2000-1 Addison Circle

Roundabout / Traffic Circle - 1997

HUITT-ZOLLARS

File Traffic Circle/ Roundabouts

Huitt-Zollars, Inc. / Engineering / Architecture / 3131 McKinney Avenue / Suite 600 / LB 105 / Dallas, Texas 75204-2416 / 214-871-3311 / FAX 214-871-0757

October 17, 1997

Mr. John Baumgartner, P.E.
Public Works Director
Town of Addison
P.O. Box 144
16801 Westgrove
Addison, TX 75001

RE: Addison Circle Phase II Public Infrastructure
Addison Circle Geometry
HZI Project No. 01-1822-21

Dear John:

Per your request, we are providing this supplemental report regarding the geometric movements on Addison Circle from Quorum Drive to Dallas Parkway including the interaction with Spectrum Drive.

There are four major areas that present unusual street conditions which would benefit from further explanation; the east leg of the round-about; movement around the divided sections of Addison Circle; the interaction of Spectrum Drive and Addison Circle; and the approach to the Tollway at Addison Circle.

SECTION "A"

The geometry of the East leg of the modern roundabout is per the design by Ourston & Doctors which is presented in a report dated November, 1995. In addition we have submitted the Phase II design to Ourston & Doctors and they returned the enclosed letter stating that the layout is in conformance with the original design.

SECTION "B"

Continuing east on Addison Circle through Sections "A" and "B", a vehicle will encounter a flush median island with a yield bar and sign which will direct traffic to the right. This vehicle will be required to yield to any traffic making a U-turn around the esplanade. The pavement at this location is widened to 25' back to back to allow for a WB-50 truck to maneuver around the turn. The trucks will drive on the flush median to complete the maneuver.

SECTION "C"

This Section of Addison Circle is 19' back to back with head-in parking. The 19' dimension is to assist with fire coverage, however, Gordon Robbins has stated that he needs 24 feet of width. In previous meetings we have discussed that the esplanade design should be hardscaped for the first 5 feet adjacent to the curb to allow for the encroachment of fire vehicles. The 19' width is not intended to provide two travel lanes but does allow for a vehicle to pass while another vehicle is stopped waiting for a parking space. It is possible that vehicles will try to use this space as two lanes and this may need to be controlled with additional signage in the future.

SECTION "D"

As a vehicle approaches Section "D" of the roadway the choice to U-turn around the esplanade or to continue east on Addison Circle is available. Again the pavement is widened to 25' b-b for WB-50 truck traffic, however a flush median is provided to direct the regular vehicular traffic. All approaches to the esplanade split are signed with advisory speeds of 15 m.p.h., yield signs and yield bars per Sheet P5 of Addison Circle Phase II Public Infrastructure

construction plans. Continuing east to Section "E" there is a natural progression to two travel lanes marked with buttons that continues to Dallas Parkway. The current design calls for a dual right turning movement at Dallas Parkway and the appropriate signage has been added to direct motorists. Buttons can be added at a future date to taper traffic to one lane if the dual right turn does not function properly.

The same conditions are encountered when traveling west on Addison Circle except at Section "D". There is a turning movement off of Dallas Parkway via a free right turn lane onto Addison Circle. We would recommend not striping Section "D" westbound for two travel lanes even though there is sufficient width for two vehicles. As a vehicle approaches the esplanade split there is only space for one vehicle to maneuver around the flush island. We should discourage two vehicles from entering this point side by side.

ADDISON CIRCLE / SPECTRUM DRIVE INTERSECTION

The intersection with Spectrum Drive will be treated as a 3-way stop under this design. Although we are providing conduit with the Phase II construction in the event signals are required in the future, it has not been determined nor is it the intent of this report to analyze whether signalization is necessary.

Vehicles traveling Spectrum Drive will be required to make two stops at Addison Circle due to the split roadway. We also propose to raise the section of Spectrum Drive between Addison Circle eastbound and Addison Circle westbound to create the illusion of a continuous esplanade area. This condition should not hamper vehicular movement as long as the intersection remains a three way stop. If the intersection ever becomes signalized where continuous green is possible in the north south direction on Spectrum the raised section could have a negative effect on traffic flow and safety without special controls. Special signage, speed limitations and a textural warning could be employed. As a last resort, the raised area could be lowered to a standard roadway profile with curbs.

In summary, we have addressed the channelization of passenger cars and trucks in this unusual street condition with the use of signage, flush medians and widening of pavement in critical locations. It is our belief that this geometry will allow the street to function as planned. However, it should be monitored to see if the actual actions of motorists warrant future adjustments.

Please call if you have any questions or comments.

Sincerely,

HUITT-ZOLLARS, INC.

David E. Meyers

David E. Meyers, P.E.

dem/psp

Enclosures

cc: Bryant Nail - Columbus Realty Trust

Ourston & Doctors
MODERN ROUNDABOUT INTERCHANGES

May 29, 1997

Mr. Andrew C. Oakley, P.E.
Huitt-Zollars, Inc.
3131 McKinney Avenue
Dallas, Texas 75204-2416

Addison Circle East Leg Plan Review

We have reviewed the subject horizontal layout and signing/striping plans. We find them to be in conformance with the original design that we completed for the other three legs of the Addison Roundabout. We have marked up the plans to show necessary corrections for location of some signs and addition of others. We also offer the following recommendations for the streets east of the roundabout.

1. Use red curb instead of the "No Parking" signs. This will reduce sign clutter and focus drivers' attention on the roundabout signs.

2. Use one-way signing at both ends of the oval roadway east of the roundabout.

3. At the entrance to the oval roadway, use a yield stripe. The new version of the MUTCD will have this yield stripe, which would also be consistent with the yield striping at the roundabout.

We look forward to the completion of the roundabout, and we would appreciate some photographs when it is completed.

Very truly yours,

Peter Doctors, P.E.

5290 Overpass Road, Suite 212 Santa Barbara, CA 93111 805/683-1383
http://www.west.net/~owendee Fax: 805/681-1135

John Baumgartner
From: Chris Terry
Sent: Tuesday, October 26, 1999 8:28 AM
To: John Baumgartner
Subject: RE: ROUNDABOUT LETTER

Then just give me the hard copy.

-----Original Message-----

From: **John Baumgartner**
Sent: Tuesday, October 26, 1999 8:22 AM
To: Chris Terry
Subject: RE: ROUNDABOUT LETTER

Chris,

I do not have a draft of the letter that you sent out on the roundabout in the computer. However, I have hard copy that I can share with you.

John

-----Original Message-----

From: **Chris Terry**
Sent: Tuesday, October 26, 1999 8:17 AM
To: John Baumgartner
Subject: RE: ROUNDABOUT LETTER

John,

Please e-mail me a copy of the previous letter you prepared for my signature on this issue.
Chris

-----Original Message-----

From: **John Baumgartner**
Sent: Tuesday, October 26, 1999 7:55 AM
To: Lea Dunn
Cc: Chris Terry
Subject: RE:

Lea,

It is my understanding that traffic issues related to the modern roundabout located at Quorum Drive and Addison Circle are being addressed by Chris Terry. Please let me know if I can be of any further assistance.

Thank you,

John

-----Original Message-----

From: **Lea Dunn**
Sent: Monday, October 25, 1999 2:45 PM
To: John Baumgartner
Cc: Chris Terry
Subject: FW:

John

If you are the appropriate person, would you please respond to this person. If not, let me know who I should direct this inquiry to. Thanks,

Lea

-----Original Message-----

From: **Mike Santamaria [mailto:m_santa@yahoo.com]**
Sent: Thursday, October 21, 1999 9:24 PM
To: ldunn@ci.addison.tx.us
Subject:

Hi,

I recently started to drive down Quorum Dr. through Addison, to get to my new job on Beltline Rd. On two separate occasions, I've nearly been struck by vehicles whipping around the Addison traffic circle. This traffic circle is extremely dangerous and something must be done, before someone gets hurt! I would like to recommend installing stop signs at all entry points to the traffic circle. This would at least slow people down, before entering the circle. Could you please pass this along to the right parties? Addison is my most favorite place in the whole Metroplex!

Thank You,

Mike Santamaria
(972) 982-4972/work
m_santa@yahoo.com

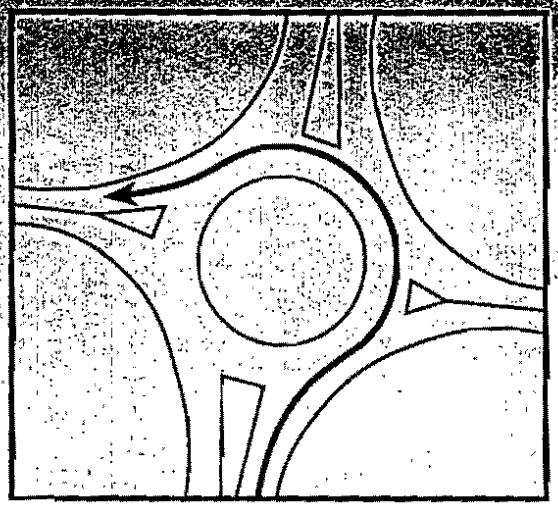
HOW TO DRIVE A ROUNDABOUT

As you approach a roundabout there will be a YIELD sign and dashed yield limit line. Slow down, watch for pedestrians and bicyclists, and be prepared to stop if necessary. When you enter, yield to circulating traffic on the left, but do not stop if it is clear.

A conventional roundabout will have ONE-WAY signs mounted in the center island. They help guide traffic and indicate that you must drive to the right of the center island. Mini-roundabouts have no one-way signs since the center island is not raised. You must still drive to the right of the domed, painted island.

Upon passing the street prior to your exit, turn on your right turn signal and watch for pedestrians and bicyclists as you exit.

Left turns are completed by traveling around the central island. *(See Figure 3)*



Left Turn
Figure 3

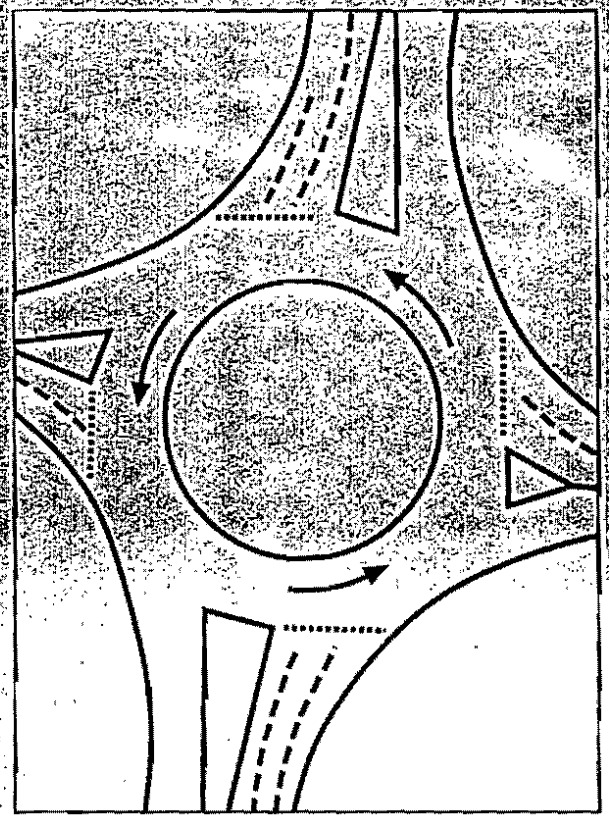
Other Traffic Information brochures available:

- Speed Zones and Speed Bumps
- Marked Crosswalks
- Pedestrian Signals
- Flashing Beacons
- Stop Signs & Traffic Signals
- Adult Crossing Guards
- Parking Pointers
- Avoiding Parking Tickets
- Left Turn Signals
- Traffic Safety Tips
- Traffic Flow Modifications
- Traffic Improvement Projects
- Children at Play
- Residential Parking Permits
- Suggested School Routes
- Vegetation and Traffic Safety
- Traffic Signal Systems

If you have questions, requests or suggestions concerning traffic, please call the Engineering Division at 654-7887.

In compliance with the Americans with Disabilities Act, this document is available in alternate formats by calling 654-7887 or through the California Relay Service.

ROUNDABOUTS



ENGINEERING DIVISION
CITY OF SAN BUENAVENTURA

John Baumgartner
From: Ron Whitehead
Sent: Friday, July 30, 1999 4:44 PM
To: John Baumgartner; Chris Terry
Cc: Lea Dunn
Subject: RE: Complaint - Speed bumps at Addison Circle

-----Original Message-----
From: John Baumgartner
Sent: Friday, July 30, 1999 4:31 PM
To: Chris Terry; Ron Whitehead
Cc: Lea Dunn
Subject: FW: Complaint - Speed bumps at Addison Circle

John,

No, I want to see how it works when the development surrounding the circle is in place first. Also, we need to see what effect the sculpture has. I think it is too early. In the spring we can reevaluate. We might want to place other traffic calming devices out there or an occassional stop sign.

Ron

Do you want to have our consultant (Huitt-Zollars) evaluate this request and make a recommendation?

-----Original Message-----
From: Lea Dunn
Sent: Friday, July 30, 1999 2:26 PM
To: John Baumgartner
Subject: FW: Complaint - Speed bumps at Addison Circle

John,

Chief Padden forwarded this information to me. Would you please follow up with Ms. Newsom regarding her request. Thanks,

Lea

-----Original Message-----
From: Gordon Robbins
Sent: Friday, July 30, 1999 9:01 AM
To: Noel Padden
Subject: Complaint - Speed bumps at Addison Circle

I recently was asked by a shop owner at Addison Circle (Andra Newsom of TRENDS) whether or not the Town could install speedbumps on Quorum at the entrances to the traffic circle.

Apparently some drivers think it quite sporting to accelerate into the circle and see how fast they can take the curve (I'm sure none of these people are Audi drivers). Andra says this wasn't too much of a problem until people started moving into Phase 2. But now that we have over 420 apartments occupied on the other side of Quorum, more and more people are crossing the street each day and the potential for a problem is much greater.

Anyhow, I wanted to forward this complaint through channels to the proper parties. Please let me know if you have questions.

~Gordo

MODERN ROUNDABOUT
for
ADDISON CIRCLE

November, 1995
Revised March 1, 1996

Prepared By:

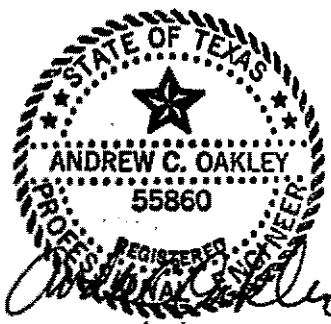
Andrew C. Oakley, P.E.
Huitt-Zollars, Inc.
3131 McKinney Ave., Suite 600
Dallas, TX 75204
(214) 871-3311

in association with

Peter Doctors, P.E.
Ourston & Doctors
5290 Overpass Road, Suite 212
Santa Barbara, CA 93111
(805) 683-1383

Prepared For:

The Town of Addison
and
Columbus Realty Trust



3/1/96

ADDISON CIRCLE
MODERN ROUNDABOUT ANALYSIS
MARCH 1, 1996

INTRODUCTION

This report was prepared for Columbus Realty Trust and the Town of Addison as supporting documentation for the design of a "modern roundabout" at the intersection of Quorum Drive and Mildred Street within the special zoning district known as "Addison Circle". The report was prepared by Peter Doctors, P.E., of the firm of Ourston and Doctors, modern roundabout consultants based in Santa Barbara, California under the direct supervision of Andrew C. Oakley, P.E., of Huitt-Zollars, Inc., Dallas, Texas, who also edited and contributed to the text.

