a minor arterial in the Town of Addison. This four lane divided arterial extends from the South Quorum Drive area northward through the Addison Circle District to Westgrove Drive. The roadway is relatively straight with few driveways and median openings. The posted speed limit in the Addison Circle District is 30 miles per hour (mph) although observations during the PM peak hour conclude that most drivers exceed the posted speed limit.

Drivers (with noted exceptions) typically drive the speed at which they feel most comfortable given roadway conditions. The conditions on Quorum Drive on either side of the ACD promote a speed greater than the posted speed limit. Without

Gardner Systems
Transportation Systems Engineering

changes to the roadway conditions or higher levels of enforcement, vehicular speed on Quorum Drive will continue to pose a safety problem within the ACD.

The development of the ACD introduces a new element in the roadway planning process; the need to consider roadway functions other than the movement of vehicular traffic. This new element does not reduce the need to meet traffic demands on arterial networks; it merely introduces the need to consider the proposed functionality of a roadway. Roadway functions include, but are not limited to the following:

- Movement of vehicular traffic
- Support roadside retail
- Serve high volumes of pedestrian traffic

Properly planned, roadways can serve any one of the functions extremely well. However, it becomes difficult to serve more than one primary function. For example, it is difficult to provide for the movement of high volumes of vehicular traffic along an arterial and at the same time promote local roadside retail and their need for on-street parking. When this occurs, conflicts often negatively impact both functions.

Such is the case on Quorum Drive. The ACD has created an urban environment along Quorum Drive with roadside businesses, on street parking, and high pedestrian activity. This is now creating conflicts with Quorum Drive's original function of moving vehicular traffic.

Addison Circle was planned and constructed with the primary function of serving the retail and residential users along its route. With it's has low design speeds, on street parking, and pedestrian amenities, it serves this primary function very well. Conditions along Addison Circle are very conducive to stopping and backing vehicles, delivery vehicles, and pedestrian activity.

The functionality of Spectrum Drive is still in the planning stages. The initial segments of Spectrum that have been constructed tend to identify Spectrum's primary function as serving roadside businesses. However, there will be pressure created by the continued development of the North Dallas Tollway Corridor for Spectrum's primary function to be the movement of vehicular traffic. The primary function of Spectrum Drive shoule determined with further analysis and implemented through the design of future segments.

The solutions to the current transportation issues in the ACD presented in this memo are based, in part on the primary function of the roadways serving the

Gardner Systems
Transportation Systems Engineering

development. It is recommended that the Town of Addison identify the primary functionality of each of the roadways in the ACD and develop design standards to promote the functionality of each functional classification.

QUORUM DRIVE

As noted above, Quorum Drive suffers from conflicts between two primary functions as it transitions from it's current primary function to move vehicular traffic to a new primary function to serve the local roadside businesses. This transition will take place over a period of time as the ACD continues to develop along Quorum Drive. The conflict is most prominent in the speed of vehicular traffic on Quorum.

It should be noted that Quorum will never be able to shed its function as part of the thoroughfare system to move vehicular traffic. It is assumed in this memorandum that this will become a secondary function and design standards for Quorum Drive will reflect a new primary function for Quorum Drive; support of the local roadside business.

Given the current design characteristics of Quorum Drive north and south of the ACD, achieving a lower average speed will be difficult. The installation of traffic signals has long been a solution to controlling speeds, but studies have shown that traffic signals (especially unwarranted ones) have little or no impact of overall roadway speeds. In fact, some studies suggest that operating speeds between traffic signals actually increase after the installation of a signal.

Addison Circle serves to lower speeds along Quorum Drive. However, this is a spot reduction of speed and the circle has little or no impact on speeds beyond its immediate boundaries.

Jiggle bars are intended to alert the driver to conditions ahead that require slower operating speeds. These are typically used prior to tollbooths where drivers must slow significantly (sometimes from freeway speeds to a complete stop).

Speed Humps are typically deployed in parking lots and residential areas where slow speeds need to be maintained. Speed humps on public streets have been met with mixed reactions. The existing and future conditions along Quorum Drive do not lend themselves to the installation of speed humps as a means to control travel speeds.

Gardner Systems
Transportation Systems Engineering

Enforcement of posted speed limits is a means of controlling speeds, but only during times when enforcement is in place. However, frequent enforcement does tend to lower speeds, as drivers become aware of the enforcement efforts.

Lower speeds on Quorum Drive will require a combination of several initiatives. The following are recommended to immediately impact travel speeds along Quorum Drive:

1. Increase enforcement of the posted speed limit. This should be done of a regular basis.
2. Increase the size and visibility of speed limit signs on Quorum Drive north and South of Addison Circle.
3. Install jiggle bars north and south of Addison Circle to alert drivers to changing traffic conditions.
4. Alert Drivers to the fact that enforcement of the speed limit is going to increase. One means to accomplish this is through the use of a speed trailer. The trailer contains a radar unit that identifies the actual speed of the vehicle and displays the speed to the driver directly below the posted speed limit.

VALET PARKING

The majority of parking for businesses in the ACD is in structured parking facilities throughout the District. Limited on-street parking is available but cannot accommodate the demand for parking created by the destination restaurants that have located in the ACD. Although signage to the parking facilities appears adequate and walking distances are well within desirable limits, valet parking is needed to meet the needs of the restaurant patrons.

