2000-1 Addison Circle

Roundabout Punchlist & Closing out Documents - 1998

John -
This arrived just as I was finishing your letter! -Andy

Ourston & Doctors
MODERN ROUNDABOUT INTERCHANGES

December 12, 1995

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

ADDISON ROUNDABOUT SENSITIVITY ANALYSIS

Pursuant to your request, we have completed a sensitivity analysis of the proposed roundabout design to determine how much additional traffic can be added to the projected volumes while still providing a level of service(LOS) D. Our analysis consists of two different sets of calculations, one at the 50th percentile and one at the 85th percentile.

Because capacity can be lower than estimated, and future demand flows can be higher than estimated, it is impossible to be 100 percent confident that future capacity needs will be met by any size of intersection, whether it is a roundabout type or signalized intersection. To achieve extremely high degrees of confidence--for example, 95 percent or 99 percent--it would be necessary to design unreasonably large intersections whose excess capacity would in most cases never be used.

Ourston & Doctors designs its roundabouts at the 85-percent confidence level. We feel that this gives a prudent balance between security that the roundabout will provide ample capacity and care not to waste land and pavement on unreasonably large designs. Partly because of this chosen margin of safety, all of our roundabouts are operating at Level of Service A. This is the highest level of service. It occurs when there is a large reserve of unused capacity.

Our preferred analytic application, RODEL, was written to take level of confidence into account. (The assumed confidence level is given in RODEL printouts in the column headed "CL.") All other traffic engineering analysis of which we are aware implicitly assumes the 50-percent confidence level. This produces higher estimates of capacity than would be produced by assuming the 85-percent confidence level.

5290 Overpass Road, Suite 212 Santa Barbara, CA 93111 805/683-1383

The attached two-page explanation of confidence level is copied from the user guide to RODEL. In it are some terms which may be unfamiliar to you. "RFC" means ratio of flow to capacity, which is the same as the United States' volume/capacity ratio. ARCADY is the roundabout analytic application of the British Department of Transport. RODEL is offered as an alternative to ARCADY. Insofar as the outputs of RODEL and ARCADY overlap, they are identical. RODEL is sold under license to the Department of Transport because it draws on their research.

Our clients estimate future demand flows, which are input into RODEL. We design to meet these design volumes with the cushion provided by RODEL's 85-percent confidence level. One can add to this cushion by increasing RODEL's flow factor above 100. When the flow factor equals 100, RODEL uses 100 percent of input flows. The flow factor is listed in RODEL's column headed "FLOF."

To use the flow factor as well as the 85-percent confidence level is to provide a double cushion. The percent increase of the double cushion is estimated by first assuming a 50-percent level of confidence, then increasing the flow factor until the design objective is met. In this case the design objective is to achieve Level of Service D.

Based on the 50th percentile(Table A), an increase in projected flows of 27% in the a.m. and 31% in the p.m. can be achieved, while still allowing for an LOS D. At the 85th percentile(Table B), an increase of 4% in the a.m. and 11% in the p.m. can be achieved, providing LOS D.

If a still greater cushion is desired, it can be met by designing a roundabout with increased lane widths, longer flare lengths, and/or a larger diameter if required for geomtrics.

Very truly yours,

Peter Doctors, P.E.

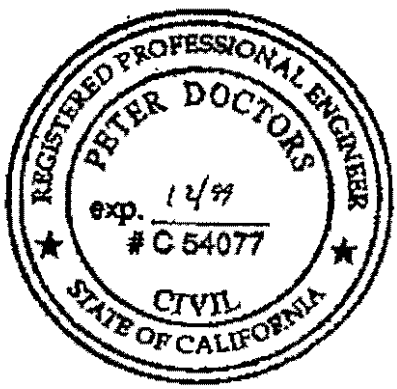


FIGURE A

ROUNDABOUT LEVELS OF SERVICE

12-12-95

50th Percentile

Ourston & Doctors

Addison Roundabout
Projected Design Flows

A.M. PEAK HOUR
(Projected +27.0%)

		LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	WHOLE ROUNDABOUT
INPUT FROM RODEL OR ARCADY								
FLOW	veh/hr	683	549	2027	632			3,891
AVE DELAY	min/veh	0.04	0.09	0.77	1.19			
OUTPUT								
AVE DELAY	sec/veh	2.4	5.4	46.2	71.4			
DELAY	sec/hr	1639	2965	93647	45125			143,376

AVE DELAY, sec/veh 36.8
LEVEL OF SERVICE **D**

P.M. PEAK HOUR
(Projected +31.0%)

		LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	WHOLE ROUNDABOUT
INPUT FROM RODEL OR ARCADY								
FLOW	veh/hr	1644	555	1138	789			4,126
AVE DELAY	min/veh	0.26	3.77	0.06	0.15			
OUTPUT								
AVE DELAY	sec/veh	15.6	226.2	3.6	9.0			
DELAY	sec/hr	25646	125541	4097	7101			162,385

AVE DELAY, sec/veh 39.4
LEVEL OF SERVICE **D**

FIGURE B

ROUNDABOUT LEVELS OF SERVICE

12-12-95

85th Percentile

Durston & Doctors

Addison Roundabout
Projected Design Flows

A.M. PEAK HOUR
(Projected +4.0%)

		LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	WHOLE ROUNDABOUT
INPUT FROM RODEL OR ARCADY								
FLOW	veh/hr	625	502	1854	578			3,559
AVE DELAY	min/veh	0.05	0.10	0.96	0.51			
OUTPUT								
AVE DELAY	sec/veh	3.0	6.0	57.6	30.6			
DELAY	sec/hr	1875	3012	106790	17687			129,364

AVE DELAY, sec/veh 36.3
LEVEL OF SERVICE **D**

P.M. PEAK HOUR
(Projected +11.0%)

		LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	WHOLE ROUNDABOUT
INPUT FROM RODEL OR ARCADY								
FLOW	veh/hr	1556	526	1077	746			3,905
AVE DELAY	min/veh	0.47	2.99	0.07	0.18			
OUTPUT								
AVE DELAY	sec/veh	28.2	179.4	4.2	10.8			
DELAY	sec/hr	43879	94364	4523	8057			150,824

AVE DELAY, sec/veh 38.6
LEVEL OF SERVICE **D**

50 % Confidence Level
AM Peak Hour

```
*****************************************************************************
*                                                                           *
*  12:12:95                  ADDISON ROUNDABOUT                        107  *
*                                                                           *
*****************************************************************************
*                                                *                          *
* 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*
*         *    *                              *    *  *             *         *
*NB QUORUM *1.05*  83  385   70  0            *1.27*50*0.75 1.125 0.75*15 45 75 *
*NB MILDRED*1.05*  31  272  129  0            *1.27*50*0.75 1.125 0.75*15 45 75 *
*SB QUORUM *1.05*  218 1074 304  0            *1.27*50*0.75 1.125 0.75*15 45 75 *
*EB MILDRED*1.05*  118  302  78  0            *1.27*50*0.75 1.125 0.75*15 45 75 *
*         *    *                              *    *  *             *         *
*         *    *                              *    *  *             *         *
*         *    *                              *    *  *             *         *
*****************************************************************************
*                                                *                          *
* FLOW        veh    683   549  2027   632      *  TOTAL DELAYS            *
* CAPACITY    veh   2016  1217  2192   723      *                          *
* AVE DELAY  mins   0.04  0.09  0.77  1.19      *       40 hrs             *
* MAX DELAY  mins   0.06  0.13  1.78  2.61      *                          *
* AVE QUEUE   veh      1     1    27    13      *      187 pounds          *
* MAX QUEUE   veh      1     1    61    29      *                          *
*                                                *                          *
*****************************************************************************
```

85 % Confidence Level
AM Peak Hour

```
*****************************************************************************
*                                                                           *
*  12:12:95                  ADDISON ROUNDABOUT                        106  *
*                                                                           *
*****************************************************************************
*                                                *                          *
* 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*
*          *   *                              *    *  *             *         *
*NB QUORUM *1.05*   83  385   70  0           *1.04*85*0.75 1.125 0.75*15 45 75 *
*NB MILDRED*1.05*   31  272  129  0           *1.04*85*0.75 1.125 0.75*15 45 75 *
*SB QUORUM *1.05*  218 1074  304  0           *1.04*85*0.75 1.125 0.75*15 45 75 *
*EB MILDRED*1.05*  118  302   78  0           *1.04*85*0.75 1.125 0.75*15 45 75 *
*          *   *                              *    *  *             *         *
*          *   *                              *    *  *             *         *
*          *   *                              *    *  *             *         *
*****************************************************************************
*                                                                  *        *
* FLOW        veh    625   502  1854   578                        * TOTAL DELAYS *
* CAPACITY    veh   1829  1101  1969   727                        *        *
* AVE DELAY   mins  0.05  0.10  0.96  0.51                        *   36 hrs *
* MAX DELAY   mins  0.07  0.14  2.17  1.00                        *        *
* AVE QUEUE   veh      1     1    30     5                        *  167 pounds *
* MAX QUEUE   veh      1     1    69     9                        *        *
*                                                                  *        *
********************************************************************************
```

50 % Confidence Level
PM Peak Hour

```
*****************************************************************************
*                                                                           *
*  12:12:95                  ADDISON ROUNDABOUT                        103  *
*                                                                           *
*****************************************************************************
*                                                 *                         *
* E    (v)   10.06   7.32  10.06   7.32           * TIME PERIOD    min    90  *
* L'   (w)   16.43  14.93  16.60  22.13           * TIME SLICE     min    15  *
* V    (w)    7.01   4.12   7.01   4.12           * RESULTS PERIOD min  15 75 *
* RAD  (g)   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  (s)   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*
*          *   *                              *   *  *              *         *
*NB QUORUM *1.05*   70 1099   86  0           *1.31*50*0.75 1.125 0.75*15 45 75 *
*NB MILDRED*1.05*   26  279  119  0           *1.31*50*0.75 1.125 0.75*15 45 75 *
*SB QUORUM *1.05*  147  553  169  0           *1.31*50*0.75 1.125 0.75*15 45 75 *
*EB MILDRED*1.05*   80  219  303  0           *1.31*50*0.75 1.125 0.75*15 45 75 *
*          *   *                              *   *  *              *         *
*          *   *                              *   *  *              *         *
*          *   *                              *   *  *              *         *
*****************************************************************************
*                                                                 *         *
* FLOW        veh    1644    555   1138    789                    * TOTAL DELAYS  *
* CAPACITY    veh    1987    560   2194   1224                    *               *
* AVE DELAY   mins   0.26   3.77   0.06   0.15                    *      45 hrs   *
* MAX DELAY   mins   0.52   7.47   0.08   0.23                    *               *
* AVE QUEUE   veh       7     40      1      2                    *    211 pounds *
* MAX QUEUE   veh      13     76      1      3                    *               *
*                                                                 *         *
*****************************************************************************
```

85 % Confidence Level
PM Peak Hour

```
*****************************************************************************
*                                                                           *
*  12:12:95                  ADDISON ROUNDABOUT                        104  *
*                                                                           *
*****************************************************************************
*                                                 *                         *
* E    (m)   10.06   7.32  10.06   7.32           * TIME PERIOD    min    90  *
* L'   (n)   16.43  14.93  16.60  22.13           * TIME SLICE     min    15  *
* V    (n)    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*
*          *   *                              *   * *              *         *
*NB QUORUM *1.05*   70 1099   86  0           *1.11*85*0.75 1.125 0.75*15 45 75 *
*WB MILORED*1.05*   26  279  119  0           *1.11*85*0.75 1.125 0.75*15 45 75 *
*SB QUORUM *1.05*  147  553  169  0           *1.11*85*0.75 1.125 0.75*15 45 75 *
*EB MILDRED*1.05*   80  219  303  0           *1.11*85*0.75 1.125 0.75*15 45 75 *
*          *   *                              *   * *              *         *
*          *   *                              *   * *              *         *
*          *   *                              *   * *              *         *
*****************************************************************************
*                                                                 *         *
* FLOW         veh    1556    526   1077    746                  * TOTAL DELAYS *
* CAPACITY     veh    1787    542   1952   1111                  *           *
* AVE DELAY    mins   0.47   2.99   0.07   0.18                  *     42 hrs *
* MAX DELAY    mins   1.01   5.92   0.09   0.29                  *           *
* AVE QUEUE    veh      12     30      1      2                  *   195 pounds *
* MAX QUEUE    veh      25     57      2      3                  *           *
*                                                                 *         *
*****************************************************************************
```

16 CONFIDENCE LEVEL

It is not possible to estimate queues and delays accurately. They can only be estimated for a particular confidence level (either implicit or explicit). If queues and delays are estimated with a 50% confidence level, it is 50% certain that the actual queues and delays will not be greater than the estimated values. (apart from random variation)

The delays and queues calculated depend on flow and capacity. Both flow and capacity contain 'error'. Kimbers capacity equation has a standard error of -15% to +15% for typical values. The forecast flows are similarly imprecise. Consequently the ratio of flow to capacity (RFC) has an even greater standard error.

This wide range of possible RFC's can produce a very wide range of possible delays and queues for a given geometry.

The delay/RFC curve (FIG. 10) illustrates the problem. The shape of the curve is such that ignoring the range of possible RFC's can lead to a gross underestimation of the possible queues and delays.

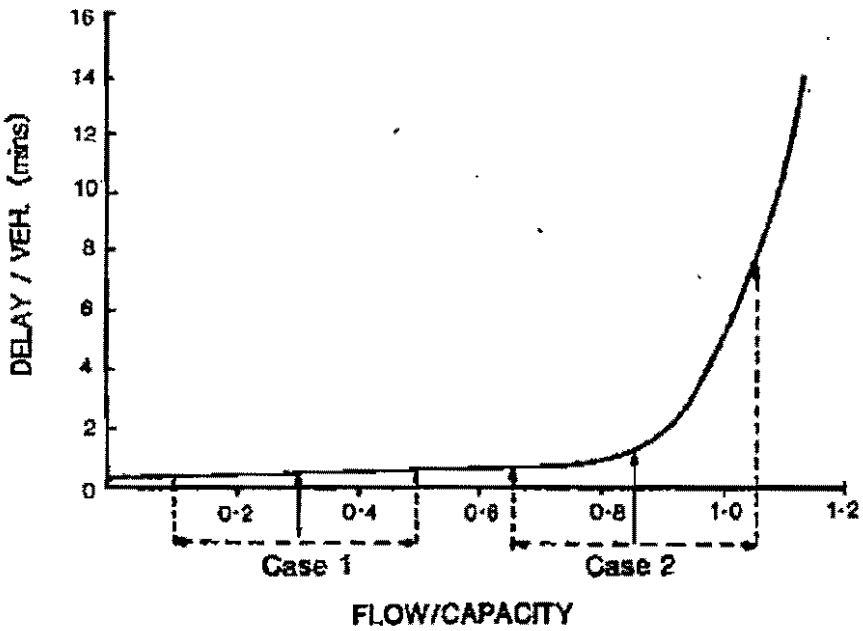


FIG. 10 DELAY / RFC

In Case 1 the whole RFC range is on the flat part of the curve, and any value of RFC in the range will produce low delays. The delay forecast is therefore robust.

Case 2 is quite different. The average RFC (50% confidence level) has delays virtually the same as Case 1. However, as Case 2 is close to the steep section of the curve, the possible values of RFC greater than the 50% value

have very high delays.

Values greater than 50% will occur if the actual flows are greater than the input flows, and/or if the actual capacity is lower than the theoretical.

ARCADY implicitly uses the 50% confidence level by using the average value for capacity with the input flows. Case 2 would appear acceptable to the Design Engineer with a 50% confidence level.

There would therefore be no incentive to modify the geometry in order to increase the capacity. Any increase would produce no significant reduction in the calculated delays since the average RFC is on the flat part of the curve. The design would therefore be considered acceptable, and the risk of very high delays not realised.

With RODEL the confidence level is input explicitly. The queues and delays can be quickly found for various confidence levels. (ie 50% to 99%)

A minimum confidence level of 85% is desireable.

RODEL at 85% would indicate that Case 1 was acceptable. However, the delays at 85% for Case 2 would be very large, providing a challenge for the designer.

The good news is that since the 85% RFC is on the steep part of the curve it is extremely senstive to small changes in RFC (changes in capacity and/or flow). The geometry therefore only requires minor alterations (in E and L') to move the 85% RFC onto the flat part of the curve producing low delays. Often this requires no extra land or service costs. The result is a robust design with low delays and, with a known confidence level.

In some cases acceptable delays can not be achieved at 85% confidence level. It may be that delays are fine at 80%, or still unacceptable at 50%. The delays can easily be tabulated or plotted for the range of Confidence Levels.

Capacity and flows are factored by the chosen confidence level, as shown in the following table.

CONFIDENCE LEVEL %	CAPACITY	FLOW
50	1.000	1.000
55	0.986	1.014
60	0.971	1.029
65	0.957	1.043
70	0.941	1.059
75	0.924	1.076
80	0.905	1.095
85	0.883	1.117
90	0.855	1.145
95	0.814	1.186
99	0.737	1.263

BARTON-ASCHMAN A PARSONS TRANSPORTATION GROUP COMPANY

Barton-Aschman Associates, Inc.
5465 Belt Line Road, Suite 199 • Dallas, Texas 75240 • (214) 991-1900 • Fax: (214) 490-9261

Memorandum

TO: John Baumgartner
Town of Addison

FROM: Gary Jost

DATE: January 5, 1996

SUBJECT: Addison Roundabout - Additional comments

We have completed our review of the sensitivity analysis completed by Ourston and Doctors and design plans prepared by Huitt-Zollars for the proposed Addison Roundabout. This memorandum presents our findings.

Sensitivity Analysis

Ourston and Doctors present in their sensitivity analysis findings based on 50 percent and 85 percent confidence levels. If queues and delays are calculated at a 85 percent confidence level, this means that one can be 85 percent certain that actual queues will not be greater than the calculated values. Based on the uncertainty of operations of the first modern roundabout in North Texas, we would recommend that the 85 percent confidence level be used for calculating operating conditions of the planned roundabout.

It should also be noted that there is currently no consensus in the transportation profession regarding the most appropriate traffic engineering tool for analyzing modern roundabouts. The Transportation Research Board has established a committee to review current capacity analysis techniques and develop a new Highway Capacity Manual by the year 2000. This committee, chaired by Mr. John Zegeer of Barton-Aschman Associates, Inc., is working to include a recommended procedure for analyzing modern roundabouts in the new manual.

The sensitivity analysis reports that at the 85 percent confidence level traffic volumes can be increased, from volumes originally projected, by 4 percent in the A. M. peak period and 11 percent in the P.M. peak period while still maintaining a level of service D. This suggests that the current design is highly sensitive to small increases in traffic volumes. With an 11 percent increase in traffic volumes, and assuming that 10 percent of daily traffic occurs during the P.M. peak hour, one could estimate that the effective capacity of Quorum Drive, assuming 10,000 vehicles per day (vpd) on

Mildred, would be less than 30,000 vpd.

Of particular note is the comparison of average and maximum queue lengths between the original projections and the maximum volumes that can be accommodated at Level of Service D. Tables 1.0 and 2.0 present this comparison for the A.M. and P.M. hours, respectively.

Table 1.0
Average and Maximum Queues
A.M. Peak Hour

APPROACH LEG	AVERAGE QUEUES (VEH)		MAXIMUM QUEUES (VEH)	
	ORIG.	LOS D	ORIG.	LOS D
NB Quorum	0	1	1	1
WB Mildred	1	1	1	1
SB Quorum	17	30	35	69
EB Mildred	4	5	6	9

Table 2.0
Average and Maximum Queues
P.M. Peak Hour

APPROACH LEG	AVERAGE QUEUES (VEH)		MAXIMUM QUEUES (VEH)	
	ORIG.	LOS D	ORIG.	LOS D
NB Quorum	4	12	6	25
WB Mildred	5	30	10	57
SB Quorum	1	1	1	2
EB Mildred	1	2	2	3

As shown in these tables, average and maximum queues increase significantly with very little increase in total volume entering the roundabout.

Based on the sensitivity to small increases in peak-hour volumes identified in the analysis conducted by Ourston and Doctors, it is our recommendation that the design of the planned Addison Roundabout be analyzed further to provide more stable conditions at these anticipated volumes.

OTHER DESIGN CONSIDERATIONS

Parking

On -street parking along Quorum and Mildred should be restricted within 150 feet of the roundabout on the departure legs of the roadways to provide adequate sight distance.

Paving Typical Section

The typical section for Quorum Drive specifies a full sawcut with existing steel to remain. The full depth sawcut will also cut the steel. If a full depth sawcut is desired, steel dowels will need to be drilled and inserted into the existing concrete pavement.

Signing and Markings

- The stop sign at Witt Mews and Mildred should be moved behind the barrier free ramps.
- The no parking signs on Mildred appear to conflict with the paving plans.
- If pedestrians are to be restricted from entering the roundabout island, then "No Pedestrian" signs should be installed in the island.
- All discussions to date regarding pedestrian crossings at the roundabout have indicated that the crossings should be located one to two vehicles behind the yield line. This needs to be reflected on the plans.
- Addison has typically utilized pavement markers rather than striping for lane delineation.
- Advance warning signs for the roundabout should be provided.
- Additional signs (i.e. chevrons) identifying the roadway curvature are recommended.

Miscellaneous

- There appears to be an abrupt change in crossfall on the north side of the roundabout at Quorum.
- Loading and unloading areas should not be allowed in the area of the roundabout.

If you have any questions, please do not hesitate to call.

TOWN OF ADDISON

PUBLIC WORKS DEPARTMENT (214) 450-2871

Post Office Box 144 Addison, Texas 75001 16801 Westgrove

ADDISON CIRCLE APARTMENTS
BUILDING PERMIT PLAN REVIEW
JANUARY 3, 1996

1. Provide plans sealed by a Texas Registered Professional Engineer.

2. Plat:

   A. Provide for separate instrument dedication of easement on property owned by others. Submit formal request for easement on property owned by the Town of Addison.

   B. Clearly provide for easement dedications on this plat.

   C. Provide the street, lane, road identifier for Witt Mews_____, and Paschal Mews_____.

   D. Dedicatory language requires the review of the City Attorney's office.

   E. Provide survey prepared by a Texas Licensed Professional Surveyor.

   F. Provide dimensional ties across the public roadway in and adjacent to the plat.

   G. Coordinate additional easements required in conjunction with the public infrastructure plans reviewed on 12/28/95. Contact Ken Roberts with Huitt-Zollars, for specific locations.

3. Drainage Plans:

   A. A license agreement is necessary for all private improvements that encroach into the public right-of-way.

   B. The location of the drainage system located on Conference Centre property has not been approved by Council. A formal easement request is required.

C. For private drainage improvements proposed to be located on public property provide the following typical details:

1. Typical trench showing the specific PVC product proposed, pipe bedding, backfill material, and performance testing, ie: mandrel test, air tests required.

2. Provide cleanout detail for roadway/sidewalk installation and detail/notes on how this is accomplished in conjunction with the public infrastructure installation. (Perhaps manholes on +/- 300 foot centers would be a better application.)

3. Provide connection details.

D. Provide material cut sheet for pipe with manufacturer's recommendation for use in this application, ie: sanitary sewer product used as for stormwater runoff.

E. Show dimensional offset to the property line. Recommend a minimum 3.0 foot setback where possible.

F. From the typical section proposed, there appears to be a conflict with proposed utilities. Illustrate on the plans, and in a cross-section where the proposed storm sewer is going in relation to the other utilities and improvements for the mews streets.

4. Architectural Plans:

A. Remove all encroachments onto public right-of-way inconsistent with the proposed license agreement that provides for no encroachments between 0 and 10 feet, a maximum 1 foot encroachment between 10 and 20 feet, and an undefined limit above 20 feet.

B. See Sections 06/32.06, 02/32.05, 05/32.05.

Provide Section XX/32.XX

C. Trash Collection:

1. It is my understanding that the trash room located on the southwest corner of building "B" was going to be serviced from the garage ramp. Please revise the plans accordingly

2. Trash collection from the neckdown portion of Mildred is undesirable. Relocate trash room or provide a workable plan to facilitate the removal of trash from the mews.

3. Trash collection from Quorum Drive is undesirable. Relocate trash room close to the park/Quorum or provide a workable plan to facilitate the removal of trash from the mews.

4. Verify sufficient clearances are provided to service the 40 yard dumpster. Both height and width appear less than adequate.

D. The doors opening out onto the sidewalk should be revised to open inward or be recessed.

E. Provide plan to minimize the pedestrian/vehicular conflicts at all the garage entrances. Submit plan to Sasaki for review.

F. Porte Cochere plans are inconsistent with the license agreement. Bollards shall be removed from the roadway. Revise plans as necessary.

G. Provide utility plan prepared by professional engineer. Include the following as a minimum:

1. Provide dimensioned plan.

2. Meter assembly details including vaults, meter cans, backflow prevention assemblies, meters, etc. All 2-inch meters shall be compound Hersey or Badger meters. All other devices shall conform to Town of Addison standards.

3. Provide installation details, ie location in relation to property line.

4. All meters located in the mews shall be in a traffic safe box/vault.

5. All backflow prevention devices shall be tested and functioning properly prior to issuance of Certificate of Occupancy.

6. Relocate private facilities from park and public street or obtain license for use. Recommend bundling private utilities with the right-of-way if they can't be accommodated on development property.

7. Provide cleanout detail for cleanouts located in public/private sidewalks.

8. Locate cleanouts on property line where possible.

9. All restaurant uses shall have grease traps. The plans do not appear to provide for any future grease traps. What are your thoughts.

H. Locate detail of light fixtures/mounting height in the mews.

I. Please explain what is happening on sheet 90.00

5. Resubmittal and re-review of affected sheets required.

cc: Lynn Chandler
Carmen Moran
Bryant Nail
Jeff Nigh
Andy Oakley

HUITT-ZOLLARS

Engineering / Architecture

Dallas • Fort Worth • Houston • El Paso • Phoenix • Orange County

FACSIMILE TRANSMITTAL

Date: 1/3/95 Fax No.: 931-6643

H-Z Proj. No. 01182204 No. of Pages: 2 (Including Cover Sheet)

TO: TOWN OF ADDISON

JOHN BAUMGARTNER

☐ URGENT ☒ For Your Review ☒ Please Call Upon Receipt ☐ Orig. To Follow By Mail

JOHN,

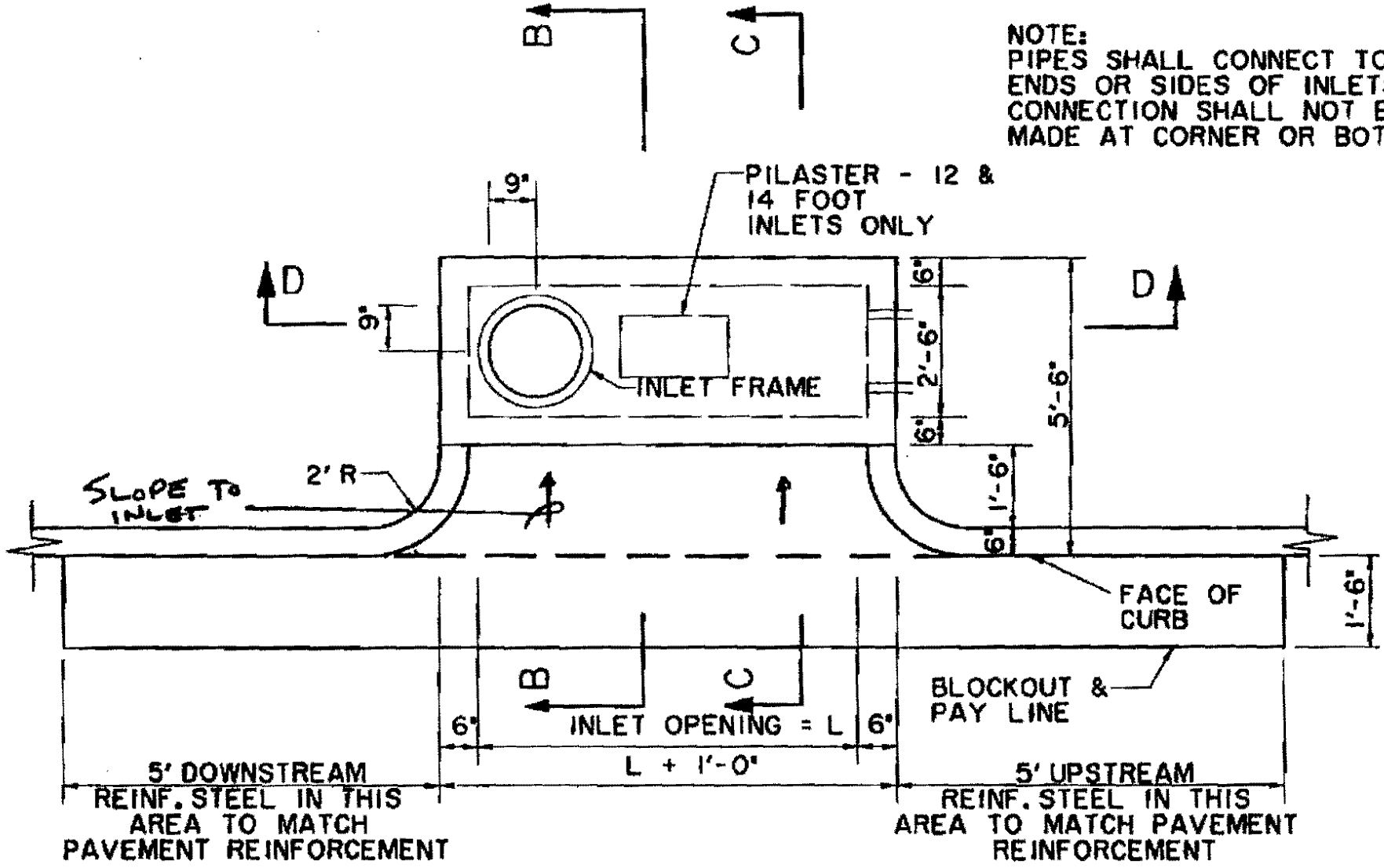
WE PROPOSE THE FOLLOWING SOLUTION FOR TO REPLACE THE STANDARD INLETS IN PARKING BAYS. WE BELIEVE THIS WILL PROVIDE THE BEST FIT AND FLEXIBILITY BETWEEN TREE PITS. THIS WILL ALSO ADDRESS THE PARKING CONCERN. THE DEPRESSION WILL BE OUT OF THE STREET

FROM: Paul Meyers

SENT BY: _____ TIME: _____ DATE: _____

If you had any problems receiving the Facsimile Transmittal, please contact Ms. Janet Willis or the individual listed above at (214) 871-3311. Thank you.