BACKGROUND/ROUNDABOUT OPERATION

The term "modern roundabout" refers to a type of traffic circle with very special characteristics of geometry and operation. The concept of the modern roundabout to replace the conventional traffic circle came about in an attempt to overcome the operational failure that occurs when there is so much traffic in the circle that gridlock occurs. A modern roundabout operates on a simple principle already familiar to drivers, the one way street. The principle uses two signs, the YIELD sign and the ONE WAY sign. A circular roadway is constructed with roads entering like spokes on a wheel. The circular road is one-way with the entering roads yielding to circulating traffic. When a driver approaches the roundabout, he/she looks to the left to see if anyone is in the circle and if empty, enters the circle. If someone is in the circle, the entering driver waits for an appropriate gap in traffic and then enters. Once in the circle the driver has the right of way and exits the circle when arriving at their chosen road. The primary differences between a modern roundabout and a traditional traffic circle are as follows:

- In a roundabout, approaching traffic yields to traffic already in the roundabout whereas, in many traffic circles, entering traffic has the right of way. A car approaching the roundabout looks to the left at circulating traffic and determines if a gap is available to

enter the roundabout safely. If there is not a gap available in the circulating traffic stream, the driver waits at the yield limit line until a gap is available. The location of the yield limit line, the presence of a yield sign and the deflection of the vehicle's path upon entering the roundabout contribute to making this a simple decision process.

- Traffic entering a roundabout is deflected around the roundabout by geometric features of both the approach road and the central island. By providing this deflection, the vehicle speeds are reduced, making decisions for the driver easier as well as increasing the safety of the intersection. The roundabout is the safest form of intersection and the deflection requirements contribute to this element of safety.

- Approach roads are widened as they near the roundabout to increase their capacity. This widening is referred to as "flare". The flare length is much shorter than a standard intersection widening. In fact, flare lengths over 80 feet do not provide any significant increases in capacity. The flare lengths used in the design provide for adequate capacity without extensive widening of the approaching roadways.

BASIS FOR DESIGN

Design parameters for the modern roundabout have been developed empirically in Europe and Australia over the last 30 years. In the last several years, modern roundabouts have gained usage in the United States. Experimentation with various combinations of entry width, approach width, entry radius, entry angle and inscribed circle diameter have led to optimum operation under variable conditions. As a result, computer programs have been developed which allow the input of traffic data and geometric characteristics with resulting output of average delays relating, in turn, to level of service.

Ourston and Doctors roundabout designs follow technical advice by the British Department of Transport. The designs of all the modern roundabouts built to date in California, Nevada, Maryland, and Colorado also follow British design advice and they operate well with little delay and few accidents.

Traffic performance estimates for the Addison Circle Roundabout were made using the computer application RODEL. RODEL is based on research by the Transportation Research Laboratory in the United Kingdom. Approximately $8M was spent on collecting data at 86 different roundabouts. From this data, equations linking the various geometric parameters were developed and applied in the computer application ARCADY and RODEL. This program estimates average vehicle delay for each approach to the roundabout. The program has been used to analyze roundabouts in California, both in Long Beach and Santa Barbara, with delay estimates of RODEL deviating from observed delay by no more than two seconds.

TRAFFIC ANALYSIS

Analysis of the proposed modern roundabout at the intersection of Quorum Drive and Mildred Street was based on the following facts and assumptions about these roadways.

- Quorum Drive is a 4-lane divided roadway with recessed parallel parking lanes to be added to both sides.

- Mildred Street, though technically wide enough to be 4 lanes, is assumed to be a 2-lane undivided roadway with parallel parking on each side. (However, approaching the roundabout, a center island is introduced and parking is eliminated consistent with standard design practice).

- ADT for Quorum Drive at buildout will be 30,000 VPD and ADT for Mildred Street will be 10,000 VPD.

The directional distribution of post-development peak hour travel routes and the volume of traffic that would be making each turning movement during the peak hours were both needed in order to design the roundabout. The volumes and distribution that were used to design the roundabout for Addison were arrived at based on the following assumptions:

- Only those tracts that face Quorum Drive and/or Mildred Street will be developed into anything other than multi-family residential uses.

- Based on the proposed land use mix for Phase I, 7% of the floor area proposed for each mixed-use tract will be developed into non-residential uses.

- The relationship between the number of dwelling units developed on a particular tract and the amount of available floor area on that tract will be similar throughout the residential subdistrict.

Based on our understanding that a total of 5,050 multi-family dwelling units are proposed for the residential subdistrict, and the three assumptions just described, the number of dwelling units that will ultimately occupy each tract could be calculated. A map of the proposed district indicating the various development tracts is presented in Figure 1a. The results of the calculation process are presented in Figure 1b.

Using trip rate information contained within the ITE Trip Generation manual and the San Diego Association of Governments *Not So Brief Guide of Vehicular Traffic Generation Rates of the San Diego Region*, daily and peak hour trip rates were calculated for each tract. The results are presented in Figure 2.

During the peak hours, site-generated traffic will be distributed about the surrounding roadway network as follows:

- 15% of site generated traffic will be traveling to or arriving from the north.
- 30% of site generated traffic will be traveling to or arriving from the south.
- 35% of site generated traffic will be traveling to or arriving from the east.
- 20% of site generated traffic will be traveling to or arriving from the west.

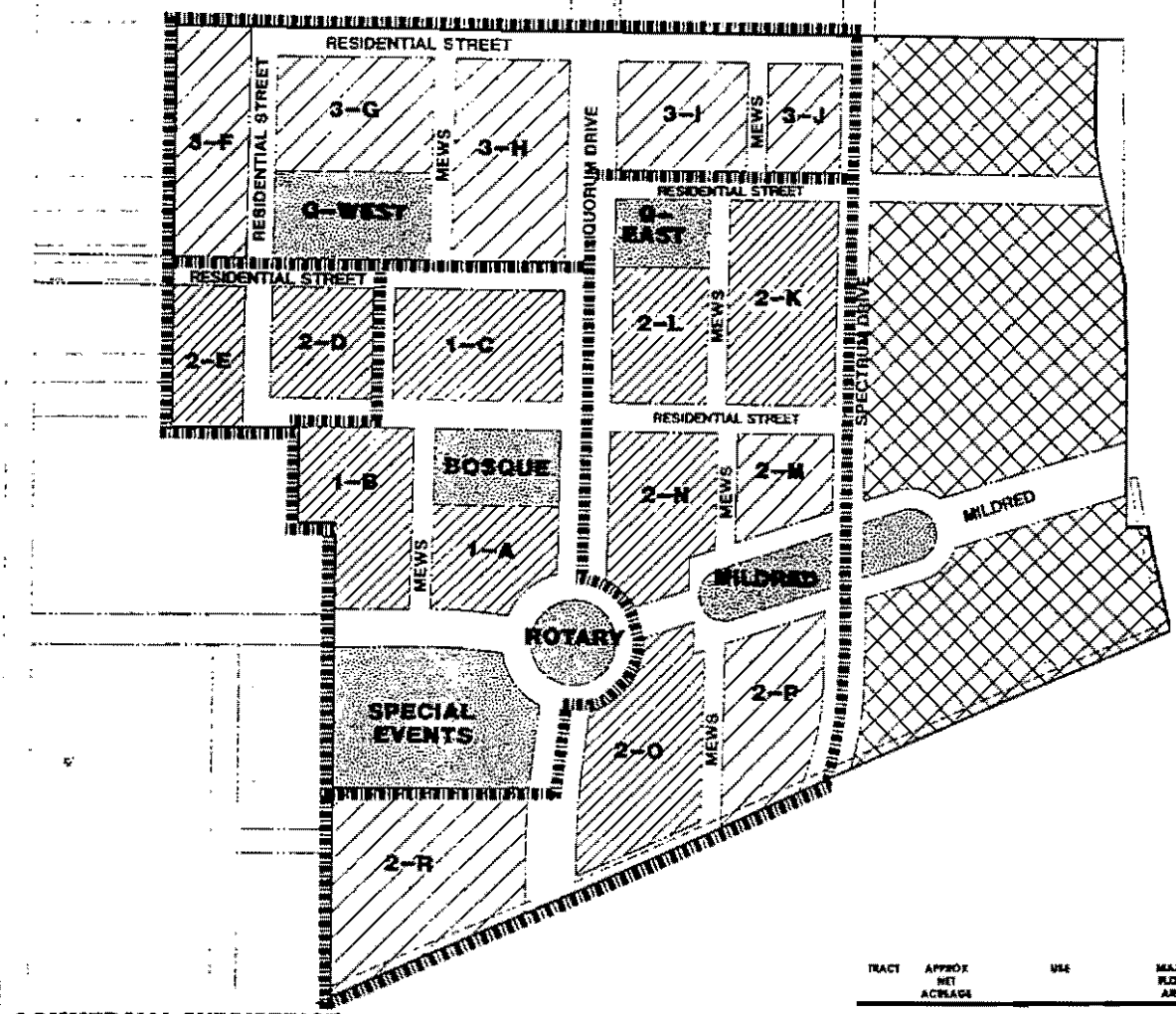
Based on this distribution, peak hour site traffic was assigned to the adjacent roadways. Then, based on the "at buildout" daily traffic volumes expected on Quorum Drive as dictated by the

VARIATIONS/ALTERATIONS

The following elements are to be determined at the development plan stage:

1. Mix of uses for separate phases.
2. Number of units by type of residential use and identification of sites intended to meet minimum residential use standards for the Residential Sub district.
3. Floor areas by category of use.
4. Locations of private recreation areas.
5. Time schedule for installation of public improvements and private development subsequent to Phase I.

DRAFT



COMMERCIAL SUBDISTRICT

(ANY PRIMARY USE OR A COMBINATION OF PRIMARY USES IN THE COMMERCIAL SUBDISTRICT OF THE U.C. DISTRICT)

RESIDENTIAL SUBDISTRICT

(A MINIMUM OF 1500 RESIDENTIAL UNITS TO OCCUR WITHIN PHASES ONE AND TWO)

MIXED USE WITH RESIDENTIAL
(RESIDENTIAL WITH NON-RESIDENTIAL GROUND FLOOR USES)

MIXED USE WITH RESIDENTIAL
ALTERNATIVE USE: MIXED USE WITHOUT RESIDENTIAL

PUBLIC OPEN SPACE

TRACT	APPROX NET ACREAGE	USE	MAX SF FLOOR AREA
PHASE 1 1-5 YEARS			
1-A	1.23	Mixed Use with Residential	144,500
1-B	1.60	Mixed Use with Residential	130,780
1-C	1.89	Mixed Use with Residential	180,900
Bosque	0.95	Open Space	0
Spec. Events	3.00	Open Space	0
Rotary	0.58	Open Space	0
PHASE 2 1-8 YEARS			
2-D	1.12	Mixed Use with Residential	176,550
2-E	1.12	Mixed Use with Residential	167,500
2-K	2.42	Mixed Use with Residential	318,630
2-L	1.38	Mixed Use with Residential	290,300
2-M	0.97	Mixed Use w/wo Residential	208,800
2-N	1.76	Mixed Use with Residential	413,600
2-O	2.41	Mixed Use with Residential	365,800
2-P	1.85	Mixed Use w/wo Residential	393,800
2-R	3.36	Mixed Use w/wo Residential	513,256
Mildred	0.76	Open Space	0
G-EAST	0.99	Open Space	0
PHASE 3 1-12 YEARS			
3-F	1.88	Mixed Use w/wo Residential	234,000
3-G	1.88	Mixed Use w/wo Residential	234,600
3-H	2.31	Mixed Use w/wo Residential	331,900
3-I	1.81	Mixed Use w/wo Residential	221,250
3-J	0.87	Mixed Use w/wo Residential	164,750
G-WEST	1.43	Open Space	0

The information is part of a concept plan submitted on March 1, 1995 for Lots 21, 22, and 23 of Block B, Lots 1A, and 2 of Block A, a portion of Lot 3 of Block B, and Lot 3 and a portion of Lot 2 of Block C all being part of Addison's Addition, and additional unplatted acreage all in the H.H. Baker Survey, Abstract No. 402 in the Town of Addison, Dallas County, Texas. This plan is being submitted by Urban Real of Columbus Realty Trust, 15851 North Dallas Parkway suite 855, Dallas, Texas 75248. Telephone: 387-1492.

PRELIMINARY CONCEPT PLAN

Scale: 1" = 100'

FIGURE 1a

ADDISON

Addison Urban Center

Special District Planning • Addison, Texas

COLUMBUS

RTKL Associates Inc.

TRACT	TOTAL FLOOR AREA* BY TRACT (SF)	COMMERCIAL FLOOR AREA** BY TRACT (SF)	RESIDENTIAL FLOOR AREA** BY TRACT (SF)	PERCENTAGE OF TOTAL RESIDENTIAL FLOOR AREA**	NO. OF DWELLING UNITS** BY TRACT
1-A	144,500.00	10,155.00	134,385.00	3.07	155.00
1-B	130,750.00	9,153.00	121,597.00	2.77	140.00
1-C	150,900.00	10,563.00	140,337.00	3.20	162.00
2-D	176,550.00	0.00	176,550.00	4.03	204.00
2-E	167,500.00	0.00	167,500.00	3.82	193.00
2-K	518,650.00	0.00	518,650.00	11.84	596.00
2-L	290,300.00	20,321.00	269,979.00	6.16	311.00
2-M	206,800.00	14,476.00	192,324.00	4.39	222.00
2-N	413,800.00	28,966.00	384,834.00	8.78	444.00
2-O	565,800.00	39,606.00	526,194.00	12.01	608.00
2-P	393,800.00	27,566.00	366,234.00	8.36	422.00
3-F	284,000.00	0.00	284,000.00	6.48	327.00
3-G	286,600.00	0.00	286,600.00	6.54	330.00
3-H	351,900.00	24,633.00	327,267.00	7.47	377.00
3-I	321,250.00	321,250.00	298,762.00	6.82	344.00
3-J	186,750.00	186,750.00	186,750.00	4.26	215.00
TOTALS	4,589,850.00	693,399.00	4,381,963.00	100.00	5,050.00

* As specified on Preliminary Concept Plan

** Assumed, based on Preliminary Concept Plan

FIGURE 1b

Assumed Land Use Mix
By Tract

TRACT	COMMERCIAL FLOOR AREA (SF)	NO. OF DWELLING UNITS	TRIPS GENERATED				
			DAILY	A.M. PEAK HOUR		P.M. PEAK HOUR	
				IN	OUT	IN	OUT
1-A	10,115	155	1,409	25	71	90	55
1-B	9,153	140	1,271	22	66	81	50
1-C	10,563	162	1,473	25	77	94	57
2-D	0	204	1,281	18	86	84	40
2-E	0	193	1,211	17	81	80	37
2-K	0	596	1,876	50	246	227	107
2-L	20,321	311	2,861	49	143	173	108
2-M	14,476	222	2,029	34	103	126	78
2-N	28,966	444	4,107	69	203	243	150
2-O	39,606	608	5,650	92	279	327	204
2-P	27,566	422	3,901	65	194	232	144
3-F	0	327	2,078	28	136	131	61
3-G	0	330	2,097	28	137	131	62
3-H	24,633	377	3,478	58	174	208	129
3-I	22,488	344	3,170	52	159	191	118
3-J	0	215	1,352	19	90	88	42
TOTALS	207,887	5,050	39,244	651	2,245	2,506	1,442

* As specified on Preliminary Concept Plan

** Assumed, based on Preliminary Concept Plan

FIGURE 2

Expected
Traffic Generation Rates
By Tract

Town of Addison, and those expected on Mildred Street as predicted by Barton-Aschman Associates, Inc., along with traffic count data collected on Quorum Drive in 1995, background traffic volumes were then added to the site generated volumes to create post-development traffic assignment models. These are presented on Figures 3 & 4 and are the basis for the design of the roundabout.