Valet parking is typically done in private parking lots next to the entrance of the restaurant or facility. Very seldom is valet parking done from public streets. To meet its primary criteria (limited walking distance) valet parking in the ACD will have to be implemented within the public right-of-way. Valet parking on public streets introduces new criteria that must be meet in the valet parking operation, including the following:

- Provide safe entering and exiting of the vehicle adjacent to moving traffic
- Do not impact roadway operations, including adjacent streets.
- Maintain identifiable boundaries of valet parking operation.
- Provide adequate lighting for night operation.

Gardner Systems
Transportation Systems Engineering

The location of the valet parking should be along roadways whose current primary function is to support the local businesses. In the ACD this would include only Addison Circle. As stated earlier, current traffic operations on Quorum Drive will not allow the criteria identified above to me met.

Recommendations related to valet parking in the ACD include the following:

1. Provide one central operator for all valet parking in the District. This will eliminate the need to search for individual restaurant valet services.
2. Locate the valet operations on Addison Circle Drive as far away from the Circle as possible.
3. Require that queues of vehicles waiting for valet parking do not encroach into the visibility zone surrounding the Circle (approximately 100 feet on all approaches/departures from the circle).
4. Do not allow valet parking on Quorum Drive.
5. The proposed valet parking operator should submit a proposed operations plan to the Town for approval prior to starting operation.
6. Provide adequate directional signing directing motorists to valet parking locations
7. Distinctly identify the boundaries for valet parking operation.

DELIVERY VEHICLES

Delivery vehicles are not afforded the opportunity for rear deliveries to the businesses in the ACD; therefore some accommodation for front door deliveries must be made. Enforcement of policies, regulations, or laws associated with the delivery of goods are difficult to enforce given the usually short-term parking needs for a delivery vehicle at any particular location.

The following recommendations regarding delivery vehicles are provided for consideration:

1. Do not allow delivery vehicles to park on Quorum Drive except in designated parking spaces.
2. Do not allow delivery vehicles to park in the visibility zone surrounding Addison Circle.
3. Do not allow delivery vehicle to park with the valet parking areas (during valet parking operation).
4. Restrict (whenever possible) deliveries to off-peak hours.
5. Publish for distribution to suppliers a map showing acceptable parking locations and times for deliveries in the ACD.

Gardner Systems
Transportation Systems Engineering

6. Enlist the assistance of local merchants in the enforcement of delivery vehicle regulations.

SURFACE PARKING

Surface parking is an important element of the ACD. Its purpose is to provide very convenient, short-term parking for businesses in the District. Having adequate on-street parking to meet the needs of the area businesses is tied solely to the ability to provide short-term parking (high turnover) spaces rather than convenient long-term parking for employees and residents. This can only be accomplished through enforcement of the posted parking limits.

CONCLUSIONS

The recommendation contained in this memorandum address the some of the current transportation related issues facing the Addison Circle District. Continued planning and definition of the primary functional requirements of the roadways in and around the district and development of design standards to meet these functional requirements will provide the basis for meeting the future needs of the District.

September 1, 2000

Ms. Cindy Harris
Post Properties
5040 Addison Circle, Suite 300
Addison, TX 75001

Dear Cindy:

As you are aware, we have been searching for solutions to some of the challenges both Post and the Town are having with traffic management in Addison Circle. The most immediate challenges have been:

-residents' moving vans and routine delivery vans parking in the public streets to make deliveries,

-complaints from Avanti Euro Bistro about its inability to provide valet parking from the curb in front of the restaurant.

As we have expressed to you, both of these challenges are particularly frustrating to us because we strongly encouraged Columbus Realty Trust to provide off-street spaces for loading/unloading in the first phases. We also made the parking situation abundantly clear to the Avanti Euro Bistro owner before he opened his restaurant. We even encouraged him not to take the space because we believed his parking needs were not consistent with the design of the district.

In your letter of August 13, 2000, you outlined a proposal for a comprehensive valet service for the district and a loading/unloading area on Quorum Drive. We shared your proposal with Gary Jost of the Gardner Group, our consulting traffic engineer. We also asked Gary to take a comprehensive look at traffic, parking, and signage in Addison Circle. Gary's report is enclosed.

We have considered the various aspects of your proposal. We agree that a district-wide valet service is the most effective way to provide valet parking in the district. However, we cannot agree to all of the locations you have proposed for the valet stands. The Town is responsible for protecting the safety of the driving public, and we cannot put that safety at risk by allowing any valet service to operate off of Quorum Drive. In addition, we cannot allow any valet service within 100 feet of all approaches to the Circle.

Our proposals for dealing with the challenges of parking and deliveries in Addison Circle are as follows:

-As previously stated, we will not allow any valet service off of Quorum Drive or within 100 feet of the approaches to the Circle. However, we will allow valet parking in locations that can comply with those restrictions. We will require that Post Properties be the sole operator of a valet service, and that the City license the service. We are exploring the details of a licensing ordinance at this time, and will require the valet operator to obtain a license before commencing operation. We will require a master valet/parking plan for the district be submitted prior to issuance of the license.

-We will allow Post to designate three of the parallel spaces on Quorum Drive for loading/unloading only.

-We will encourage our officers to use more discretion in allowing short-term deliveries and the temporary blocking of roadways or fire lanes for moving vans and other delivery trucks (furniture etc.).