3131 McKinney Avenue • Suite 600 • Dallas, Texas 75204 • (214) 871-3311 • FAX (214) 871-0757



PLAN - MODIFIED RECESSED INLET

N.T.S.

TOWN OF ADDISON
PUBLIC WORKS DEPARTMENT (214) 450-2871
Post Office Box 144 Addison, Texas 75001 16801 Westgrove

December 26, 1995

Mr. Andy Oakley, P.E.
Huitt-Zollars, Inc.
3131 McKinney Avenue, Suite 600
Dallas, Texas 75204

Re: Addison Circle - Public Infrastructure

Dear Andy:

The following information is needed to complete the review of the plans for the public infrastructure:

1. Provide three copies of an updated design report for the rotary. Please remove the language regarding the constrained design or provide an unconstrained design alternative. Please provide sections in the report that address grading, roadway profile, and drainage; and incorporate a full set of plans for the rotary (geometrics, lighting, signage, grading, etc.) with the design report recommendations. This information is necessary for our transportation consultant to complete their review.

2. Provide a design report supported by an engineering recommendation for the use/application for the materials/elements not historically used within Addison. As a minimum, please address operation, safety and serviceability of the material/elements recommended.

   A. Bricks

      Please provide information regarding the use of the brick for roadway and sidewalk purposes. Please include elements addressing the function, safety and serviceability of the proposed product. Of particular concern is the use of brick in the valley of the Mews streets and at the valley intersections where runoff/irrigation water mixed with vehicular traffic may subject them to accelerated deterioration or affect their skid resistance.

B. Curbless Street/Mews Intersections

Please address how this functions. Of particular concern is the potential for conflict between the pedestrians and vehicular traffic at these intersections and our ability to maintain signage that will not require continual replacement.

C. Mid-block Crosswalks on Quorum Drive

We have a number of concerns with mid-block crosswalks on streets with ultimate traffic characteristics of Quorum Drive.

If you desire the proposed crosswalks at stations 7+75 and 20+57 Quorum Drive, please include information in your engineering report that addresses the function operation, safety, signage, markings, visibility of/for both the pedestrians and vehicular traffic including the affects of roadway geometrics and landscaping. This should be supported by an engineering recommendation.

In addition, a complete set of plans and bid documents are necessary to complete our review of this project.

Please call me if you have any questions or need additional information.

Sincerely,

John R. Baumgartner
Director of Public Works

JRB/st

HUITT-ZOLLARS

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

January 16, 1996

Ms. Carmen Moran
Director of Development Services
Town of Addison
5300 Belt Line Road
Addison, Texas 75001

RE: Easements on Town Property
Addison Circle Phase I
HZI Project No. 01-1932-01

Dear Ms. Moran:

We are transmitting, herewith, three originals each of metes and bounds descriptions for the following easements which are needed on property owned by the Town of Addison as part of the development of Phase I of Addison Circle. Please let this letter serve as our formal request for the Town of Addison to grant these easements across their property.

1. Electric easement along north side of Addison Conference Center.

2. Drainage easement along east side of Addison Conference Center.

These descriptions have been checked and staked in the field and are signed and sealed by our surveyor pursuant to approval by the City to be incorporated into your standard easement forms.

A copy of the pertinent engineering plan sheets which illustrate the need for the easements are also enclosed for reference. By copy of this letter, we are transmitting the same materials directly to Mr. John Baumgartner for his review.

Please give me a call if you require further copies or additional information to process this request.

Sincerely,

HUITT-ZOLLARS, INC.
Engineering/Architecture

Andrew C. Oakley, P.E.
Senior Vice President

cc: Bryant Nail, Mike McWilliams, John Baumgartner - W/Enclosures

G:\PROJ\01193201\2CM0115.LTR

LAND DESCRIPTION
ELECTRIC EASEMENT

BEING a tract of land situated in the G.W. Fisher Survey, Abstract No. 482, Town of Addison, Dallas County, Texas, and being a portion of Lot 1, Block 1 of Addison Conference Center-Addison Centre Theatre plat, an addition to the Town of Addison as recorded in Volume 90241, Page 2807 of the Deed Records of Dallas County, Texas, and being more particularly described as follows:

COMMENCING at a one-inch iron rod found at the northwest corner of said Addison Conference Center-Addison Centre Theatre plat, said corner being on the east right-of-way line of Addison Road;

THENCE, North 89 degrees 46 minutes 15 seconds East along the north line of said Addison Conference Center plat a distance of 20.00 feet to the POINT OF BEGINNING;

THENCE, North 89 degrees 46 minutes 15 seconds East continuing along the north line of said Addison Conference Center plat a distance of 272.59 feet to a point for corner;

THENCE, South 64 degrees 27 minutes 58 seconds East a distance of 8.26 feet to a point for corner on an east line of said Addison Conference Center plat;

THENCE, South 00 degrees 13 minutes 46 seconds East along the east line of said Addison Conference Center plat a distance of 11.10 feet to a point for corner;

THENCE, North 64 degrees 27 minutes 58 seconds West a distance of 10.80 feet to a point for corner;

THENCE, South 89 degrees 46 minutes 15 seconds West parallel with the north line of said Addison Conference Center plat a distance of 270.30 feet to a point for corner;

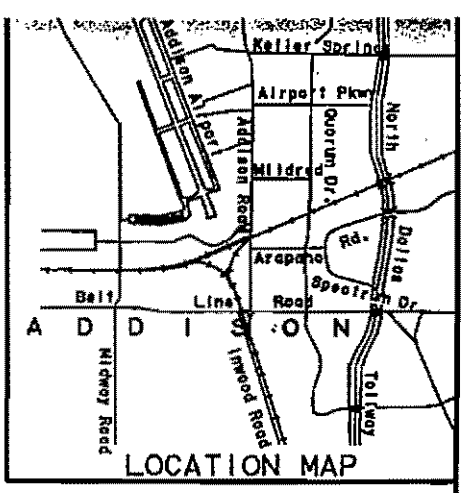
THENCE, North 00 degrees 14 minutes 37 seconds West a distance of 10.00 feet to the POINT OF BEGINNING and CONTAINING 2,809 square feet of land, more or less.

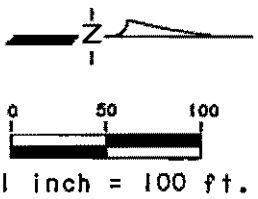
For: Huitt-Zollars, Inc.

Eric J. Yaboudy
Registered Professional Land Surveyor
Texas Registration No. 4862
Huitt-Zollars, Inc.
3131 McKinney Ave.
Suite 600
Dallas, Texas 75204
(214) 871-3311

Date: January 11, 1996

G:\PROJ\011932O1\ELECESMT.DES
1/15/96





G.W. FISHER SURVEY
ABSTRACT No. 482

A.J. AIROLDI
VOL. 78010, PG. 1121
D.R.D.C.T.

POINT OF COMMENCING
1" IRON ROD FOUND
POINT OF BEGINNING

20.00'

N 89°46'15"E 272.59'

S 89°46'15"W 270.30'

2,809 Sq. Ft.

S 64°27'58"E
8.26'

S 00°13'46"E
11.10'

N 64°27'58"W
10.80'

GAYLORD PROPERTIES, INC.
(FORMERLY OPUBCO PROPERTIES, INC.)
VOL. 82020, PG. 684 & 688
D.R.D.C.T.

N 00°14'37"W
10.00'

20' X 20'
ELECTRIC ESM'T.
VOL. 90241, PG. 2807

FINAL PLAT
LOT 1 BLOCK 1
ADDISON CONFERENCE CENTER-
ADDISON CENTRE THEATRE
VOL. 90241, PG. 2807
D.R.D.C.T.

20' ALLEY AND
UTILITY ESM'T.
VOL. 90241, PG. 2807

ADDISON ROAD

MILDRED STREET
50' R.O.W.
VOL. 1, PG. 538

JULIAN'S ADDITION
VOL. 1, PG. 538
M.R.D.C.T.

BASIS OF BEARING:
THE FINAL PLAT OF LOT 1, BLOCK 1 OF THE ADDISON CONFERENCE CENTER-ADDISON CENTER THEATRE AS RECORDED IN VOLUME 90241, PAGE 2807 OF THE DEED RECORDS OF DALLAS COUNTY, TEXAS.

SHEET 2 OF 2

HUITT-ZOLLARS
3131 McKINNEY AVENUE/SUITE 600
DALLAS, TEXAS 214-871-3311

EXHIBIT MAP

ELECTRIC EASEMENT ALONG THE NORTH SIDE OF ADDISON CONFERENCE CENTER-ADDISON CENTRE THEATRE
TOWN OF ADDISON
DALLAS COUNTY, TEXAS

FOR: HUITT-ZOLLARS, INC.

ERIC J. YAHOUDY
REGISTERED PROFESSIONAL LAND SURVEYOR
TEXAS REGISTRATION No. 4862
DATE: JANUARY 15, 1996

LAND DESCRIPTION
DRAINAGE EASEMENT

BEING a tract of land situated in the G.W. Fisher Survey, Abstract No. 482, Town of Addison, Dallas County, Texas, and being a portion of Lot 1, Block 1 of Addison Conference Center-Addison Centre Theatre plat, an addition to the Town of Addison as recorded in Volume 90241, Page 2807 of the Deed Records of Dallas County, Texas, and being more particularly described as follows:

BEGINNING at a one-inch iron rod found at the most easterly northeast corner of said Addison Conference Center-Addison Centre Theatre plat;

THENCE, South 00 degrees 33 minutes 30 seconds East along the east line of said Addison Conference Center plat a distance of 6.00 feet to a point for corner;

THENCE, South 89 degrees 21 minutes 53 seconds West parallel with a north line of said Addison Conference Center plat a distance of 75.91 feet to a point for corner;

THENCE, North 45 degrees 38 minutes 25 seconds West a distance of 15.52 feet to a point for corner;

THENCE, North 00 degrees 41 minutes 13 seconds West parallel with an east line of said Addison Conference Center plat a distance of 197.61 feet to a point on a north line of said Addison Conference Center plat;

THENCE, North 89 degrees 18 minutes 47 seconds East along a north line of said Addison Conference Center plat a distance of 6.00 feet to a northeast corner of said Addison Conference Center plat;

THENCE, South 00 degrees 41 minutes 13 seconds East along an east line of said Addison Conference Center plat a distance of 202.59 feet to a 1/2 inch iron rod found with "Huitt-Zollars" cap for a corner of said Addison Conference Center plat;

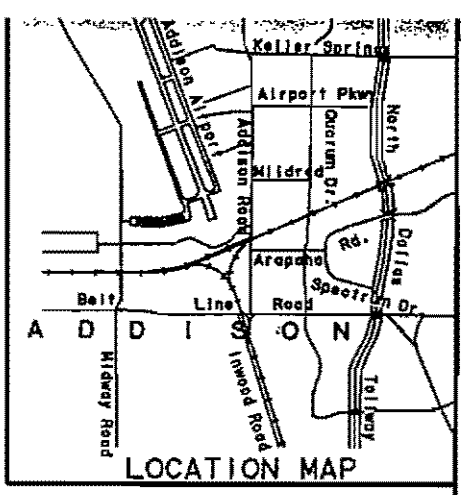
THENCE, North 89 degrees 21 minutes 53 seconds East along a north line of said Addison Conference Center-Addison Centre Theatre plat a distance of 80.89 feet to the POINT OF BEGINNING and CONTAINING 1,677 square feet of land, more or less.

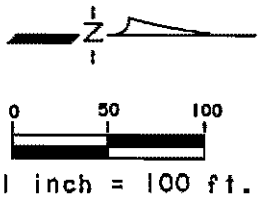
For: Huitt-Zollars, Inc.

Eric J. Yahoudy
Registered Professional Land Surveyor
Texas Registration No. 4862
Huitt-Zollars, Inc.
3131 McKinney Ave.
Suite 600
Dallas, Texas 75204
(214) 871-3311

Date: January 11, 1996

G:\PROJ\01193201\DRAINAGE.DES
1/15/96





A.J. AIROLDI
VOL. 78010, PG. 1121
D.R.D.C.T.

GAYLORD PROPERTIES, INC.
(FORMERLY OPUBCO PROPERTIES, INC.)
VOL. 82020, PG. 684 & 688
D.R.D.C.T.

N 89°18'47"E
6.00'

PK NAIL FOUND
IN CONC. BASE
OF FENCE POST

20' X 20'
ELECTRIC ESM'T.
VOL. 90241, PG. 2807

G.W. FISHER SURVEY
ABSTRACT No. 482

1,677 Sq. Ft.

N 00°41'13"W 197.61'

S 00°41'13"E 202.59'

N 89°21'53"E
80.89'

POINT OF BEGINNING
1" IRON ROD FOUND

IRF

FINAL PLAT
LOT 1 BLOCK 1
ADDISON CONFERENCE CENTER-
ADDISON CENTRE THEATRE
VOL. 90241, PG. 2807
D.R.D.C.T.

N 45°38'25"W
15.52'

S 89°21'53"W
75.91'

S 00°33'30"E
6.00'

20' ALLEY AND
UTILITY ESM'T.
VOL. 90241, PG. 2807

A D D I S O N R O A D

M I L D R E D S T R E E T
50' R.O.W.
VOL. 1, PG. 538

JULIAN'S ADDITION
VOL. 1, PG. 538
M.R.D.C.T.

BASIS OF BEARING:
THE FINAL PLAT OF LOT 1, BLOCK 1
OF THE ADDISON CONFERENCE CENTER-
ADDISON CENTER THEATRE AS RECORDED
IN VOLUME 90241, PAGE 2807 OF THE DEED
RECORDS OF DALLAS COUNTY, TEXAS.

LEGEND

•IRF 1/2" IRON ROD FOUND WITH "HUITT-ZOLLARS" CAP

SHEET 2 OF 2

FOR: HUITT-ZOLLARS, INC.

ERIC J. YANOUDY
REGISTERED PROFESSIONAL LAND SURVEYOR
TEXAS REGISTRATION No. 4862
DATE: JANUARY 15, 1996

HUITT - ZOLLARS
3131 McKINNEY AVENUE/SUITE 600
DALLAS, TEXAS 214-871-3311

EXHIBIT MAP

DRAINAGE EASEMENT ALONG THE
EAST SIDE OF ADDISON CONFERENCE
CENTER-ADDISON CENTRE THEATRE
TOWN OF ADDISON
DALLAS COUNTY, TEXAS

TOWN OF ADDISON
PUBLIC WORKS DEPARTMENT (214) 450-2871
Post Office Box 144 Addison, Texas 75001 16801 Westgrove

December 26, 1995

Mr. Andy Oakley, P.E.
Huitt-Zollars, Inc.
3131 McKinney Avenue, Suite 600
Dallas, Texas 75204

Re: Addison Circle - Public Infrastructure

Dear Andy:

The following information is needed to complete the review of the plans for the public infrastructure:

1. Provide three copies of an updated design report for the rotary. Please remove the language regarding the constrained design or provide an unconstrained design alternative. Please provide sections in the report that address grading, roadway profile, and drainage; and incorporate a full set of plans for the rotary (geometrics, lighting, signage, grading, etc.) with the design report recommendations. This information is necessary for our transportation consultant to complete their review.

2. Provide a design report supported by an engineering recommendation for the use/application for the materials/elements not historically used within Addison. As a minimum, please address operation, safety and serviceability of the material/elements recommended.

   A. Bricks

      Please provide information regarding the use of the brick for roadway and sidewalk purposes. Please include elements addressing the function, safety and serviceability of the proposed product. Of particular concern is the use of brick in the valley of the Mews streets and at the valley intersections where runoff/irrigation water mixed with vehicular traffic may subject them to accelerated deterioration or affect their skid resistance.

B. Curbless Street/Mews Intersections

Please address how this functions. Of particular concern is the potential for conflict between the pedestrians and vehicular traffic at these intersections and our ability to maintain signage that will not require continual replacement.

C. Mid-block Crosswalks on Quorum Drive

We have a number of concerns with mid-block crosswalks on streets with ultimate traffic characteristics of Quorum Drive.

If you desire the proposed crosswalks at stations 7+75 and 20+57 Quorum Drive, please include information in your engineering report that addresses the function operation, safety, signage, markings, visibility of/for both the pedestrians and vehicular traffic including the affects of roadway geometrics and landscaping. This should be supported by an engineering recommendation.

In addition, a complete set of plans and bid documents are necessary to complete our review of this project.

Please call me if you have any questions or need additional information.

Sincerely,

John R. Baumgartner
Director of Public Works

JRB/st

TOWN OF ADDISON

PUBLIC WORKS DEPARTMENT (214) 450-2871

Post Office Box 144 Addison, Texas 75001 16801 Westgrove

December 26, 1995

Mr. Andy Oakley, P.E.
Huitt-Zollars, Inc.
3131 McKinney Avenue, Suite 600
Dallas, Texas 75204

Re: Addison Circle - Public Infrastructure

Dear Andy:

The following information is needed to complete the review of the plans for the public infrastructure:

1. Provide three copies of an updated design report for the rotary. Please remove the language regarding the constrained design or provide an unconstrained design alternative. Please provide sections in the report that address grading, roadway profile, and drainage; and incorporate a full set of plans for the rotary (geometrics, lighting, signage, grading, etc.) with the design report recommendations. This information is necessary for our transportation consultant to complete their review.

2. Provide a design report supported by an engineering recommendation for the use/application for the materials/elements not historically used within Addison. As a minimum, please address operation, safety and serviceability of the material/elements recommended.

   A. Bricks

      Please provide information regarding the use of the brick for roadway and sidewalk purposes. Please include elements addressing the function, safety and serviceability of the proposed product. Of particular concern is the use of brick in the valley of the Mews streets and at the valley intersections where runoff/irrigation water mixed with vehicular traffic may subject them to accelerated deterioration or affect their skid resistance.

B. Curbless Street/Mews Intersections

Please address how this functions. Of particular concern is the potential for conflict between the pedestrians and vehicular traffic at these intersections and our ability to maintain signage that will not require continual replacement.

C. Mid-block Crosswalks on Quorum Drive

We have a number of concerns with mid-block crosswalks on streets with ultimate traffic characteristics of Quorum Drive.

If you desire the proposed crosswalks at stations 7+75 and 20+57 Quorum Drive, please include information in your engineering report that addresses the function operation, safety, signage, markings, visibility of/for both the pedestrians and vehicular traffic including the affects of roadway geometrics and landscaping. This should be supported by an engineering recommendation.

In addition, a complete set of plans and bid documents are necessary to complete our review of this project.

Please call me if you have any questions or need additional information.

Sincerely,

John R. Baumgartner
Director of Public Works

JRB/st

HUITT-ZOLLARS

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

January 16, 1996

Ms. Carmen Moran
Director of Development Services
Town of Addison
5300 Belt Line Road
Addison, Texas 75001

RE: Final Plat
Addison Circle Phase I
HZI Project No. 01-1932-01

Dear Ms. Moran:

We are transmitting, herewith for review by the Planning and Zoning Commission and City Council, 18 copies of the final plat for Addison Circle Phase I along with the required submittal form and fees of $135. Pursuant to staff comments and the qualifications placed on the approval of the preliminary plat by the City Council, we have addressed the issues as follows:

1. A separate application has been submitted through the City Attorney's office for abandonment of a portion of Mildred Street. It is assumed that the abandonment will go to the City Council at the same time as this plat and we will note the abandonment ordinance number on the plat prior to filing in the County records.

2. A "Reservation Agreement" is currently being reviewed by the City Attorney which will address most issues relative to encroachments of building features and utilities into the public right-of-way. For the "Private Utilities" the agreement indicates that individual easements are or will be delineated on the plat(s). We have shown these easements on the current plat to the best of our ability but we believe that others will be needed before the Phase I project is complete. We request that the plat be approved subject to allowing revision or addition of easements based on utility plans to be reviewed by the Public Works Department prior to filing of the plat. If the plat is filed and easement additions or revisions are required later, we will file an amended plat or replat as appropriate. It is assumed that the Reservation Agreement will go to City Council at the same time as the plat and we will note the pertinent information about the Agreement on the face of the plat prior to filing it in the County records.

3. A separate set of documents has been created for the easements needed on city-owned property and they are being submitted with a separate request for approval.

G:\PROJ\01193201\CM0115.LTR

4. Construction plans for the streets are currently being bid and should be in their final form before this plat goes to City Council. All issues will be resolved with staff prior to this plat going to the Planning and Zoning Commission.

5. The rond point (roundabout) design is being finalized along with the other construction plans as noted in #4.

6. We do not know what process is required to receive sign-off from the franchised utilities but we believe we have coordinated our design efforts with each of them as necessary to establish easement and construction requirements.

7. The engineering plans for the private development that this plat encompasses have been reviewed by city staff and we submitted signed, sealed drawings in response to comments on January 10th.

Please give me a call if there is anything more that we may do to assist in bringing this plat to the Planning and Zoning Commission with a positive recommendation from staff.

Sincerely,

HUITT-ZOLLARS, INC.
Engineering/Architecture

Andrew C. Oakley, P.E.
Senior Vice President

ACO/psp

cc: Bryant Nail - Columbus - W/Enclosures
Mike McWilliams - W/Enclosures
John Baumgartner - Town of Addison - W/Enclosures

COWLES & THOMPSON

A PROFESSIONAL CORPORATION

ATTORNEYS AT LAW

901 MAIN STREET, SUITE 4000
DALLAS, TEXAS 75202-3793

TELEPHONE (214) 672-2000

FAX (214) 672-2020

CHARLES SORRELLS
(1925-1982)

307 W. WASHINGTON, SUITE 100
P.O. BOX 1127
SHERMAN, TEXAS 75091-1127
TELEPHONE (903) 893-8999

NCNB TEXAS NATIONAL BANK BLDG, SUITE 321
100 WEST ADAMS AVENUE
P.O. BOX 785
TEMPLE, TEXAS 76503-0785
TELEPHONE (817) 771-2800

ONE AMERICAN CENTER, SUITE 777
909 E.S.E. LOOP 323
TYLER, TEXAS 75701-9684
TELEPHONE (903) 581-5588

JOHN M. HILL
(214) 672-2170

January 12, 1996

VIA TELECOPY AND U.S. MAIL

Mr. John Baumgartner
City Engineer
Town of Addison
P.O. Box 144
Addison, Texas 75001

Re: Addison Circle Phase I - Contract Documents

Dear John:

In reviewing the Master Facilities Agreement I came across another item which should be included in the construction contract. Section 6.B.2.(c) of the Master Facilities Agreement provides as follows:

> "In the event that claims from a contractor under a construction contract result from the wrongful failure by the City to make construction payments in accordance with the terms of this Agreement, Gaylord and Columbus may seek reimbursement in accordance with this paragraph. In the event Gaylord and Columbus intends to seek reimbursement from the City for the expense incurred by Gaylord and Columbus in resolving any claim caused directly by the City's wrongful failure to make such construction payments, Gaylord and Columbus shall notify the City in writing of the claim and any proposed settlement or resolution. The City reserves the right upon such notice, and at the City's sole election, to make an audit of all books, records, accounts and other data of the construction contractor relating to the claim and overall performance of the construction contract before approving payment of such claim. *The construction contract shall provide for the City's right to audit such claims.*"

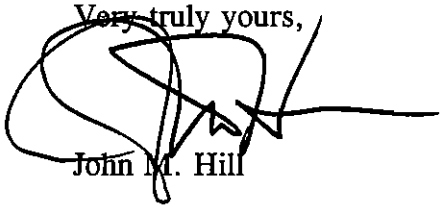
Therefore, in order to reflect in the construction contract the City's right to audit such claims, Paragraph P of the Instructions to Bidders should be further amended to read as follows (the language below includes the amendments to Paragraph P which were in my January 11 letter, with the additional amendments being underlined and in bold):

"The successful bidder will be required to enter into a contract with the Owner within seven (7) calendar days notice by the Owner that his bid has been accepted. Failure to enter into a contract within the established time limit ~~without proper justification~~ shall be considered grounds for forfeiture of the bid bond. In conjunction and simultaneous with the construction of Addison Circle Phase I, Gaylord Properties, Inc. ("Gaylord") and Columbus Realty Trust ("Columbus") will be constructing certain private improvements within Addison Circle Phase I ~~upon that portion of the Property included within the applicable phase or sub-phase~~. Therefore, **and in accordance with a Master Facilities Agreement previously entered into on July 17, 1995 between the Town of Addison, Gaylord and Columbus (which provides in part for the coordination of the construction of the public and private improvements in the Addison Circle),** upon the award and execution of the construction contract between the Town of Addison and the successful bidder as the contractor and in order to coordinate the construction of the public and private facilities, the Town of Addison will ~~shall~~ assign all of its rights, powers, duties and obligations under the construction contract to Gaylord and Columbus. Gaylord and Columbus shall thereafter act and serve as the owner and construction manager under the contract for all purposes, including inspection, material testing, staking, supervision and coordination of all construction work. The successful bidder as the contractor shall look solely to Gaylord and Columbus concerning any claim under the contract.

In the event that any such claim results from the wrongful failure by the Town of Addison to make construction payments in accordance with the terms of the Master Facilities Agreement, Gaylord and Columbus may seek reimbursement in accordance with this paragraph. In the event Gaylord and Columbus intends to seek reimbursement from the City for the expense incurred by Gaylord and Columbus in resolving any claim caused directly by the City's wrongful failure to make such construction payments, Gaylord and Columbus shall notify the City in writing of the claim and any proposed settlement or resolution. The City reserves the right upon such notice, and at the City's sole election, to make an audit of all books, records, accounts and other data of the construction contractor relating to the claim and overall performance of the construction contract before approving payment of such claim."

Please let me know if you have any questions.