DESIGN ANALYSIS

The project post-development volumes were entered into the RODEL model, as were iterative values for each of the five geometric parameters. The analysis was performed based on achieving a Level of Service C or above. After several iterations, the model arrived at a roundabout with acceptable levels of service in both the AM and PM peak hours based on a combination of geometric variables that created an acceptable urban pedestrian environment while also meeting the vehicular needs for roundabout operation. The primary elements of the final recommended geometry are an inner curb radius of 67 feet; an outer curb radius of 100 feet; approximately 33 feet of flare (3 lanes) on the Quorum Drive approaches; and approximately 23 feet of flare (2 lanes) on the Mildred Street approaches. This final geometry is illustrated in Figure 5 and with a greater level of detail on the construction plans in Appendix A. The RODEL printouts indicating estimates of average delay on all legs are included herein as Figures 6 & 7.

Geometric information is shown in the upper left hand portion of the RODEL printouts. Dimensions are in meters. The following symbol key is provided to interpret the variables.

E	Entry Width	(the width of flare on approach)
V	Approach Width	
RAD	Entry Radius	
PHI	Entry Angle	
DIA	Inscribed Circle Diameter	(the outer curb)

Estimates of the average delay for all vehicles entering the roundabout are 22.2 seconds per vehicle for the A.M. peak hour and 11.6 seconds per vehicle for the P.M. peak hour. These

ADDISON CIRCLE MODERN ROUNDABOUT ANALYSIS

NORTH

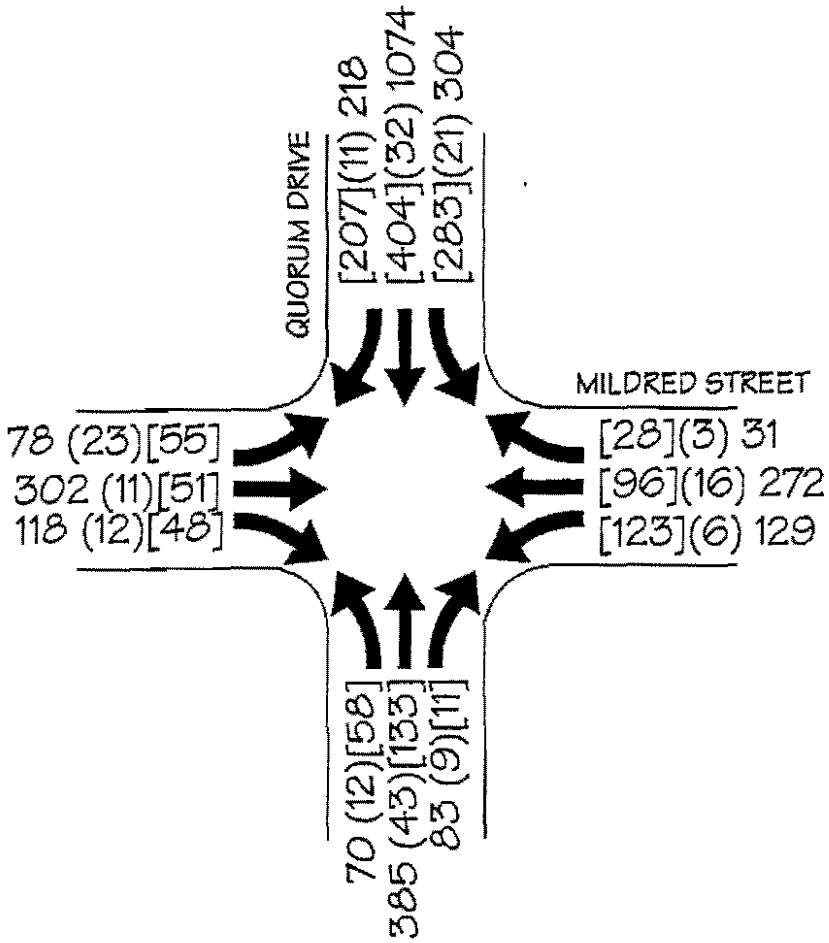


FIGURE 3

A.M. Peak Hour
Site Plus Background
Traffic Volumes

LEGEND

[99] SITE GENERATED TRAFFIC VOLUMES (RESIDENTIAL)
(99) SITE GENERATED TRAFFIC VOLUMES (NON-RESIDENTIAL)
999 SITE PLUS BACKGROUND TRAFFIC VOLUMES

HUITT-ZOLLARS

ADDISON CIRCLE MODERN ROUNDABOUT ANALYSIS

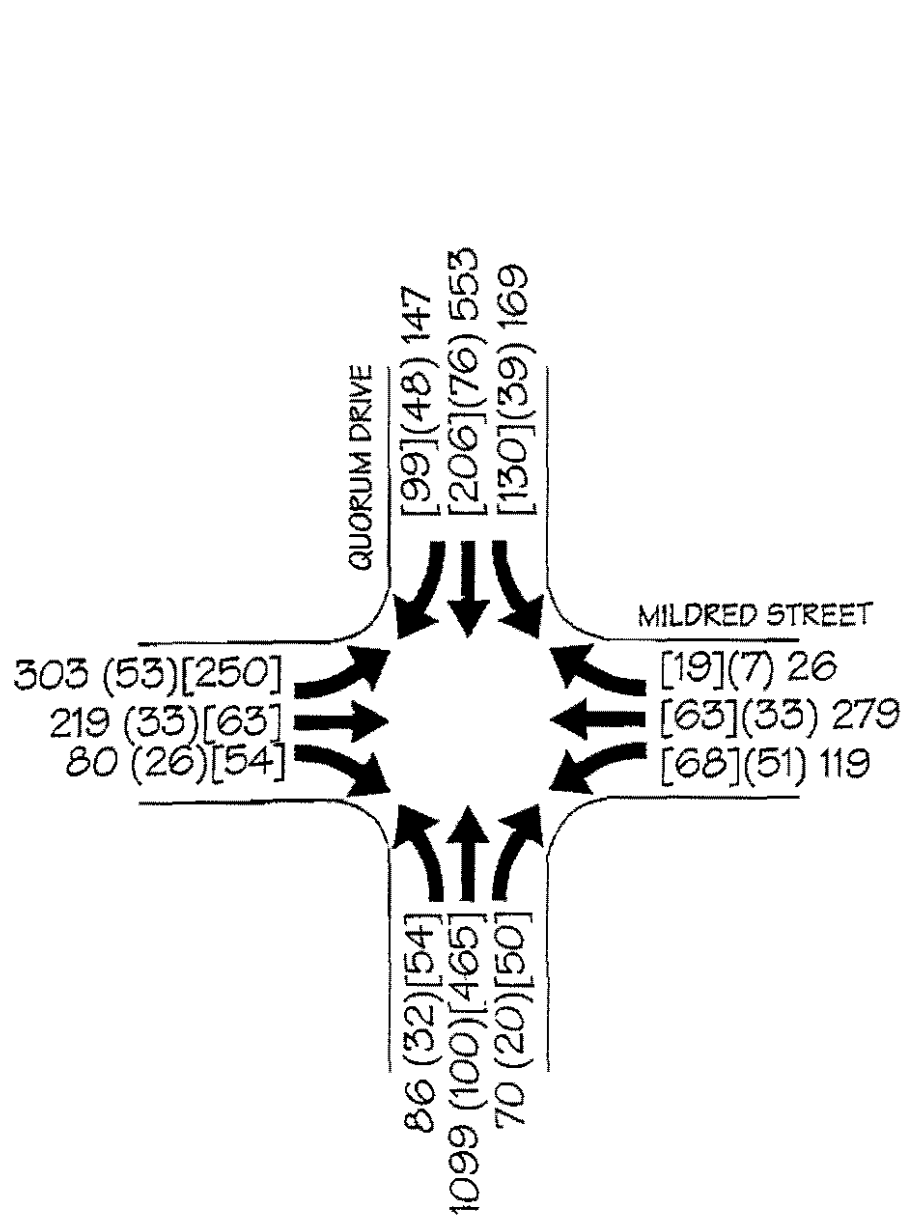


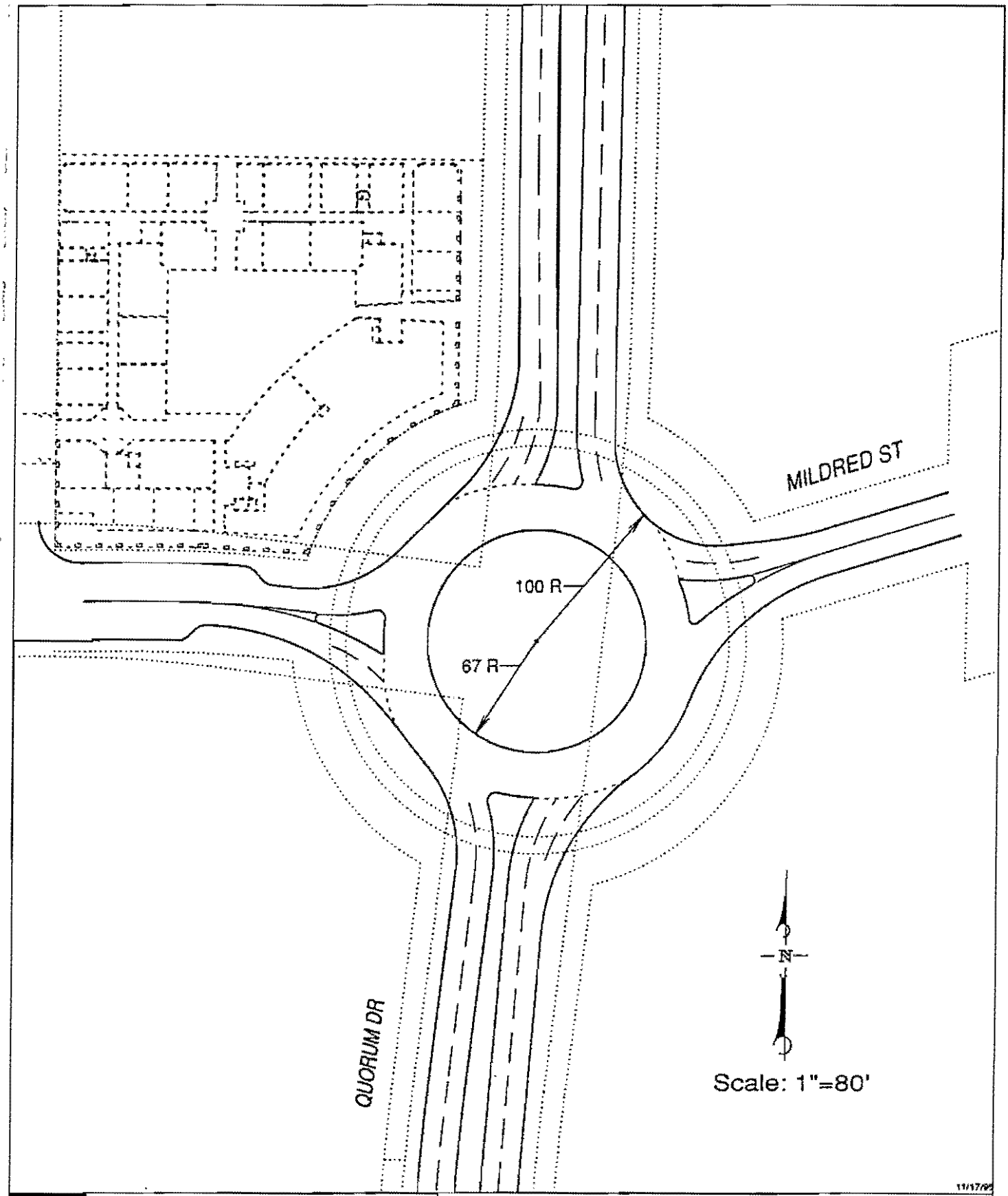
FIGURE 4

P.M. Peak Hour
Site Plus Background
Traffic Volumes

LEGEND

[99] SITE GENERATED TRAFFIC VOLUMES (RESIDENTIAL)
(99) SITE GENERATED TRAFFIC VOLUMES(NON-RESIDENTIAL)
999 SITE PLUS BACKGROUND TRAFFIC VOLUMES

HUITT-ZOLLARS



Ourston & Doctors

MODERN ROUNDABOUT INTERCHANGES

5290 Overpass Road #212 Santa Barbara, CA 93111

ADDISON ROUNDABOUT

Addison Circle

FIGURE 5

```
*******************************************************************************
*                                                                             *
*  10:10:95                     ADDISON ROUNDABOUT                       45  *
*                                                                             *
*******************************************************************************
*                  (1)      (2)     (3)      (4)         *                    *
* E    (m)      10.06    7.32   10.06    7.32           * TIME PERIOD    min       90  *
* L'   (m)      16.43   14.93   16.60   22.13           * TIME SLICE     min       15  *
* V    (m)       7.01    4.12    7.01    4.12           * RESULTS PERIOD min   15 75  *
* RAD  (m)      39.63   18.29   36.58   45.73           * TIME COST    p/min     7.79  *
* PHI  (d)      27.00   57.00   30.00   27.00           * FLOW PERIOD    min   15 75  *
* DIA  (m)      60.98   60.98   60.98   60.98           * FLOW TYPE  pcu/veh     VEH  *
* GRAD SEP          0       0       0       0           * FLOW PEAK am/op/pm     AM  *
*                                                       *                    *
*******************************************************************************
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL*  FLOW RATIO   *FLOW TIME*
*          *    *                            *    *  *               *         *
(1) *WB QUORUM *1.05*   83  385   70  0       *1.00*85*0.75 1.125 0.75*15 45 75 *
(2) *WB MILDRED*1.05*   31  272  129  0       *1.00*85*0.75 1.125 0.75*15 45 75 *
(3) *SB QUORUM *1.05*  218 1074  304  0       *1.00*85*0.75 1.125 0.75*15 45 75 *
(4) *EB MILDRED*1.05*  118  302   78  0       *1.00*85*0.75 1.125 0.75*15 45 75 *
*          *    *                            *    *  *               *         *
*          *    *                            *    *  *               *         *
*          *    *                            *    *  *               *         *
*******************************************************************************
*                                                        *                    *
* FLOW        veh      601     483    1783     556        *   TOTAL DELAYS     *
* CAPACITY    veh     1848    1111    1982     763        *                    *
* AVE DELAY  mins     0.05    0.09    0.55    0.38        *       21 hrs       *
* MAX DELAY  mins     0.06    0.13    1.22    0.73        *                    *
* AVE QUEUE   veh        0       1      17       4        *       99 pounds    *
* MAX QUEUE   veh        1       1      35       6        *                    *
*                                                        *                    *
*******************************************************************************
```

Input → (E … GRAD SEP rows)

Level of Service → (AVE DELAY row)

A.M. Peak Hour

FIGURE 6

```
*********************************************************************************
*                                                                               *
*  10:10:95                    ADDISON ROUNDABOUT                          40   *
*                                                                               *
*********************************************************************************
*              (1)     (2)     (3)     (4)          *                          *
* E     (m)   10.06    7.32   10.06    7.32          * TIME PERIOD    min     90  *
* L'    (m)   16.43   14.93   16.60   22.13          * TIME SLICE     min     15  *
* V     (m)    7.01    4.12    7.01    4.12          * RESULTS PERIOD min  15 75  *
* RAD   (m)   39.63   18.29   36.58   45.73          * TIME COST    p/min   7.79  *
* PHI   (d)   27.00   57.00   30.00   27.00          * FLOW PERIOD    min  15 75  *
* DIA   (m)   60.98   60.98   60.98   60.98          * FLOW TYPE  pcu/veh    VEH  *
* GRAD SEP        0       0       0       0          * FLOW PEAK am/op/pm     PM  *
*                                                   *                          *
*********************************************************************************
* LEG NAME *PCU *FLOWS (1st exit 2nd etc...U)*FLOF*CL*  FLOW RATIO   *FLOW TIME*
*          *    *                            *    *  *              *         *
(1)*N8 QUORUM *1.05*   70 1099   86  0         *1.00*85*0.75 1.125 0.75*15 45 75 *
(2)*W8 MILDRED*1.05*   26  279  119  0         *1.00*85*0.75 1.125 0.75*15 45 75 *
(3)*SB QUORUM *1.05*  147  553  169  0         *1.00*85*0.75 1.125 0.75*15 45 75 *
(4)*EB MILDRED*1.05*   80  219  303  0         *1.00*85*0.75 1.125 0.75*15 45 75 *
*          *    *                            *    *  *              *         *
*          *    *                            *    *  *              *         *
*          *    *                            *    *  *              *         *
*********************************************************************************
*                                                                   *           *
* FLOW         veh    1402    474    971    672                    *  TOTAL DELAYS   *
* CAPACITY     veh    1843    625   1973   1162                    *              *
* AVE DELAY    mins   0.16    0.65   0.06   0.13                   *      11 hrs  *
* MAX DELAY    mins   0.28    1.33   0.08   0.19                   *              *
* AVE QUEUE    veh       4       5      1      1                   *      53 pounds *
* MAX QUEUE    veh       6      10      1      2                   *              *
*                                                                   *              *
*********************************************************************************
```

Input →

Level of Service →

P.M. Peak Hour

FIGURE 7

delays equate to Level of Service C and B during the AM and PM peak traffic hours, respectively. Level of Service C corresponds with 16 to 30 seconds of delay per vehicle. Calculations are shown on the attached Roundabout Level of Service worksheet, Figure 8.