-We will increase speed limit enforcement on Quorum Drive in order to reduce speeds in the area. We will also add advisory signage encouraging drivers to slow down when entering the Addison Circle area. We are also exploring technologies (such as pavement grooving or changes in texture) that will get the attention of drivers entering the Circle area.

We are thrilled with the success of Addison Circle and realize that is normal to go through these "growing pains" while the district matures. We hope these steps will help your retailers resolve their parking and delivery challenges while still assuring the safety of the residents, customers, and visitors to Addison Circle.

Sincerely

Ron Whitehead
City Manager

Gardner Systems
Transportation Systems Engineering

Post-it® Fax Note 7671	Date 8-25	# of pages ▸ 8
To Mike	From Bill S.	
Co./Dept.	Co.	
Phone #	Phone #	
Fax #	Fax #	

FAX COVER SHEET

TO: Mr Bill Shipp

OF: Town of Addison

FAX NO.: (972) 450-7043

RE: Addison Circle District Transportation Issues

FROM: Gary D. Jost

DATE: August 24, 2000

TOTAL NUMBER OF PAGES (including this cover sheet): 8

COMMENTS:

Bill,

Here is the first draft of the memorandum to address the current transportation issues in the Addison Circle District. I have made some recommendations but, most are intended to create discussions on solutions to meet short and long term needs.

Give me a call if you want to get together to discuss.

Thanks,
Gary D. Jost

look into traffic control.
SPEEDERS SIGN.

708 St. John Drive, Mansfield, TX 76063, USA • Voice: (817) 477-3002 • Fax: (817) 473-7075 • gjost@gardnersys.com

Gardner Systems
Transportation Systems Engineering

MEMORANDUM

DRAFT

TO: Mr. Michael Murphy, P.E.
Town of Addison

FROM: Gary D. Jost, P.E.

DATE: August 24, 2000

SUBJECT: Addison Circle Transportation Issues - Draft

The success of the Addison Circle Development has identified several new transportation related issues related to the movement of people and goods in and around the existing and future development. Recognizing the need to comprehensively address these issues to create a transportation system that serves the needs of its citizens, the Town of Addison has retained the services of Gardner Systems to provide analysis and recommendations to meet both the existing and long-term transportation needs of the area.

This memorandum identifies the current transportation issues facing the Addison Circle area. Alternatives are identified that could, either individually or in combination, provide solutions to these issues. Those alternatives that are felt best provide the opportunity to meet the transportation goals of the Town are recommended for further analysis or implementation.

GOALS

The Town of Addison has established the following goals related to the transportation system serving the Addison Circle District:

- Provide a safe and efficient transportation system
- Serve the residents and businesses of the district
- Support the District's aesthetics
- Provide an acceptable level of mobility in, around, and through the district

CURRENT ISSUES

The current transportation related issues facing the Town of Addison in the Addison Circle District include the following:

Gardner Systems
Transportation Systems Engineering

- Valet Parking
- Speed on Quorum Drive
- Delivery vehicles
- Surface parking

It is difficult to discuss solutions to any of these issues individually. Each is related to the other and to achieving the goals of the transportation system. A total solution to any single issue could have negative impacts on the others. Recommendations contained in this memorandum are intended to provide a collective solution to these issues.

BACKGROUND

The Addison Circle District (ACD) is centered on the modern roundabout constructed at the intersection of Quorum Drive and Addison Circle. Quorum Drive provides the major access to the District. Addison Circle provides circulation within the district. The future construction of Spectrum Drive between Arapaho Road and Airport will provide additional access to the District.

ROADWAY FUNCTIONALITY

Roadway planning has historically classified roads based on their ability to carry traffic. The classifications (freeway, major arterial, minor arterial, collector, residential, etc.) typically have attached to them certain design standards such as design speed, number of lanes, access control, etc. The standards are intended to safely accommodate the volume of vehicular traffic predicted on a particular roadway classification.

Quorum Drive is classified as a minor arterial in the Town of Addison. This four lane divided arterial extends from the South Quorum Drive area northward through the Addison Circle District to Westgrove Drive. The roadway is relatively straight with few driveways and median openings. The posted speed limit in the Addison Circle District is 30 miles per hour (mph) although observations during the PM peak hour conclude that most drivers exceed the posted speed limit.

Drivers (with noted exceptions) typically drive the speed at which they feel most comfortable given roadway conditions. The conditions on Quorum Drive on either side of the ACD promote a speed greater than the posted speed limit. Without

Gardner Systems
Transportation Systems Engineering

changes to the roadway conditions or higher levels of enforcement, vehicular speed on Quorum Drive will continue to pose a safety problem within the ACD.

The development of the ACD introduces a new element in the roadway planning process; the need to consider roadway functions other than the movement of vehicular traffic. This new element does not reduce the need to meet traffic demands on arterial networks; it merely introduces the need to consider the proposed functionality of a roadway. Roadway functions include, but are not limited to the following:

- Movement of vehicular traffic
- Support roadside retail
- Serve high volumes of pedestrian traffic

Properly planned, roadways can serve any one of the functions extremely well. However, it becomes difficult to serve more than one primary function. For example, it is difficult to provide for the movement of high volumes of vehicular traffic along an arterial and at the same time promote local roadside retail and their need for on-street parking. When this occurs, conflicts often negatively impact both functions.