Very truly yours,



John M. Hill

JMH:wn

ADDISON CIRCLE (01-1822-04)
OPINION OF PROBABLE CONSTRUCTION COST BASED ON BID QTYS.
JAN. 11, 1996

SUMMARY

PHASE I PAVING SUBTOTAL:	$900,818.00
PHASE I STREETSCAPE SUBTOTAL:	$1,137,966.75
PHASE I STORM WATER SUBTOTAL:	$490,287.00
PHASE I WASTEWATER SUBTOTAL:	$149,611.00
PHASE I WATER SUBTOTAL:	$177,163.00
PHASE I BOSQUE PARK SUBTOTAL:	$244,588.00
PHASE I ELECTRICAL DUCTBANK SUBTOTAL:	$359,405.00
PHASE II STREETSCAPE SUBTOTAL:	($102,070.00) –
BASE BID PROJECT TOTAL:	$3,561,908.75
	3,459,000.00
PHASE I STREETSCAPE ALTERNATES SUBTOTAL:	$132,650.00
PROJECT TOTAL W/ STREETSCAPE ALTERNATES:	$3,693,978.75

z:\proj\011822\bidqty1.wk1

ITEM NO.	DESCRIPTION	UNIT	QTY	PRICE	COST
PHASE I PAVING					
101	MOBILIZATION	LS	1	$25,000.00	$25,000.00
102	UNCLASSIFIED STREET EXCAVATION	CY	7309	$3.00	$21,927.00
103	REM. EXIST. CONC. PAVEMENT	SY	4163	$6.00	$24,978.00
104	REM. EXIST. CONC. SIDEWALK	SY	1392	$1.00	$1,392.00
105	6" LIME STAB. SUBGRADE	SY	15115	$1.40	$21,161.00
106	HYDRATED LIME (36 LBS/SY)	TON	272.2	$85.00	$23,137.00
107	8" 650 PSI REINF. CONC. PAVEMENT	SY	12285	$20.00	$245,700.00
108	8" 650 PSI REINF. CONC. DROP SLAB	SY	3415	$20.00	$68,300.00
109	4" 3000 PSI REINF. CONC. SIDEWALK	SF	16712	$3.00	$50,136.00
110	4" 3000 PSI REINF. CONC. SUBBASE	SF	57195	$2.50	$142,987.50
111	6" 3000 PSI REINF. CONC. SUBBASE	SF	1906	$18.00	$34,308.00
112	8" 650 PSI REINF. CONC. DRIVE	SY	69	$27.00	$1,863.00
113	6" 650 PSI REINF. CONC. DRIVE	SY	89	$25.00	$2,225.00
114	6" 650 PSI REINF. CONC INTEGRAL CURB	LF	5630	$1.00	$5,630.00
115	REINF. CONC. STREET HEADER	LF	99	$6.00	$594.00
116	SAWCUT EXIST. CONCRETE	LF	1116	$2.00	$2,232.00
117	SPECIAL PAVING ENHANCEMENTS	SF	26593	$6.00	$159,558.00
118	CROSSWALK BOLLARD	EA	60	$250.00	$15,000.00
119	4" THERMOPLASTIC LANE STRIPE	LF	54	$0.50	$27.00
120	4" NON-REFL. BUTTON TYPE W	EA	110	$5.00	$550.00
121	4" REFL. BUTTON TYPE I-W-C	EA	208	$5.00	$1,040.00
122	4" REFL. BUTTON TYPE II-Y-Y	EA	20	$6.00	$120.00
123	24" THERMOPLASTIC STOP LINE	LF	70	$17.00	$1,190.00
124	24" THERMOPLASTIC YIELD LINE	LF	70	$17.00	$1,190.00
125	STREET SIGN	EA	88	$170.00	$14,960.00
126	SIGN POST, FOUNDATION, HARDWARE	EA	49	$150.00	$7,350.00
127	STREET BARRICADE	LF	75	$23.50	$1,762.50
128	BARR., SIGNS, TRAFFIC CONTROL	MO	15	$1,500.00	$22,500.00
129	6' VINYL COATED CHAIN LINK FENCE	LF	200	$20.00	$4,000.00
	PHASE I PAVING SUBTOTAL:				$900,818.00

ITEM NO.	DESCRIPTION	UNIT	QTY	PRICE	COST
PHASE I STREETSCAPE					
201	BRICK PAVER (SIDEWALK)	SF	58797	$3.00	$176,391.00
202	1" PVC SCH. 40 TREE LIGHT CONDUIT	LF	4056	$2.00	$8,112.00
203	2" PVC SCH. 40 STREET LIGHT CONDUIT	LF	3856	$3.00	$11,568.00
204	STREET LIGHT PULL BOX	EA	20	$200.00	$4,000.00
205	2" PVC SCH. 40 SLEEVE	LF	282	$3.00	$846.00
206	3" PVC SCH. 40 SLEEVE	LF	510	$3.50	$1,785.00
207	4" PVC SCH. 40 SLEEVE	LF	1613	$4.50	$7,258.50
208	6" PVC SCH. 40 SLEEVE	LF	827	$6.50	$5,375.50
209	IRRIGATION SYSTEM	LS	1	$41,500.00	$41,500.00
210	TREE FENCE	EA	186	$402.00	$74,772.00
211	STANDARD TREE GRATE	EA	28	$650.00	$18,200.00
212	STREETLIGHT FOUNDATION	EA	66	$500.00	$33,000.00
213	ANTIQUE STREET LIGHT	EA	66	$2,200.00	$145,200.00
214	HANGING LIGHT	EA	8	$1,100.00	$8,800.00
215	HANGING LIGHT POLE	EA	2	$1,000.00	$2,000.00
216	TEMP. HANGING LIGHT POLE	EA	4	$1,000.00	$4,000.00
217	4" PVC SUBDRAIN SYSTEM	LF	6363	$10.00	$63,630.00
218	5' DOUBLE BOWERY BENCH	EA	11	$2,100.00	$23,100.00
219	5' BOWERY BENCH	EA	16	$1,100.00	$17,600.00
220	6' EXPO BENCH	EA	13	$1,200.00	$15,600.00
221	BOWERY TRASH RECEPTACLE	EA	8	$600.00	$4,800.00
222	EXPANDED POLE TRASH RECEPTACLE	EA	3	$250.00	$750.00
223	CUSTOM POLE TRASH RECEPTACLE	EA	4	$200.00	$800.00
224	BIKE RACK	EA	15	$350.00	$5,250.00
225	DBL. ARM METRO WATER FOUNTAIN	EA	2	$5,000.00	$10,000.00
226	PLANTER POT	EA	10	$600.00	$6,000.00
227	200 GAL. RED OAK TREE, 14'-16' HT.	EA	119	$1,400.00	$166,600.00
228	200 GAL. LIVE OAK TREE, 14'-16' HT.	EA	63	$1,400.00	$88,200.00
229	4" CAL. CHANTICLEER PEAR TREE	EA	23	$400.00	$9,200.00
230	1 GAL. DWARF YAUPON HOLLY	EA	4110	$12.00	$49,320.00
231	1 GAL. NEW MEXICO AGAVE	EA	18	$25.00	$450.00
232	4" CONT. AUTUMN ASTER	EA	34	$4.00	$136.00
233	4" CONT. SHASTA DAISY	EA	276	$4.00	$1,104.00
234	4" CONT. RED RUM DAYLILY	EA	84	$2.00	$168.00
235	4" CONT. STELLA DE ORO DAYLILY	EA	136	$2.00	$272.00
236	4" CONT. MIXED DAYLILY	EA	125	$2.00	$250.00
237	1 GAL. RED YUCCA	EA	32	$12.00	$384.00
238	PURPLE BEARDED IRIS, #1 BULB	EA	532	$2.00	$1,064.00
239	YELLOW BEARDED IRIS, #1 BULB	EA	438	$2.00	$876.00
240	WHITE BEARDED IRIS, #1 BULB	EA	68	$2.00	$136.00
241	BLUE JAPANESE IRIS, #1 BULB	EA	24	$2.00	$48.00
242	4" CONT. SPIDER LILY	EA	192	$4.00	$768.00
243	MIXED DAFFODIL, #1 BULB	EA	389	$2.00	$778.00
244	PEB. GOLD DAFFODIL, #1 BULB	EA	357	$2.00	$714.00
245	PEEPING TOM DAFFODIL, #1 BULB	EA	157	$2.00	$314.00
246	4" CONT. THRIFT	EA	65	$4.00	$260.00
247	1 GAL. ADAMS NEEDLE STARBURST	EA	34	$12.00	$408.00
248	4" CONT. PURPLE HEART	EA	65	$4.00	$260.00
249	BBRMUDA GRASS SPOT SOD	SF	10800	$5.00	$54,000.00
250	WEEPING LOVE GRASS	SF	34500	$0.25	$8,625.00
	PHASE I STREETSCAPE SUBTOTAL:				$1,137,966.75

ITEM NO.	DESCRIPTION	UNIT	QTY	PRICE	COST
PHASE I STORM DRAINAGE					
301	18" CL. III RCP	LF	785	$25.00	$19,625.00
302	21" CL. III RCP	LF	541	$29.00	$15,689.00
303	24" CL. III RCP	LF	188	$32.00	$6,016.00
304	27" CL. III RCP	LF	109	$36.00	$3,924.00
305	30" CL. III RCP	LF	112	$41.00	$4,592.00
306	33" CL. III RCP	LF	251	$45.00	$11,295.00
307	36" CL. III RCP	LF	437	$52.00	$22,724.00
308	39" CL. III RCP	LF	191	$63.00	$12,033.00
309	42" CL. III RCP	LF	357	$68.00	$24,276.00
310	45" CL. III RCP	LF	351	$75.00	$26,325.00
311	60" CL. III RCP	LF	267	$88.00	$23,496.00
312	66" CL. III RCP	LF	248	$125.00	$31,000.00
313	72" CL. III RCP	LF	116	$145.00	$16,820.00
314	REM. EXIST. INLET	EA	10	$450.00	$4,500.00
315	6' REC. INLET W/ REC. TOP	EA	4	$1,700.00	$6,800.00
316	8' REC. INLET W/ REC. TOP	EA	3	$1,800.00	$5,400.00
317	8' REC. INLET (EX. DEPTH) W/ REC. TOP	EA	1	$1,800.00	$1,800.00
318	10' REC. INLET W/ REC. TOP	EA	2	$1,900.00	$3,800.00
319	10' REC. INLET	EA	1	$1,700.00	$1,700.00
320	10' REC. INLET (EXTRA DEPTH)	EA	2	$1,900.00	$3,800.00
321	12' REC. INLET W. REC. TOP	EA	1	$2,150.00	$2,150.00
322	14' STD. INLET	EA	1	$2,100.00	$2,100.00
323	4 GRATE INLET	EA	1	$2,100.00	$2,100.00
324	6 GRATE INLET	EA	1	$3,800.00	$3,800.00
325	3 GRATE COMBINATION INLET	EA	2	$2,000.00	$4,000.00
326	5' X 5' 'Y' INLET	EA	4	$2,000.00	$8,000.00
327	REM. EXIST. RCP	LF	1048	$10.00	$10,480.00
328	TYPE 'A' MANHOLE	EA	2	$2,000.00	$4,000.00
329	MODIFIED TYPE 'A' MANHOLE	EA	1	$2,500.00	$2,500.00
330	TYPE 'B' MANHOLE	EA	5	$3,000.00	$15,000.00
331	RCP 60 DEGREE FACTORY WYE	EA	33	$400.00	$13,200.00
332	RCP 45 DEGREE FACTORY WYE	EA	1	$400.00	$400.00
333	RCP 60 DEGREE FACTORY BEND	EA	2	$1,300.00	$2,600.00
334	RCP 45 DEGREE FACTORY BEND	EA	2	$1,300.00	$2,600.00
335	RCP 30 DEGREE FACTORY BEND	EA	3	$1,300.00	$3,900.00
336	PIPE TO PIPE CONNECTION	EA	7	$420.00	$2,940.00
337	PIPE TO INLET CONNECTION	EA	1	$500.00	$500.00
338	PRECAST CONCRETE PLUG	EA	22	$100.00	$2,200.00
339	UNCLASSIFIED CHANNEL EXCAVATION	CY	7175	$5.00	$35,875.00
340	ROCK CHANNEL EXCAVATION	CY	4511	$10.00	$45,110.00
341	REM. EXIST. CONC. HEADWALL	LS	1	$3,000.00	$3,000.00
342	2' STONE RIP RAP	CY	238	$100.00	$23,800.00
343	HYDROMULCH, SEEDING & FERTILIZER	SY	1686	$3.50	$5,901.00
344	FIBERNET	SY	1686	$2.00	$3,372.00
345	INLET PROTECTION	EA	23	$150.00	$3,450.00
346	SILT FENCE	LF	7735	$3.00	$23,205.00
347	STRAW BALE DIKE	LF	200	$4.00	$800.00
348	ROCK BERM	CY	10	$50.00	$500.00
349	STAB. CONSTRUCTION ENTRANCE	SY	333	$10.00	$3,330.00
350	TV INSPECTION	LF	3953	$2.00	$7,906.00
351	TRENCH SAFETY DESIGN	LS	1	$2,000.00	$2,000.00
352	TRENCH SAFETY	LF	3953	$1.00	$3,953.00
	PHASE I STORM WATER SUBTOTAL:				$490,287.00

ITEM NO.	DESCRIPTION	UNIT	QTY	PRICE	COST
PHASE I WASTEWATER					
401	8" SDR 26 PVC WASTEWATER	LF	40	$25.00	$1,000.00
402	8" SDR 35 PVC WASTEWATER	LF	1566	$20.00	$31,320.00
403	10" SDR 35 PVC WASTEWATER	LF	357	$30.00	$10,710.00
404	12" SDR 26 PVC WASTEWATER	LF	1564	$35.00	$54,740.00
405	6" SDR 35 PVC LAT. W/ CLEANOUT	EA	17	$775.00	$13,175.00
406	4' DIA. MANHOLE	EA	3	$1,500.00	$4,500.00
407	5' DIA. MANHOLE	EA	11	$2,100.00	$23,100.00
408	TV INSPECTION	LF	3527	$2.00	$7,054.00
409	TRENCH SAFETY	LF	4012	$1.00	$4,012.00
	PHASE I WASTEWATER SUBTOTAL:				$149,611.00

ITEM NO.	DESCRIPTION	UNIT	QTY	PRICE	COST
PHASE I WATER					
501	CONCRETE BLOCKING	CY	18.5	$100.00	$1,850.00
502	D.I. CL. 250 IRON FITTINGS	TON	4.9	$3,000.00	$14,700.00
503	6" PVC DR 14 CL. 200 WATER PIPE	LF	225.5	$14.00	$3,157.00
504	8" PVC DR 14 CL. 200 WATER PIPE	LF	1945	$18.00	$35,010.00
505	12" PVC DR 14 CL. 200 WATER PIPE	LF	76	$22.00	$1,672.00
506	24" RCCP WATER LINE	LF	248	$200.00	$49,600.00
507	ABANDON & GROUT EXIST. 24" RCCP	LF	200	$15.00	$3,000.00
508	6" GATE VALVE/BOX	EA	12	$400.00	$4,800.00
509	8" GATE VALVE/BOX	EA	11	$600.00	$6,600.00
510	12" GATE VALVE/BOX	EA	1	$850.00	$850.00
511	FIRE HYDRANT	EA	9	$1,200.00	$10,800.00
512	REM., SALVAGE & DELIVER EXIST. FH	EA	4	$180.00	$720.00
513	CONN. TO EXIST. WATER MAIN	EA	4	$500.00	$2,000.00
514	1.5" WATER SERVICE	EA	2	$935.00	$1,870.00
515	2" WATER SERVICE	EA	19	$1,000.00	$19,000.00
516	6" WATER SERVICE	EA	3	$1,500.00	$4,500.00
517	20" X 18" TAPPING SLEEVE/VALVE/BOX	EA	1	$2,250.00	$2,250.00
518	20" X 12" TAPPING SLEEVE/VALVE/BOX	EA	1	$3,050.00	$3,050.00
519	2000 PSI CONC. ENCASEMENT	LF	80	$10.00	$800.00
520	ADJUST EXIST. WATER VALVE	EA	7	$135.00	$945.00
521	TRENCH SAFETY	LF	2494.5	$2.00	$4,989.00
522	WATER TEST	LS	1	$2,000.00	$2,000.00
523	FILL & CAP EXIST. WATER WELL	LS	1	$3,000.00	$3,000.00
	PHASE I WATER SUBTOTAL:				$177,163.00

ITEM NO.	DESCRIPTION	UNIT	QTY	PRICE	COST
PHASE I BOSQUE PARK					
601	CLEARING, PRUNING & GRUBBING	SF	37500	$2.00	$75,000.00
602	REL. EXIST. QUORUM MEDIAN TREE	EA	13	$600.00	$7,800.00
603	PERIMETER WALL	LF	820	$150.00	$123,000.00
604	BRICK PAVER (SIDEWALK)	SF	3634	$3.00	$10,902.00
605	4" 3000 PSI REINF. CONC. SUBBASE	SF	3634	$2.50	$9,085.00
606	4" 3000 PSI REINF. CONC. SIDEWALK	SF	6267	$3.00	$18,801.00
	PHASE I BOSQUE PARK SUBTOTAL:				$244,588.00

ITEM NO.	DESCRIPTION	UNIT	QTY	PRICE	COST
PHASE I ELECTRICAL DUCTBANK					
701	6E6 CONC. ENCASED DUCTBANK	LF	2827	$75.00	$212,025.00
702	4E6 CONC. ENCASED DUCTBANK	LF	363	$60.00	$21,780.00
703	4-WAY MANHOLE	EA	9	$10,000.00	$90,000.00
704	2-WAY MANHOLE	EA	1	$7,500.00	$7,500.00
705	5' X 5' X 6" CONC. PAD AROUND MH	EA	2	$200.00	$400.00
706	PRECAST 25 KV SWITCHPAD	EA	3	$2,000.00	$6,000.00
707	6" TYPE EB PVC 90 DEGREE SWEEP	EA	12	$100.00	$1,200.00
708	10E6 CONC. ENCASED DUCTBANK	LF	205	$100.00	$20,500.00
	PHASE I ELECTRICAL DUCT BANK SUBTOTAL:				$359,405.00

ITEM NO.	DESCRIPTION	UNIT	QTY	PRICE	COST
PHASE II STREETSCAPE					
801	2" PVC SCH. 40 STREETLIGHT CONDUIT	LF	1550	$4.00	$6,200.00
802	IRRIGATION SYSTEM (E. SIDE QUORUM)	LS	1	$6,500.00	$6,500.00
803	RED OAK TREE	EA	49	$1,400.00	$68,600.00
804	4" PVC SCH. 40 SUBDRAIN SYSTEM	LF	1550	$10.00	$15,500.00
805	WEEPING LOVE GRASS	SF	21080	$0.25	$5,270.00
	PHASE II STREETSCAPE SUBTOTAL:				$102,070.00

ITEM NO.	DESCRIPTION	UNIT	QTY	PRICE	COST
PHASE I STREETSCAPE ALTERNATES					
901	TREE GRATE UPGRADE	EA	28	$325.00	$9,100.00
902	ORNAMENTAL FENCE (MILDRED)	LF	150	$25.00	$3,750.00
903	PLANTER POT	EA	22	$600.00	$13,200.00
904	DISTRICT COLUMN	EA	4	$24,000.00	$96,000.00
905	DOUBLE BOWL DRINKING FOUNTAIN	EA	1	$3,500.00	$3,500.00
906	SINGLE BOWL DRINKING FOUNTAIN	EA	2	$2,800.00	$5,600.00
907	WALL MOUNTED CLOCK	EA	1	$1,500.00	$1,500.00
	PHASE I STREETSCAPE ALTERNATES SUBTOTAL:				$132,650.00

HUITT-ZOLLARS

Engineering / Architecture

Dallas • Fort Worth • Houston • El Paso • Phoenix • Orange County

FACSIMILE TRANSMITTAL

Date: 1-11-96 Fax No.: 931-6643

H-Z Proj. No. 01-1822-04 No. of Pages: 8 (Including Cover Sheet)

TO: Town of Addison

John Baumgartner

☐ URGENT ☒ For Your Review ☐ Please Call Upon Receipt ☐ Orig. To Follow By Mail

Phase I Cost - Addison Circle

FROM: Ken Roberts

SENT BY: _____ TIME: _____ DATE: _____

If you had any problems receiving the Facsimile Transmittal, please contact Ms. Janet Willis or the individual listed above at (214) 871-3311. Thank you.

3131 McKinney Avenue • Suite 600 • Dallas, Texas 75204 • (214) 871-3311 • FAX (214) 871-0757

HOLOPHANE
LEADER IN LIGHT CONTROL

Ron Whitehead
City Manager
City of Addison
PO BOX 144
Addison, TX 75001-0144

Ron:

Enclosed are some photographs of plastic acorns around Dallas. The picture of the two fixtures on one pole shows what happens when you don't change out yellowed acorns at the same time. They will not yellow at the same rate but, rest assured, they will discolor and crack.

The other photographs are of down town Ft. Worth. Several months ago, a major hale storm demolished many of the plastic acorns in the area. However, The Holophane *Granville* fixtures were unscathed. The permanence and rugged durability of borosilicate glass could not be represented any clearer.

I hope this can assist you in some way. I would be happy to bring in a sample of the fixture to show any of the involved parties.

Thank you,

Tim Filesi
Holophane
PO BOX 1314
Addsion, TX 75001
PH-214-250-4537
FX-214-250-3968

TOWN OF ADDISON

PUBLIC WORKS DEPARTMENT (214) 450-2871

Post Office Box 144 Addison, Texas 75001 16801 Westgrove

December 14, 1995

Mr. Gary Jost
Barton-Aschman, Inc.
5485 Belt Line Rd. Suite 199
Dallas, TX 75240

Re: Addison Circle

Dear Gary:

Attached is the sensitivity analysis provided by Columbus' design professionals.

Please review and comment at your earliest convenience..

Thanks,

John R. Baumgartner, P.E.
Director of Public Works

John
This arrived just as I was finishing your letter! -Andy

Ourston & Doctors
MODERN ROUNDABOUT INTERCHANGES

December 12, 1995

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

ADDISON ROUNDABOUT SENSITIVITY ANALYSIS

Pursuant to your request, we have completed a sensitivity analysis of the proposed roundabout design to determine how much additional traffic can be added to the projected volumes while still providing a level of service(LOS) D. Our analysis consists of two different sets of calculations, one at the 50th percentile and one at the 85th percentile.

Because capacity can be lower than estimated, and future demand flows can be higher than estimated, it is impossible to be 100 percent confident that future capacity needs will be met by any size of intersection, whether it is a roundabout type or signalized intersection. To achieve extremely high degrees of confidence--for example, 95 percent or 99 percent--it would be necessary to design unreasonably large intersections whose excess capacity would in most cases never be used.

Ourston & Doctors designs its roundabouts at the 85-percent confidence level. We feel that this gives a prudent balance between security that the roundabout will provide ample capacity and care not to waste land and pavement on unreasonably large designs. Partly because of this chosen margin of safety, all of our roundabouts are operating at Level of Service A. This is the highest level of service. It occurs when there is a large reserve of unused capacity.

Our preferred analytic application, RODEL, was written to take level of confidence into account. (The assumed confidence level is given in RODEL printouts in the column headed "CL.") All other traffic engineering analysis of which we are aware implicitly assumes the 50-percent confidence level. This produces higher estimates of capacity than would be produced by assuming the 85-percent confidence level.

5290 Overpass Road, Suite 212 Santa Barbara, CA 93111 805/683-1383

The attached two-page explanation of confidence level is copied from the user guide to RODEL. In it are some terms which may be unfamiliar to you. "RFC" means ratio of flow to capacity, which is the same as the United States' volume/capacity ratio. ARCADY is the roundabout analytic application of the British Department of Transport. RODEL is offered as an alternative to ARCADY. Insofar as the outputs of RODEL and ARCADY overlap, they are identical. RODEL is sold under license to the Department of Transport because it draws on their research.

Our clients estimate future demand flows, which are input into RODEL. We design to meet these design volumes with the cushion provided by RODEL's 85-percent confidence level. One can add to this cushion by increasing RODEL's flow factor above 100. When the flow factor equals 100, RODEL uses 100 percent of input flows. The flow factor is listed in RODEL's column headed "FLOF."

To use the flow factor as well as the 85-percent confidence level is to provide a double cushion. The percent increase of the double cushion is estimated by first assuming a 50-percent level of confidence, then increasing the flow factor until the design objective is met. In this case the design objective is to achieve Level of Service D.

Based on the 50th percentile(Table A), an increase in projected flows of 27% in the a.m. and 31% in the p.m. can be achieved, while still allowing for an LOS D. At the 85th percentile(Table B), an increase of 4% in the a.m. and 11% in the p.m. can be achieved, providing LOS D.

If a still greater cushion is desired, it can be met by designing a roundabout with increased lane widths, longer flare lengths, and/or a larger diameter if required for geomtrics.

Very truly yours,

Peter Doctors, P.E.

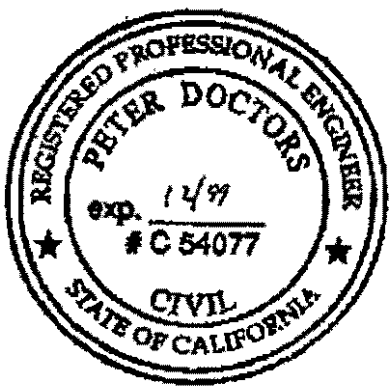


FIGURE A

ROUNDABOUT LEVELS OF SERVICE

12-12-95

50th Percentile

Ourston & Doctors

Addison Roundabout
Projected Design Flows

A.M. PEAK HOUR
(Projected +27.0%)

		LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	WHOLE ROUNDABOUT
INPUT FROM RODEL OR ARCADY								
FLOW	veh/hr	683	549	2027	632			3,891
AVE DELAY	min/veh	0.04	0.09	0.77	1.19			
OUTPUT								
AVE DELAY	sec/veh	2.4	5.4	46.2	71.4			
DELAY	sec/hr	1639	2965	93647	45125			143,376

AVE DELAY, sec/veh 36.8
LEVEL OF SERVICE **D**

P.M. PEAK HOUR
(Projected +31.0%)

		LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	WHOLE ROUNDABOUT
INPUT FROM RODEL OR ARCADY								
FLOW	veh/hr	1644	555	1138	789			4,126
AVE DELAY	min/veh	0.26	3.77	0.06	0.15			
OUTPUT								
AVE DELAY	sec/veh	15.6	226.2	3.6	9.0			
DELAY	sec/hr	25646	125541	4097	7101			162,385

AVE DELAY, sec/veh 39.4
LEVEL OF SERVICE **D**

FIGURE B
ROUNDABOUT LEVELS OF SERVICE

12-12-95

85th Percentile

Ourston & Doctors

Addison Roundabout
Projected Design Flows

A.M. PEAK HOUR
(Projected +4.0%)

		LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	WHOLE ROUNDABOUT
INPUT FROM RODEL OR ARCADY								
FLOW	veh/hr	625	502	1854	578			3,559
AVE DELAY	min/veh	0.05	0.10	0.96	0.51			
OUTPUT								
AVE DELAY	sec/veh	3.0	6.0	57.6	30.6			
DELAY	sec/hr	1875	3012	106790	17687			129,364

AVE DELAY, sec/veh 36.3
LEVEL OF SERVICE **D**

P.M. PEAK HOUR
(Projected +11.0%)

		LEG 1	LEG 2	LEG 3	LEG 4	LEG 5	LEG 6	WHOLE ROUNDABOUT
INPUT FROM RODEL OR ARCADY								
FLOW	veh/hr	1556	526	1077	746			3,905
AVE DELAY	min/veh	0.47	2.99	0.07	0.18			
OUTPUT								
AVE DELAY	sec/veh	28.2	179.4	4.2	10.8			
DELAY	sec/hr	43879	94364	4523	8057			150,824

AVE DELAY, sec/veh 38.6
LEVEL OF SERVICE **D**

50 % Confidence Level
AM Peak Hour

12:12:95			ADDISON ROUNDABOUT						107
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	(a)	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
WB QUORUM	1.05	83	385	70	0	1.27	50	0.75 1.125 0.75	15 45 75
WB MILDRED	1.05	31	272	129	0	1.27	50	0.75 1.125 0.75	15 45 75
SB QUORUM	1.05	218	1074	304	0	1.27	50	0.75 1.125 0.75	15 45 75
EB MILDRED	1.05	118	302	78	0	1.27	50	0.75 1.125 0.75	15 45 75

FLOW	veh	683	549	2027	632	TOTAL DELAYS
CAPACITY	veh	2016	1217	2192	723	
AVE DELAY	mins	0.04	0.09	0.77	1.19	40 hrs
MAX DELAY	mins	0.06	0.13	1.78	2.61	
AVE QUEUE	veh	1	1	27	13	187 pounds
MAX QUEUE	veh	1	1	61	29	

85 % Confidence Level
AM Peak Hour

12:12:95				ADDISON ROUNDABOUT					106
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
N0	QUORUM	1.05	83 385	70	0	1.04	85	0.75 1.125 0.75	15 45 75
NB	MILDRED	1.05	31 212	129	0	1.04	85	0.75 1.125 0.75	15 45 75
S0	QUORUM	1.05	218 1074	304	0	1.04	85	0.75 1.125 0.75	15 45 75
EB	MILDRED	1.05	118 302	78	0	1.04	85	0.75 1.125 0.75	15 45 75

FLOW	veh	625	502	1854	578	TOTAL DELAYS
CAPACITY	veh	1829	1101	1969	727	
AVE DELAY	mins	0.05	0.10	0.96	0.51	36 hrs
MAX DELAY	mins	0.07	0.14	2.17	1.00	
AVE QUEUE	veh	1	1	30	5	167 pounds
MAX QUEUE	veh	1	1	69	9	

50 % Confidence Level
PM Peak Hour

```
*****************************************************************************
*                                                                           *
*  12:12:95                  ADDISON ROUNDABOUT                        103  *
*                                                                           *
*****************************************************************************
*                                                *                          *
* 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*
*         *   *                                *   *  *             *         *
*NB QUORUM *1.05*   70 1099   86  0           *1.31*50*0.75 1.125 0.75*15 45 75 *
*WB MILDRED*1.05*   26  279  119  0           *1.31*50*0.75 1.125 0.75*15 45 75 *
*SB QUORUM *1.05*  147  553  169  0           *1.31*50*0.75 1.125 0.75*15 45 75 *
*EB MILDRED*1.05*   80  219  303  0           *1.31*50*0.75 1.125 0.75*15 45 75 *
*         *   *                                *   *  *             *         *
*         *   *                                *   *  *             *         *
*         *   *                                *   *  *             *         *
*****************************************************************************
*                                                *                          *
* FLOW        veh   1644   555  1138   789      *  TOTAL DELAYS            *
* CAPACITY    veh   1987   560  2194  1224      *                          *
* AVE DELAY   mins  0.26  3.77  0.06  0.15      *       45 hrs             *
* MAX DELAY   mins  0.52  7.47  0.08  0.23      *                          *
* AVE QUEUE   veh      7    40     1     2      *      211 pounds          *
* MAX QUEUE   veh     13    76     1     3      *                          *
*                                                *                          *
*****************************************************************************
```

85 % Confidence Level
PM Peak Hour

12:12:95	ADDISON ROUNDABOUT	104

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
NB QUORUM	1.05	70	1099	86	0	1.11	85	0.75 1.125 0.75	15 45 75
WB MILDRED	1.05	26	279	119	0	1.11	85	0.75 1.125 0.75	15 45 75
SB QUORUM	1.05	147	553	169	0	1.11	85	0.75 1.125 0.75	15 45 75
EB MILDRED	1.05	80	219	303	0	1.11	85	0.75 1.125 0.75	15 45 75

FLOW	veh	1556	526	1077	746	TOTAL DELAYS
CAPACITY	veh	1787	542	1952	1111	
AVE DELAY	mins	0.47	2.99	0.07	0.18	42 hrs
MAX DELAY	mins	1.01	5.92	0.09	0.29	
AVE QUEUE	veh	12	30	1	2	195 pounds
MAX QUEUE	veh	25	57	2	3	

16 CONFIDENCE LEVEL

It is not possible to estimate queues and delays accurately. They can only be estimated for a particular confidence level (either implicit or explicit). If queues and delays are estimated with a 50% confidence level, it is 50% certain that the actual queues and delays will not be greater than the estimated values. (apart from random variation)

The delays and queues calculated depend on flow and capacity. Both flow and capacity contain 'error'. Kimbers capacity equation has a standard error of -15% to +15% for typical values. The forecast flows are similarly imprecise. Consequently the ratio of flow to capacity (RFC) has an even greater standard error.