Capacity and delay estimates are made at the 85-percent confidence level. These estimates are conservative compared to capacity and delay estimates for signalized intersections in the United States, which are made at the 50-percent confidence level.

FINAL DESIGN AND CONSTRUCTION DRAWINGS

The traffic analysis for design of a modern roundabout results in the horizontal geometry of the circle itself and its approaches. There are, however, many other consideration and design elements necessary to produce a complete, functional roadway. These include vertical geometry, including profiles and typical sections; drainage; pedestrian circulation; relationships to on-street parking; lighting; signage; markings; and landscape limitations. The basis for design of these elements is explained in the following paragraphs and the results for the Addison Circle Roundabout are illustrated on a partial set of reduced construction drawings which are included herein as Appendix A.

Grading, Drainage and Roadway Profile

A unique design approach to the vertical geometry of a modern roundabout has been developed to provide a safe comfortable driving experience and to facilitate the traffic movements that occur through the circle. The base element of the design is an imaginary line one-third of the way between the outer curb and the inner curb. For the Addison Circle Roundabout this distance is 11 feet. The profile of this baseline (or "centerline") is a single phase of a cosine curve whose apex is usually set at the point of the highest entering roadway and whose nadir is 180° away. For the Addison Circle Roundabout, the base line is the invert of the street with a reverse parabolic crown approximating a straight crown of 2%. (See Figure 9)

The physical centerline of the travel lanes of each of the entering and exiting roadways is merged

FIGURE 8
ROUNDABOUT LEVELS OF SERVICE

10-10-95

Ourston & Doctors

Addison Roundabout
Projected Design Flows

A.M. PEAK HOUR

		LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	WHOLE ROUNDABOUT
INPUT FROM RODEL OR ARCADY								
FLOW	veh/hr	601	483	1783	556			3,423
AVE DELAY	min/veh	0.05	0.09	0.55	0.38			
OUTPUT								
AVE DELAY	sec/veh	3.0	5.4	33.0	22.8			
DELAY	sec/hr	1803	2608	58839	12677			75,927

AVE DELAY, sec/veh 22.2
LEVEL OF SERVICE C

P.M. PEAK HOUR

		LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	WHOLE ROUNDABOUT
INPUT FROM RODEL OR ARCADY								
FLOW	veh/hr	1402	474	971	672			3,519
AVE DELAY	min/veh	0.16	0.65	0.06	0.13			
OUTPUT								
AVE DELAY	sec/veh	9.6	39.0	3.6	7.8			
DELAY	sec/hr	13459	18486	3496	5242			40,682

AVE DELAY, sec/veh 11.6
LEVEL OF SERVICE B

Level of Service
FIGURE 8

with the cosine curve to create, in this case, 8 smooth profiles. The result is a roadway that helps guide the motorist around the circle with minimum undulation in the traveling surface which would cause discomfort. Drainage is concentrated along the base line and may be collected by grate inlets as necessary or as desired to minimize flow depth and ponding.

Pedestrian Circulation

All research from Europe and Australia suggests that pedestrians are safer at roundabouts than at signalized intersections. Lower pedestrian accident rates at roundabouts have been attributed to three factors:

(1) Traffic moves slowly, about 15 to 20 miles per hour at roundabouts of this size.
(2) The pedestrian must look only one way before choosing a large enough gap in traffic to assure a safe crossing.
(3) The pedestrian's passage is broken into two stages; from the nearside wheelchair ramp to the refuge in the median island, and from the median island to the farside wheelchair ramp.

The recommended locations of the pedestrian crossings are shown in Figure 5, indicated by two concentric dotted circles. More detailed information is shown on the construction drawings included herein. These locations comply with the recommended distance of between one and three car lengths from the yield line. A break in the median or splitter island is used for barrier-free passage across the street.

On-street Parking Locations

The location of on-street parking must be considered so that it does not impair the operation of the roadway or cause traffic to back up into the roundabout. For entering roadways the location of the parking should be limited to a minimum 20 foot transition before the BCR (begin curb return) of the roundabout. For exiting roadways the location of the parking should start at a point no closer than 100 feet from the inscribed circle diameter. This will allow adequate stopping

sight distance and storage for waiting vehicles.

Lighting Requirements

Lighting columns should be arranged around the perimeter of the roundabout in a simple ring, with the lights equidistant from the center and from each other. Lighting should extend at least 200 feet back along each exit road. Mounting height should be uniform throughout the intersection and not less than any approach road. Minimum horizontal illuminance at the curblines should be 1.9 footcandles. The minimum illuminance required should be not less than the highest level of lighting for any of the approach roads. (Final lighting plans are not included in Appendix A. Only pedestrian lights are shown at this time).

Signing and Striping Requirements

The approach to signing and striping of a roundabout is similar to other major intersections. Advance guidance signs are provided to inform motorist of destinations before they enter the roundabout. Advance warning signs, yield signs, one-way signs or chevron boards and splitter island guidance signs are also necessary for the roundabout to operate successfully. The nature of the advance warning signs is somewhat unique to roundabouts and they are illustrated in detail in Appendix A.

The striping required at a roundabouts consists of a yield legend and yield limit line. The limit line is not found in the MUTCD, but must be used in a roundabout to indicate the location for the motorist to yield.

Landscaping Limitations

To provide adequate sight distance as motorists make their way around the circle, significant landscaping and sculptural features in the central island of this roundabout should be confined within a diameter of 70 feet. In this area any landscaping or statue can be constructed of infinite elevation. The remaining 32 feet between this landscaping/statue area and the central island curb

must be landscaped with some type of ground cover or low plant that will not obscure the driver's visibility around the circle.

Landscaping of the medians or splitter islands should be limited to a maximum height of 3.5 feet to allow drivers to see circulating traffic, with exceptions for carefully placed single-trunk trees, limbed up a minimum of 7 feet.

CONCLUSIONS

The installation of a modern roundabout at the junction of Quorum Drive and Mildred Street will provide for a safe and efficient intersection. An acceptable level of service can be achieved for the intersection without the necessity of a traffic signal even during the AM and PM peak hours. The roundabout will provide an aesthetic benefit to the community through the creation of a significant space for public art and will help foster the urban environment by reducing the speed of traffic that might otherwise be experienced on Quorum Drive, without a loss in capacity.

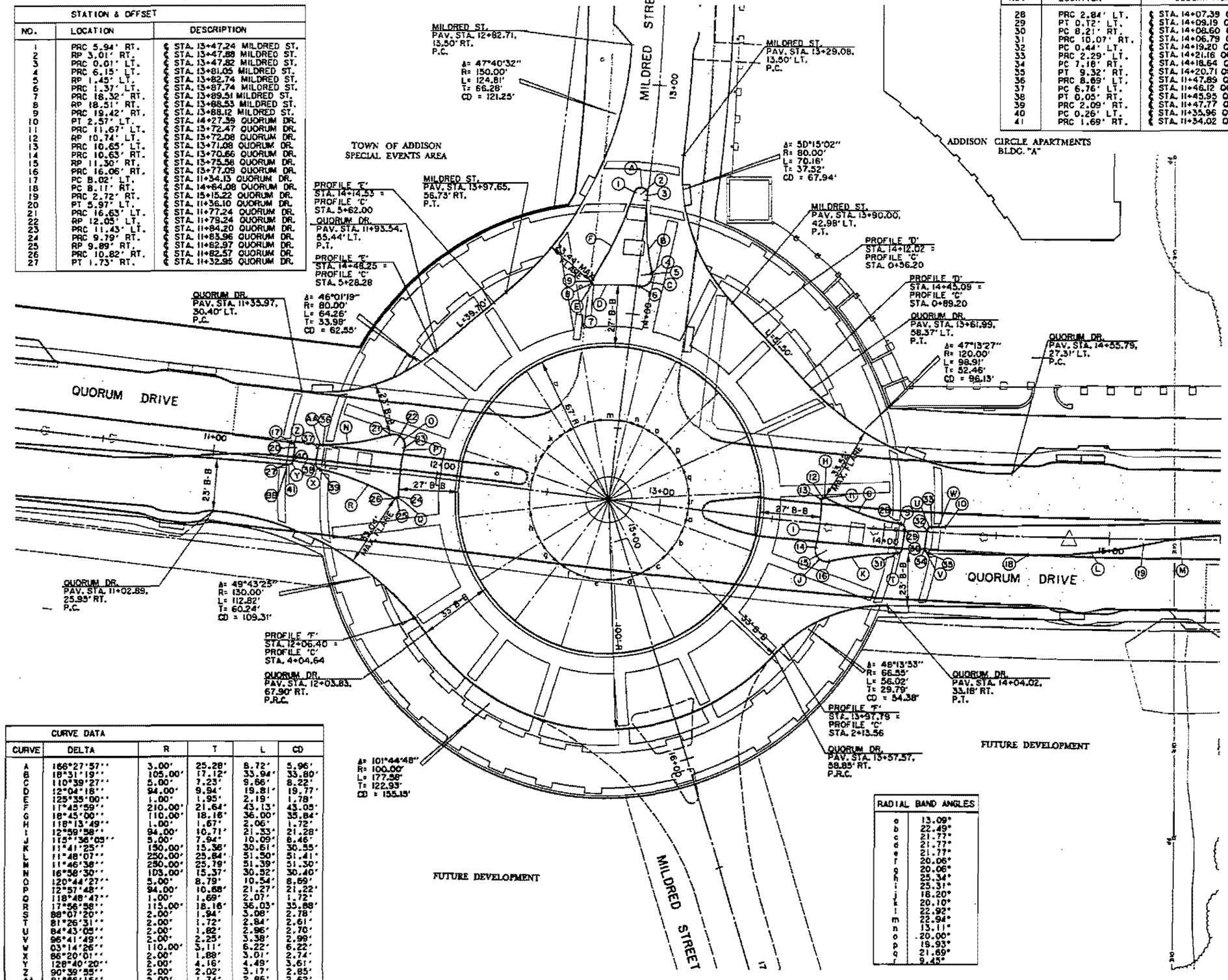
APPENDIX A

ADDISON CIRCLE PHASE I
MODERN ROUNDABOUT

- **GEOMETRIC PLAN**
- **STREETSCAPE PLAN**
- **ROUNDABOUT PROFILE**
- **APPROACH PROFILES**
- **SIGNAGE & STRIPING PLAN**
- **TRAFFIC SIGN DETAILS**

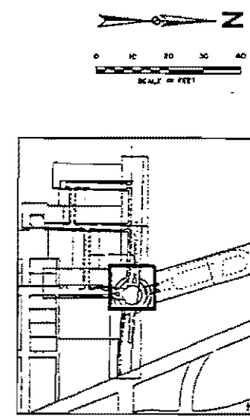
STATION & OFFSET		
NO.	LOCATION	DESCRIPTION
1	PRC 5.94' RT.	℄ STA. 13+47.24 MILDRED ST.
2	RP 3.01' RT.	℄ STA. 13+47.88 MILDRED ST.
3	PRC 0.01' LT.	℄ STA. 13+47.82 MILDRED ST.
4	PRC 6.15' LT.	℄ STA. 13+81.05 MILDRED ST.
5	RP 1.45' LT.	℄ STA. 13+82.74 MILDRED ST.
6	PRC 1.37' LT.	℄ STA. 13+87.74 MILDRED ST.
7	PRC 18.32' RT.	℄ STA. 13+89.51 MILDRED ST.
8	RP 18.51' RT.	℄ STA. 13+88.53 MILDRED ST.
9	PRC 19.42' RT.	℄ STA. 13+88.12 MILDRED ST.
10	PT 2.57' LT.	℄ STA. 14+27.39 QUORUM DR.
11	PRC 11.67' LT.	℄ STA. 13+72.47 QUORUM DR.
12	RP 10.74' LT.	℄ STA. 13+72.08 QUORUM DR.
13	PRC 10.65' LT.	℄ STA. 13+71.08 QUORUM DR.
14	PRC 10.63' RT.	℄ STA. 13+70.66 QUORUM DR.
15	RP 11.30' RT.	℄ STA. 13+75.56 QUORUM DR.
16	PRC 16.06' RT.	℄ STA. 13+77.09 QUORUM DR.
17	PC 8.02' LT.	℄ STA. 11+34.13 QUORUM DR.
18	PC 8.11' RT.	℄ STA. 14+84.08 QUORUM DR.
19	PRC 2.72' RT.	℄ STA. 15+15.22 QUORUM DR.
20	PT 5.97' LT.	℄ STA. 11+36.10 QUORUM DR.
21	PRC 16.63' LT.	℄ STA. 11+77.24 QUORUM DR.
22	RP 12.05' LT.	℄ STA. 11+79.24 QUORUM DR.
23	PRC 11.43' LT.	℄ STA. 11+84.20 QUORUM DR.
24	PRC 9.79' RT.	℄ STA. 11+83.96 QUORUM DR.
25	RP 9.89' RT.	℄ STA. 11+82.97 QUORUM DR.
26	PRC 10.82' RT.	℄ STA. 11+82.57 QUORUM DR.
27	PT 1.73' RT.	℄ STA. 11+32.95 QUORUM DR.