Such is the case on Quorum Drive. The ACD has created an urban environment along Quorum Drive with roadside businesses, on street parking, and high pedestrian activity. This is now creating conflicts with Quorum Drive's original function of moving vehicular traffic.

Addison Circle was planned and constructed with the primary function of serving the retail and residential users along its route. With it's has low design speeds, on street parking, and pedestrian amenities, it serves this primary function very well. Conditions along Addison Circle are very conducive to stopping and backing vehicles, delivery vehicles, and pedestrian activity.

The functionality of Spectrum Drive is still in the planning stages. The initial segments of Spectrum that have been constructed tend to identify Spectrum's primary function as serving roadside businesses. However, there will be pressure created by the continued development of the North Dallas Tollway Corridor for Spectrum's primary function to be the movement of vehicular traffic. The primary function of Spectrum Drive shoule determined with further analysis and implemented through the design of future segments.

The solutions to the current transportation issues in the ACD presented in this memo are based, in part on the primary function of the roadways serving the

Gardner Systems
Transportation Systems Engineering

development. It is recommended that the Town of Addison identify the primary functionality of each of the roadways in the ACD and develop design standards to promote the functionality of each functional classification.

QUORUM DRIVE

As noted above, Quorum Drive suffers from conflicts between two primary functions as it transitions from it's current primary function to move vehicular traffic to a new primary function to serve the local roadside businesses. This transition will take place over a period of time as the ACD continues to develop along Quorum Drive. The conflict is most prominent in the speed of vehicular traffic on Quorum.

It should be noted that Quorum will never be able to shed its function as part of the thoroughfare system to move vehicular traffic. It is assumed in this memorandum that this will become a secondary function and design standards for Quorum Drive will reflect a new primary function for Quorum Drive; support of the local roadside business.

Given the current design characteristics of Quorum Drive north and south of the ACD, achieving a lower average speed will be difficult. The installation of traffic signals has long been a solution to controlling speeds, but studies have shown that traffic signals (especially unwarranted ones) have little or no impact of overall roadway speeds. In fact, some studies suggest that operating speeds between traffic signals actually increase after the installation of a signal.

Addison Circle serves to lower speeds along Quorum Drive. However, this is a spot reduction of speed and the circle has little or no impact on speeds beyond its immediate boundaries.

Jiggle bars are intended to alert the driver to conditions ahead that require slower operating speeds. These are typically used prior to tollbooths where drivers must slow significantly (sometimes from freeway speeds to a complete stop).

Speed Humps are typically deployed in parking lots and residential areas where slow speeds need to be maintained. Speed humps on public streets have been met with mixed reactions. The existing and future conditions along Quorum Drive do not lend themselves to the installation of speed humps as a means to control travel speeds.

Gardner Systems
Transportation Systems Engineering

Enforcement of posted speed limits is a means of controlling speeds, but only during times when enforcement is in place. However, frequent enforcement does tend to lower speeds, as drivers become aware of the enforcement efforts.

Lower speeds on Quorum Drive will require a combination of several initiatives. The following are recommended to immediately impact travel speeds along Quorum Drive:

1. Increase enforcement of the posted speed limit. This should be done of a regular basis.
2. Increase the size and visibility of speed limit signs on Quorum Drive north and South of Addison Circle.
3. Install jiggle bars north and south of Addison Circle to alert drivers to changing traffic conditions.
4. Alert Drivers to the fact that enforcement of the speed limit is going to increase. One means to accomplish this is through the use of a speed trailer. The trailer contains a radar unit that identifies the actual speed of the vehicle and displays the speed to the driver directly below the posted speed limit.

VALET PARKING

The majority of parking for businesses in the ACD is in structured parking facilities throughout the District. Limited on-street parking is available but cannot accommodate the demand for parking created by the destination restaurants that have located in the ACD. Although signage to the parking facilities appears adequate and walking distances are well within desirable limits, valet parking is needed to meet the needs of the restaurant patrons.

Valet parking is typically done in private parking lots next to the entrance of the restaurant or facility. Very seldom is valet parking done from public streets. To meet its primary criteria (limited walking distance) valet parking in the ACD will have to be implemented within the public right-of-way. Valet parking on public streets introduces new criteria that must be meet in the valet parking operation, including the following:

- Provide safe entering and exiting of the vehicle adjacent to moving traffic
- Do not impact roadway operations, including adjacent streets.
- Maintain identifiable boundaries of valet parking operation.
- Provide adequate lighting for night operation.

Gardner Systems
Transportation Systems Engineering

The location of the valet parking should be along roadways whose current primary function is to support the local businesses. In the ACD this would include only Addison Circle. As stated earlier, current traffic operations on Quorum Drive will not allow the criteria identified above to me met.

Recommendations related to valet parking in the ACD include the following:

1. Provide one central operator for all valet parking in the District. This will eliminate the need to search for individual restaurant valet services.
2. Locate the valet operations on Addison Circle Drive as far away from the Circle as possible.
3. Require that queues of vehicles waiting for valet parking do not encroach into the visibility zone surrounding the Circle (approximately 100 feet on all approaches/departures from the circle).
4. Do not allow valet parking on Quorum Drive.
5. The proposed valet parking operator should submit a proposed operations plan to the Town for approval prior to starting operation.
6. Provide adequate directional signing directing motorists to valet parking locations
7. Distinctly identify the boundaries for valet parking operation.