This wide range of possible RFC's can produce a very wide range of possible delays and queues for a given geometry.

The delay/RFC curve (FIG. 10) illustrates the problem. The shape of the curve is such that ignoring the range of possible RFC's can lead to a gross underestimation of the possible queues and delays.

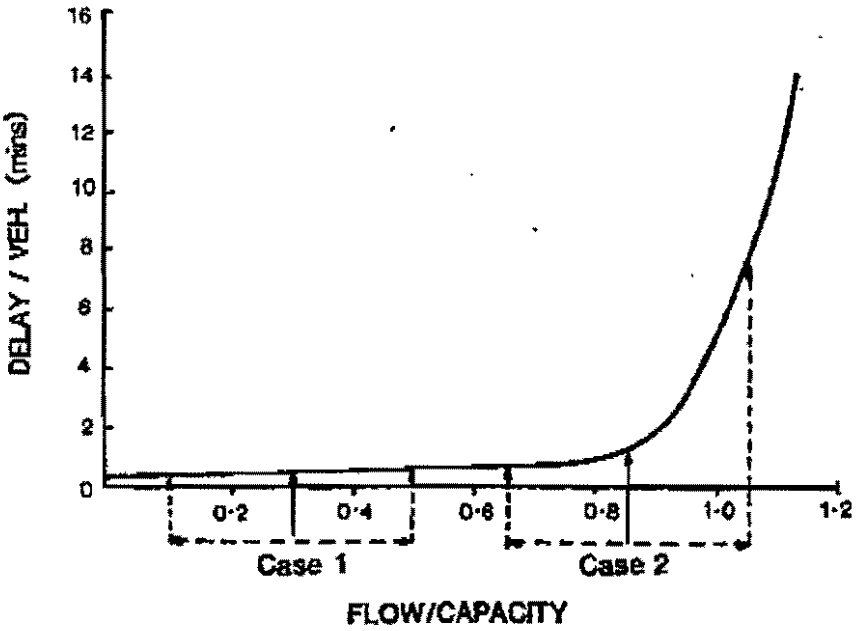


FIG. 10 DELAY / RFC

In Case 1 the whole RFC range is on the flat part of the curve, and any value of RFC in the range will produce low delays. The delay forecast is therefore robust.

Case 2 is quite different. The average RFC (50% confidence level) has delays virtually the same as Case 1. However, as Case 2 is close to the steep section of the curve, the possible values of RFC greater than the 50% value

have very high delays.

Values greater than 50% will occur if the actual flows are greater than the input flows, and/or if the actual capacity is lower than the theoretical.

ARCADY implicitly uses the 50% confidence level by using the average value for capacity with the input flows. Case 2 would appear acceptable to the Design Engineer with a 50% confidence level.

There would therefore be no incentive to modify the geometry in order to increase the capacity. Any increase would produce no significant reduction in the calculated delays since the average RFC is on the flat part of the curve. The design would therefore be considered acceptable, and the risk of very high delays not realised.

With RODEL the confidence level is input explicitly. The queues and delays can be quickly found for various confidence levels. (ie 50% to 99%)

A minimum confidence level of 85% is desireable.

RODEL at 85% would indicate that Case 1 was acceptable. However, the delays at 85% for Case 2 would be very large, providing a challenge for the designer.

The good news is that since the 85% RFC is on the steep part of the curve it is extremely senstive to small changes in RFC (changes in capacity and/or flow). The geometry therefore only requires minor alterations (in E and L') to move the 85% RFC onto the flat part of the curve producing low delays. Often this requires no extra land or service costs. The result is a robust design with low delays and, with a known confidence level.

In some cases acceptable delays can not be achieved at 85% confidence level. It may be that delays are fine at 80%, or still unacceptable at 50%. The delays can easily be tabulated or plotted for the range of Confidence Levels.

Capacity and flows are factored by the chosen confidence level, as shown in the following table.

CONFIDENCE LEVEL %	CAPACITY	FLOW
50	1.000	1.000
55	0.986	1.014
60	0.971	1.029
65	0.957	1.043
70	0.941	1.059
75	0.924	1.076
80	0.905	1.095
85	0.883	1.117
90	0.855	1.145
95	0.814	1.186
99	0.737	1.263

HUITT-ZOLLARS

Engineering / Architecture

Dallas • Fort Worth • Houston • El Paso • Phoenix • Orange County

Called Andy 10-27-95

FACSIMILE TRANSMITTAL

Date: Oct 23, 1995 Fax No.: 931-6643

H-Z Proj. No. 01-1822-04 No. of Pages: 4 (Including Cover Sheet)

TO: John Baumgartner
Town of Addison

☐ URGENT ☐ For Your Review ☐ Please Call Upon Receipt ☐ Orig. To Follow By Mail

Current Status of Addison Circle Design

cc: Bryant Nail - 770-5129
Ken Roberts

FROM: Andy Oakley

SENT BY: _____ TIME: _____ DATE: _____

If you had any problems receiving the Facsimile Transmittal, please contact Ms. Janet Willis or the individual listed above at (214) 871-3311. Thank you.

3131 McKinney Avenue • Suite 600 • Dallas, Texas 75204 • (214) 871-3311 • FAX (214) 871-0757

HUITT-ZOLLARS
Engineering / Architecture
3131 McKinney Avenue, Suite 600, Dallas, Texas 75204
Phone: (214) 871-3311 / Fax: (214) 871-0757

ANDREW C. OAKLEY, P.E.
Senior Vice President

John -

Bryant Nail asked me to call you to discuss a draw schedule for the Addison Circle public infrastructure. We will need to work that out together based on a probable bid date. Our current status is as follows:

- We are responding to your comments on the master infrastructure study to determine if there is any effect on the final design plans.

- We are awaiting Columbus' approval of the streetscape concepts (and reconciliation of these elements with the budget) so we can make a final presentation to City Staff prior to completing the plans. Columbus should give their approval this week and I would like to meet with the City before next Wed. (Nov 1).

- After we get City input on the Streetscape we can complete the construction documents in about a week. (except planting & Irrigation plans which will take 2 weeks)

- The first draft of the Roundabout study was sent to me on Oct 11. It needs work and I am making comments to Peter Doctors to give

HUITT-ZOLLARS
Engineering / Architecture
3131 McKinney Avenue, Suite 600, Dallas, Texas 75204
Phone: (214) 871-3311 / Fax: (214) 871-0757

ANDREW C. OAKLEY, P.E.
Senior Vice President

it more substance. (He assumes the reader knows more than most readers will know about Roundabouts) I have not pursued this very diligently but it doesn't really serve any purpose without the plans.

- We have begun design of the electric duct system for Phase I. We are keeping the plans separate from the other infrastructure so it can be bid separately and since it will be owned by T.U.E. and not the City. I think we will get a better price by bidding it directly to the small group of contractors that T.U.E. has certified rather than paying a general contractor's mark-up.

- We do not know how long it will take T.U.E. to approve our plans and there are several meetings to be held to finalize the route & equipment locations before we can really get into the design. However, actually plan production will only take a couple of weeks.

- What is your understanding of the proposed locations for Switchgear & Transformers?

HUITT-ZOLLARS
Engineering / Architecture
3131 McKinney Avenue, Suite 600, Dallas, Texas 75204
Phone: (214) 871-3311 / Fax: (214) 871-0757

ANDREW C. OAKLEY, P.E.
Senior Vice President

In Summary, our next major milestone is City approval of the streetscape concepts, targeted for Nov 1.

Paving, Drainage, Water, Sewer & Streetscape plans should be submitted to you by November 10th along with the revised infrastructure report and the Roundabout study. Planting and irrigation plans should follow by Nov. 17th

I hope that electric duct plans can be completed by Nov. 24, but with Thanksgiving, Nov 30 may be more realistic.

A project bid date will depend upon the review time that you and your consultants need and on our ability to respond to any comments in a timely manner.

The draw schedule will be a function of the time we give the contractor for the infrastructure work. I have not developed a construction schedule but this is probably a 12 month project from NTP to final acceptance with the last 3 months on sidewalks trees and lights, working around the apartment construction. We need to get with Bryant on his target schedule to see how they mesh.

Give Me a call when you have a chance.

- Andy

HUITT-ZOLLARS

Dallas • Fort Worth • Houston • El Paso • Phoenix • Tustin • Ontario • Albuquerque

FACSIMILE TRANSMITTAL

Date: 11/6/97 Fax No.: See Below

H-Z Proj. No. _____ No. of Pages: 2 (Including Cover Sheet)

TO: See Below

☐ URGENT ☐ For Your Review ☐ Please Call Upon Receipt ☒ Orig. To Follow By Mail

George Esqueda - TUG - 972-888-1804

Bryant Nail - Post - 972-770-5129

Mike Robbins - Post - 972-~~770~~-866-6560

John Baumgartner - Town of Addison - 972-450-2837

FROM: David Meyer

SENT BY: _____ TIME: _____ DATE: _____

If you had any problems receiving the Facsimile Transmittal, please contact the individual listed above at (214) 871-3311. Thank you.

3131 McKinney Avenue, • Suite 600 • Dallas, Texas 75204-2489 • (214) 871-3311 • FAX (214) 871-0757

HUITT-ZOLLARS

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

November 10, 1997

Mr. George Esqueda
T.U. Electric
14400 Josey Lane
Farmers Branch, TX 75234

RE: Addison Circle Phase II
Town of Addison
HZI Project No. 01-1822-21

Dear George:

The Addison Circle Park/Esplanade area will require power for pedestrian street lights, possibly a water fountain and special events that may be held in this area. You should contact John Baumgartner for additional information on the possible uses for electricity in the park. In previous discussions you stated that the power source for the park would come from a transformer in the Block "Q" garage. Huitt-Zollars needs to make provisions for sleeves in the construction plans for the conduit runs to the park.

It is our understanding that the design of the line from the transformer location to the park is to be provided by TUE and installed by the developer as a private cost, however, the alignment may require conduits to be placed in the public right-of-way in some areas. Please provide Huitt-Zollars with the routes for this conduit and sleeve sizes and locations that will be needed at street crossings.

Please call if you have any questions.

Sincerely,

HUITT-ZOLLARS, INC.

David E. Meyers

David E. Meyers, P.E.

cc: Bryant Nail, Post Properties, Inc.
Mike Robbins, Post Properties, Inc.
John Baumgartner, Town of Addison

H:\PROJ\01182221\GE110897.LTR

HUITT-ZOLLARS

Dallas • Fort Worth • Houston • El Paso • Phoenix • Tustin • Ontario • Albuquerque

FACSIMILE TRANSMITTAL

Date: 11/20/97 Fax No.: See Below

H-Z Proj. No. No. of Pages: 3 (Including Cover Sheet)

TO: Mike Robbins - Post – 972-866-6560
John Baumgartner - Addison - 972-450-2837

☐ URGENT ☒ For Your Review ☐ Please Call Upon Receipt ☒ Orig. To Follow By Mail

RE: Addison Circle Phase II

8" Fire Service addition for
Bldg "O" Garage

FROM: David Meyer

SENT BY: TIME: DATE:

If you had any problems receiving the Facsimile Transmittal, please contact the individual listed above at (214) 871-3311. Thank you.

3131 McKinney Avenue, • Suite 600 • Dallas, Texas 75204-2489 • (214) 871-3311 • FAX (214) 871-0757

Project Addison Circle II
Client Town of Addison
Task Water Fire Service Addition

HUITT ZOLLARS INCORPORATED

Job No. 012013.10
By DGM Date 11/9/97
Chkd _____ Date _____
Sheet 1 of 2

Additional Fire Service Required To Bldg "O" Garage:

See the following Sketch:

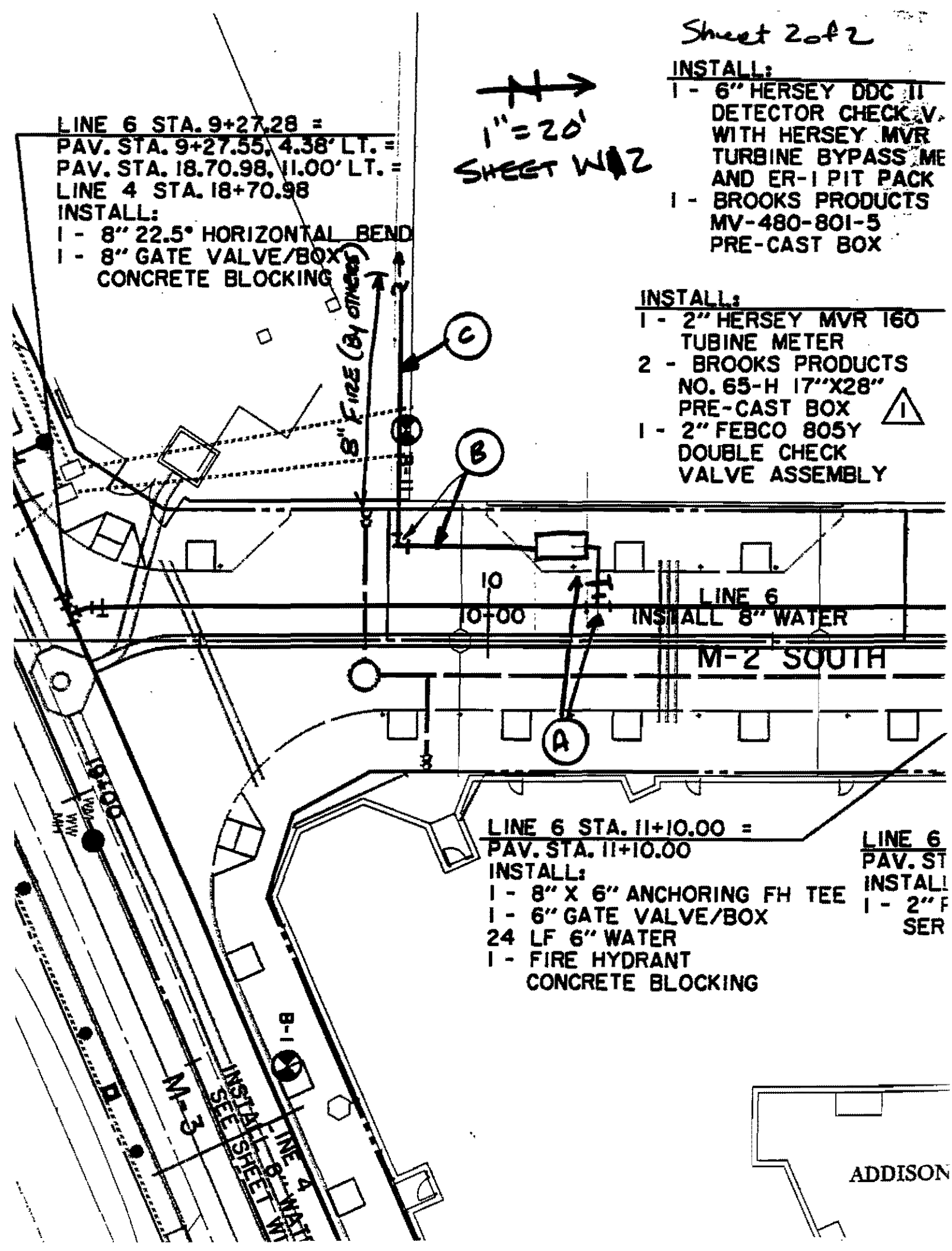
(A) Line 6 Pav. Sta. 10+20 = Pav. Sta. 10+20
Install:
1- 8" Hersey DDC II Detector Check Valve w/ Hersey MVR 30 Turbine Bypass Meter and ERT Pit Pak

1- 8" x 8" Tee
1- 8" Gate Valve / Box, Concrete Blocking
1- 8" - 90° Bend, Conc. Blocking

(B) Pav. Sta ± 9+83, ± 16.5' LT.
Install:
1- 8" 90° Bend, Concrete Blocking
Continue Fire Service Line

(C) 8" Fire Service line ; Approx Location (To be installed by others)

* Keep Pre-Cast Box clear of driveway.


1"=20'
SHEET W#2
LINE 6 STA. 9+27.28 =
PAV. STA. 9+27.55, 4.38' LT. =
PAV. STA. 18.70.98, 11.00' LT. =
LINE 4 STA. 18+70.98
INSTALL:
1 - 8" 22.5° HORIZONTAL BEND
1 - 8" GATE VALVE/BOX
CONCRETE BLOCKING
INSTALL:
1 - 6" HERSEY DDC II
DETECTOR CHECK V.
WITH HERSEY MVR
TURBINE BYPASS ME
AND ER-1 PIT PACK
1 - BROOKS PRODUCTS
MV-480-801-5
PRE-CAST BOX
INSTALL:
1 - 2" HERSEY MVR 160
TUBINE METER
2 - BROOKS PRODUCTS
NO. 65-H 17"X28"
PRE-CAST BOX
1 - 2" FEBCO 805Y
DOUBLE CHECK
VALVE ASSEMBLY
8" FIRE (BY OTHERS)
C
B
A
10
10+00
LINE 6
INSTALL 8" WATER
M-2 SOUTH
19+00
M-3
INSTALL SEE SHEET
LINE 4
8" WATER
LINE 6 STA. 11+10.00 =
PAV. STA. 11+10.00
INSTALL:
1 - 8" X 6" ANCHORING FH TEE
1 - 6" GATE VALVE/BOX
24 LF 6" WATER
1 - FIRE HYDRANT
CONCRETE BLOCKING
LINE 6
PAV. ST
INSTALL
1 - 2" F
SER
ADDISON

HUITT-ZOLLARS file

Huitt-Zollars, Inc. / 3131 McKinney Avenue / Suite 600 / LB 105 / Dallas, Texas 75204-2489 / 214/871-3311 / FAX 214/871-0757

November 18, 1996

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

RE: Addison Circle Phase I Public Infrastructure
Sight Visibility Modern Roundabout
HZI Project No. 01-1822-04

Dear John:

As requested, we have asked our roundabout consultant, Peter Doctors, to review the roundabout with respect to the current placement of buildings in Phase I and the proposed placement of buildings in Phase II of Addison Circle. Per the enclosed letter and sketch, Ourston and Doctors has concluded that the placement of a building on the right-of-way line does not violate sight requirements.

At the same time we asked Ourston and Doctors to review the other proposed elements within the roundabout for compliance with visibility requirements. Peter provided us with a sketch which indicates the zones that are to be kept clear below 6 inches and 25 inches.

After reviewing the guidelines for visibility and transferring the sight triangles to our plans we believe that some small modifications are prudent. The inside row of tree pits nearest the curb in the roundabout currently includes under-planting of Dwarf Yaupon Hollies. The Yaupons violate the not greater than 6" triangles at four locations. From an aesthetic perspective, the landscape architect has recommended that all hollies in the roundabout be deleted and replaced with groundcover as opposed to partial deletion of the hollies. It is our opinion that the 12" high tree fence is not an obstruction in the 6" triangle because of the gap in the fence, therefore, they will remain as designed. The 35" high sight triangle is not a factor since the hollies are being replaced with groundcover. All red oaks will be planted around the circle as planned since they are no more imposing than obstructions such as light posts and bridge columns which are allowed in the sight triangles.

The letter also states that no landscaping greater than 35" is allowed in the center medians on the approach roadways. A review of the roundabout design guide states that higher elements are allowed such as light poles, bridge columns or sign posts. As stated above, we believe that the planned red oaks are less imposing than a bridge column and therefore may be planted in the center islands as designed.

G:\PRO\01182204\JB1107.LTR

In addition, we have reviewed the questions and comments in your letter dated October 28, 1996 which transmitted a copy of the 1986 Australian manual on roundabouts. In general, this manual is somewhat dated because so much has been learned about the design and operation of modern roundabouts with their proliferation over the last 10 years. However, there is nothing specifically outdated about Table 2.1 and as the table suggests, the choice of a roundabout at Addison Circle was made on a site-specific basis by experts in the field. Figure 4.7 is not particularly detailed in its criteria and Ourston & Doctors have applied more detailed criteria for visibility using the figures enclosed. Chapter 8 seems to be written from a rural highway perspective (mountable curb? no trees near roadway?) placing all of its emphasis on the vehicle and none on the pedestrian experience (or safety). While its overall message of care to preserve visibility in the design is valid, its examples do not seem appropriate given the location and conditions of the Addison Circle Roundabout.

Please call if you have any questions.

Sincerely,

HUITT-ZOLLARS, INC.

Andrew C. Oakley, P.E.
Senior Vice President

ACO/psp

Enclosure

cc: Bryant Nail - Columbus Realty Trust
Paul Shaw-Newman, Jackson & Bieberstein

Ourston & Doctors
MODERN ROUNDABOUT INTERCHANGES

November 6, 1996

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

SIGHT DISTANCE ANALYSIS

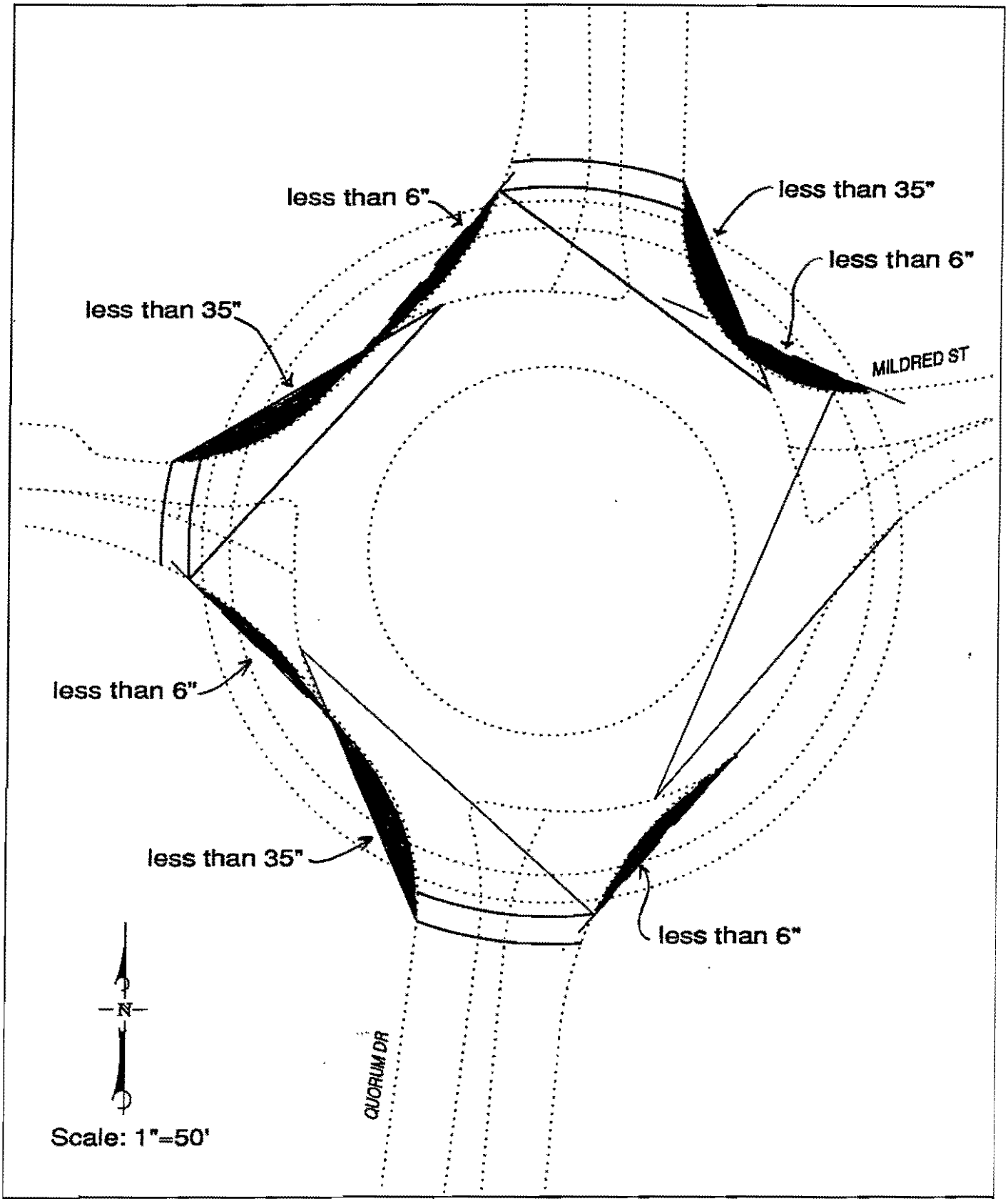
Pursuant to your request, we have completed a sight distance analysis for the areas adjacent to the roundabout to determine if a building facia can be within 30 feet of the inscribed circle diameter (ICD). Indicated on the attached diagram are areas of landscaping of less than 35 inches and 6 inches. In addition to these slivers of limited height obstructions, the splitter islands must not have any landscaping greater than 35 inches. We see no reason why a building could not be at the proposed location on the south east corner.

Attached to this report are the sight distance requirements set forth in *Roundabout Design Guidelines*, Ourston & Doctors, 1995. These requirements are derived from British manuals on roundabout design which we have used in all our designs. The sight distance requirements referenced by John R. Baumgartner, P.E. are not current with British practice. The British have studied this "sight triangle" approach to sight distance and found that the increase in sight distance has a negative effect on safety. Excessive visibility at entry only promotes higher entry speeds. We have seen at least one case of this here in California.

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



Ourston & Doctors

MODERN ROUNDABOUT INTERCHANGES

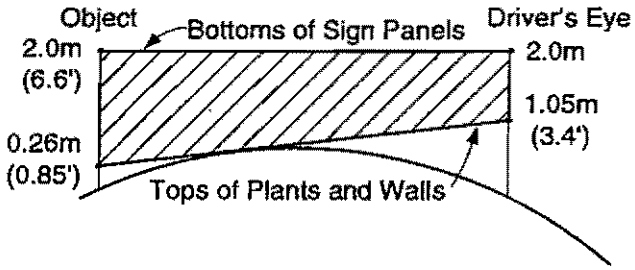
5290 Overpass Road #212 Santa Barbara, CA 93111

Site Distance Evaluation

Addison Roundabout

11/05/96

Figure 7/20b
Vertical Visibility Envelope, All Other Visibility



Signs in these areas should be mounted not less than 2.0 meters above the roadway surface. The envelope should be checked on site if there are changes in gradient.

Visibility to the Left

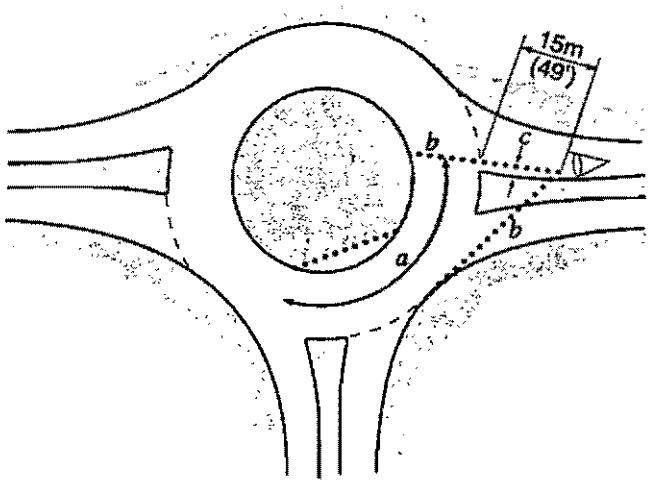
Drivers of all vehicles approaching the yield line should be able to see the full width of the circulatory roadway to their left, from the yield line for a distance appropriate to the stopping sight distance for circulating traffic, measured along the centerline of the circulatory roadway, as indicated in Table 7/2.