STATION & OFFSET		
NO.	LOCATION	DESCRIPTION
28	PRC 2.84' LT.	℄ STA. 14+07.39 QUORUM DR.
29	PT 0.72' LT.	℄ STA. 14+09.19 QUORUM DR.
30	PC 8.21' RT.	℄ STA. 14+08.60 QUORUM DR.
31	PRC 10.07' RT.	℄ STA. 14+06.79 QUORUM DR.
32	PC 0.44' LT.	℄ STA. 14+19.20 QUORUM DR.
33	PRC 2.29' LT.	℄ STA. 14+21.16 QUORUM DR.
34	PC 7.18' RT.	℄ STA. 14+18.64 QUORUM DR.
35	PT 9.32' RT.	℄ STA. 14+20.71 QUORUM DR.
36	PRC 8.69' LT.	℄ STA. 11+47.89 QUORUM DR.
37	PC 6.76' LT.	℄ STA. 11+48.12 QUORUM DR.
38	PT 0.05' RT.	℄ STA. 11+45.95 QUORUM DR.
39	PRC 2.09' RT.	℄ STA. 11+47.77 QUORUM DR.
40	PC 0.26' LT.	℄ STA. 11+35.96 QUORUM DR.
41	PRC 1.69' RT.	℄ STA. 11+34.02 QUORUM DR.



CURVE DATA					
CURVE	DELTA	R	T	L	CD
A	166°27'57"	3.00'	25.28'	8.72'	5.96'
B	18°31'19"	105.00'	17.12'	33.94'	33.80'
C	110°39'27"	5.00'	7.23'	9.66'	8.22'
D	12°04'18"	94.00'	9.94'	19.81'	19.77'
E	125°35'00"	1.00'	1.95'	2.19'	1.78'
F	11°45'59"	210.00'	21.64'	43.13'	43.05'
G	18°45'00"	110.00'	18.16'	36.00'	35.84'
H	118°13'49"	1.00'	1.67'	2.06'	1.72'
I	12°59'58"	94.00'	10.71'	21.33'	21.28'
J	115°36'05"	5.00'	7.94'	10.09'	8.46'
K	11°41'25"	150.00'	15.36'	30.61'	30.55'
L	11°48'07"	250.00'	25.84'	51.50'	51.41'
M	11°46'38"	250.00'	25.79'	51.39'	51.30'
N	16°58'30"	103.00'	15.37'	30.52'	30.40'
O	120°44'27"	5.00'	8.79'	10.54'	8.69'
P	12°57'48"	94.00'	10.68'	21.27'	21.22'
Q	118°48'47"	1.00'	1.69'	2.07'	1.72'
R	17°56'58"	115.00'	18.16'	35.03'	35.88'
S	88°07'20"	2.00'	1.94'	3.08'	2.78'
T	81°26'31"	2.00'	1.72'	2.84'	2.61'
U	84°43'05"	2.00'	1.82'	2.96'	2.70'
V	96°41'49"	2.00'	2.25'	3.38'	2.99'
W	03°14'26"	110.00'	3.11'	6.22'	6.22'
X	86°20'01"	2.00'	1.88'	3.01'	2.74'
Y	128°40'20"	2.00'	4.16'	4.49'	3.61'
Z	90°39'55"	2.00'	2.02'	3.17'	2.85'
AA	81°56'16"	2.00'	1.74'	2.86'	2.62'
BB	00°32'01"	115.00'	0.54'	1.07'	1.07'

RADIAL BAND ANGLES	
a	13.09°
b	22.49°
c	21.77°
d	21.77°
e	21.77°
f	20.06°
g	20.06°
h	25.34°
i	25.31°
j	18.20°
k	20.10°
l	22.92°
m	22.94°
n	13.11°
o	20.00°
p	19.93°
q	21.69°
r	9.45°



LEGEND

ELECTRIC — OHE —
- LIGHT POLE
- POWER POLE
- GUY WIRE

TELEPHONE — T —
- TELEPHONE MANHOLE
- TELEPHONE PEDESTAL
- TELEPHONE SIGN

GAS — G —
- GAS METER
- GAS SIGN

LAND USE
- RAILROAD SIGN
- SIGN

SURVEY
- FOUND IRON ROD
- TEMP BENCHMARK

WASTEWATER — WW —
- WASTEWATER MANHOLE
- CLEANOUT

WATER — W —
- FIRE HYDRANT
- METER
- WATER VALVE

MISC.
- EX. STORM SEWER
- CHAIN LINK FENCE
- WOOD FENCE
- EXISTING ASPHALT
- EXISTING DIRT OR GRAVEL
- EX. CONCRETE
- TREE/TREE LINE
- EXISTING CURB
- PROP. CURB
- PROP. EDGE OF PAVEMENT NO CURB
- EX. PROPERTY LINE
- PROP. CENTERLINE
- PROP. R.O.W.
- PROP. INLET
- T.P. TOP OF PAVEMENT
- T.C. TOP OF CURB
- C.R. CURB RETURN
- EX. G EXISTING GUTTER
- B-20 BORING LOCATION

BENCHMARKS:

BM#1
"T" CUT AT CENTER BACK OF CURB OF INLET, 190 FEET SOUTH FROM THE CENTERLINE INTERSECTION OF MILDRED STREET, WEST SIDE OF QUORUM DRIVE.
ELEV. 621.89

BM#2
"T" CUT AT CENTER BACK OF CURB OF INLET, 200 FEET NORTH FROM THE CENTERLINE INTERSECTION OF MILDRED STREET, WEST SIDE OF QUORUM DRIVE.
ELEV. 621.68

ISSUED FOR CONSTRUCTION
MARCH 11, 1996

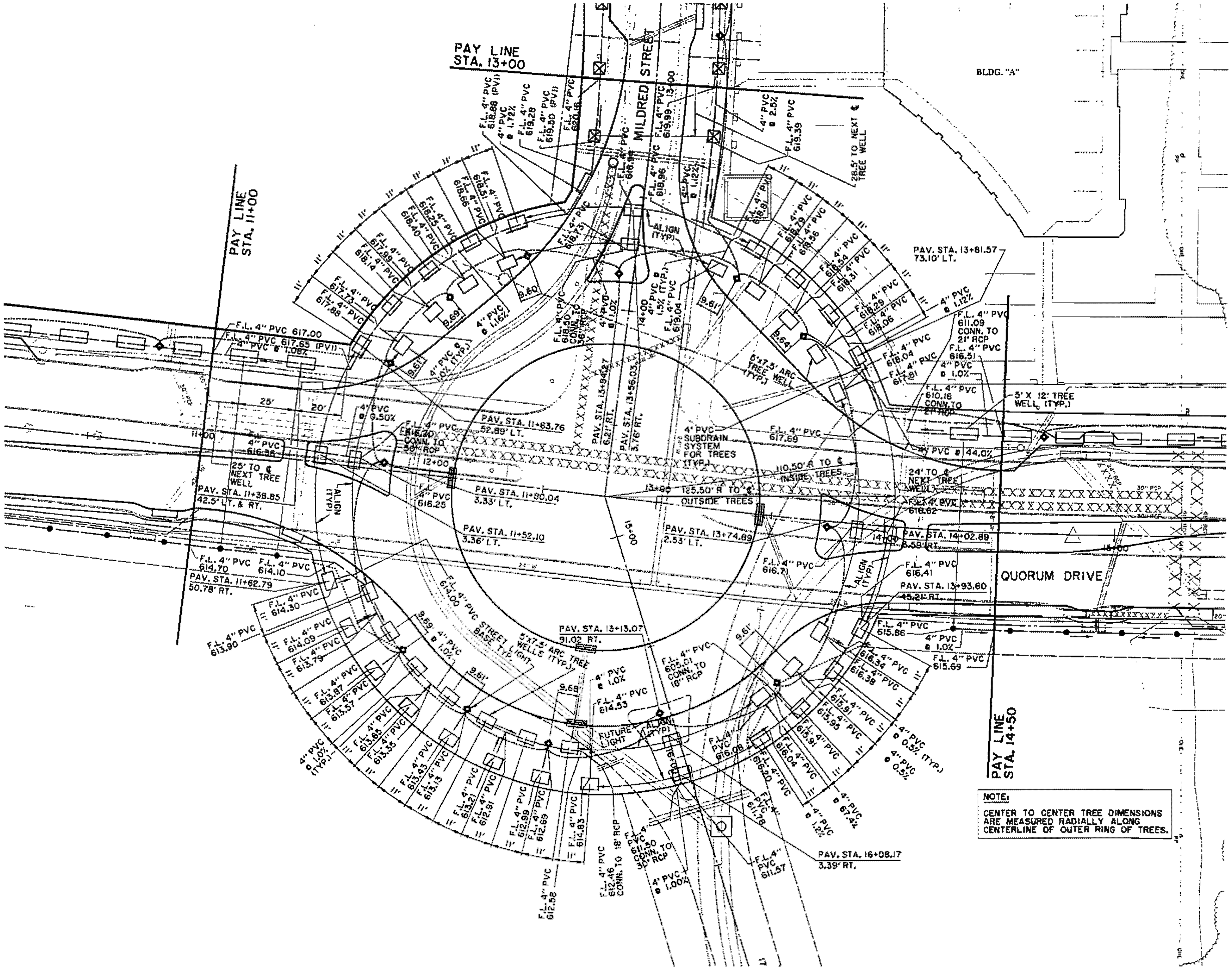
THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY KENNETH A. ROBERTS, P.E. 55446 ON JANUARY 4, 1996.

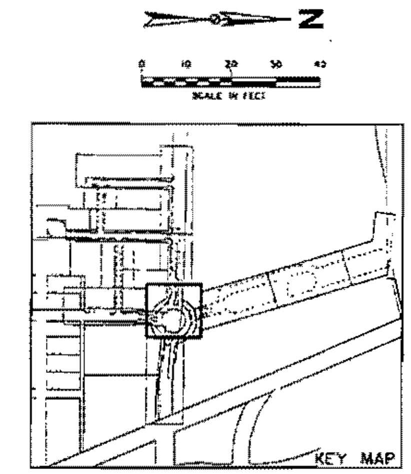
STATE OF TEXAS · KENNETH A. ROBERTS · 55446 · REGISTERED PROFESSIONAL ENGINEER · 1-4-96

GEOMETRIC PLAN
ROUNDABOUT - QUORUM DR. & MILDRED ST.
ADDISON CIRCLE
PHASE I PUBLIC INFRASTRUCTURE
TOWN OF ADDISON, TEXAS

Halff-Zollars, Inc./Engineering/Architecture
Dallas, Fort Worth, Houston, El Paso, Phoenix, Austin, Ontario, San Clemente

DESIGN	DRAWN	APPR.	SCALE	DATE	PROJECT NO.	NO.
HZI	HZI	KAR	1"=20'	JAN. 96	1822-04	28 / 137





LEGEND

ELECTRIC — OHE —
- LIGHT POLE
- POWER POLE
- GUY WIRE

TELEPHONE — T —
- TELEPHONE MANHOLE
- TELEPHONE PEDESTAL
- TELEPHONE SIGN

GAS — G —
- GAS METER
- GAS SIGN

LAND USE
- RAILROAD SIGN
- SIGN

SURVEY
- FOUND IRON ROD
- TEMP BENCHMARK

WASTEWATER — WW —
- WASTEWATER MANHOLE
- CLEANOUT

WATER — W —
- FIRE HYDRANT
- METER
- WATER VALVE

MISC.
- 48" RCP EX. STORM SEWER
- CHAIN LINK FENCE
- WOOD FENCE
- EXISTING ASPHALT
- EXISTING DIRT OR GRAVEL
- EX. CONCRETE
- TREE/TREE LINE
- EXISTING CURB
- PROP. CURB
- PROP. EDGE OF PAVEMENT NO CURB
- EX. PROPERTY LINE
- PROP. CENTERLINE
- PROP. R.O.W.
- PROP. INLET
- T.P. TOP OF PAVEMENT
- T.C. TOP OF CURB
- C.R. CURB RETURN
- EX. G EXISTING GUTTER
- B-20 BORING LOCATION

BENCHMARKS:

BM#1
"□" CUT AT CENTER BACK OF CURB OF INLET, 190 FEET SOUTH FROM THE CENTERLINE INTERSECTION OF MILDRED STREET, WEST SIDE OF QUORUM DRIVE.
ELEV. 621.89

BM#2
"□" CUT AT CENTER BACK OF CURB OF INLET, 200 FEET NORTH FROM THE CENTERLINE INTERSECTION OF MILDRED STREET, WEST SIDE OF QUORUM DRIVE.
ELEV. 621.66

ISSUED FOR CONSTRUCTION
MARCH 11, 1996

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STATE OF TEXAS
KENNETH A. ROBERTS
55446
REGISTERED PROFESSIONAL ENGINEER
1-4-96

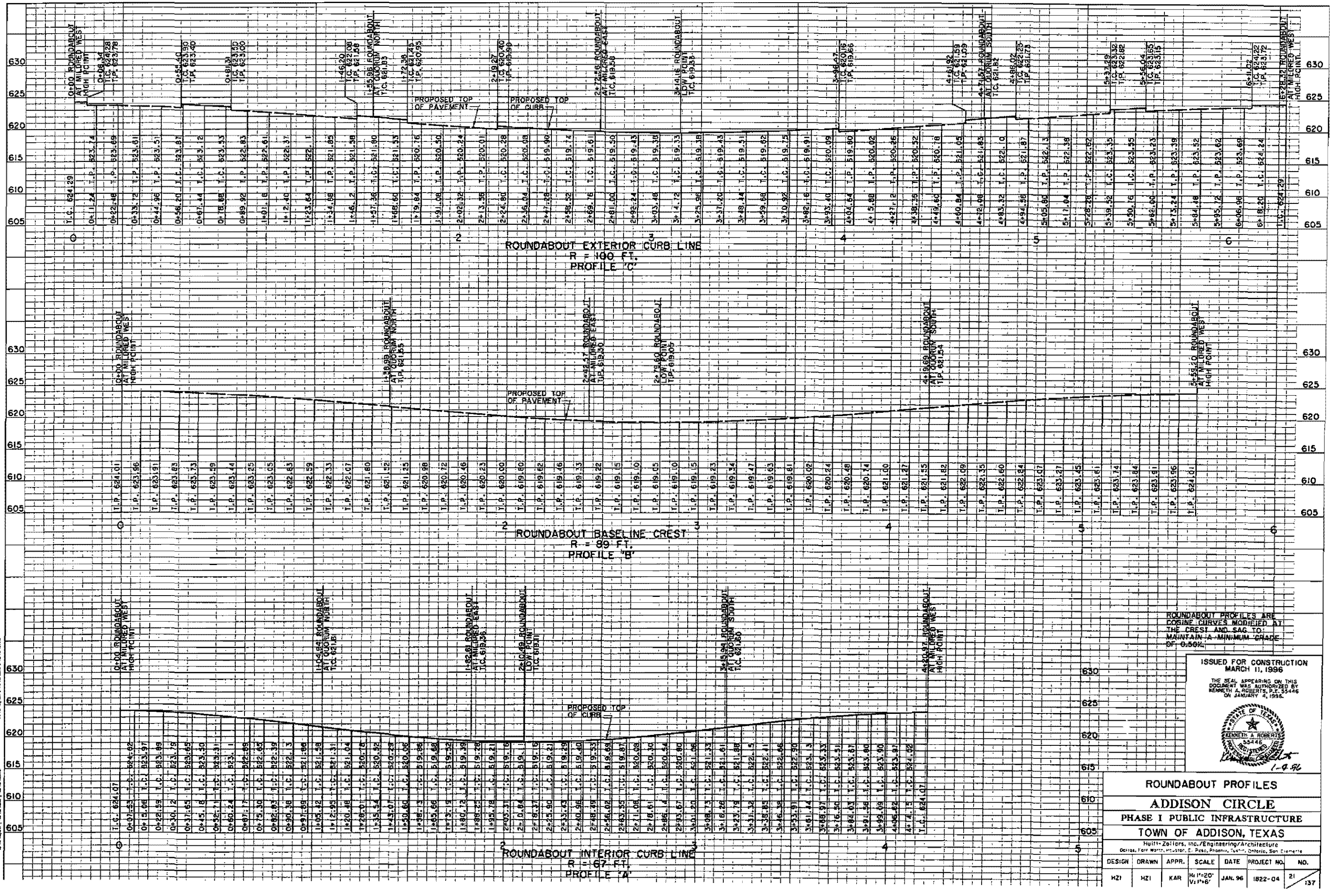
STREETSCAPE PLAN
QUORUM DRIVE & MILDRED STREET

ADDISON CIRCLE
PHASE I PUBLIC INFRASTRUCTURE

TOWN OF ADDISON, TEXAS

Huitt-Zollars, Inc./Engineering/Architecture
Dallas, Fort Worth, Houston, El Paso, Phoenix, Tustin, Ontario, San Clemente

DESIGN	DRAWN	APPR.	SCALE	DATE	PROJECT NO.	NO.
HZI	HZI	KAR	1"=20'	JAN. 96	1822-04	50/137



ROUNDABOUT PROFILES ARE COSINE CURVES MODIFIED AT THE CREST AND SAG TO MAINTAIN A MINIMUM GRADE OF 0.50%.