DELIVERY VEHICLES

Delivery vehicles are not afforded the opportunity for rear deliveries to the businesses in the ACD; therefore some accommodation for front door deliveries must be made. Enforcement of policies, regulations, or laws associated with the delivery of goods are difficult to enforce given the usually short-term parking needs for a delivery vehicle at any particular location.

The following recommendations regarding delivery vehicles are provided for consideration:

1. Do not allow delivery vehicles to park on Quorum Drive except in designated parking spaces.
2. Do not allow delivery vehicles to park in the visibility zone surrounding Addison Circle.
3. Do not allow delivery vehicle to park with the valet parking areas (during valet parking operation).
4. Restrict (whenever possible) deliveries to off-peak hours.
5. Publish for distribution to suppliers a map showing acceptable parking locations and times for deliveries in the ACD.

Gardner Systems
Transportation Systems Engineering

6. Enlist the assistance of local merchants in the enforcement of delivery vehicle regulations.

SURFACE PARKING

Surface parking is an important element of the ACD. Its purpose is to provide very convenient, short-term parking for businesses in the District. Having adequate on-street parking to meet the needs of the area businesses is tied solely to the ability to provide short-term parking (high turnover) spaces rather than convenient long-term parking for employees and residents. This can only be accomplished through enforcement of the posted parking limits.

CONCLUSIONS

The recommendation contained in this memorandum address the some of the current transportation related issues facing the Addison Circle District. Continued planning and definition of the primary functional requirements of the roadways in and around the district and development of design standards to meet these functional requirements will provide the basis for meeting the future needs of the District.

POST PROPERTIES

POST WEST
DEVELOPMENT DIVISION
FAX: 972.774.3366

FAX COVER SHEET

DATE:	August 15, 2000
FROM:	Cindy Harris (972) 851-3218
RE:	Addison Circle Valet Parking

PLEASE DISTRIBUTE TO:	PHONE	FAX
Carmen Moran		(972) 450-7043

ORIGINAL:
SETTING:

PAGES: 7

8-15-00

Mike,

FYI. I Sent a copy to Gary Joost.

Bill

POST
PROPERTIES

August 13, 2000

Ms. Carmen Moran
Town of Addison
5300 Beltline Road
Addison, Texas 75001

Re: Addison Circle Valet Parking

Dear Carmen,

For the last several months we have been discussing the addition of valet parking services to Addison Circle Phase II. Post has been a strong proponent of expanding the valet service for the benefit of the retail patrons and the residents of Addison Circle. Because of the urban design of Addison Circle as well as the upscale quality of several of the retail businesses, valet parking service has been in demand for some time. In the greater Dallas area, all upscale restaurants offer valet service regardless of the convenience and location of the parking. Additionally, Post believes that offering valet service to our residents and office guests would be a valuable amenity within the neighborhood. Addison Circle is becoming a popular place to eat and shop as well the home to over 3,000 residents and employees.

Currently, valet parking service is offered only by Antonio's restaurant. This service is managed by Antonio's and has been criticized in the past for its inefficient operation of that service. As a result of the concerns by the Town of Addison, Post consulted with DeShazo, Tang and Associates, Inc. (DeShazo) to determine the viability of expanding valet parking services in Addison Circle.

DeShazo provided the traffic engineering consulting services during the initial planning and design of Addison Circle. After studying the current environment, analyzing the available parking and evaluating the traffic circulation system, DeShazo's report concluded that valet parking would improve the efficient use of the parking garages. (Exhibit 1)

Post recognizes the Town's concerns about potential inadequate parking in the garage as well as wanting to encourage residents and visitors to walk in the neighborhood. However, the use of valet parking in the neighborhood would provide a much-needed amenity and enhance the efficiency of the available parking in the parking garages.

After careful study of the needs of our retailers and the benefits to the patrons and residents of the district, as well as the unique traffic conditions in the neighborhood, we have come up with a proposed plan that we believe to be workable. Post plans to hire and manage a professional valet service for the entire district. Valet stands would be provided in several locations throughout the district at convenient locations and at times of highest demand for the service. A description of the plan and location of valet stands on a map is attached.

The valet service could provide several benefits as noted below

- more efficient use of the parking garages
- prestigious image for Addison Circle and its retail establishments
- valet parking attendants would serve as "Ambassadors" in the area, providing directions and information about the area
- increase the service to all patrons and residents of the district

Post Properties, Inc.
5040 Addison Circle | Suite 300 | Addison, Texas 75001
Phone 972.851.3200 | Fax 972.774.3366
www.postproperties.com

The plan requires that some parallel parking spaces along Quorum be converted to valet parking only at the hours the service is in use. Delivery trucks could also utilize these spaces at non-peak traffic times to remove goods/packages from trucks out of the main driving lanes of Quorum Road. The service could be easily expanded as the district grows without disrupting traffic.

Post would like to implement this service as soon as possible. Our implementation strategy would include a public awareness program, retaining an experienced and professional valet service and working with various Town of Addison agencies on the details and timing of the service.

As always, we appreciate the ongoing efforts of yourself and Ron to work through the myriad of issues that affect this vibrant and urban neighborhood that we all have worked so hard to create. I look forward to your comments about the valet parking service and a timeline for implementation; our retail management group and myself are available at your convenience to discuss this issue in further detail.