Table 7/2
Roundabout Visibility

Inscribed Circle Diameter		Sight Distance	
(Meters)	(Feet)	(Meters)	(Feet)
<40	<131	Whole Int.	Whole Int.
40-60	131-197	40	131
60-100	197-328	50	164
>100	>328	70	230

This sight distance should be checked from the center of the left lane at a distance of 15 meters (49 feet) back from the yield line, as shown in Figure 7/20c. Checks should be made that poor crossfall design or construction and sign location do not restrict visibility.

Figure 7/20c
Visibility to the Left Required at Entry



LEGEND

a Sight distance related to circulatory speed, as given in Table 7/2.

b Sight line.

c Half-lane width.

Area of circulatory roadway over which visibility should be obtained from viewpoint ◁.

In some circumstances excessive forward visibility at entry or visibility between adjacent entries can result in approach and entry speeds greater than desirable for the intersection geometry. Considcration should be given to limiting visibility by the selective use of landscaping. Visibility to adjacent entries may be limited to the visibility from 15 meters (49 feet) back on the approach, and the visibility along the approach may be limited to the stopping sight distance for the design speed of the approach.

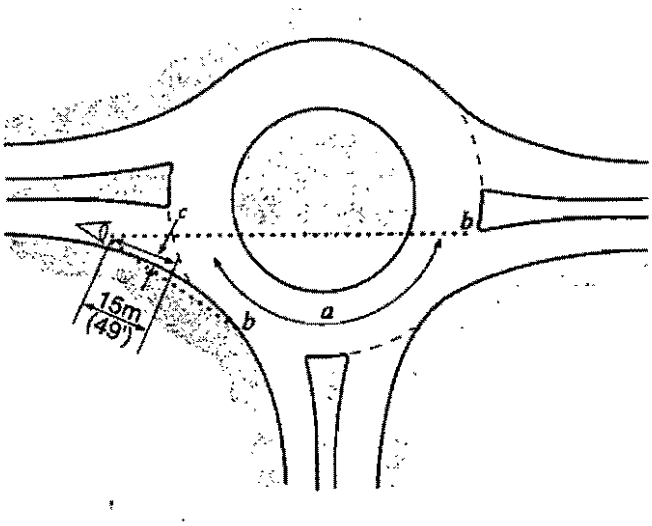
Forward Visibility at Entry

Drivers of all vehicles approaching the yield line should be able to see the full width of the circulatory roadway ahead of them for a distance, measured along the centerline of the circulatory roadway, appropriate to the size of the roundabout

as indicated in Table 7/2. The visibility should be checked from the center of the right lane at a distance of 15 meters (49 feet) back from the yield line as shown in Figure 7/21.

Figure 7/21

Forward Visibility Required at Entry



LEGEND

a Sight distance related to circulatory speed, as given in Table 7/2.

b Sight line.

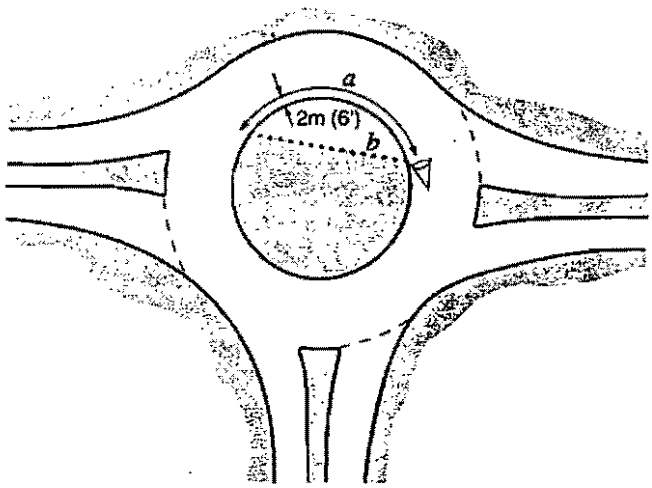
c Half-lane width.

Area of circulatory roadway over which visibility should be obtained from viewpoint ◁.

surface treatment. In these situations limited penetration into the visibility envelope by vegetative growth of a dispersed nature would be acceptable.

Figure 7/22

Circulatory Visibility



LEGEND

a Sight distance related to circulatory speed, as given in Table 7/2.

b Sight line.

Area of circulatory roadway over which visibility should be obtained from viewpoint ◁.

Circulatory Visibility

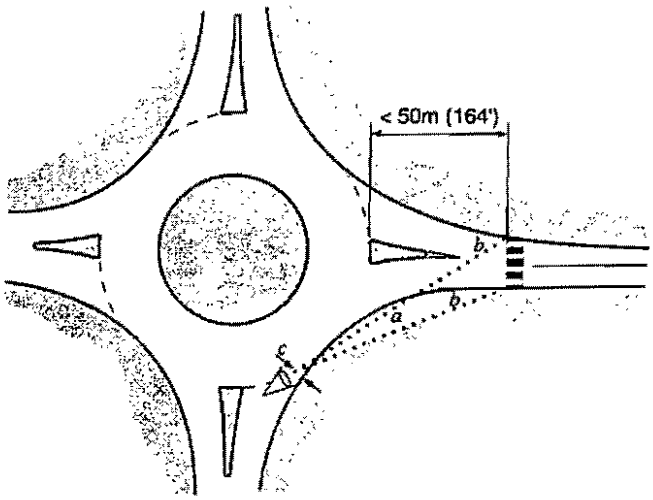
Drivers of all vehicles circulating on a roundabout should be able to see the full width of the circulatory roadway ahead of them for a distance appropriate to the size of roundabout, as indicated in Table 7/2. This visibility should be checked from a point 2 meters (6 feet) in from the central island, as shown in Figure 7/22. It is often useful to improve the conspicuity of central islands by the use of landscaping, but this could obstruct circulatory visibility. The circulatory visibility envelope will encroach onto the height of vegetation or

Pedestrian Crossing Visibility

Drivers approaching a pedestrian crossing across an entry should have a minimum sight distance to the crossing equal to the desirable stopping sight distance for the design speed of the approach link road (Table 7/1). At the yield line drivers of all vehicles should be able to see the full width of a pedestrian crossing across the next exit if the crossing is within 50 meters (164 feet) of the roundabout (Figure 7/23). However, in urban areas adjacent roadside development may prevent this sight triangle from being fully established.

Figure 7/23

Visibility Required at Entry to Pedestrian Crossing at Next Exit



LEGEND

- Minimum area over which unobstructed visibility is required from viewpoint ◁ when crossing is within 50 meters (164 feet) of exit.
- Sight line.
- Half-lane width.

Visual Intrusions

Signs, plantings, and other raised objects should not be placed within the visibility envelopes so as to obstruct visibility, but infringements by isolated slim projections such as lamp columns, sign supports, or bridge columns can be ignored provided they are less than 550 millimeters (1.8 feet) wide. The only exception to this will be the positioning of low KEEP RIGHT signs on splitter islands and chevron boards on central islands. Where possible, walkways should be located outside visibility envelopes. Where this is not possible, care should be taken to minimize the effects of pedestrians on visibility requirements.

Visibility at Interchanges

Where roundabouts are above the main through route, it is most important to provide visibility at the off-ramp entries. Layouts should be checked at the initial design stage to ensure that entry visibilities will not be obstructed by bridge railings or walls. Cross hatching on the outside of roundabouts can be used to advantage to improve the situation where visibility for traffic entering from off-ramps is limited. If a roundabout is on the lower level, the bridge abutments should be set back to provide the recommended visibilities at the off-ramp entries. Restricted sight distances of this nature at entries may generate delays and reduce safety. It is important that the yield line is clearly visible to approaching drivers and is not obscured by a vertical curve in the road surface. This can be achieved by the provision of a short length, say 10 meters (33 feet), of level approach road immediately prior to the yield line.

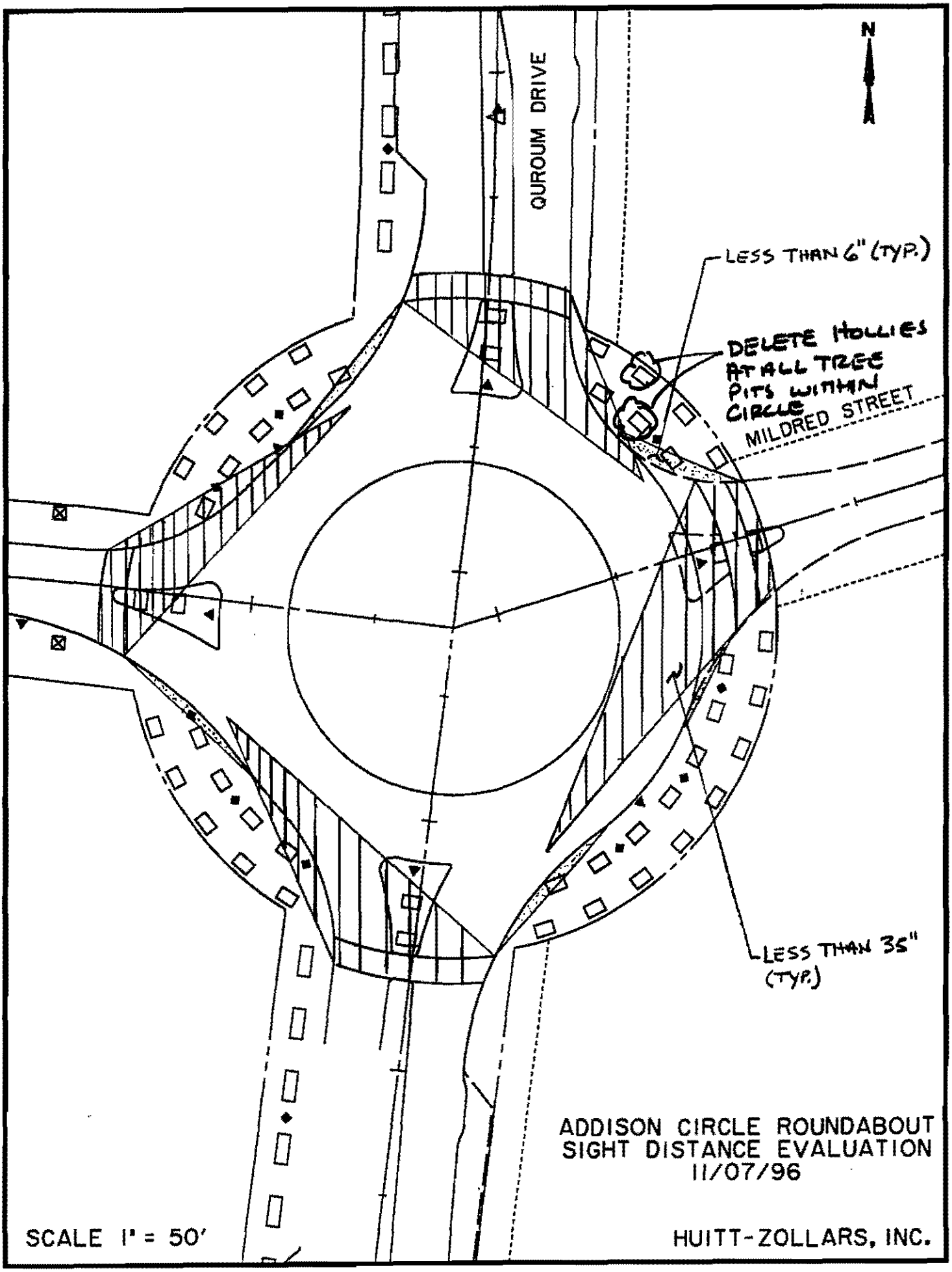
Circulatory Roadway

If possible the circulatory roadway should be circular, avoiding tight bends as shown in Figure 4/1. The width of the circulatory roadway should not exceed 15 meters (49 feet). The largest inscribed circle diameter (ICD) for a mini-roundabout should be 28 meters (92 feet).

The width of the circulatory roadway should be constant. It should be between 1.0 and 1.2 times the maximum entry width. However, see Figure 7/24a if small inscribed circle diameters are contemplated.

It is normal practice to avoid short lengths of reverse curve between an entry and an adjacent exit by linking these curves or joining them with a tangent between the entry curve and the exit curve. One method is to increase the exit radius. However, where there is a considerable distance between the entry and the next exit, as at 3-entry roundabouts, reverse curvature may result (Figure 7/20c).

There may be situations where the turning proportions are such that one section of circulatory roadway will have a relatively low flow. In this case there may be an over provision in circulatory roadway width and an area of roadway, usually adjacent to an entry deflection island, becomes


N
QUROUM DRIVE
LESS THAN 6" (TYP.)
DELETE HOLLIES AT ALL TREE PITS WITHIN CIRCLE
MILDRED STREET
LESS THAN 35" (TYP.)
ADDISON CIRCLE ROUNDABOUT
SIGHT DISTANCE EVALUATION
11/07/96
SCALE 1" = 50'
HUITT-ZOLLARS, INC.

File

[redacted]

More than a home --
It's a new hometown.

TOWN OF
ADDISON

Gaylord Properties, Inc.

[redacted]
REALTY TRUST

We cordially invite you to attend
the groundbreaking ceremony
of Addison Circle

Intersection of Mildred Street and Quorum Drive
Addison, Texas

Monday, January 8, 1996, 12:30 p.m.

Reception immediately following ceremony
Addison Conference and Theatre Centre

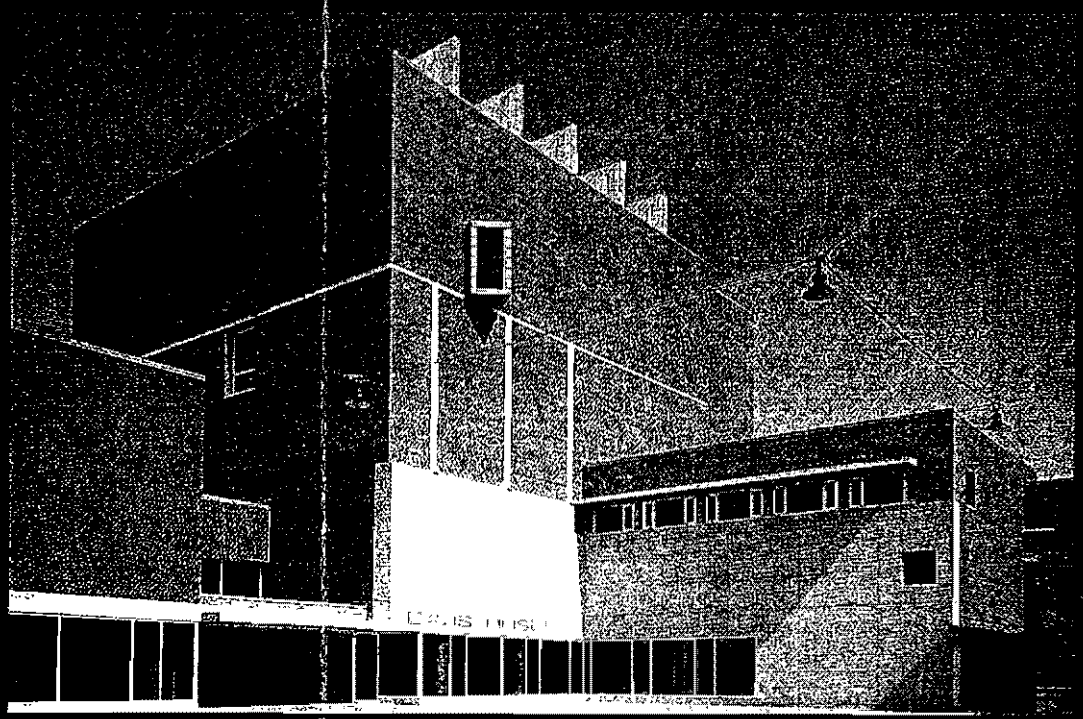
Please R.S.V.P. by December 29 to 770-5566

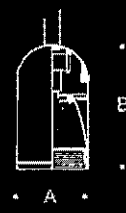
Supplement to
Catalog Number Six

BEGA

File
Addison Circle

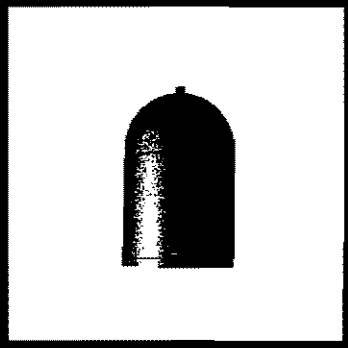
Luminaires for Cable or Stem Supension

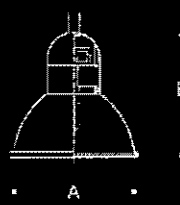




Die cast aluminum housing with step baffle and clear tempered glass. Full specular anodized aluminum reflector.
Color: Black or white.

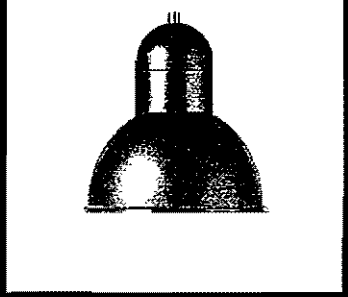
	Lamp	Lumen	A	B
6188	1 100W A-19	1750	6	11¼
6188P	1 13W PLC	875	6	11¼
6189	1 150W A-21	2850	8¾	13⅝
6189M	1 50W E-17 MV	1575	8¾	13⅝
6189S	1 70W E-17 HPS	6400	8¾	13⅝
6189MH	1 100W E-17 MH	8500	8¾	13⅝
6191S	1 150W E-17 HPS	16000	11¾	18¾
6191MH	1 175W E-17 MH	14000	11¾	18¾

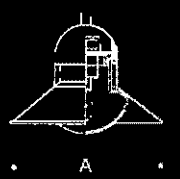




Die cast aluminum housing with specular anodized aluminum reflector. Clear tempered glass.
Color: Black.

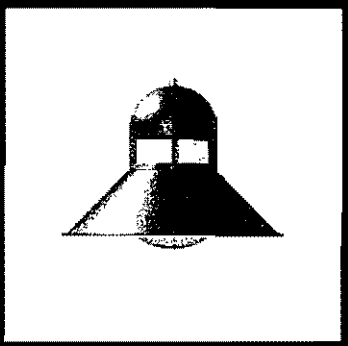
	Lamp	Lumen	A	B
6406P	1 18W PLC	1250	10¾	11¾
6408	1 150W A-21	2850	15	17
6408M	1 50W E-17 MV	1575	15	17
6408S	1 50W E-17 HPS	4000	15	17
9498S	1 70W E-17 HPS	6400	20¾	20½
9498MH	1 100W ED-17 MH	8500	20¾	20½

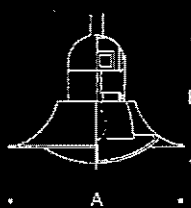




Die cast aluminum housing with additional top light output. Three-ply opal glass. Optional white polyethylene diffuser available - suffix: PD.
Color: Black.

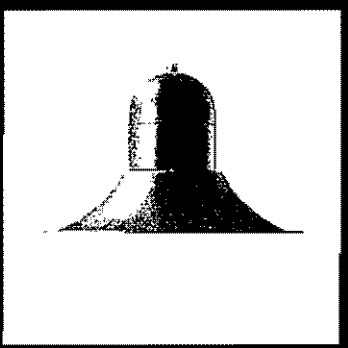
	Lamp	Lumen	A	B
9484	1 150W A-21	2850	25½	16½
9484S	1 50W E-17 HPS	4000	25½	16½
9484MH	1 100W ED-17 MH	8500	25½	16½

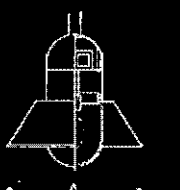




Die cast aluminum housing with rotatable, dual reflector asymmetrical optical system. Acrylic lens.
Color: Black.

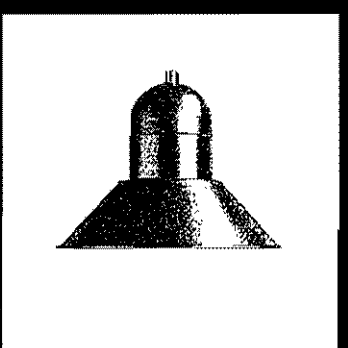
	Lamp	Lumen	A	B
9166	1 150W A-21	2850	19⅝	15
9166M	1 50W E-17 MV	1575	19⅝	15
9559S	1 100W E-17 HPS	9500	26⅝	19½
9559MH	1 100W ED-17 MH	8500	26⅝	19½





Die cast aluminum housing with heavy aluminum shade. Three-ply opal glass. Optional white polyethylene diffuser available for 9437 and 9471 - suffix: PD.
Color: Black.

	Lamp	Lumen	A	B
6412	1 60W A-19	890	10¼	10¼
6412P	1 13W PLC	860	10¼	10¼
6110	1 100W A-19	1750	17½	15¾
6110S	1 50W E-17 HPS	4000	17½	15¾
6133S	1 100W E-17 HPS	9500	23⅝	19¾
6133MH	1 100W ED-17 M	8500	23⅝	19¾



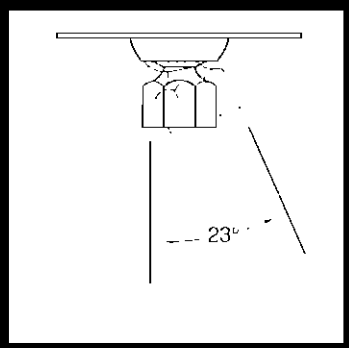
BEGA 1005 Mark Avenue, Carpinteria, CA 93013 (805)684-0533 FAX(805)684-6682

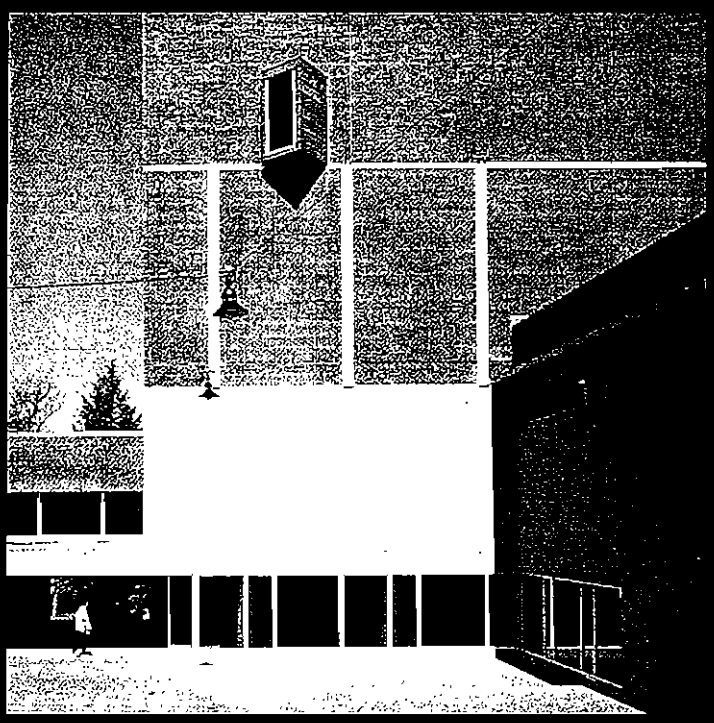
Cable or Stem Suspension

The luminaires included in this brochure may be fitted for suspension from stretched cable systems using the BEGA #477 cable hanger. or stem pendant mounted with "hang straight" swivel.
These enclosed luminaires may be used for interior spaces or outdoor under canopies, overhanging roofs, in passages or on open structures where the luminaires must be resistant against corrosion, water, dust and insects.
U.L. listed, suitable for wet locations.
Note: When installed in the open, luminaires must be protected against excessive pendulum movement due to wind.

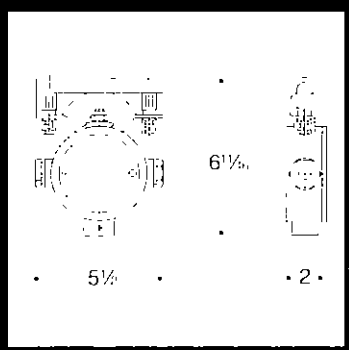
There are additional luminaires for cable or stem suspension on the back page of this brochure. Matching wall mounted and pole mounted luminaires can be found in the BEGA Catalog #6.
These luminaires can be supplied in custom colors on special order.

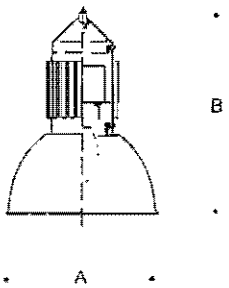
Pendants are provided with stems manufactured to specified lengths and are supplied with a heavy duty 23° swivel plate.





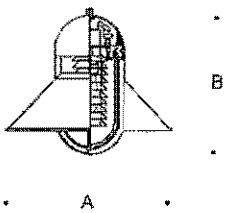
#477 Cable Hanger consists of a through wiring connection box of die cast aluminum with ½" IP stainless steel nipple to support luminaire and stainless steel cable clamp. For cables 3/16" to ½" in diameter and up to 10° off level. Color: Black.



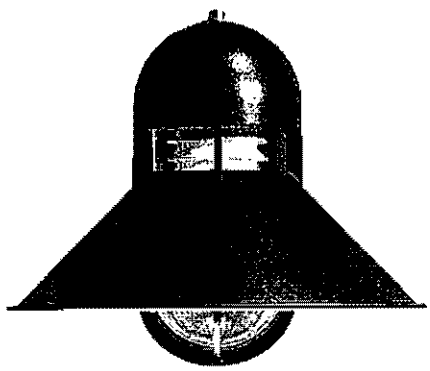


Pendant mounted luminaires with wide beam, round symmetrical light distribution. Die cast aluminum "heat sink" housing/ ballast compartment. Specular anodized aluminum reflector with matte clear anodized outer finish. Clear tempered glass enclosure. Color: Black with natural aluminum. Custom colors can be supplied on special order.

	Lamp	Lumen	A	B
8174S	1 100W E-17 HPS	9500	15	20 1/16
8174MH	1 100W ED-17 MH	8500	15	20 1/16
8175P	5 26W PLC	9000	20 3/4	26
8175S	1 250W E-28 HPS	28000	20 3/4	26
8175MH	1 250W ED-28 MH	22000	20 3/4	26



Pendant mounted luminaires with wide beam, round symmetrical light distribution. Die cast aluminum housing/ballast compartment with additional top light output. Die cast aluminum guard with white louver stack inside clear crystal glass with vertical structure.
Clear polycarbonate plastic available - suffix PD.
Color: Black with inside of reflector painted white. Custom colors can be supplied on special order.



	Lamp	Lumen	A	B
8176S	1 50W E-17 HPS	4000	21 5/8	17 3/8
8176MH	1 100W ED-17 MH	8500	21 5/8	17 3/8

HUITT-ZOLLARS

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

December 12, 1995

Mr. John R. Baumgartner, P.E.
Director of Public Works
Town of Addison
16801 Westgrove Drive
Addison, Texas 75001

Re: Addison Circle Phase I
Huitt-Zollars Project No. 01-1822-04

Dear John:

Pursuant to our telephone conversation this morning, I would like to update you on our progress regarding resolution of issues on the project. As I mentioned when we spoke, my primary focus is on the seven items that were specifically noted as not approved along with the Development Plan when it was tabled at the City Council meeting of November 28th. It is my goal to assure the Council that these issues are being addressed and will be resolved to the complete satisfaction of the City Staff prior to a full building permit being issued. We fully understand that Council approval of the Development Plan is subject to future resolution of these items but are hopeful that such an approval can be received tonight.

1. Streetscape plans.

   We believe our final construction plans will address all of your concerns about pedestrian and vehicular conflicts. Those plans will be complete this week.

2. Paving plan for mews street.

   We have still not resolved the best way to intersect the mews with the other streets but are committed to arriving at a design that both the developer and the Town will be happy with. Final plans will reflect the latest input on this issue from all parties as well as your comments on the pavement itself.

3. Security gates and control devices will be detailed by the architects in their permit set to be submitted this week.

4. Landscape Architectural contract documents for the public work will be complete by early next week. We understand that Newman, Jackson, Bieberstein is meeting with Slade Strickland as the design develops to be sure that his goals are being met.

5. The master street plan for the district is a combination of the concept plan and the typical

street sections in the ordinance. The final concept plan should reflect resolution of dead-end streets and other concerns you have expressed. It this is not the case, please let us know specifically what you would like to see and we will prepare it.

6. The Master Drainage and Utility plans for the District have been revised per your latest comments and will be transmitted with the final plans this week. We have removed all references to "by others".

7. The final (physical) design for the roundabout is included in the construction plans. The support for this design is contained in the study which was previously submitted. Our response to some of the comments on the study are enclosed herein, however, Peter Doctors will not have the information on the revised level of service until later today or tomorrow.

I know that as of our plan review meeting of November 21st there seemed to be a great many items yet to be addressed. However, I did not then, and do not now, feel that we are in disagreement on the resolution of many, if any, of those items. This is a very complex project for which the standards are being developed at the same time as the final design and we are therefore taking a lot of time to be sure that the appropriate standard is established in Phase I for the remainder of the district. When we met on November 21st, the plans consisted of 66 sheets. They have expanded to over 120 sheets for additional clarity and detail yet we have still not completely addressed every issue. We are, however, committed to doing so and are confident that you will be pleased with the results. Toward that end, I am enclosing draft copies of the responses to your various review memos and other comments that will, in their final form, accompany the plans for your review later this week. I offer these at this time, even though they are incomplete, as an indication of our continued work and progress toward full resolution of all issues.