ISSUED FOR CONSTRUCTION
MARCH 11, 1996

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STATE OF TEXAS
KENNETH A ROBERTS
55446
REGISTERED PROFESSIONAL ENGINEER

1-9-96

ROUNDABOUT PROFILES

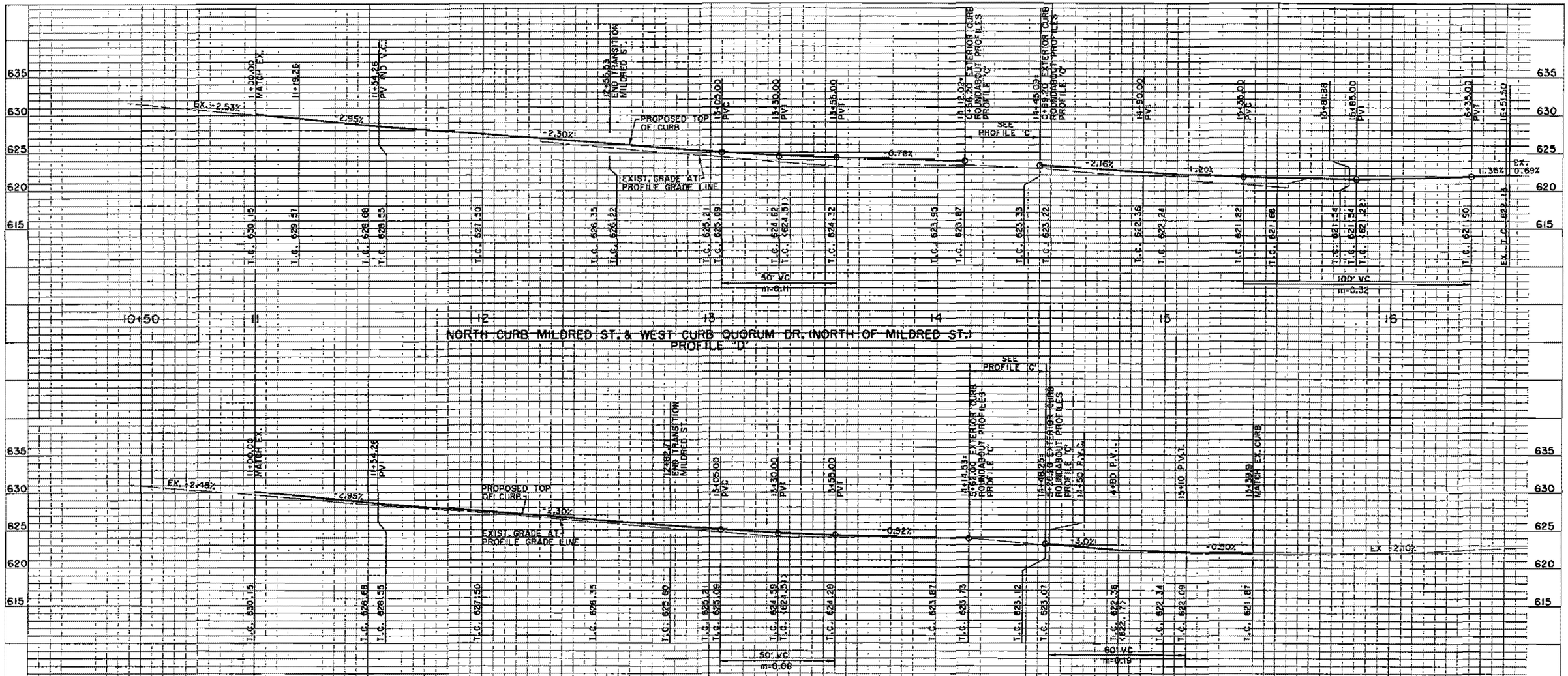
ADDISON CIRCLE

PHASE I PUBLIC INFRASTRUCTURE

TOWN OF ADDISON, TEXAS

Huitt-Zollars, Inc./Engineering/Architecture
Dallas, Fort Worth, Houston, El Paso, Phoenix, Austin, Ontario, San Clemente

DESIGN	DRAWN	APPR.	SCALE	DATE	PROJECT NO.	NO.
HZI	HZI	KAR	H: 1"=20' V: 1"=6'	JAN. 96	1822-04	21 / 137



NORTH CURB MILDRED ST. & WEST CURB QUORUM DR. (NORTH OF MILDRED ST.)
PROFILE "D"

SOUTH CURB MILDRED ST. & WEST CURB QUORUM DR. (SOUTH OF MILDRED ST.)
PROFILE "E"

NOTE:

PROFILE STATIONING IS ALONG THE CURB LINE OR PGL LINE ON PAVING PLANS.

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MARCH 11, 1996

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STATE OF TEXAS
KENNETH A. ROBERTS
55446
REGISTERED
PROFESSIONAL ENGINEER
1-4-96

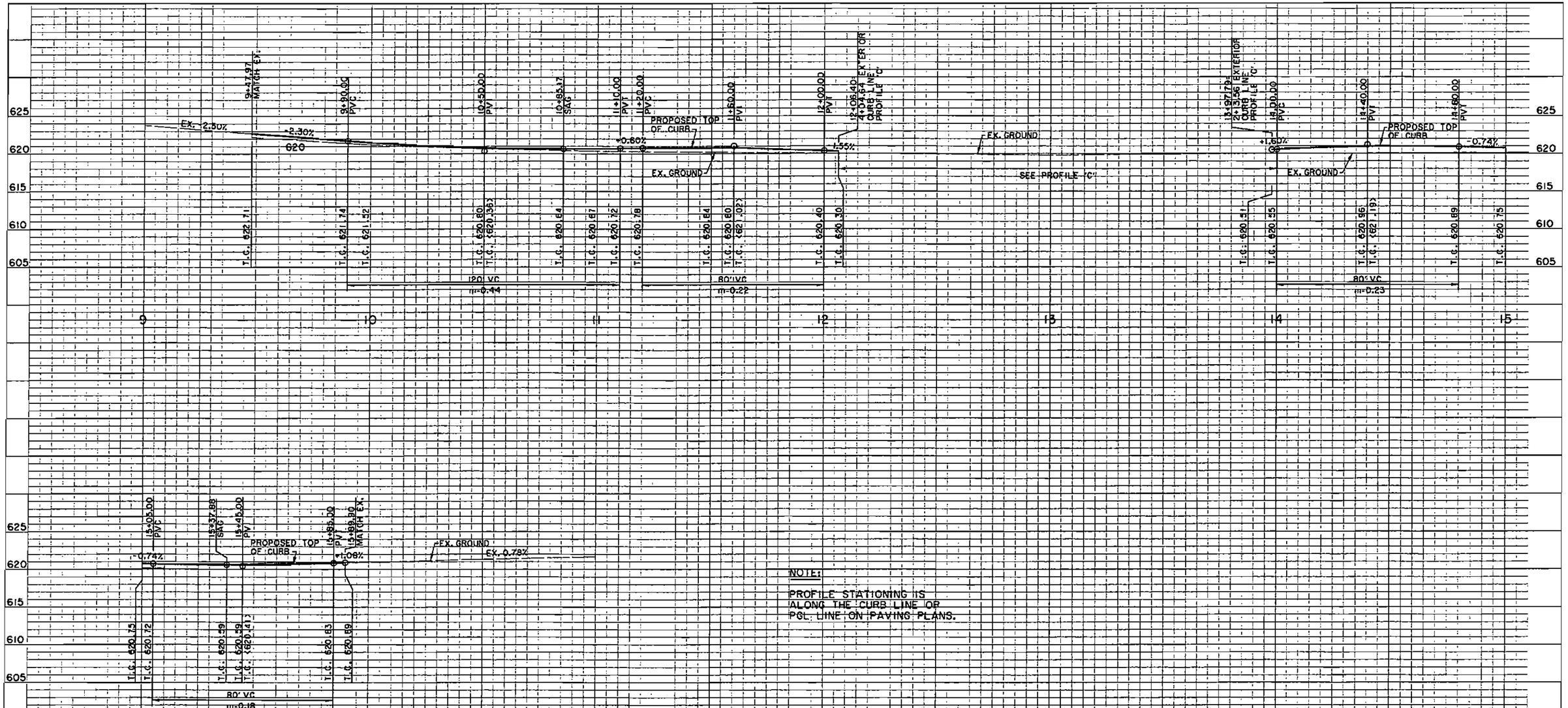
ROUNDABOUT PROFILES
ENTERING AND EXITING EXTERIOR LEGS

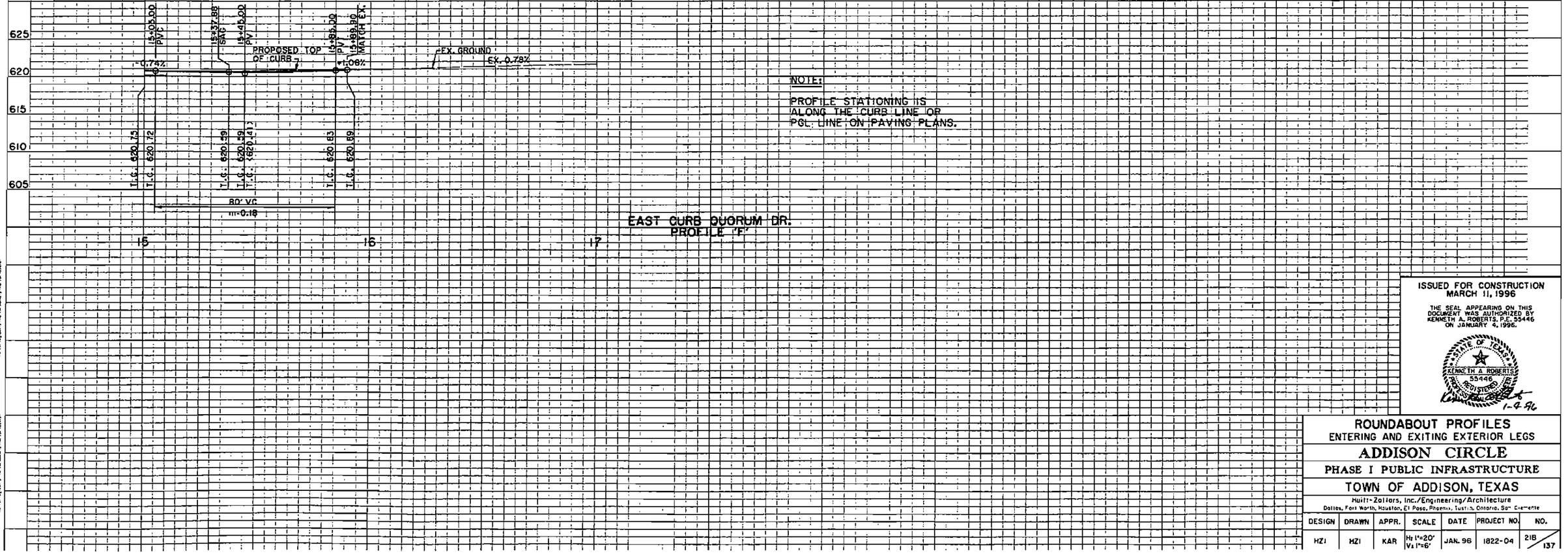
ADDISON CIRCLE
PHASE I PUBLIC INFRASTRUCTURE

TOWN OF ADDISON, TEXAS

Huitt-Zollars, Inc./Engineering/Architecture
Dallas, Fort Worth, Houston, El Paso, Phoenix, Austin, Ontario, San Clemente

DESIGN	DRAWN	APPR.	SCALE	DATE	PROJECT NO.	NO.
HZI	HZI	KAR	H: 1"=20' V: 1"=6'	JAN. 96	1622-04	21A / 137





NOTE:

PROFILE STATIONING IS ALONG THE CURB LINE OR PGL LINE ON PAVING PLANS.