Warmest regards,

Cindy Harris
Vice President - Development

Cc: Art Lomenick
Catherine Howell
Lori Fall

ADDISON CIRCLE VALET PARKING

OBJECTIVE: PROVIDE QUALITY VALET SERVICE, THROUGH ONE COMPANY, TO ACCOMMODATE VISITORS TO ADDISON CIRCLE. THIS WILL IMPROVE THE LEVEL OF SERVICE TO ADDISON CIRCLE VISITORS, ALLOW FOR MORE EFFICIENT USE OF THE PARKING GARAGES, AND HELP CREATE A SAFER PEDESTRIAN ENVIRONMENT

DATE: IMMEDIATELY

MANAGED BY: POST PROPERTIES

VALET COMPANY: A REPUTABLE FIRM CURRENTLY DOING BUSINESS IN THE DALLAS AREA. THE COMPANY WILL HAVE ADEQUATE STAFFING, INSURANCE AND VERIFIED RECOMMENDATIONS. VALET STAFF WILL BE REQUIRED TO HAVE COMPANY UNIFORMS, PROFESSIONAL APPEARANCE AND POSITIVE ATTITUDE

LOCATION: INITIALLY TWO, WITH A MAXIMUM OF FOUR LOCATIONS (SEE THE ATTACHED MAP)

1) QUORUM DRIVE NORTH BOUND, WITH PARKING IN DECK N
-OR-
1A) ADDISON CIRCLE EAST BOUND, WITH PARKING IN DECK N

2) QUORUM DRIVE SOUTH BOUND, WITH PARKING IN DECK B -
-OR-
2A) ADDISON CIRCLE WEST BOUND, WITH PARKING IN DECK B

3) ADDISON CIRCLE EAST BOUND, WITH PARKING IN DECK Q

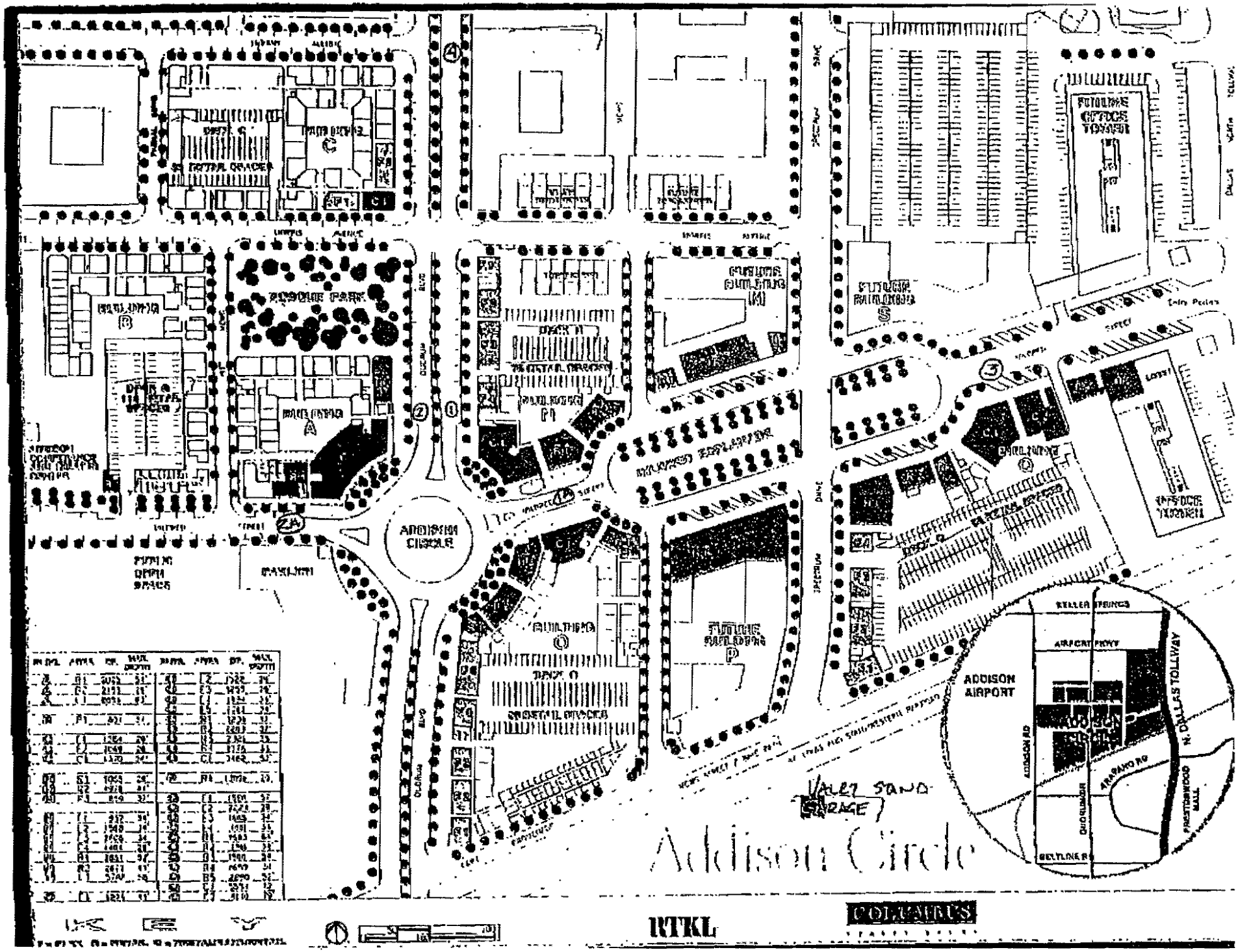
4) QUORUM DRIVE NORTH BOUND, WITH PARKING IN TO BE BUILT DECK FOR PHASE IV.