Sincerely,

HUITT-ZOLLARS, INC.
Engineering/Architecture

Andrew C. Oakley, P.E.
Senior Vice President

ACO/psp

cc: Bryant Nail - Columbus Realty Trust
Carmen Moran - Town of Addison

G:\PROJ\01182204\JB1212.LTR

ADDISON CIRCLE
RESPONSE TO CITY REVIEW COMMENTS IN MEMO DATED SEPTEMBER 5, 1995
FROM JOHN BAUMGARTNER

1. *Utility and Drainage:*

   A. *A water and sanitary sewer study prepared by a professional engineer is necessary to verify the adequacy of the proposed system. This study shall include all property included in the approved concept plan and its respective drainage basin.*

   The water and sanitary sewer study has been prepared and reviewed by City Staff- See separate response to review comments.

   B. *A storm-water study prepared by a professional engineer is necessary to verify the adequacy of the system. As a minimum this study shall include all property included in the approved concept plan and its respective drainage basins.*

   The storm-water study has been prepared and reviewed by City Staff - See separate response to review comments.

   C. *Storm drainage system shall be extended to provide for the properties north and west of the proposed development. The design engineers shall demonstrate that the downstream system has sufficient capacity for the 100-year storm event or provide storm water detention.*

   Done and addressed in study.

   D. *The sanitary sewer shall be extended to provide service to the properties north and west of the proposed development.*

   Done and addressed in study.

   E. *No residential water, irrigation, or fire sprinkler service is available from the transmission mains in Quorum and Mildred.*

   Acknowledged - Plans reflect this limitation.

   F. *A sewer line extension is necessary to provide service to the properties on the northwest and southwest corners of Mildred and Quorum.*

   Done and reflected on plans.

   G. *The actual location within the road right-of-way of the various utilities will be determined at the time of development. These locations must provide for the installation of private utilities (electric, gas, telephone, fiber, television, etc...) with franchise or license agreements.*

Acknowledged and reflected on plans.

H. *Additional utility and storm drainage easements are required.*

Shown on Plat and Plans.

I. *What happens with the storm drainage east of the rotary? Does it affect the existing residence on the northwest corner of the tollway and railroad?*

There is no effect on the existing residence.

2. *Quorum Drive:*

A. *A design report should be provided that details the appropriate roadway geometrics, traffic control, markings, signage and parking for the proposed rotary prior to finalizing the lot layout. See the attached review provided by Barton Aschman.*

Plans now indicate all elements of the roundabout necessary for its construction and operation as dictated by the study.

B. *The street section should be revised to reflect the minimum roadway dimensions indicated in the ordinance which provides for two 11 foot lanes and an 8 foot parking lane from face of curb to face of curb.*

Done and reflected on Plans.

C. *Quorum Drive is currently identified as a major arterial on the thoroughfare plan. The developer should provide evidence from his traffic consultants to verify the proposed revision to the plan.*

The changes to Quorum Drive do not preclude its use as a major arterial and our plans neither contemplate nor address such a revision to the thoroughfare plan. The level of service provided by the introduction of the roundabout is consistent with arterial operation.

D. *The additional right-of-way required for Quorum Drive corridor should be dedicated with Phase I from the railroad to the northern district boundary. Because this development is the first phase of a multi-phase project, this corridor is necessary for utilities and possible roadway expansion.*

Due to the complex arrangements of the partnership between Gaylord and Columbus, the dedication of all right-of-way for Quorum Drive at this time is not possible. However, the dedication of easements for utility, landscape, sidewalk and related purposes over the future R.O.W. area is possible and has been reflected on the final plat and plans.

E. *Ingress, egress, and parking shall be situated so they do not interfere with the operation of the rotary. Additional design information is required to determine the appropriate location.*

Done - Refer to Roundabout Study and Final Design.

3. *Residential:*

A. *All streets shall be designated by a name or number.*

Done and reflected on Plat and Plans (Currently as numbers-names are pending).

B. *If some of the property accessing the proposed streets is not residential, alternative cross sections are required.*

All property accessing the residential streets in Phase I is residential with the exception of some ground floor retail near Quorum Drive which was contemplated by the ordinance. No office buildings or other major deviations exist.

C. *With the exception of the double parking where people were moving into apartments and the parking in the neck-down areas, we were comfortable with the residential street widths of 37 feet from back of curb to back of curb with neck-down areas at intersections being 23 feet (back to back). However, this assumes the appropriate radius is provided for emergency/service vehicles and street lights, furniture, trees, etc., are set back sufficiently to avoid any conflicts with turning vehicles and visibility at the intersections.*

35' visibility triangles and 30' radii provided have been coordinated with City fire officials.

D. *Where the residential streets dead-end, provisions should be made to provide a vehicular turnaround until the roadway are continued.*

Done and shown on plans for Phase I and Concept Plan for future phases.

4. *Mew's:*

A. *If the mew's are going to be dedicated as public streets then a standard curb and gutter section is recommended to control traffic and drainage. As a compromise, a section with a roll up curb may be acceptable.*

See Below

B. *The current cross-section proposed in the preliminary constructions plans does not match the concept plan cross-section. Has this changed? Please revise as necessary.*

The inverted, curbless section for the mews has now been recommended for approval by staff and P & Z. The final plans reflect this cross-section. (See further discussion under later comments). Council action is pending.

5. *Mildred:*

   A. *The approved concept plan does not reflect a reduction in Mildred's cross-section to approximately 60 feet. This reduction appears inconsistent with the current use of the street and will limit our ability to add additional parking or lanes if the demand warrants at the approach to the rotary.*

   The 61' (B-B) section for Mildred has now been recommended for approval by staff and P & Z. Council action is pending.

   B. *If the reduced cross-section is approved, the relocation of the existing 24" waterline is required.*

   The 24-inch waterline is being relocated.

   C. *Ingress, egress and parking adjacent to the rotary shall be located so that they do not interfere with the operation of the rotary. Additional design information is required to determine the appropriate location.*

   Refer to Roundabout Study and Final Design.

6. *Alternate material for brick accents bands, crosswalks, sidewalks, streets, etc..., should be considered. In the past, the Town has successfully used patterned concrete or pave stone (placed on a concrete base) to give an appearance of brick with more durability, serviceability, and less susceptibility to settlement.*

   It has been the developer's and the designer's opinion that certain materials, such as brick and granite cobbles, impart a more established feel to the urban environment that helps keep the project from looking so new and "manufactured". Pavestone-type products are not as compatible with the intended feel of this district and patterned concrete has its own set of maintenance and durability problems. Therefore, the chosen accent paver material is (clay) brick, with different ratings for pedestrian and vehicular applications.

7. *Vehicular visibility should be provided for all streets, mews and driveway approaches/intersections.*

   The required 35' visibility triangles have been honored at all public street intersections, including the mews. As we have discussed, garage exits with limited visibility onto the streets is a common urban issue and will be dealt with in the architectural plans using signage, gates, lights, mirrors and other typical mechanisms for pedestrian safety.

8. *Miscellaneous Plat:*

   A. *Lot 1 Block "B" does not meet the minimum lot width of 200 feet required in the concept plan ordinance.*

      Variance recommended by P & Z. Council action is pending.

   B. *Additional right-of-way is required to provide sufficient sidewalk width at the street-street and street-mew intersections.*

      Based on the final design, the only location that additional width may be required is at the southwest corner of Mildred and Quorum on the Town's (future) property.

9. *Private Utilities:*

   A. *Provide details regarding the location and access to the TU facilities serving the district.*

      Complete construction plans for the T.U. Electric facilities to serve Phase I of the district are included in our submittal.

   B. *Provide sign-off from private utilities to approval of easements and cross-sections for the district.*

      Letters we have received from the franchised utility companies concerning their need for facilities within the district are enclosed. Note, however, that telephone and CATV service throughout the district will be handled by a secondary provider who will install his own duct system under license agreement.

10. *Preliminary Construction Plans:*

   A. *Provide additional information from rotary consultant regarding markings, parking, signage, transitions associated with the Quorum/Mildred intersection.*

      Refer to Roundabout Study and Final Design.

   B. *Provide details and design information regarding bricks/pavers being considered for use in the public open space. Of particular concern is the hardness, durability and friction provided by the proposed material. This report shall be prepared by a professional engineer and submitted to our design consultants for review and recommendation.*

      Test results on the pedestrian brick are enclosed for your review. Test results on the vehicular brick are pending.

C. *Additional material submittals may be required prior to bidding for review of street lights, furniture, etc...*

Catalog cuts and other details are enclosed herein or included in the plans for the following streetscape elements.

Benches
Street Lights
Trash Cans
Tree Grates
Tree Fences
Bollards

D. *Pavement marking/signage plan is required for the roadway and parking areas.*

Pavement markings and signage are shown on the final plans as follows:

Signs are indicated individually
Striping is indicated by typical detail

E. *Sidewalk eyebrows are required at the intersection of the mews with Mildred and the residential streets. This provides protection of the site visibility areas and turning radii for commercial and emergency vehicles.*

Raised neckdowns (or sidewalk eyebrows) have not been used because they negatively impact the street hierarchy that the urban designers are trying to establish. However, a brick pattern flush with the driving lanes which delineates the clear zone, coupled with a "No Parking" sign on each side of the intersection is proposed.

F. *Site visibility areas shall be protected from encroachment at all intersections and driveways. The minimum requirement calls for a 35' visibility triangle in some cases additional protection may be necessary. This requires revision to the proposed buildings and the starting location of the parking.*

Done and reflected on plans. (Note: Showing the visibility triangles on every intersection cluttered up the plans and is of no use to the Contractor so the lines have been deleted).

G. *Provide details regarding loading and unloading of deliveries for commercial property, household furnishings, etc... The current preliminary plans do not seem to provide for these elements.*

Final plans reflect areas to be marked as loading zones.

H. *Our current ordinance requires hydrant spacing of 300 feet in retail/commercial areas and 500 feet in residential areas. Hydrant spacing and location requires the*

approval of both the Fire Department and Public Works Department.

Our general approach to the urban center district is that all of the property is commercial for the purposes of fire coverage and similar issues. Though we refer to "residential" streets, these are not residential in the traditional sense. Therefore, our goal is to achieve approximately 300 foot fire hydrant spacing. However, the block lengths are such that the usual positioning of fire hydrants at intersections results in some cases of slightly over 300 foot spacing. Considering the fact that all structures are sprinklered, we felt it would be excessive to add mid-block fir hydrants. We can do so if the fire marshall believes it is necessary.

I. *The proposed plans seem to encumber property owned by others to provide service to this district. Particularly Building "B" and the provisions for TU Electric and drainage.*

The encumbrance to City property for transformer access to building B has been eliminated. The storm sewer line west of building B serves primarily to collect the runoff from the City property and is located to provide for your future use without physically encumbering other uses of the property. Easements are indicated as required.

J. *Are the plans for the public space enhancement within the rotary consistent with the existing and proposed utilities?*

All existing and proposed utilities have been routed around the central island of the roundabout except the 24-inch waterline. If the waterline must be moved to accommodate the central feature, the plans can be modified.

K. *What are the plans for trash collection?*

The procedures for trash collection have been described in separate correspondence to your environmental official. Our plans reflect thickened pavement in the areas adjacent to the compactors as requested.

L. *Drainage from the buildings and mews shall be collected prior to entering the streets.*

A complete system of downspouts and private collection pipes is proposed in the "onsite" civil drawings to capture roof drainage. Without this contribution of runoff from the buildings, the mews generate between 0.7 & 2.5 cfs of runoff in a 100 year event. We did not feel that these flows justified the addition of 4 inlets and pipes at the four entrances to the mews, however, they can be added if you prefer.

M. *A more detailed utility plan is required.*

Done and included in plans.

N. *The minimum curb return radii for fire vehicles is 30 feet. Variances to this requirement are approved by the Fire Department.*

All curb radii (or theoretical turning radii where no continuous curb exists) have been increased to 30 feet.

O. *It is necessary to recess the inlets in the parking areas to prevent encroachment of the parking in the traffic lanes.*

The primary purposes of recessed inlets are the increase in capture that they allow and the area they provide outside the driving lane for the concentrated depth of flow. They are a suburban thoroughfare-type detail and are not used in highly urbanized areas, particularly with parallel parking and significant pedestrian activity. whether the inlets are recessed or not will not affect how cars are parked. We believe that recessed inlets in this environment are a hazard to pedestrians and those that are getting out of vehicles. We therefore recommend and have designed standard curb inlets throughout Phase I, except along the portions of Quorum Drive where there is no parallel parking.

P. *The minimum throat width for the residential streets shall be 23 feet back to back.*

Shown on plans.

Q. *It was our understanding that significant portions of the mews is going to have a brick overlay. In addition, some areas of the residential streets Mildred and Quorum were going to be brick enhancements. Has this changed?*

The mews have substantial areas of brick while the remaining streets have only brick crosswalks and sidewalks.

R. *The cross-sections do not seem to provide for all licensed utilities and any additional private utilities (i.e., private electric, cable and communications between buildings "A" and "B"). What is the status of additional private utilities?*

A sleeving plan for private utilities will be included in the onsite civil plans and its installation will be coordinated with the public contractor. (License agreements are being handled by Columbus' attorney).

S. *Turn lane on Quorum requires 150 feet of storage, 150 feet of transition and a width of 11 feet.*

Done and shown on plans.

T. *What is the status of the landscaping, irrigation and street treatment plans?*

Full streetscape plans are included in this submittal. Planting and irrigation plans are nearing completion and will be submitted for Slade Strickland's review on

December 18th.

U. *Additional drainage information is required to verify inlet/line locations and sizes.*

Done

V. Inlets are required uphill from the intersection of Quorum and Mildred to eliminate stormwater runoff in the rotary.

Done

W. *What are the plans for Mildred east of Quorum? Would it be advisable to add to the rotary during the next phase rather than installing barricades today?*

Plans have been changed to reflect a closed rotary to the east so that no barricades will be required.

X. *Fire hydrants and gate valves are required at the end of all water lines.*

Done

Y. *Insufficient vehicular visibility is provided at all garage motor court entrances and several street intersections.*

See response to #7.

Z. *Retail use and driveway access may not be consistent with the existing or proposed use of Mildred Street. This is an issue that will be addressed on the development plan.*

No Comment

AA. *The boiler plate construction contract requires the review of our City Attorney. Of particular concern are issues regarding the assignment of the agreement to Columbus insurance coverage, additional insured's, etc...*

Acknowledged

BB. *The sidewalk pavers/bricks shall have a concrete base. This is not provided for in the current cross-sections.*

All sidewalks are now shown with a concrete base.

CC. *Additional water valves are necessary to provide for proper isolation in the event of a line break.*

Done

DD. Provide street lighting plans. Show the proposed location of lights, transformers and switch gear.

Street lights are shown on the streetscape plans. Switchgears and transformers are shown on the electrical duct plans. The connection between the street light runs and the transformers is dependent upon T.U. Electric's proposed circuitry which has not yet been developed. (T.U. also needs to comment on the handhole locations and other aspects of the conduit routing). We have not asked T.U. to perform this design work yet because of the possibility that the system will be owned by the City.

11. Additional review is necessary upon submittal of the required information.

Acknowledged

ADDISON CIRCLE
RESPONSE TO CITY REVIEW COMMENTS IN MEMO DATED OCTOBER 16, 1995
FROM JOHN BAUMGARTNER

1. *Utilities and Drainage:*

   A. *The master utility and drainage reports require refinement and resubmittal. Comments sent to Huitt-Zollars under separate cover on 10/11/95.*

      Done - See separate response to those comments.

   B. *Storm drainage system shall be extended to provide for the properties north and west of the proposed development. The design engineers shall demonstrate that the downstream system has sufficient capacity for the 100-year storm event or provide storm water detention.*

      Done

   C. *No residential water, irrigation or fire sprinkler service is available from the transmission mains in Quorum and Mildred.*

      Acknowledged

   D. *A sewer line extension is necessary to provide service to the properties on the northwest and southwest corners of Mildred and Quorum.*

      Done and shown on plans.

   E. *The actual location within the road right-of-way of the various utilities will be determined at the time of development. These locations must provide for the installation of private utilities (electric, gas, telephone, fiber, television, etc...) with franchise or license agreements.*

      Acknowledged

   F. *Additional utility and storm drainage easements are required.*

      Shown on plat and plans.

   G. *What happens with the storm drainage east of the rotary? Does it affect the existing residence on the northwest corner of the tollway and railroad?*

      No effect.

   H. *All dead-end wastewater lines shall have clean outs or manholes and all dead-end water lines shall have fire hydrants.*

Done

I. *Storm sewer inlet is proposed on property used for Town's water tower. This will encumber this property and requires approval by the Town.*

See comment #10I on September 5th memo. This item was recommended for acceptance by P & Z at their November 21st meeting subject to staff approval of final plans.

2. *Quorum Drive:*

A. *A design report should be provided that details the appropriate roadway geometric, traffic control, markings, signage, lighting and parking for the proposed rotary prior to finalizing the lot layout. See review provided by Barton Aschman.*

Report has been submitted and reviewed. See separate response to comments and final design.

B. *The street section should be revised to reflect the minimum roadway dimensions indicated in the ordinance which provides for two 11 foot lanes and an 8 foot parking lane from face of curb to face of curb.*

Done

C. *Quorum Drive is currently identified as a major arterial on the thoroughfare plan. The developer should provide evidence from his traffic consultants to verify the proposed revision to the plan.*

See Item #2C on September 5th memo.

D. *The additional right-of-way required for Quorum Drive corridor should be dedicated with Phase I from the railroad to the northern district boundary. Because this development is the first phase of a multi-phase project, this corridor is necessary for utilities and possible roadway expansion.*

See Item #2D on September 5th memo.

E. *Ingress, egress and parking shall be situated so they do not interfere with the operation of the rotary. Additional design information is required to determine the appropriate location.*

See Item #2E on September 5th memo.

F. *Turn lane should include a transition of 150 feet with 150 feet of storage.*

Done and shown on plans.

3. *Residential:*

   A. *All streets shall be designated by a name or number. There are different designations for each street that appear throughout the plans.*

   There may be a need to go back to the development plan and concept plan and add the street names when they are selected.

   B. *If some of the property accessing the proposed streets is not residential, alternative cross sections are required.*

   See Item #3B on September 5th memo.

   C. *With the exception of the double parking where people were moving into apartments and the parking in the neck-down areas, we were comfortable with the residential street widths of 37 feet from back of curb to back of curb with neck-down areas at intersections being 23 feet (back to back). However, this assumes the appropriate radius is provided for emergency/service vehicles and street lights, furniture, trees, etc., are set back sufficiently to avoid any conflicts with turning vehicles and visibility at the intersections.*

   Acknowledged

   D. *Where the residential streets dead-end, provisions should be made to provide a vehicular turnaround until the roadway are continued. A concrete cross-section is required. Turnaround shall be in a dedicated easement.*

   Done and shown on plans.

4. *Mews:*

   A. *The building overhangs shown encroach into the public street. Recommend City Attorney's office be contacted to determine if street license agreement is appropriate and what, if any, insurance/indemnification is required and what provisions are appropriate to provide for future maintenance.*

   Though not applicable to the public infrastructure plans, this item was recommended for approval by P & Z on November 21st, with qualifications. Columbus' attorney is preparing license agreements.

   B. *Portecochere between building "A" & "B" encroaches into the public right-of-way. Street license agreement seems necessary. Recommend City Attorney's office develop appropriate license and advise regarding insurance, indemnification and maintenance requirements. If concept is approved, we recommend a minimum vertical clearance of 18 feet and that the developer locate all columns outside of the right-of-way.*

Architectural issue (See 4A)

C. *The current proposal requests that the mew's be constructed with a swale down the middle. If this section is approved, then an additional variance may be required from our drainage standards to vary from our requirement to maintain one (1) lane clear of concentrated storm water. The developer has proposed to allow a maximum depth of 3" in the mews. It appears that the maximum spread of water would be approximately 25 feet with a "V" section and 35 to 45 feet with a parabolic section. If the swale in the middle of the mews is approved, Public Works recommend a concrete swale be placed in the center to facilitate the conveyance of the irrigation, washing, and drainage water; and to protect the deterioration of the bricks and joints where water may regularly traverse.*

The concrete drainage way is a variance from the original proposal that showed 100% brick mews but does not appear to be a dramatic departure from their current proposal.

As a minimum, the current pointed concrete elements should be eliminated to avoid spalling and breaking. As proposed, they may be difficult to maintain if they get chipped or broken.

The inverted mews section has been recommended for approval by P & Z. We have eliminated most of the brick in the valley area of the pavement but still have bands which cross at several locations. It is possible that some deterioration of the binder between the bricks could occur over time due to concentrated runoff. However, there are several other issues to consider:

- Stormwater flows in the mews are extremely minimal.
- The bricks are set in an asphaltic binder course and swept with cement stabilized sand.
- A continuous concrete valley in the mews would make it look like a wide flat drainage ditch rather than an intimate public space.
- Periodic maintenance of all streets will be required anyway and the potential need for repair seems relatively minor compared to the importance of creating the right kind of space.

We have, therefore, shown the periodic brick crossings of the mews as designed and requested by the landscape architect, which eliminates the pointed pattern in favor of a more practical rectangular pattern. Please let us know if this is acceptable.

5. *Mildred:*

A. *If the reduced cross-section is approved, the relocation of the existing 24" waterline is recommended.*

Done

B. *Ingress, egress and parking adjacent to the rotary shall be located so that they do not interfere with the operation of the rotary. Additional design information is required to determine the appropriate location.*

See Roundabout Study

C. *Recommend conferring with the City Attorney's office to determine the steps necessary to effectuate the right-of-way abandonment, if conceptually approved by the Council.*

Abandonment documents are being prepared by Columbus' attorney for City Council approval concurrent with final plat approval.

D. *The current proposal shows an encroachment into the public right-of-way. Recommend City Attorney's office be contacted to determine if street license agreement is appropriate and what, if any, insurance/indemnifications required and what provisions are appropriate to provide for future maintenance.*

Architectural issue - not pertinent to infrastructure plans.

6. *Alternate material for brick accents bands, crosswalks, sidewalks, streets, etc... should be considered. In the past, the Town has successfully used patterned concrete or pave stone (placed on a concrete base) to give an appearance of brick with more durability, serviceability and less susceptibility to settlement.*

See Item #6 on September 5th memo.

7. *Vehicular visibility should be provided for all streets, mews and driveway approaches/intersections. Our current standards require a minimum visibility triangle of 35 feet be maintained at all entrances/intersections to the street. Recommend our urban planners evaluate this practice to determine if under urban standards an alternative design is appropriate where the garage exits intersect the streets.*

See Item #7 on September 5th memo.

8. *Site Plan:*

A. *The current proposal encumbers Conference Centre property to access garbage and electrical facilities for building "B".*

Encumbrance and access from city property is no longer required.

B. *Garbage collection utilizes public right-of-way for dumpster pick-up and consolidation. If approved, recommend a thickened section of pavement to prevent future deterioration of roadway/sidewalks sections. How are the dumpsters serviced when there is a car parked in front of the doors adjacent to the park or Quorum?*

Pavement has been thickened in these areas.

C. *Provision for loading and unloading of vehicles is not apparent on information provided.*

Loading zones will be posted throughout the property and are shown on the plans.

D. *There appear several inconsistencies between the development plans, civil plans and landscape plans regarding the location of median opening, pavers/bricks and crosswalks. Recommend revising plans to provide consistency and allow complete review.*

The definitive plans for most elements are the public infrastructure plans by Huitt-Zollars. Any differences between these plans and the concept or development plans are due to refinements inherent in final design. There should be some latitude for staff to judge if the construction plans meet the intent of the more conceptual prior plans. Please let us know if there are any remaining discrepancies that pose a problem.

E. *Parking is not permitted in crosswalks. Recommend the use of sidewalk eyebrows to protect pedestrians and minimize crossing widths. Parking areas should be located so they do not shield the pedestrians prior to crossing. Recommend that out urban planners provide appropriate detail for the eyebrow.*

Parking is not intended in crosswalks and we believe that final plans address the safety of pedestrians at these crossings.

F. *Recommend that a sidewalk eyebrow be provided on street "A" ('R-4') for the garage entrance to prevent encroachment of parking on the minimal driveway width.*

Parking will be restricted by signage as shown on the plans.

G. *The plan appears to detail tree diameters of 4". This is not consistent with the proposal to place 8" diameter mature trees within the right-of-way. Our estimates for infrastructure improvements were based on 8" diameter trees.*

200 gallon trees are proposed in all locations except the mews which will have 100 gallon trees. This has been approved by Slade Strickland.

H. *The original details for Quorum Drive illustrated a double row of trees in the median. Estimates for infrastructure participation was based on a double row of trees in Quorum.*

The City Manager has stated that wholesale removal of the existing trees in the Quorum median is undesirable. In addition, there is not adequate space for a double row of large canopy trees. Therefore, the plan, as acknowledged by Slade

Strickland, is to selectively remove existing trees and supplement them for a more uniform look.

I. *The plans appear to indicate light fixtures strung across the mews on wire. Our cost estimates for public participation assumed pole mounted fixtures. If this assembly is approved, Public Works recommends that TU be contacted regarding whose lights they are and the Fire Department determine what impact they have on their ability to provide service. If they are a private facility, we recommend the City Attorney's office be contacted to develop the appropriate license.*

The plans indicate fixtures in the mews strung on cables attached either to the buildings or, where future buildings are proposed, temporary poles. The fixtures will be maintained by the developer but will be part of the overall system, whether it belongs to T.U.E. or the City. Columbus' attorney is working on license requirements.

J. *Provide survey seal by licensed surveyor with closure documentation.*

As we have discussed, the majority of the district has been surveyed and a certified drawing is available. This does not, however, include the Gaylord property adjacent to the tollway which was delineated based on deed records. We cannot, therefore, sign and seal a boundary survey of the entire district at this time but have provided a boundary "exhibit" which we believe meets the intent of the requirements.

K. *The Park dimensions on the site plan do not appear to match the survey. Does Building "A" encroach into the park space?*

The public sidewalk between building A and the park is on park property, therefore, the park space enclosed by the proposed wall is somewhat smaller than the space on the boundary exhibit.

L. *What are the dimensions of the proposed parallel parking spaces?*

The length of a parallel parking space was considered 22 feet, however, we do not intend to stripe them.

M. *What do the dashed lines on Mildred and the residential streets represent?*

These have been clarified on final plans but they were the limits of parking (or an imaginary eyebrow).

N. *It is difficult to determine where the curbs stop and start. If a curbless section is desired for the mews, recommend stopping the curbs after the curb returns to control drainage, traffic and parking.*

Clarified on final plans.

O. *Typical street sections are required.*

Done

P. *Additional information required on utility locations. See preliminary plat comments.*

Done

Q. *Provide data regarding width of streets, driveways, entrances to parking areas/structures and calculations of impervious cover.*

Done

R. *Provide plan of existing and proposed gas, electric, telephone and cable necessary to serve this development.*

Existing facilities are shown on final plans and an allocations of space for proposed extensions in each roadway is shown in typical sections. The final layouts of these systems are still being developed by the utility providers.

9. *Additional comments associated with the preliminary plat/construction plan submittal dated September 5, 1995.*

Acknowledged

10. *Resubmittal to address review comments recommended.*

Acknowledged

ADDISON CIRCLE
RESPONSE TO CITY REVIEW COMMENTS IN MEETING OF NOVEMBER 21, 1995
FROM JOHN BAUMGARTNER

1. *Material cut sheets with engineer's certification regarding application, operation and maintenance (i.e. bricks, pavestone, street furniture, etc.)*

   Materials Cut Sheets are provided in the bid documents or are detailed on plans for the following items:

   Benches
   Street Lights
   Trash Cans
   Tree Grates
   Tree Fences
   Bollards

   Our inclusion of these items, either referenced on the signed and sealed plans or in the signed and sealed bid documents is our certification that, to the best of our professional knowledge and belief, they are suitable for the applications indicated. Please let us know if the Town feels otherwise or if there is insufficient information for your own evaluation.

2. *Funds for Phase 2 improvements are not available - Phase 2 improvements can be included but must be separately identified in bid tabulation.*

   A separate bid schedule has been provided.

3. *Offsite easements required.*

   Offsite easements are indicated on the plat with special language calling attention to he fact that they are outside the boundaries of the platted lots. All owners of property affected by these easements will execute the plat (Columbus, Gaylord and the Town of Addison).

4. *Utility company sign-off see list.*

   Please clarify what is required.

5. *Pavement markings and signage plan.*

   Pavement markings and signage are now shown on the plans.

6. *Hydrant details (i.e. specific location paint, etc.)*

   Specifications cover the locations and color of fire hydrants.

7. *Overall water/wastewater plan that depicts lines, hydrants services, sizes, etc.*

   An overall water and wastewater plan has been added.

8. *Thicken sidewalk and designed bricks for areas servicing garbage transformers, switchgear, loading traffic, etc.*

   Sidewalks adjacent to service areas have been thickened to 6-inches of concrete under the brick. The sidewalk brick is designed for light duty vehicular loads and is appropriate for these locations (except at the 40 yard compactor where heavy duty materials are specified).

9. *Meter installations/back flow prevention devices - private property improvement - details required.*

   Why 2-2" - use compound meter 3" or 4"?
   What is a service?
   Traffic safe boxes? Typical detail - materials sheet - engineering certification, bollards location detail.