EAST CURB QUORUM DR.
PROFILE "F"

ISSUED FOR CONSTRUCTION
MARCH 11, 1996

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STATE OF TEXAS
KENNETH A ROBERTS
55446
REGISTERED
PROFESSIONAL ENGINEER
1-9-96

ROUNDABOUT PROFILES
ENTERING AND EXITING EXTERIOR LEGS

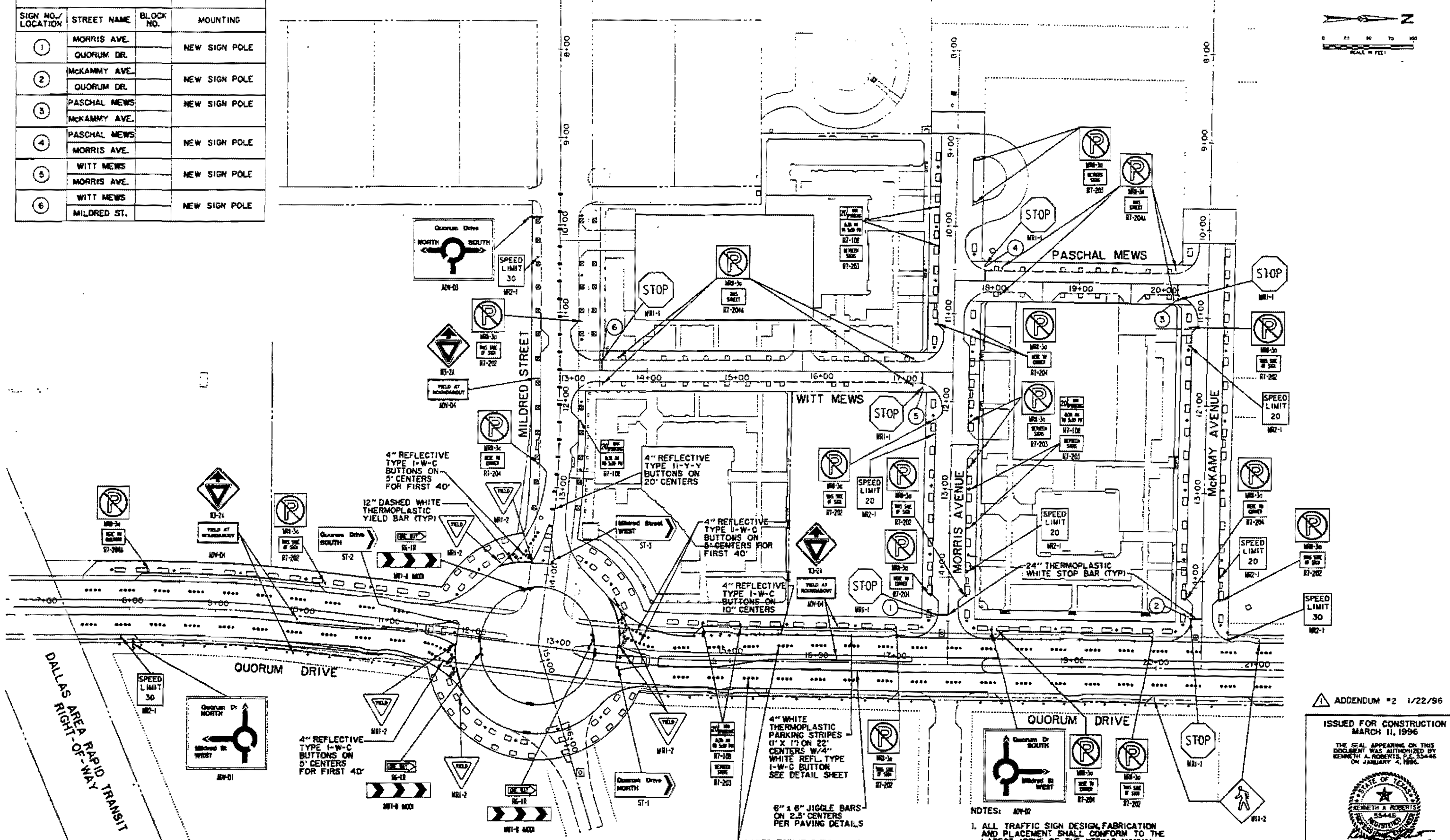
ADDISON CIRCLE
PHASE I PUBLIC INFRASTRUCTURE

TOWN OF ADDISON, TEXAS

Huitt-Zollars, Inc./Engineering/Architecture
Dallas, Fort Worth, Houston, El Paso, Phoenix, Austin, Ontario, San Clemente

DESIGN	DRAWN	APPR.	SCALE	DATE	PROJECT NO.	NO.
HZI	HZI	KAR	H: 1"=20' V: 1"=6'	JAN. 96	1822-04	218 / 137

STREET NAME SIGNS			
SIGN NO./ LOCATION	STREET NAME	BLOCK NO.	MOUNTING
1	MORRIS AVE.		NEW SIGN POLE
	QUORUM DR.		
2	McKAMMY AVE.		NEW SIGN POLE
	QUORUM DR.		
3	PASCHAL MEWS		NEW SIGN POLE
	McKAMMY AVE.		
4	PASCHAL MEWS		NEW SIGN POLE
	MORRIS AVE.		
5	WITT MEWS		NEW SIGN POLE
	MORRIS AVE.		
6	WITT MEWS		NEW SIGN POLE
	MILDRED ST.		



⚠ ENTIRE SHEET REVISED PER ADDENDUM #2

⚠ ADDENDUM #2 1/22/96

NOTES:

1. ALL TRAFFIC SIGN DESIGN, FABRICATION AND PLACEMENT SHALL CONFORM TO THE LATEST ISSUE OF THE "TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS".
2. STREET NAME SIGNS ARE TO BE MOUNTED PER TABLE ON THIS DRAWING.
3. PRIOR TO FINAL INSTALLATION OF SIGNS, CONTRACTOR SHALL REVIEW PLACEMENT WITH THE DIRECTOR OF PUBLIC WORKS TO ENSURE PROPER VISIBILITY RELATIVE TO COMPLETION OF OTHER IMPROVEMENTS.
4. MOUNTING HEIGHT OF ALL ONE-WAY WITH CHEVRON SIGNS SHALL BE 1' CLEAR FROM TOP OF CURB TO BOTTOM OF SIGN.
5. SEE SHEET 32 FOR LANE STRIPING DETAILS.

ISSUED FOR CONSTRUCTION MARCH 11, 1996

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SIGNAGE & STRIPING PLAN

ADDISON CIRCLE

PHASE I PUBLIC INFRASTRUCTURE

TOWN OF ADDISON, TEXAS

Huitt-Zollars, Inc./Engineering/Architecture

DESIGN	DRAWN	APPR.	SCALE	DATE	PROJECT NO.	NO.
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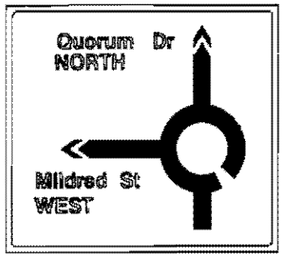
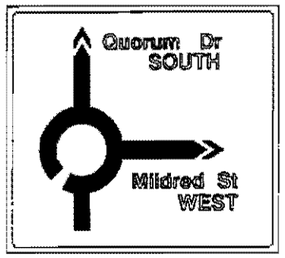


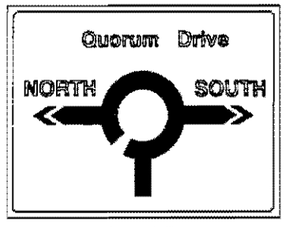
6" U.C. WHITE LETTERS
4-1/2" L.C. WHITE LETTERS
5" U.C. WHITE LETTERS (DIRECTION)
ON GREEN BACKGROUND
8' X 7' PANEL

ADV-D1
(ITEM NO. 136)



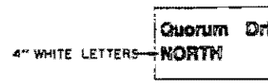
6" U.C. WHITE LETTERS
4-1/2" L.C. WHITE LETTERS
5" U.C. WHITE LETTERS (DIRECTION)
ON GREEN BACKGROUND
8' X 7' PANEL

ADV-D2
(ITEM NO. 136)



6" U.C. WHITE LETTERS
4-1/2" L.C. WHITE LETTERS
5" U.C. WHITE LETTERS (DIRECTION)
ON GREEN BACKGROUND
8' X 6' PANEL

ADV-D3
(ITEM NO. 137)

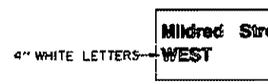


5" U.C. WHITE LETTERS
4" L.C. WHITE LETTERS
ON GREEN BACKGROUND
5' x 2' PANEL

ST-1
(ITEM NO. 138)

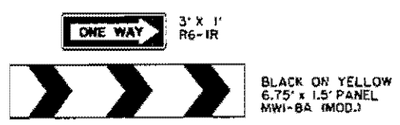
5" U.C. WHITE LETTERS
4" L.C. WHITE LETTERS
ON GREEN BACKGROUND
5' x 2' PANEL

ST-2
(ITEM NO. 138)



5" U.C. WHITE LETTERS
4" L.C. WHITE LETTERS
ON GREEN BACKGROUND
5' x 2' PANEL

ST-3
(ITEM NO. 138)



3' X 1'
R6-1R

BLACK ON YELLOW
6.75' x 1.5' PANEL
MW1-8A (MOD.)

W-CHEV WITH R10
(ITEM NO. 125)
ON CENTRAL ISLANDS
OPPOSITE EVERY ENTRY

3' x 3' PANEL
W3-2A

4" BLACK LETTERS
4' x 18" PANEL
ADV-D4

R1-2
(ITEM NO. 125)

⚠ ADDENDUM #3 1/26/96

ISSUED FOR CONSTRUCTION
MARCH 11, 1996

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STATE OF TEXAS
KENNETH A ROBERTS
55446
REGISTERED
PROFESSIONAL ENGINEER

1-4-96

TRAFFIC SIGN DETAILS

ADDISON CIRCLE

PHASE I PUBLIC INFRASTRUCTURE

TOWN OF ADDISON, TEXAS

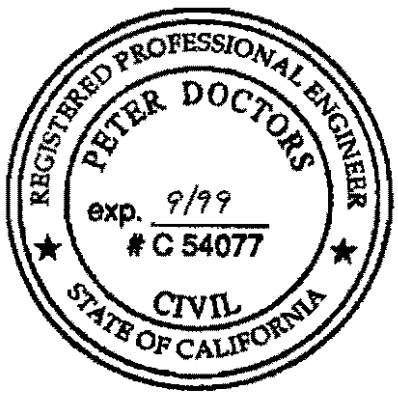
Huitt-Zollars, Inc./Engineering/Architecture
Dallas, Fort Worth, Houston, El Paso, Phoenix, Tustin, Ontario, San Clemente

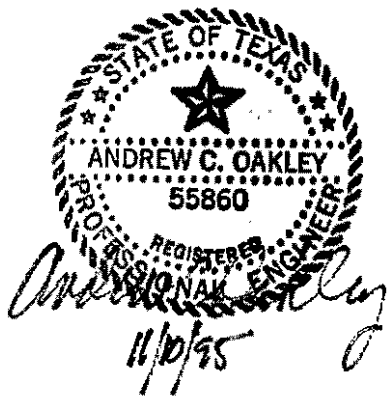
DESIGN	DRAWN	APPR.	SCALE	DATE	PROJECT NO.	NO.
HZI	HZI	KAR	N.T.S.	JAN. 96	1822-04	17A / 137

Modern Roundabout
for
Addison Circle

November, 1995

Prepared
by





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ADDISON CIRCLE
MODERN ROUNDABOUT ANALYSIS
NOV. 8, 1995

Introduction

This report was prepared for Columbus Realty Trust and the Town of Addison as supporting documentation for the design of a "modern roundabout" at the intersection of Quorum Drive and Mildred Street within the special zoning district known as "Addison Circle". The report was prepared by Peter Doctors, P.E., of the firm of Ourston and Doctors, modern roundabout consultants based in Santa Barbara, California under the direct supervision of Andrew C. Oakley, P.E., of Huitt-Zollars, Inc., Dallas, Texas, who also edited and contributed to the text.

Background/Roundabout Operation

The term "modern roundabout" refers to a type of traffic circle with very special characteristics of geometry and operation. The primary differences between a modern roundabout and a traditional traffic circle are as follows:

In a roundabout approaching traffic yields to traffic already in the roundabout. A car approaching the roundabout looks to the left at circulating traffic and determines if a gap is available to enter the roundabout safely. If there is not a gap available in the circulating traffic stream, the driver waits at the yield limit line until a gap is available. The yield limit line, yield sign and the deflection of the vehicles path upon entering the roundabout contribute to this simple decision process.

Traffic entering a roundabout is deflected around the roundabout by geometric features of the both the approach road and the central island. By providing this deflection, the vehicle speeds are reduced making decisions for the driver easier as well as increasing the

safety of the intersection. The roundabout is the safest form of intersection and the deflection requirements provide for this safety.

Approach roads flare on the approach to the roundabout to allow increases in capacity. The flare length is much shorter than a standard intersection widening, with flare lengths over 80' not providing any significant increases in capacity. The flare lengths used in the design provide for adequate capacity without unnecessary widening of the roadways.

The concept of the modern roundabout to replace the conventional traffic circle came about in an attempt to overcome the operational failure that occurs when there is so much traffic in the circle that gridlock occurs.

A modern roundabout operates on a simple principle already familiar to drivers, the one way street. The principle uses two signs, the YIELD sign and the ONE WAY sign. A circular roadway is constructed with roads entering like spokes on a wheel. The circular road is one-way with the entering roads yielding to circulating traffic.

When a driver approaches the roundabout, he/she looks to the left to see if anyone is in the circle and if empty, enters the circle. If someone is in the circle, the entering driver waits for an appropriate gap in traffic and then enters. Once in the circle the driver has the right of way and exits the circle when arriving at their chosen road.

Basis For Design

Design parameters for the modern roundabout have been developed empirically in Europe and Australia over the last 30 years. In the last several years, modern roundabouts have gained usage in the United States. Experimentation with various combinations of entry width, approach width, entry radius, entry angle and inscribed circle diameter has led to optimum operation under variable conditions. As a result, computer programs have been developed which allow the input of traffic data and

geometric characteristics with resulting output of average delays relating, in turn, to level of service.

Our roundabout designs follow technical advice by the British Department of Transport. The designs of all the modern roundabouts built in California, Nevada, Maryland, and Colorado also follow British design advice and they operate well with little delay and few accidents.

Traffic performance estimates for the Addison Circle Roundabout were made using the computer application RODEL. RODEL is based on research by the Transportation Research Laboratory in the United Kingdom. Approximately $8M was spent on collecting data at 86 different roundabouts. From this data, equations linking the various geometric parameters were developed and applied in the computer application ARCADY and RODEL. This program estimates average vehicle delay for each approach to the roundabout. The program has been used to analyze roundabouts in California, both in Long Beach and Santa Barbara, with delay estimates of RODEL deviating from observed delay by no more than two seconds.

Capacity Analysis

The analysis of the proposed modern roundabout at the intersection of Quorum Drive and Mildred Street was based on the following facts and assumptions about these roadways:

- Quorum drive is a 4-lane divided roadway.

- Mildred Street, though technically wide enough to be 4 lanes, operates as a 2-lane undivided roadway. Parallel parking will be permitted on both sides of the street, except that, approaching the roundabout, where a center island is introduced, parking will be prohibited consistent with standard design practice.

- ADT volumes on Quorum Drive and Mildred Street are expected to reach 30,000 VPD and 10,000 VPD, respectively, upon buildout of the proposed development.

The directional distribution of post-development peak hour travel routes and the volume of traffic that would be making each turning movement during the peak hours were both needed in order to design the roundabout. The volumes and distribution that were used to design the roundabout for Addison were arrived at based on the following assumptions:

- Only those tracts that face Quorum drive and/or Mildred Street will be developed into anything other than multi-family residential uses.

- Based on the proposed land use mix for Phase I, 7% of the floor area proposed for each mixed-use tract will be developed into non-residential uses.

- The relationship between the number of dwelling units developed on a particular tract and the amount of available floor area on that tract will be similar throughout the residential subdistrict.

Based on our understanding that a total of 5,050 multi-family dwelling units are proposed for the residential subdistrict, and the three assumptions just identified above, the number of dwelling units that will ultimately occupy each tract could be calculated. The results of the calculation process are presented in Figure 1.

Using trip rate information contained within the Institute of Transportation Engineers *Trip Generation* manual and the San Diego Association of Governments *Not So Brief Guide to Vehicular Traffic Generation Rates for the San Diego Region*, daily and peak hour trip rates were calculated for each tract. The results are presented in Figure 2.

During the peak hours, site-generated traffic will be distributed about the surrounding roadway network as follows:

- 15% of site generated traffic will be traveling to or arriving from the north.

- 30% of site generated traffic will be traveling to or arriving from the south.

- 35% of site generated traffic wale be traveling to or arriving from the east.

- 20% of site generated traffic will be traveling to or arriving from the west.

Based on this directional distribution, peak hour site traffic was assigned to the adjacent roadways. Then, based on the "at buildout" daily traffic volumes expected on Quorum Drive, as dictated by the Town of Addison, and those expected on Mildred street, as predicted by Barton-Aschman Associates, Inc.; along with traffic count data collected on Quorum Drive in 1995, background traffic volume projections were made for each individual turning movement. The projected background volumes were then added to the site generated volumes to create post-development traffic assignment models. These are presented on Figures 3 & 4.

The projected post-development volumes were entered into the RODEL model, as were iterative values for each of five critical geometric parameters. Geometry was established and adjusted to reflect the following:

- Space limitations imposed by the proposed right-of-way, proposed development and existing streets.