DAYS OF WEEK TIMES OF DAY VALET STANDS WILL BE ATTENDED DURING THE FOLLOWING HOURS; ACTUALLY USAGE MAY VERY DEPENDING ON DEMAND. FREQUENCY WOULD BE NO MORE OFTEN THAN SET FORTH BELOW:

MONDAY THROUGH FRIDAY	LUNCH: 11:00 AM TO 2:00 PM
MONDAY THROUGH WEDNESDAY	DINNER: 5:00 PM TO 10:00 PM
THURSDAY THROUGH SATURDAY	DINNER: 5:00 PM TO 12:00 PM

ADDITIONAL REQUIREMENTS: TEMPORARY VALET STANDS AND RELATED SIGNAGE WILL BE PLACED AT PASSENGER DROP LOCATIONS SPECIFIED ABOVE.

TWO PARKING SPACES ON EITHER SIDE OF QUORUM WILL BE CONVERTED TO VALET ONLY (AND LOADING ONLY DURING NON VALET HOURS).



DeShazo, Tang & Associates, Inc.
Engineers ◆ Planners
400 South Houston, Suite 330
Dallas, TX 75202-4899
214/748-6740 • FAX 214/748-7037
email: dtainc@airmail.net

TECHNICAL MEMORANDUM

TO: Cindy Harris — Post Properties

FROM: DeShazo, Tang & Associates, Inc.

DATE: July 15, 1999

RE: **Traffic Circulation and Parking Impact Assessment of Proposed Avanti Restaurant in Addison Circle - Phase 2 (DT&A No. 99104)**

BACKGROUND

This memorandum is provided to address DeShazo, Tang & Associates, Inc.'s (DT&A) review of the proposal to add an 8,000-square-foot Avanti restaurant in *Block N* of Addison Circle *Phase 2*. Under the Addison Circle zoning ordinance, the maximum area for a single restaurant is 5,000 SF; therefore, a code variance is required. DT&A's evaluation of this proposal consists of two components: traffic circulation and parking space allocation. Each item is addressed in the following sections.

TRAFFIC CIRCULATION

The local street layout of Addison Circle is composed of a rectangular street grid generally with north/south and east/west streets. The main east/west roadway, also known as Addison Circle, contains a modern roundabout and a pedestrian esplanade. Though these elements are largely traffic calming features, they also create excellent opportunities for traffic circulation and re-circulation. As in most business districts, the tight street grid also facilitates excellent traffic access and circulation. These roadway characteristics support the original concept of ground floor commercial uses in Addison Circle.

In order to enhance parking in conjunction with retail presence in Addison Circle, an expanded valet service has been proposed. The location of valet stations could have some impact on traffic circulation if poorly planned. However, in conjunction with staff from RTKL, DT&A has identified several locations that would be suitable for valet

parking stations in *Phase 2*. The selection of the station locations considers the street widths and the level of through-traffic for the on-street locations. To facilitate efficient traffic circulation patterns, the installation of guide signs that direct motorists to valet parking and self-parking is highly recommended. A recommended sign placement strategy is also presented in illustrations provided by RTKL with the implementation of these measures, the construction of an 8,000-SF restaurant has no impact upon the efficiency of traffic circulation.

PARKING ALLOCATION

In the design stage of Addison Circle - *Phase 2*, DT&A performed a comprehensive shared parking analysis for the proposed *Phase 2* uses. Included in the development program was an excess of 8,000 SF of space for restaurant uses. Since parking was allocated on a per-square-foot basis for restaurants (as opposed to the actual number of restaurants), the number of parking spaces planned for *Phase 2* is not impacted by the size of individual restaurants but rather the gross square footage of restaurant use. The provision of a single, 8,000-SF restaurant (as opposed to two, 4,000-SF restaurants, or a 5,000-SF and a 3,000-SF restaurant, etc.) does not create any significant impacts to the parking space supply originally approved in the shared parking analysis. In fact, RTKL has validated the parking supply calculations for the uses in *Phase 2*.

In the DT&A shared parking analysis, no credits were made to acknowledge the efficiency of valet parking. In other words, a conservative efficiency factor more indicative of self-parking was incorporated into the calculations. The use of valet parking will actually improve parking space efficiency due to higher overall utility and discipline of an experienced valet service provider.

CONCLUSIONS

Based upon traffic circulation and parking space allocation, DT&A notes no significant negative impacts associated with the construction of a single, 8,000-SF restaurant space in *Block N* of Addison Circle *Phase 2*. The provision of parking guide signs and an expansion of valet parking services is recommended to improve overall parking conditions. Herewith, DT&A can support the proposed variance request for the Avanti restaurant.