   We have reviewed the proposed domestic water meter configurations with the mechanical engineer for the private development work. He prefers to stay with multiple 2-inch meters because they are more cost effective than larger meters and they are easier to fit into the streetscape.

   The purposes for the various services have been clarified on our plans and the responsibility between public and private work has been better defined.

   There is nothing proposed that is other than standard municipal construction for water meters. There is no reason to use heavy duty boxes or bollards for these elements.

10. *Services to future phases.*

    Where appropriate, service stubs have been provided to future development areas.

11. *Hydrant location/detail turn radius - bollard protection.*

    Fire hydrants have been located outside the required 30-foot turning radius at all intersections and are set back from the edge of pavement or curb. We do not believe special bollard protection is justified.

12. *What happens to existing lights and trees?*

    The disposition of existing lights and trees is now noted on the plans.

13. *Spoils disposals.*

The specifications indicate that the Contractor is to dispose excess street excavation onsite to be used by the private contractor to fill the building pads. Excess spoil from the storm drainage outfall is to be stockpiled adjacent to the channel per the plans. Excess utility spoil is to be coordinated with the private construction but is ultimately to be hauled off for disposal, if not needed elsewhere.

14. Typical details.

Typical details for items not covered by City or other applicable standards are included in the plans.

15. Typical notes.

Typical notes for items not covered by City or other applicable standards are included in the plans.

16. What type of information is available for contractor to establish and maintain control.

The horizontal control plan indicates the points which will be set for the Contractor. It will be his responsibility to maintain this control however he sees fit or pay to have it reset.

17. Quality control plan for contractor.

The Contractor is responsible for his own quality control.

18. Waterline under the rotary?

The existing 24-inch waterline under the roundabout is to remain unless otherwise instructed by the Town following refinement of the design for the central feature.

19. Street light design - private system.

We are prepared to perform a complete electrical design for the street light system if the Town chooses to take it over. However, our plans currently reflect fixtures and details relating to a system to be owned by T.U. Electric.

20. Mews street lights?

Details for the mews lighting have been added to the plans.

21. Plan submittals to Carmen, Sasaki, fire, police, and Slade Strickland.

Separate customized sets of partial plans will be supplied to you in this transmittal for each of the reviewers listed.

22. Seal before submittal.

The current submittal is fully signed and sealed.

23. *Who is providing survey control throughout the project? (i.e. for franchise utilities?)*

All entities and contractors are responsible for their own control based on our horizontal control plan and the plat (R.O.W.) monumentation.

24. *Location of switchgear/transformer.*

Switchgear locations are shown on the plans along with several transformers that will serve public functions. All other transformers are on the developer's property, most in parking garages.

25. *Quorum crosswalks?*

We have consulted with the landscape architect and further considered the proposed brick crosswalks across Quorum Drive. We believe that the crosswalks should remain for the following reasons:

> It will be better to do all of our crossings of Quorum Drive now while traffic is the lowest it will ever be and there are no residents in the district.
>
> There is adequate sight distance at the railroad crossing and this crosswalk is intended to work with the Town's proposed hike and bike trail.

26. *Water tower property line?*

Our surveys reflect the water tower (Town) propertyline correctly to the best of our professional knowledge and belief. It appears that the fence is constructed in the wrong location.

27. *Signed survey.*

See response to Item #8J from the October 16th memo.

28. *2 year maintenance bond.*

The instructions to bidders and contract requirements specify a 2 year maintenance bond.

29. *Street bores.*

Based on location within the construction zone, the primary candidate for street boring is electrical duct across Quorum Drive. However, due to the nature of a concrete-encased duct system with its multiple conduits and spacers, boring is very difficult and costly. We have positioned the ducts to take advantage of pavement removal for crosswalks and recommend that they be installed by cut and cover methods.

ADDISON CIRCLE
RESPONSE TO COMMENTS ON THE MODERN ROUNDABOUT STUDY FROM BARTON-ASCHMAN, ASSOCIATES, INC.

Comments have been received, both in meetings and in Barton Aschman's review memo, which express concern about the implication in the roundabout study that artificial constraints may have been placed on the designer. This is indeed the case and we purposefully noted it in the report. However, there is possibly a need to elaborate further on this point.

First, there is apparently a misunderstanding that, in roundabout design, bigger is better. This is not true. A larger diameter circle in and of itself does not necessarily increase the capacity or safety of operation of the roundabout. The beauty of a modern roundabout is that it can function well in a relatively small amount of space. It is true that there are no existing structures to limit the size of the proposed Addison Circle roundabout. However, if available space were our only consideration, we could propose several other methods of handling the traffic, but they might not be consistent with the goals of the Urban Center District.

The roundabout geometry that we have proposed was developed in an iterative process between the roundabout specialist (Mr. Peter Doctors, P.E.) and the Addison Circle project design team, Huitt-Zollars (Engineers), RTKL (Architects) and Newman, Jackson, Bieberstien (Landscape Architects). The initial outside right-of-way diameter of 300 feet was established based on research into the "typical" size of modern roundabouts. Mr. Doctors was provided this information with the intersecting geometry of existing and proposed Mildred Street and Quorum Drive and asked if it was adequate. His response was that it was as much or more space than he had ever had in which to design a roundabout and he proceeded with the design without further input from the design team other than a target dimension of approximately 100 feet for the outside curb radius and traffic projections. Based on the outer curb dimension, the traffic characteristics to be expected and the alignment and lane configurations of the approaching roadways, Mr. Doctors arrived at a design for the roundabout. The primary components of the resulting design were the deflection, flare and inside curb radii of the entering and exiting roadways. The initial design operated at a level of service A.

The design team reviewed the geometry with respect to the urban design goals of the district which included the following:

- Adequate space for public art
- Pedestrian safety and comfort
- Definition of the urban space being created
- Impact on the public streetscape

It was a basic understanding that the traffic issues were covered by Mr. Doctors with his design.

It was the team's opinion that the design that was proposed compromised the intent of an urban environment because the dimensions of the flare and the very large inside radii of the deflection at the entering and exiting roadways were too rural in character such that they:

Destroyed the circular shape of the urban space by their very wide penetrations of the circle (which in turn eliminated many proposed trees that were intended to define the circle and shade pedestrians);

Created excessive distances for pedestrians to cross, even though median refuge was provided;

Clipped the corners of the sidewalks narrowing the space for the sidewalk and streetscape.

The design team asked Mr. Doctors if he could modify any of the parameters to narrow the flare and/or reduce the radii of the inside curbs at the deflection. He responded that no appreciable changes could be made given the existing conditions without a reduction in the level of service. He was asked to revise the design to address the team's urban design concerns with whatever reduction in level of service he felt he could support.

In summary, the Addison Circle development and the Urban Center District are first and foremost an urban neighborhood. It is not our goal to create an intersection for Quorum and Mildred that operates at the highest possible level of service and then fit the development around it. It is our goal to create a quality urban environment first and build into it an adequate ability to deal with traffic. The roundabout concept was chosen as the mechanism for handling this major intersection more because of the interesting space and focal point which it creates than for its inherent ability to improve the level of service. Therefore, its final design considers its impact on the district from more than one perspective and is necessarily a compromise.

(Response to comments on traffic generation and levels of service to follow.)

ADDISON CIRCLE

RESPONSE TO OTHER ITEMS MENTIONED IN THE REVIEW MEETING OF NOVEMBER 21, 1995 AND IN VARIOUS TELEPHONE CONVERSATIONS WITH JOHN BAUMGARTNER

1. Proximity of parallel parking to intersections/or, length of neckdown area. (Per AASHTO and MUTCD.)

   AASHTO and MUTCD differ somewhat in their rationale and in the detail of their approach to this issue. However, the common element seems to be a desire for a minimum of 20 feet of clear area between crosswalks and the beginning of parallel parking. We have provided 20 feet from crosswalk to parking transition which provides 26 minimum feet to the first car to the crosswalk and up to 46 feet from the first car to the curb line of the intersecting street.

2. We have added an 8-inch waterline stub-out across Mildred to the Special Events Area.

3. Overhead power line (and other utilities) to elevated water storage tank, conference center, etc.

   We are coordinating with the utility companies to provide interim service during construction and permanent service once the duct systems are in place. Our plans currently reflect early removal of the overhead line through coordination between the contractor and the utility companies. We expect to meet with T.U.E. in the next week to review their proposed system and will discuss this issue further at that time.

(MORE TO FOLLOW)

M075

Legal - Metrocrest

ADVERTISEMENT FOR BIDS

1. Sealed bids addressed to the Town of Addison, Texas, for Paving, Drainage, Wastewater, Water, Streetscape, Electrical Ductbank, and Park Improvements for ADDISON CIRCLE, PHASE I PUBLIC INFRASTRUCTURE for the Town of Addison, Texas, hereinafter called "Town " in accordance with plans, specifications and contract documents prepared by Huitt-Zollars, Inc., will be received at the office of Clyde Johnson, Purchasing Manager, Finance Building, 5350 Belt Line Road, Addison, Texas until 2:00 p.m. on the 26th day of January, 1996. Bids received by the appointed time will be opened and read aloud. Any bids received after closing time will be returned unopened.

2. The Contractor shall identify his bid on the outside of the envelope by writing the words ADDISON CIRCLE PHASE I PUBLIC INFRASTRUCTURE.

3. Bids shall be accompanied by a cashier's check or certified check upon a national or state bank in an amount not less than five percent (5%) of the total maximum bid price payable without recourse to the Town of Addison, or a bid bond in the same amount from a reliable surety company licensed by the State of Texas to act as a Surety, or a Binder of Insurance executed by a surety company licensed by the State of Texas to act as a surety or its authorized agent as a guarantee that the bidder will enter into a contract and execute a Performance Bond within three (3) business days after notice of award of contract to him.

4. Plans, specifications and bidding documents may be secured beginning at 9:00 A.M. Monday, January 8, 1996 from Clyde Johnson, Purchasing Manager, Finance Building, 5350 Belt Line Road, Addison, Texas for the non-refundable sum of $25.00 per set.

5. The right is reserved by the Mayor and the Town Council as the interest of the Town may require to reject any or all bids and to waive any informality in bids received.

6. The Bidder (Proposer) must supply all the information required by the Proposal Form.

7. A Performance Bond, Labor and Material Payment Bond, and Maintenance Bond will be required by the Owner, each Bond shall be in the amount of 100% of the total contract amount. Bonds shall be issued by a surety company licensed by the State of Texas to act as a Surety. The performance and payment bonds shall name the Town of Addison and Gaylord Properties, Inc. (Gaylord), 10111 North Central Expressway, Dallas, Texas 75231, (214) 739-9999 and Columbus Realty Trust (Columbus), 15851 North Dallas Parkway, Suite 855, Dallas, Texas 75248 (214) 770-5151 as joint obligees (or such other entities as may be designated at the time a contract is executed).

8. For information on bidding or to secure bid documents, call Clyde Johnson (214) 450-7090. For information on the work to be performed, call John Baumgartner, City Engineer, (214) 450-2886 or Ken Roberts, Huitt-Zollars, Inc. (214) 871-3311.

9. This project consists of providing paving, sidewalk, water, wastewater, landscape, stormwater, electric ductbank, and other miscellaneous improvements as shown on the plans and in accordance with the specifications.

10. The contract will be assigned to and the construction of the project will be administered by Columbus Realty Trust, and/or Garlord Properties, their successors and assigns per the Master Facilities Agreement with the Town of Addison.

11. A Pre-Bid Meeting will be held at 2:00 p.m. on January 17, 1996 at the Addison Service Center, 16801 Westgrove Drive, Addison, TX. All bidders are encouraged to attend.

TOWN OF ADDISON

MN CPN: 100
PUB: 01/04/96 & 01/11/96

SECTION "A"

ADVERTISEMENT FOR BIDS

Sealed proposals, addressed to the City of Carrollton, will be received at the office of the City Engineer, City Hall, Engineering Department, 1945 E. Jackson Road, Carrollton, Texas 75011-0535, until 10:00 a.m., on January 19, 1996 for:

WATER LOOPING 94-2W
INTERSTATE 35E WEST SERVICE ROAD
12" WATERLINE PROJECT
WEST CROSBY ROAD TO THIRD STREET

Bidders must submit, with their bids, a cashier's, or certified check in the amount of five percent (5%) of the maximum amount bid, payable without recourse to the City of Carrollton, Texas, or a Proposal Bond in the same amount from an approved Surety Company (according to the latest list of companies holding certificates of approval by the State Board of Insurance under 7.19-1 of the Texas Insurance Code) as guarantee that the Bidder will enter into a contract and execute bond and guarantee forms provided within ten (10) days after award of contract to him.

The successful Bidder must furnish Performance and Payment Bonds each in the amount of 100% of the contract price from an approved Surety Company holding a permit from the State of Texas, to act as Surety and acceptable according to the latest list of companies holding certificates of approval from the State Board of Insurance under 7.19-1 of the Texas Insurance Code. The successful bidder must also be able to show evidence that it is authorized to do business in the State of Texas prior to executing the contract and that they have performed projects of comparable size and type in the past three years.

All unit prices must be stated in both script and figures. The Owner reserves the right to reject any or all bids and to waive formalities. In case of ambiguity or lack of clearness in stating the price in the bids the Owner reserves the right to consider the most advantageous construction thereof, or to reject the bid. Unreasonable or unbalanced unit price will be considered sufficient cause of rejection of any bid or bids.

Bidders are expected to inspect the site of the work and to inform themselves regarding local conditions & conditions under which the work is to be done. Attention is called to the provisions of the Act of the 43rd Legislature of the State of Texas and subsequent amendments concerning the wage scale and payment of prevailing wage specified. Prevailing wage rate will be established by the City of Carrollton for this project. All bidders must comply with the rules and regulations for the Americans with Disabilities Act of 1990.

Instructions to Bidders, Proposal Forms, Specifications, Plans and Contract Documents may be examined without charge at the office of the City Engineer, City Hall, Engineering Department, 1945 E. Jackson Road, Carrollton, Texas 75011-0535, and/or may be obtained for a $15.00 non-refundable fee.

A pre-bid meeting will be held at the office of the City Engineer, City Hall, Engineering Department, 1945 E. Jackson Road, Carrollton, Texas, at 10:00 A.M., on January 12, 1995.

CITY OF CARROLLTON, TEXAS

P

DON PENNY, P.E.

PENNY AND ASSOCIATES
TRANSPORTATION ENGINEERS

1411 NATCHES DRIVE
ARLINGTON, TEXAS 76014

817/465-1072

HUITT-ZOLLARS

Engineering / Architecture

Dallas • Fort Worth • Houston • El Paso • Phoenix • Orange County

FACSIMILE TRANSMITTAL

Date: Dec 28, 1995

Fax No.: 931-6643

H-Z Proj. No. 01-1822-04

No. of Pages: 3
(Including Cover Sheet)

TO: Town of Addison
John Baumgartner

☐ URGENT ☐ For Your Review ☐ Please Call Upon Receipt ☐ Orig. To Follow By Mail

John -

This may be the information you are needing regarding insurance and indemnification for the Addison Circle Public Infrastructure construction contract. I do not think it is appropriate to include in the construction documents since it does not involve the contractor. The Town is protected by virtue of this Master Facilities Agreement.

FROM: Andy Oakley

SENT BY: [signature] TIME: 12:00 pm DATE: 12-28-95

If you had any problems receiving the Facsimile Transmittal, please contact Ms. Janet Willis or the individual listed above at (214) 871-3311. Thank you.

3131 McKinney Avenue • Suite 600 • Dallas, Texas 75204 • (214) 871-3311 • FAX (214) 871-0757

Columbus of such bids and the City Staff's proposal to the City Council regarding the award of the bid. The City Council shall thereafter award the bid.

2. In conjunction and simultaneous with the construction of the Improvements, Gaylord and Columbus will be constructing certain private improvements upon that portion of the Property included within the applicable phase or subphase. Therefore, upon the award and execution of the construction contract between the City and the contractor and in order to coordinate the construction of the public and private facilities, the City shall assign all of its rights, powers, duties and obligations under the construction contract to Gaylord and Columbus. Gaylord and Columbus shall thereafter act and serve as the owner and construction manager under such construction contract for all purposes, including inspection, material testing, staking, supervision and coordination of all construction work, in accordance with the following:

(a) Gaylord and Columbus shall use their best efforts to insure that all Improvements are completed in a timely manner in accordance with the construction contract documents, plans and specifications. Gaylord and Columbus shall thoroughly inspect the work of the contractor to guard the City against defects and deficiencies in the Improvements without assuming responsibility for the means and methods used by the contractor.

(b) Except as provided in Subparagraph (c) of this Section 6.B.2., Gaylord and Columbus shall fully and completely pay or settle, by litigation or otherwise, any claims of the construction contractor arising out of the performance of the construction contract without involving the City.

(1) Any construction contract for the construction of the Public Infrastructure Improvements shall specify that the contractor shall look solely to Gaylord and Columbus concerning any claim under the contract. In accordance therewith:

(i) For each such construction contract Gaylord and Columbus shall acquire and maintain, during any period for which a phase or subphase of the development of the Property is under construction, comprehensive general liability insurance in the amount of the construction contract or $1,000,000, whichever is greater. Such insurance shall cover any and all claims which might arise out of the construction contract, whether by the contractor, a subcontractor, materialman or otherwise. All such insurance shall: (a) be issued by a carrier which is rated "A-1" or better by A.M. Best's Key Rating Guide and licensed to do business in the State of Texas, and (b) name the City as an additional insured. Certified copies of all of such policies shall be delivered to the City upon the execution of a construction contract; provided, however, that the City, in its sole discretion and in lieu of certified copies of such policies, may permit the delivery of certificates of insurance together with the declaration page of such policies, along with the endorsement naming the City as an additional insured. Each such policy shall provide that, at least 30 days prior to the cancellation, non-renewal or modification of the same, the City shall receive written notice of such cancellation, non-renewal or modification.

(ii) Gaylord and Columbus shall also indemnify the City, its officers and employees against, and hold the City, its officers and employees harmless from, at Gaylord's and Columbus' cost, any and all actions, causes of action, lawsuits, judgments, claims, damages,

costs or fees, including reasonable attorney's fees (including claims for contractual damages, or claims for injury to person or property or death of any person) resulting from or based on, in whole or in part, any act or omission of Gaylord and Columbus under a construction or professional services contract entered into in the development of the Property during construction of the Improvements and until the City's Engineer accepts the Improvements as finally complete. The provisions of this Subparagraph (b)(1)(ii) shall survive the termination of this Agreement.

(c) In the event that claims from a contractor under a construction contract result from the wrongful failure by the City to make construction payments in accordance with the terms of this Agreement, Gaylord and Columbus may seek reimbursement in accordance with this Subparagraph (c). In the event Gaylord and Columbus intend to seek reimbursement from the City for the expense incurred by Gaylord and Columbus in resolving any claim caused directly by the City's wrongful failure to make such construction payments, Gaylord and Columbus shall notify the City in writing of the claim and any proposed settlement or resolution. The City reserves the right upon such notice, and at the City's sole election, to make an audit of all books, records, accounts and other data of the construction contractor relating to the claim and overall performance of the construction contract before approving payment of such claim. The construction contract shall provide for the City's right to audit such claims.

(d) Gaylord and Columbus shall review all invoices or pay estimates received from the contractor and forward the same to the City for payment with such supporting documentation as the City may require. All payments for work performed under the construction contract shall be made by the City to Gaylord and Columbus for forwarding to the construction contractor. The City shall not make a payment under any such invoice or pay estimate unless Gaylord and Columbus have provided to the City a certification regarding the invoice or pay estimate and Gaylord and Columbus have reviewed and approved the same. Gaylord's and Columbus' certification shall be by affidavit sworn to by the appropriate official of Gaylord and Columbus authorized to submit the same, and shall certify that the estimate of work completed for the relevant period is true and correct to the best of Gaylord's and Columbus' information and belief, has been measured and verified in accordance with the construction contract documents, and that all construction contract preconditions to payment have been met. Copies of all material testing results shall be furnished with the certification.

3. All change orders shall be processed and approved in accordance with the City's procedure for the review and approval thereof.

4. The construction contract shall require, among other things, that the contractor provide performance and payment bonds in a form acceptable to the City. The performance and payment bonds shall name the City and Gaylord and Columbus as joint obligees.

5. All Public Infrastructure Improvements shall become the sole property of the City upon completion of the work and acceptance of the work by the City. Upon final completion of the Improvements and acceptance thereof by the City in accordance with the construction contract for the Improvements for each phase or subphase, the City shall take the Public Infrastructure Improvements free from any liens or encumbrances thereon except for any private utility easements and any rights reserved regarding public parking.

BARTON-ASCHMAN ASSOCIATES TRANSPORTATION GROUP

Barton-Aschman Associates, Inc.
5485 Belt Line Road Suite 199 • Dallas, Texas 75240 • (214) 991-1900 • Fax (214) 490-9261

Memorandum

TO: John Baumgartner
Town of Addison

FROM: Gary Jost

DATE: January 5, 1996

SUBJECT: Addison Roundabout - Additional comments

We have completed our review of the sensitivity analysis completed by Ourston and Doctors and design plans prepared by Huitt-Zollars for the proposed Addison Roundabout. This memorandum presents our findings.

Sensitivity Analysis

Ourston and Doctors present in their sensitivity analysis findings based on 50 percent and 85 percent confidence levels. If queues and delays are calculated at a 85 percent confidence level, this means that one can be 85 percent certain that actual queues will not be greater than the calculated values. Based on the uncertainty of operations of the first modern roundabout in North Texas, we would recommend that the 85 percent confidence level be used for calculating operating conditions of the planned roundabout.

It should also be noted that there is currently no consensus in the transportation profession regarding the most appropriate traffic engineering tool for analyzing modern roundabouts. The Transportation Research Board has established a committee to review current capacity analysis techniques and develop a new Highway Capacity Manual by the year 2000. This committee, chaired by Mr. John Zegeer of Barton-Aschman Associates, Inc., is working to include a recommended procedure for analyzing modern roundabouts in the new manual.

The sensitivity analysis reports that at the 85 percent confidence level traffic volumes can be increased, from volumes originally projected, by 4 percent in the A. M. peak period and 11 percent in the P.M. peak period while still maintaining a level of service D. This suggests that the current design is highly sensitive to small increases in traffic volumes. With an 11 percent increase in traffic volumes, and assuming that 10 percent of daily traffic occurs during the P.M. peak hour, one could estimate that the effective capacity of Quorum Drive, assuming 10,000 vehicles per day (vpd) on

Mildred, would be less than 30,000 vpd.

Of particular note is the comparison of average and maximum queue lengths between the original projections and the maximum volumes that can be accommodated at Level of Service D. Tables 1.0 and 2.0 present this comparison for the A.M. and P.M. hours, respectively.

Table 1.0
Average and Maximum Queues
A.M. Peak Hour

APPROACH LEG	AVERAGE QUEUES (VEH)		MAXIMUM QUEUES (VEH)	
	ORIG.	LOS D	ORIG.	LOS D
NB Quorum	0	1	1	1
WB Mildred	1	1	1	1
SB Quorum	17	30	35	69
EB Mildred	4	5	6	9

Table 2.0
Average and Maximum Queues
P.M. Peak Hour

APPROACH LEG	AVERAGE QUEUES (VEH)		MAXIMUM QUEUES (VEH)	
	ORIG.	LOS D	ORIG.	LOS D
NB Quorum	4	12	6	25
WB Mildred	5	30	10	57
SB Quorum	1	1	1	2
EB Mildred	1	2	2	3

As shown in these tables, average and maximum queues increase significantly with very little increase in total volume entering the roundabout.

Based on the sensitivity to small increases in peak-hour volumes identified in the analysis conducted by Ourston and Doctors, it is our recommendation that the design of the planned Addison Roundabout be analyzed further to provide more stable conditions at these anticipated volumes.

OTHER DESIGN CONSIDERATIONS

Parking

On -street parking along Quorum and Mildred should be restricted within 150 feet of the roundabout on the departure legs of the roadways to provide adequate sight distance.

Paving Typical Section

The typical section for Quorum Drive specifies a full sawcut with existing steel to remain. The full depth sawcut will also cut the steel. If a full depth sawcut is desired, steel dowels will need to be drilled and inserted into the existing concrete pavement.

Signing and Markings

- The stop sign at Witt Mews and Mildred should be moved behind the barrier free ramps.
- The no parking signs on Mildred appear to conflict with the paving plans.
- If pedestrians are to be restricted from entering the roundabout island, then "No Pedestrian" signs should be installed in the island.
- All discussions to date regarding pedestrian crossings at the roundabout have indicated that the crossings should be located one to two vehicles behind the yield line. This needs to be reflected on the plans.
- Addison has typically utilized pavement markers rather than striping for lane delineation.
- Advance warning signs for the roundabout should be provided.
- Additional signs (i.e. chevrons) identifying the roadway curvature are recommended.

Miscellaneous

- There appears to be an abrupt change in crossfall on the north side of the roundabout at Quorum.
- Loading and unloading areas should not be allowed in the area of the roundabout.

If you have any questions, please do not hesitate to call.

Special Events & Marketing

BARBARA KOVACEVICH
MANAGER

MEMORANDUM

DATE: December 1, 1995

TO: John Baumgartner, Lynn Chandler, Ron Davis, Robin Jones, Carmen Moran, Greg Pynes, Gordon Robbins, Mary Rosenbleeth, Slade Strickland, Bob Wallingford

FROM: Barbara Kovacevich

RE: Columbus Realty Trust Bid Specifications

Attached for your review is an excerpt from the Addison Circle Bid Specifications that outlines CRT's specific instructions on construction activities allowed during special event times. Please review this information and let me know your thoughts by Tuesday, December 5.

Thank you.

Barbara

P.O. BOX 144
16801 WESTGROVE ROAD
ADDISON, TEXAS 75001
(214) 450-2851
FAX: (214) 248-7814

DRAFT - Excerpt from Addison Circle Specifications - November 15, 1995

Construction Planning and Special Sequencing

Addison Urban Center Phase I is located in an area that hosts several special events throughout the year. These events will continue to be held during the construction and certain provisions must be made to accommodate them. The dates, durations and operating hours of events vary from year to year and it is therefore not possible to specify all restrictions prior to execution of the construction contract. The following information should, however, aid the Contractor in evaluating the impact of such events on his schedule.

The major events and scheduled dates for 1996 are as follows:

Taste of Addison	Sat. & Sun. - May 18-19
Addison's Kaboom Town	Wed. - July 3
~~Spikefest~~	~~Sat. & Sun. - August 3-4~~
Addison's Oktoberfest	Thur., Fri., Sat. & Sun. September 19-22
Run for the Children	Sat. - September 21

Most events occur along Mildred Street between Addison Road and Quorum Drive, occupying areas several hundred feet north and south of the roadway. Events that occur during construction will be designed to operate outside the area of the private development to be built on the north side of Mildred but certain events will function best if the street itself is available. Therefore, a goal of the contract will be to sequence the work to allow the use of Mildred Street for the "Taste of Addison" and "Addison's Oktoberfest". + Run for the Children" Kaboom Town

Parking for events can occupy much of the vacant property surrounding the project and access is primarily via Quorum Drive. During _____, _____ and _____ (events) the Contractor will be required to maintain 2 lanes of traffic in each direction on Quorum Drive.