- Spatial relationships dictated by good urban design following the Roundabout Design Guidelines.

- Past experience with roundabout characteristic similar to the Addison Circle conditions.

After several iterations, the model arrived at a roundabout with acceptable levels of service based on an acceptable combination of geometric variables. The final geometry is illustrated in Figure 5. The RODEL printouts indicating estimates of average delay on all legs are included herein as Figures 6 & 7.

Geometric information is shown in the upper left hand portion of the RODEL printouts. Dimensions are in meters. The following symbol key is provided to interpret the variables.

E	Entry Width
V	Approach Width
RAD	Entry Radius
PHI	Entry Angle
DIA	Inscribed Circle Diameter

Estimates of the average delay for all vehicles entering the roundabout are 22.2 seconds per vehicle for the A.M. peak hour and 11.6 seconds per vehicle for the P.M. peak hour. These delays equate to Level of Service C and B during the AM and PM peak traffic hours respectively. Level of Service C corresponds with 16 to 30 seconds of delay per vehicle. Calculations are shown on the attached Roundabout Level of Service worksheet, Figure 8.

Capacity and delay estimates are made at the 85-percent confidence level. These estimates are conservative compared to capacity and delay estimates for signalized intersections in the United States, which are made at the 50-percent confidence level.

Pedestrian Circulation

All research from Europe and Australia suggests that pedestrians are safer at roundabouts than at signalized intersections. Lower pedestrian accident rates at roundabouts have been attributed to three factors:

(1) Traffic moves slowly, about 15 to 20 miles per hours at roundabouts of this size.
(2) The pedestrian must look only one way before choosing a large enough gap in traffic to assure a safe crossing.
(3) The pedestrian's passage is broken into two stages, from the nearside wheelchair ramp to the refuge in the median island, and from the median island to the farside wheelchair ramp.

The location of the pedestrian crossing is shown on the attached roundabout drawing, indicated by two concentric dotted circles. This location complies with the recommended location of between one and three car lengths from the yield line. A break in the median will be necessary for pedestrian access with handicap access if not at grade level.

On-street Parking Locations

The location of on-street parking must be considered so that it does not impair the operation of the roadway or back up into the roundabout. For entering roadways the location of the parking should be limited to a minimum 20 foot transition before the BCR (begin curb return) of the roundabout. For exiting roadways the location of the parking should start at a point no closer than 100 feet from the inscribed circle diameter. This will allow adequate stopping sight distance and storage for waiting vehicles.

Lighting Requirements

Lighting columns should be arranged around the perimeter of the roundabout in a simple ring, with the lights equidistant from the center and from each other. Lighting should extend at least 200 feet back along each exit road. Mounting height should be uniform throughout the intersection and not less than any approach road.

Minimum horizontal illuminance at the curblines should be 1.9 footcandles. The minimum illuminance required should be not less than the highest level of lighting for any of the approach roads.

Signing and Striping Requirements

The approach to signing and striping of a roundabout is similar to other intersections. Advance guidance signs are provided to inform motorist of destinations before they enter the roundabout. Advance warning signs, yield signs, one-way signs or chevron boards and splitter islands guidance signs are also necessary for the roundabout to operate successfully.

The striping required at a roundabout consists of a yield legend and yield limit line. The limit line is not found in the MUTCD, but must be used in a roundabout to indicate the location for the motorist to yield.

Landscaping Limitations

To provide adequate sight distance as motorists make their way around the circle, significant landscaping and sculptural features in the central island should be confined within a diameter of 70 feet. In this area any landscaping or statue can be constructed of infinite elevation. The remaining 32 feet between this landscaping/statue area and the central island curb must be landscaped with some type of ground cover or low plant that will not obscure the driver's visibility around the circle.

Landscaping of the medians should be limited to a maximum height of 3.5'

to allow drivers to see circulating traffic, with exceptions for carefully placed single-trunk trees, limbed up a minimum of 7 feet.

Conclusion

The installation of a roundabout at the junction of Quorum Drive and Mildred Street will provide for a safe and efficient intersection. During the peak hours of the day, an acceptable level of service can be achieved for the intersection without the necessity of a traffic signal. The roundabout will provide an aesthetic benefit to the community as well as reducing speeds adjacent to the roundabout.

TRACT	TOTAL FLOOR AREA* BY TRACT (SF)	COMMERCIAL FLOOR AREA** BY TRACT (SF)	RESIDENTIAL FLOOR AREA** BY TRACT (SF)	PERCENTAGE OF TOTAL RESIDENTIAL FLOOR AREA**	NO. OF DWELLING UNITS** BY TRACT
1-A	144,500.00	10,155.00	134,385.00	3.07	155.00
1-B	130,750.00	9,153.00	121,597.00	2.77	140.00
1-C	150,900.00	10,563.00	140,337.00	3.20	162.00
2-D	176,550.00	0.00	176,550.00	4.03	204.00
2-E	167,500.00	0.00	167,500.00	3.82	193.00
2-K	518,650.00	0.00	518,650.00	11.84	596.00
2-L	290,300.00	20,321.00	269,979.00	6.16	311.00
2-M	206,800.00	14,476.00	192,324.00	4.39	222.00
2-N	413,800.00	28,966.00	384,834.00	8.78	444.00
2-0	565,800.00	39,606.00	526,194.00	12.01	608.00
2-P	393,800.00	27,566.00	366,234.00	8.36	422.00
3-F	284,000.00	0.00	284,000.00	6.48	327.00
3-G	286,600.00	0.00	286,600.00	6.54	330.00
3-H	351,900.00	24,633.00	327,267.00	7.47	377.00
3-I	321,250.00	321,250.00	298,762.00	6.82	344.00
3-J	186,750.00	186,750.00	186,750.00	4.26	215.00
TOTALS	**4,589,850.00**	**693,399.00**	**4,381,963.00**	**100.00**	**5,050.00**

* As specified on Preliminary Concept Plan

** Assumed, based on Preliminary Concept Plan

FIGURE 1

Assumed Land Use Mix
By Tract

TRACT	COMMERCIAL FLOOR AREA (SF)	NO. OF DWELLING UNITS	TRIPS GENERATED				
			DAILY	A.M. PEAK HOUR		P.M. PEAK HOUR	
				IN	OUT	IN	OUT
1-A	10,115	155	1,409	25	71	90	55
1-B	9,153	140	1,271	22	66	81	50
1-C	10,563	162	1,473	25	77	94	57
2-D	0	204	1,281	18	86	84	40
2-E	0	193	1,211	17	81	80	37
2-K	0	596	1,876	50	246	227	107
2-L	20,321	311	2,861	49	143	173	108
2-M	14,476	222	2,029	34	103	126	78
2-N	28,966	444	4,107	69	203	243	150
2-O	39,606	608	5,650	92	279	327	204
2-P	27,566	422	3,901	65	194	232	144
3-F	0	327	2,078	28	136	131	61
3-G	0	330	2,097	28	137	131	62
3-H	24,633	377	3,478	58	174	208	129
3-I	22,488	344	3,170	52	159	191	118
3-J	0	215	1,352	19	90	88	42
TOTALS	**207,887**	**5,050**	**39,244**	**651**	**2,245**	**2,506**	**1,442**

* As specified on Preliminary Concept Plan
** Assumed, based on Preliminary Concept Plan

FIGURE 2

Expected
Traffic Generation Rates
By Tract

ADDISON CIRCLE MODERN ROUNDABOUT ANALYSIS

NORTH

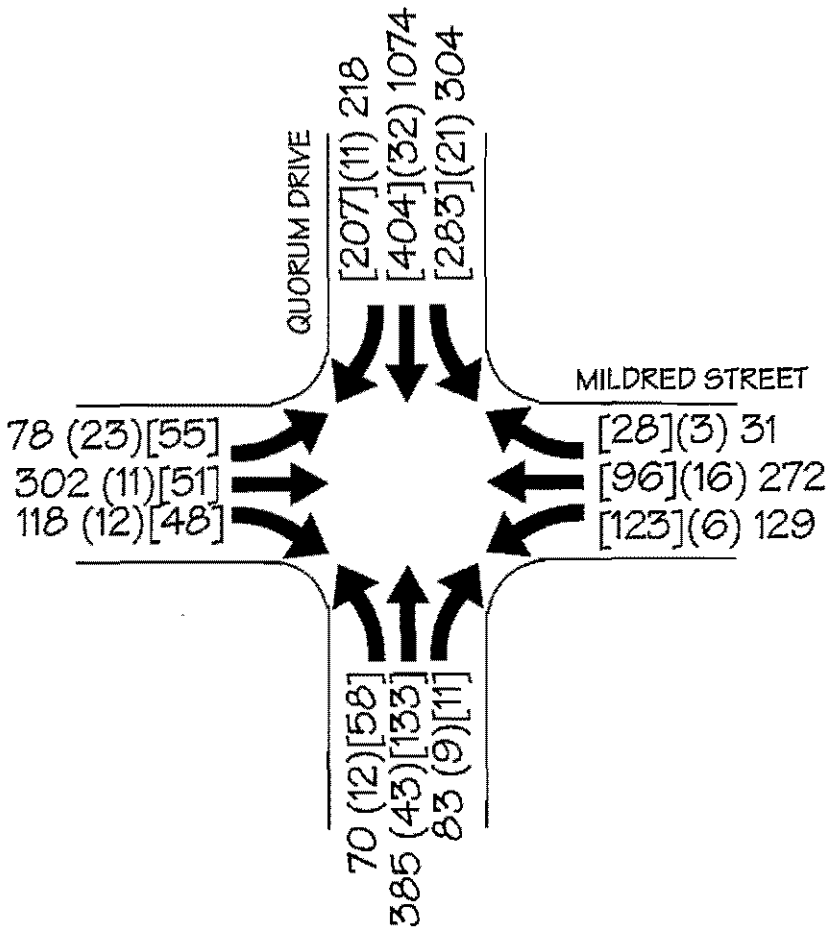


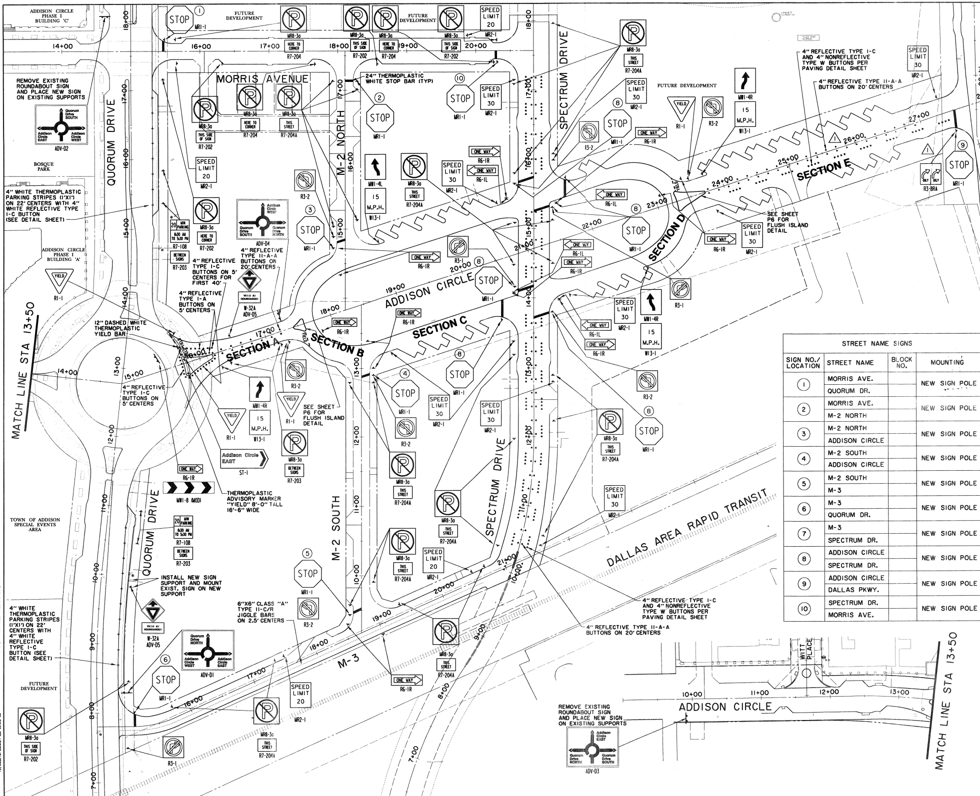
FIGURE 3

A.M. Peak Hour
Site Plus Background
Traffic Volumes

LEGEND

[99] SITE GENERATED TRAFFIC VOLUMES (RESIDENTIAL)
(99) SITE GENERATED TRAFFIC VOLUMES (NON-RESIDENTIAL)
999 SITE PLUS BACKGROUND TRAFFIC VOLUMES

HUITT-ZOLLARS



STREET NAME SIGNS			
SIGN NO./ LOCATION	STREET NAME	BLOCK NO.	MOUNTING
1	MORRIS AVE.		NEW SIGN POLE
	QUORUM DR.		
2	MORRIS AVE.		NEW SIGN POLE
	M-2 NORTH		
3	M-2 NORTH		NEW SIGN POLE
	ADDISON CIRCLE		
4	M-2 SOUTH		NEW SIGN POLE
	ADDISON CIRCLE		
5	M-2 SOUTH		NEW SIGN POLE
	M-3		
6	M-3		NEW SIGN POLE
	QUORUM DR.		
7	M-3		NEW SIGN POLE
	SPECTRUM DR.		
8	ADDISON CIRCLE		NEW SIGN POLE
	SPECTRUM DR.		
9	ADDISON CIRCLE		NEW SIGN POLE
	DALLAS PKWY.		
10	SPECTRUM DR.		NEW SIGN POLE
	MORRIS AVE.		

NOTES:

1. ALL TRAFFIC SIGN DESIGN, FABRICATION AND PLACEMENT SHALL CONFORM TO THE LATEST ISSUE OF THE "TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS".
2. STREET NAME SIGNS ARE TO BE MOUNTED PER TABLE ON THIS DRAWING.
3. PRIOR TO FINAL INSTALLATION OF SIGNS, CONTRACTOR SHALL REVIEW PLACEMENT WITH THE DIRECTOR OF PUBLIC WORKS TO ENSURE PROPER VISIBILITY RELATIVE TO COMPLETION OF OTHER IMPROVEMENTS.
4. MOUNTING HEIGHT OF ALL ONE-WAY WITH CHEVRON SIGNS SHALL BE 1' CLEAR FROM TOP OF CURB TO BOTTOM OF SIGN.
5. SEE SHEET P21 FOR LANE STRIPING DETAILS.

THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY DAVID E. MEYERS, P.E. 81512 ON OCTOBER 3, 1997.

STATE OF TEXAS — DAVID E. MEYERS — 81512 — REGISTERED PROFESSIONAL ENGINEER

DATE	DESCRIPTION	REF NO.
10/17/97	DELETED BUTTONS: ADDED DUAL RIGHT SIGN	1
10/3/97	ISSUED FOR CONSTRUCTION	N/A
7/14/97	ISSUED FOR BID	N/A

SIGNAGE AND STRIPING PLAN

ADDISON CIRCLE

PHASE II PUBLIC INFRASTRUCTURE

TOWN OF ADDISON, TEXAS

Huitt-Zollars, Inc./Engineering/Architecture
Dallas, Fort Worth, Houston, El Paso, Phoenix, Tustin, Ontario

DESIGN	DRAWN	APPR.	SCALE	DATE	PROJECT NO.	NO.
HZI	HZI	DEM	1"=50'	OCT. 97	01-1822-21	P5

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