END

PARSONS TRANSPORTATION GROUP INC.
5486 Belt Line Road, Suite 199, Dallas, Texas 75240 (972) 991-1900 (972) 490-9261 fax

MEMORANDUM

TO: Carmen Moran, Director of Development Services
City of Addison, Texas

FROM: Parsons Transportation Group

DATE: August 20, 1999

RE: Valet Parking in the Addison Urban Center, Addison, Texas; 653509.01000

We have reviewed the plans of valet station locations and offer the attached comments. In general, we recommend valet parking be prohibited on narrow or two-lane (one lane in each direction) public streets or areas without sufficient vehicle queuing area off of travel lanes. The following identifies potential solutions to existing valet service operations:

Block "N"

Background

The valet station is located 50-60 feet east of Quorum on the westbound approach of Addison Circle. The roadway cross-section within this area is 26' (face-to-face of curb) and is striped to allow one 13' travel lane in each direction.

With one lane of travel, this location temporarily blocks westbound access to Quorum and creates an unsafe condition with people accessing vehicles in close proximity to the traffic circle. Additionally, trolley service may be disrupted (in terms of maintaining a timetable) in that valet queues may prevent trolleys from passing to maintain travel routes. Finally, under this scheme, valet parkers are required to circulate around the entire block to access parking structure "N".

Potential Solution

To maintain valet service, this station should be relocated to either the M-2 North mew or the eastern side of the Addison Circle/M-2 North intersection. Relocation to the M-2N mew, reduces vehicle queuing on Addison Circle, reduces potential pedestrian/vehicular conflicts and provides direct access to the parking structure. The setback is temporary blockage to access of the parking structure due to two-way travel within 24' of pavement area.

Alternatively, relocation of the valet stand to the eastern side of the Addison Circle/M-2N mew would provide over 150' (7 vehicles) of temporary vehicle storage area, maintain a short distance to the parking structure and eliminate the need to circulate around the block to access parking. In this alternative, a departure valet station would be located on the M-2N mew. With 18' of pavement area, this alternative would allow for one 8' queue lane and 10' drive lane. The setback to this

alternative is the potential of temporarily blocking on-street parking. Additionally, such station may also require the use of parking space for valet podium/operations because of the presence of sidewalk furniture.

Block "O"

Background

This station is located just west of M-2 South on Addison Circle. Approximately 80 feet separate M-2S from the west main leg of Addison Circle connecting to Quorum. Based on the tree planting scheme, the valet station is located 30 feet from M-2S leaving 50 feet of queuing area for valet service drop-off. The roadway pavement in this area is 25 feet back to back of curb.

A drop-off zone of 50' provides space for 2-3 vehicles prior to encroaching on the main leg of Addison Circle. With only one lane available, disruption of flow at this point could cause a residual effect back to the Quorum Circle.

Potential Solution

To maintain valet service, this station should be relocated to either the M-2 South mew or the western side of the Addison Circle/Spectrum intersection. Operations for each would be similar to those identified in Block "N".

Block "Q"

This valet station is located off of Addison Circle and appears to be adequately situated.

Block "B"

Background

This valet station is located east of the Witt Place/Addison Circle intersection. The distance from this intersection to the Quorum traffic circle is about 125 feet. The roadway cross-section within this area is 26' (face-to-face of curb) and is striped to allow one 13' travel lane in each direction.

With one lane of travel, this location temporarily blocks westbound travel and creates an unsafe condition with vehicle queues extending (back) into the traffic circle merge area.

Potential Solution

To maintain valet service, this station should be relocated to either in the Witt Place mew or to the on-street parking area (southbound Quorum)on the east side of Block "B". Relocation of the station to Witt Place should be placed adjacent to the entry of the parking structure to allow a sufficient queuing area within the mew itself. Relocation within the mew may temporary block to access the parking structure due to minimal pavement area. Relocation to Quorum would eliminate on-street parking spaces.

Trolley Operations
The maintenance of valet stations within the area do not appear to impact trolley operations because of the minimum number of stops, the minimum amount of distance between stops, and the presence of one-way streets. To preserve the capacity of the thoroughfare network within the urban center, trolleys should be prohibited from dwelling at a stop location to maintain a travel time schedule.

Trip Generation
A comparison of trip generation of existing retail/restaurant to Block "Q" retail/restaurant uses was performed to gauge the impact that these uses may have on valet services. The implementation of Block "Q" will increase PM peak hour trip activity by 45% (additional 93 vehicles). Under the assumption of the same desire for valet services, the impacts to area circulation could potentially double to that currently existing.

Data of forecasted traffic reveal volumes on Quorum increasing to 25,000 vehicles daily. Traffic volumes on Spectrum are projected to reach 14,000 daily upon full completion of the roadway. With this level of volume, it may be necessary to discontinue on-street valet service due to the increased potential for vehicular/pedestrian conflicts.

PTG will be undertaking a traffic count update for 90 locations within Addison in late August. Upon completion of this data collection effort, analysis of valet activities should be further evaluated.

Conclusion
It is recommended that valet parking stations be prohibited on narrow or two-lane (one lane in each direction) public streets or areas without sufficient vehicle queuing area off of travel lanes. Valet parking activities should not be permitted in areas where vehicle queues could cause a residual disruption to operations in the Quorum traffic circle. The relocation of valet services as identified above should be considered. Such relocations may provide temporary relief of circulation problems currently experienced within the area. However, consistent monitoring of these activities should be implemented to ensure no unsafe pedestrian or driving situations arise.

To assist motorists with the location of such services, a public awareness program through individual retail/restaurant establishments or signage system demarking valet service locations should also be considered.