+ S/L must be

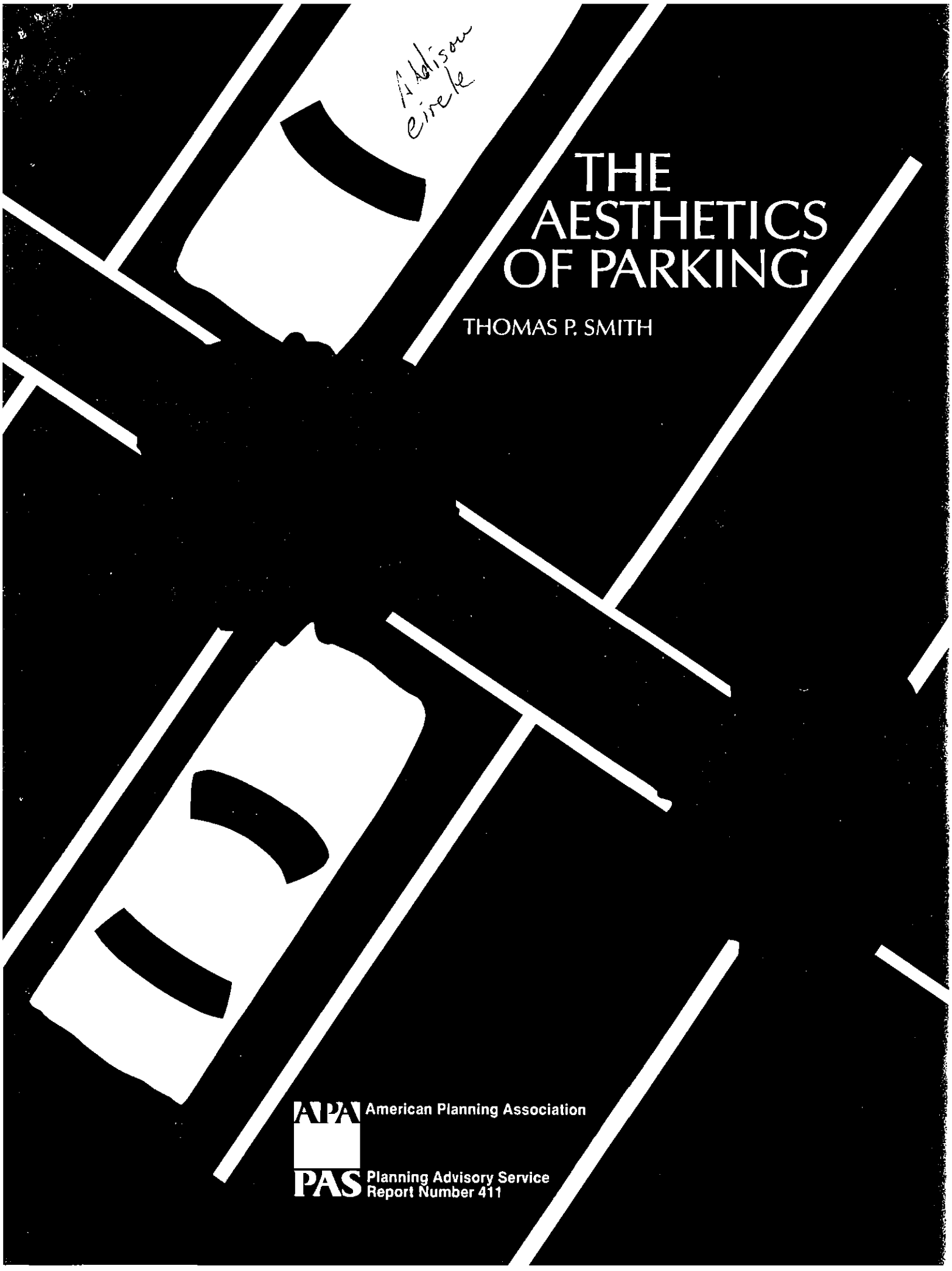
For bidding purposes, the Contractor should assume that no work can occur on the project during an event. At least two weeks prior to a scheduled event the Contractor shall be required to coordinate through the Director of Public Works with the managers of the event and inform them of his planned construction activities during the event. Depending upon the nature and timing of the Contractor's activities with respect to the event's activities, a determination will be made by the Director as to whether construction will be temporarily suspended entirely or in the immediate vicinity of the event.

All debris must be cleared

contradiction?

During the event, special effort must be made to secure the construction site and provide for the safety of the public. Though the standard specifications and normal construction practices dictate measures to be employed, during an event, the public will be moving about in a manner that is not typical relative to this type of construction project.

Mildred St must be able to accommodate traffic - If construction is not complete → place temp. pavers



THE AESTHETICS OF PARKING

THOMAS P. SMITH

APA American Planning Association

PAS Planning Advisory Service
Report Number 411

Chapter 4. Parking Structures and Urban Design

Parking structures[8] are a far more efficient use of land than are surface parking lots. A parking structure typically takes up less land because parking is "stacked" in levels. Most parking structures are constructed in a way that maximizes efficiency and economy. For example, a recently constructed 1,000-space parking garage in Indianapolis was built in 60 days.[9] Because of such efficiency, these large garages are the trend. According to Robert Weant of the ENO Foundation, 500- to 700-space garages are now the norm, and 1,000- to 3,000-space structures are no longer considered exceptional. Weant reports that the old attendant garages of 90 to 200 spaces are found only in big cities and most are considered remnants of a bygone era.

In downtown locations and employment centers, planners encourage construction of parking garages rather than parking lots in order to maintain urban densities and to prevent any waste of land. Strict requirements for the use of underground or aboveground parking structures, however, are rare. Instead, planners encourage underground or structured parking by providing floor area bonuses or other zoning incentives.

Modern zoning codes also encourage or require street-level retail space; staggered setbacks to soften the impact of parking structures at street level; and architectural compatibility between parking structures and the buildings they serve.

The most advanced codes for parking structures not only address the aesthetics of parking garages, they also examine how structures function. These codes evaluate whether parking structures adversely affect existing traffic and commuting patterns or conflict with city goals for continuous retail frontages and safe pedestrian streets.

In the coming generations, these aesthetic and functional issues may fade away. The technology for excavating underground may substantially improve and the costs of building underground parking structures may be substantially reduced. This, however, does not appear probable in the near future. Building aboveground parking is still substantially less expensive than building underground parking. The cost per space is approximately $7,400 in multilevel garages, compared to nearly $10,000 dollars per space for underground parking.[10] These cost comparisons include all costs for design and professional services, equipment, and construction, but they do not include land acquisition.

In the foreseeable future, it will remain much less expensive to improve the design of parking structures than to require parking to be underground. The costs of facade improvements, landscaping, and ground-floor retail are often minimal. Ground-floor retail space typically shows a positive economic return, and aesthetic improvements increase the property values and marketability of garage space. The following sections look at the current boom in garage construction, what cities are doing in terms of encouraging (or, in some cases, discouraging) garage construction, and what they are doing to improve the appearance of garages and their compatibility with surrounding buildings.

8. Parking structures are often referred to as garages or ramps. They are usually multilevel structures in which one or more levels are stacked and supported above the lowest level. These structures may be publicly or privately owned.

9. Richard F. Roti, "Construction and Development Costs," in *The Dimensions of Parking* (2d ed.) by the Urban Land Institute and the National Parking Association (Washington, D.C.: Urban Land Institute, 1983), 24.

Architect Stanley Tigerman had fun designing the facade of this small, 200-space garage in downtown Chicago. The front is the grill of a 1930s Rolls Royce. The grill is topped by what Tigerman calls a "general hood ornament"—a man holding a torch. Flanking the grill are two fenders and two "tire-like" canopies over the pedestrian entranceways. (Roger Stevens)

10. *What's Going on Out There?: A Statistical Analysis of Construction Trends in the Parking Industry, 1986–1989* (Alexandria, Va.: Parking Market Research Co., 1987), p. 11 of summary.

Parking garages are getting enormous. This garage, built to serve a new Bloomingdale's in Chicago, is 15 stories high and contains 1,450 parking spaces.

THE BOOM IN GARAGE CONSTRUCTION

The urban design issues related to parking structures are of increasing importance and interest due to the tremendous boom in garage construction. According to a 1986 survey by the Parking Market Research Company, more than 1,181 parking decks over 300 spaces were either under construction or planned for the period 1986 to 1989.[11] These decks include over 1,140,000 parking spaces. Many, of course, were being constructed or planned in big cities—Los Angeles (22 decks); Atlanta (16 decks); and New York City (13 decks)—but many were also underway in middle-size towns— Raleigh, North Carolina (11 decks); Indianapolis, Indiana (15 decks); and Orlando, Florida (11 decks).

In Chicago, between 1985 and 1987, construction was completed or begun on garages containing more than 6,500 spaces. One that recently opened is a 15-story, 1,450-space colossus just off the city's fashionable North Michigan Avenue shopping area. The *Chicago Tribune* reported that the structure boosted that shopping district's off-street parking capacity by 30 percent. Three newly opened structures in the city's downtown Loop have boosted that area's parking capacity by 2,720 spaces, an estimated gain of 25 percent.

Planning commissions and citizen groups have responded to the parking garage construction boom with new requirements that force parking decks to respect their surroundings. In some cases, this has meant keeping parking facilities off certain pedestrian-oriented streets. In other cases, it means that parking garages must include ground-floor retail space; be architecturally compatible with the buildings they serve; and include landscaping improvements that enhance their appearance.

PROHIBITIONS ON PARKING GARAGES

In a few locations, even well-designed parking garages simply do not fit. For example, in 1986, a developer proposed a parking structure along one of Chicago's most important pedestrian areas, the State Street Mall. Actually, the garage was planned for the corner of Washington and State Streets with access only off of Washington. Despite developers' promises of ground-level retail space and a facade treatment (with an estimated cost of over $200,000) that respected the Marshall Field's department store (across the street) and the Carson Pirie Scott department store (two blocks away), the city planning commission and city council strongly rejected the proposal. The city's rejection was based on the importance of State Street as a pedestrian shopping area and the city's long-range plans to intensify shopping and retail space in this area.

Other cities, both large and small, have prohibited parking garages in certain locations. In downtown San Francisco, commercial parking garages (i.e., garages that are not accessory to a business) are only permitted in locations on the periphery of downtown and only after review and approval by the city planning commission. This prohibition on parking garages is intended to maintain the pedestrian character of the city's shopping area and to promote the use of mass transit. The New York City zoning code also prohibits parking structures along stretches of pedestrian-oriented streets such as Fifth Avenue and the Avenue of the Americas. Other cities, such as Seattle and Toronto, have, with varying success, tried to control the construction of parking garages in areas in which they may conflict with other development goals.

These total prohibitions against parking structures are not unique to big cities. In the central core of Vail, Colorado, the zoning code prohibits any on-site parking, including surface parking lots and parking garages.

MANDATES OR INCENTIVES FOR PARKING GARAGES

Some zoning codes require parking structures or provide incentives to developers to build garages rather than surface parking. More and more communities want parking to be built up rather than spread out. In pedestrian-oriented commercial areas, cities combine the requirements or incentives for parking structures with requirements or incentives for ground-floor retail space.

Cities as diverse as San Diego and Beverly Hills, California, and Vail and Aurora, Colorado, require parking to be enclosed in structures in certain circumstances. Within sections of Vail's commercial core, the city mandates that at

11. Ibid., p. 6 of summary.

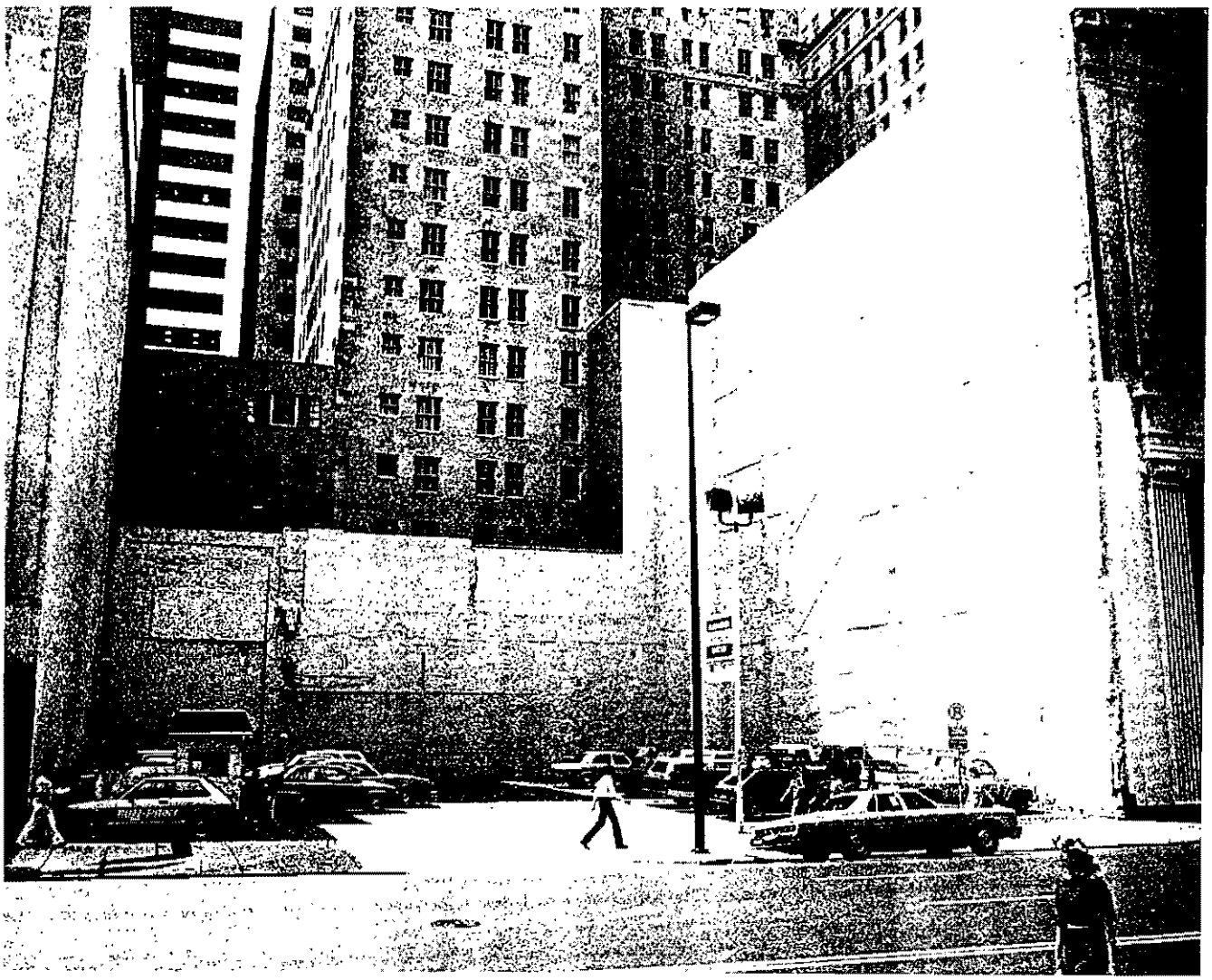
least one-half of the required parking be enclosed within the main building or buildings. The Aurora code is very similar. Within Aurora's city center district, the zoning code requires offices, shops, hotels, and other businesses with large amounts of parking to provide for at least half of the parking within a garage, an underground facility, or on the building's rooftop. In the Beverly Hills commercial-retail overlay zone (Rodeo Drive and other posh retail streets), the city not only requires parking in multilevel structures, but it also requires that two complete levels of these garages be underground. In San Diego's central city area zoning district, the city requires any developer building parking "at a ratio greater than one space per 2,000 square feet of gross building area to enclose the parking within the principal building or a parking garage."

Zoning incentives for builders using parking garages are far more common than mandatory requirements for parking structures. The object of these bonus systems is to shape downtowns or employment centers so that they remain compact, dense, and urban. Many of the communities offering these bonuses do not want to end up with commercial areas in which businesses are surrounded by a sea of asphalt. Short descriptions of various bonus systems for underground and multilevel structured parking areas are described in the following paragraphs.

- Bellevue, Washington, is a major office and retail center in the Seattle metropolitan area. The city's downtown zoning code includes bonuses for plazas, public art, pedestrian improvements, and parking facilities. For underground parking, bonuses range from .5 to three square feet of added floor area depending on the zoning district) for each square foot of underground parking constructed. According to local planners, this bonus has proven highly effective.

  For structured parking, the bonuses range from one to four square feet of added floor area for each square foot of parking area provided. This bonus, however, applies only to residential development and only if the parking is part of the main building and architecturally

Surface lots can break up the continuity of busy retail areas and give downtowns a vacant, desolate look. (Dennis McClendon)



compatible with the principal structure.

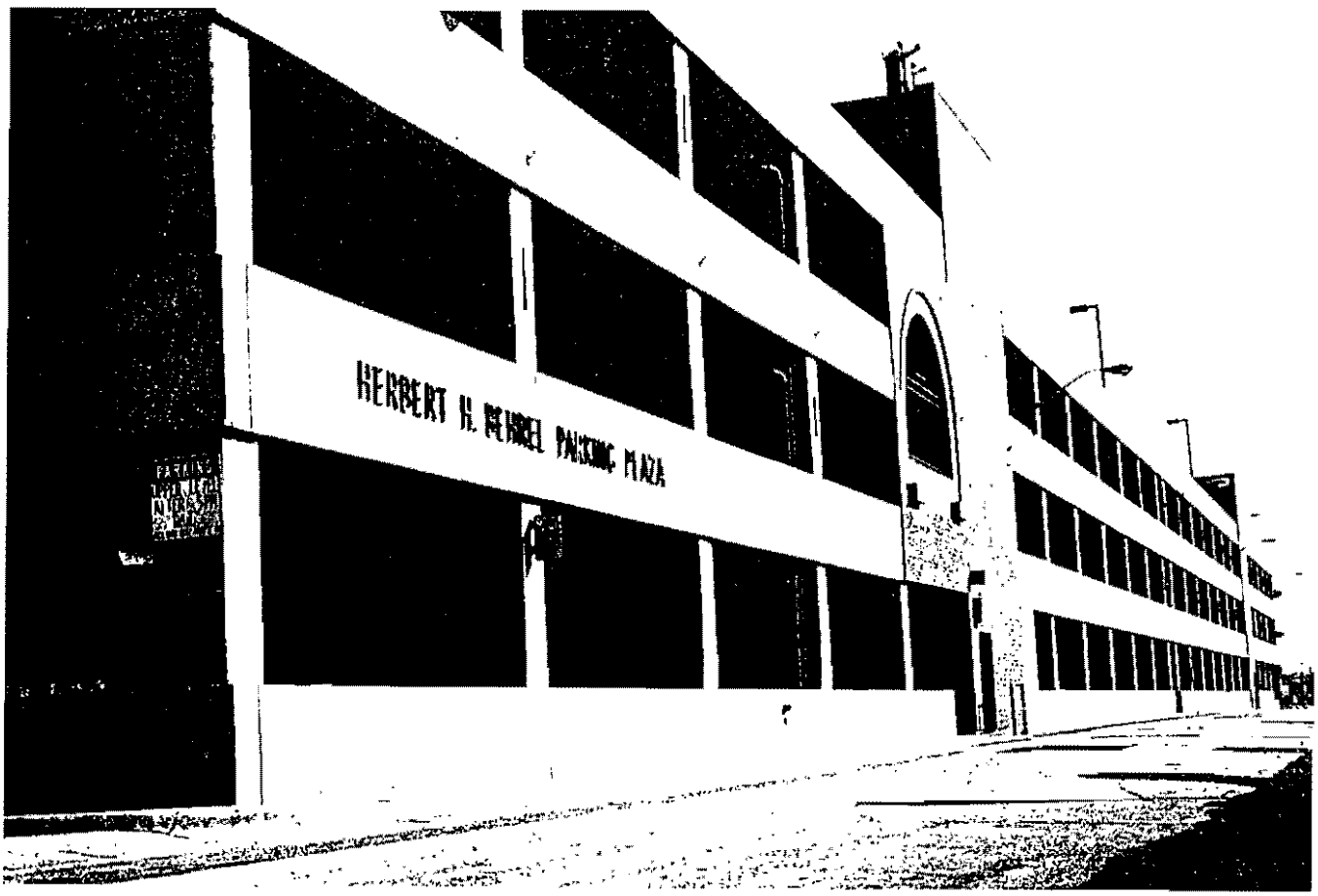
- In Hamden, Connecticut, the zoning ordinance allows developers to build bulkier or taller buildings in high-density business districts and the town center area if they also build underground or structured parking. If underground parking is chosen, the percentage of the site that can be covered by buildings may be increased by 50 percent. If structured parking is part of the principal building, the number of floors devoted to parking is not counted in calculating the building's height.
- In commercial and industrial districts in Irvine, California, one story can be added to a building's permitted height if parking is enclosed in the principal building and if the structure's facade is consistent and architecturally compatible with the main building.
- In various special zoning districts, Austin, Texas, grants an additional one-half square foot of floor area for each square foot of parking built in a parking structure. An additional one square foot of floor area may be permitted for each one square foot of parking constructed below grade.
- In high-density development projects around Washington Metro stops and in designated town center areas in Prince George's County, Maryland, the county authorizes floor area bonuses for developments using parking structures and underground parking. A 50 percent increase in permitted floor area is allowed if structured or underground parking is used. The county's elected board may also grant reductions in the required amounts of parking as an incentive for developers to use structured or underground parking.

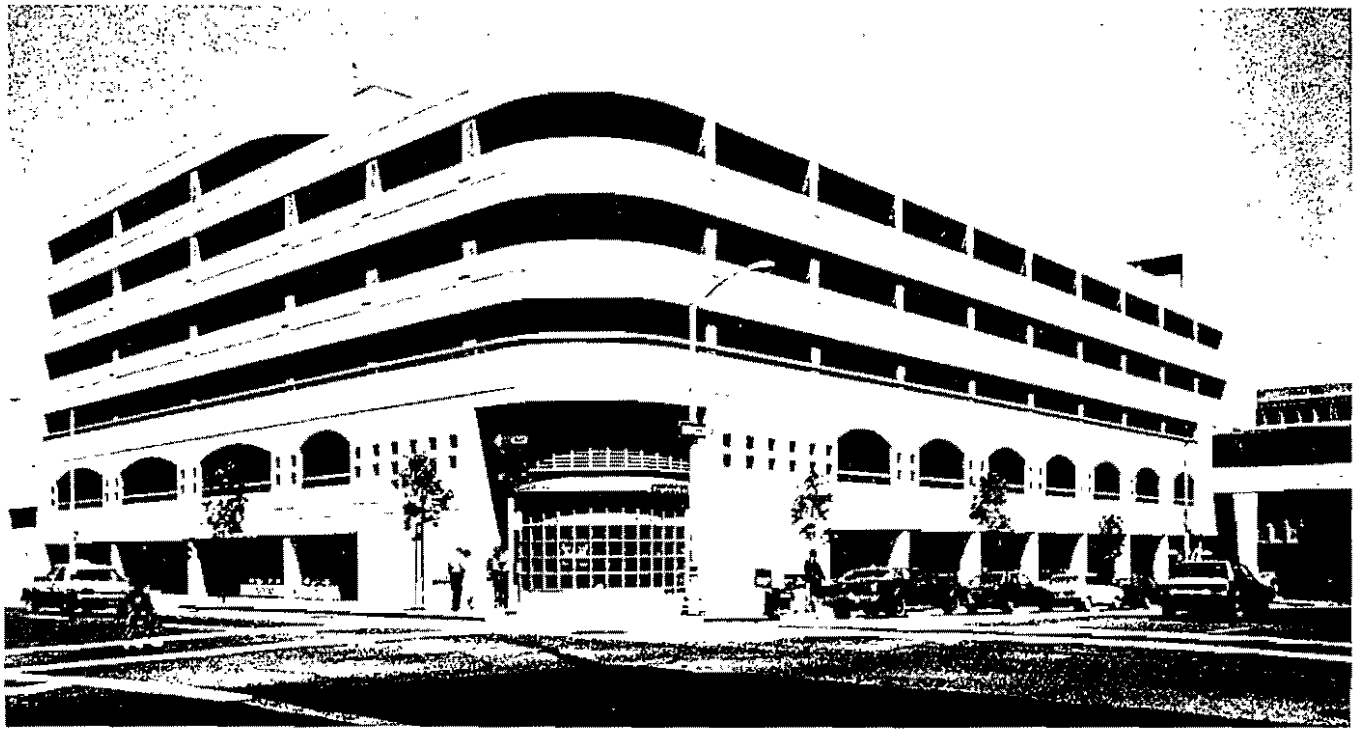
DESIGN STANDARDS FOR PARKING GARAGES

Most new parking structures are built with concrete columns and slabs with little or no attention to screening or facade treatments. When screening is used, it is typically for safety and security purposes and usually consists of chain link fencing, wire mesh panels, corrugated sheet metal, steel or aluminum bumpers, and precast concrete. The overall effect of this type of construction led the *Chicago Tribune*'s architecture critic to conclude that parking structures "have given America some of the ugliest urban architecture for several decades."

Citizen groups and planners have described multilevel parking structures as monolithic, deadening, empty, cavernous, and contributors to urban blight. The Herbert H. Behrel parking garage in downtown Des Plaines, Illinois, for example, has been called a "concrete casket" and the "Berlin Wall." Some local aldermen refer to it simply as "the zit." The 385-space facility is four stories high and runs for about

This garage in downtown Des Plaines, Illinois, has been called the Berlin Wall and a concrete casket. Local aldermen refer to it as "the zit."





(Above) *This seven-story, 690-space garage in Oakland, California, includes ground-floor retail space, a rooftop garden, and a penthouse. (Kaiser Hospitals and Maintenance Organization.)* (Below) *Many older parking and service garages included facade treatments that helped identify their use.*

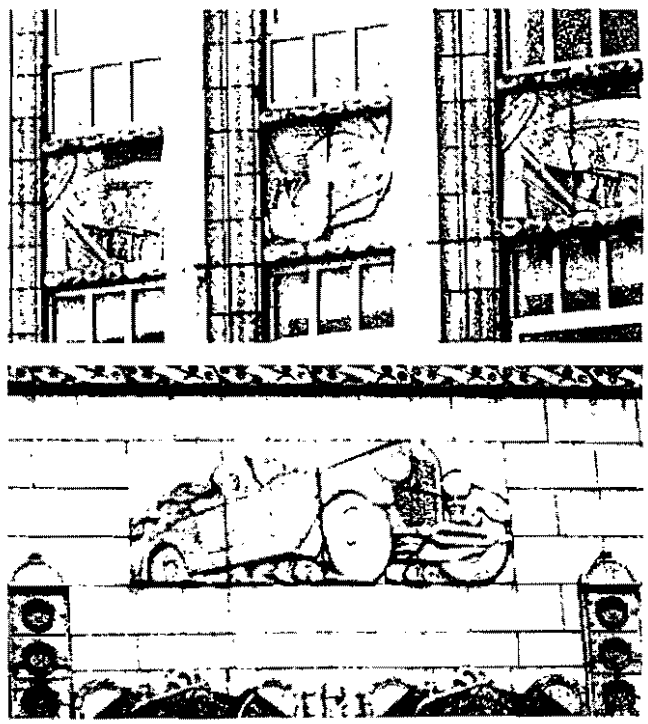
600 feet in the middle of the city's downtown. The structure and a series of railroad tracks split the downtown in two. The garage has had such an adverse impact on the appearance of the city's downtown that there have been calls for its demolition. Community opinion appears in favor of the wrecking ball, but the city fathers are resisting such action because Des Plaines still owes about $1 million on the 1976 structure.

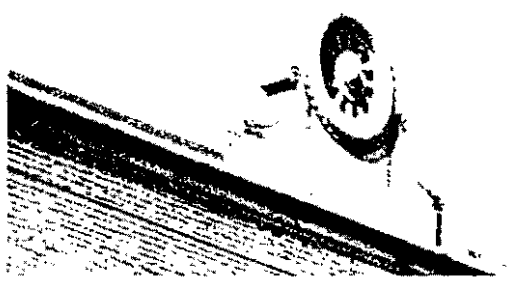
In small business districts like Des Plaines' downtown, parking structures can be the most prominent structure. Their aesthetic, traffic, and economic impacts can extend for blocks. Too often they are simply made of concrete slabs, built for strength and durability rather than appearance. Some cities have tried to change this standard. They have established architectural standards, required street-level improvements, and set comprehensive standards for the design, operation, and appearance of structures.

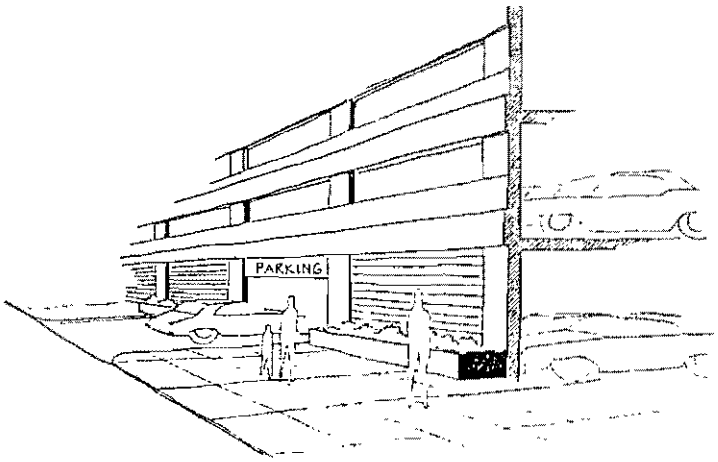
Architectural Standards

Some city zoning codes and urban design plans have stressed the importance of architectural compatibility in the parking structure design. The zoning codes of Orlando, Florida; Oak Brook, Illinois; and Irvine, Glendale, and Los Angeles, California, have architectural standards for parking structures. The urban design plans of Boulder, Colorado; Ann Arbor, Michigan; and Portland, Oregon, also stress compatibility in the appearance, size, scale, and bulk of parking structures with their surroundings.

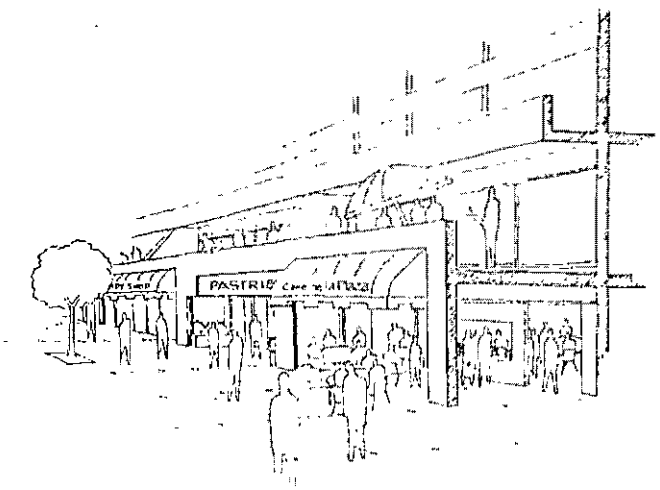
The Irvine code requires that "the exterior elevations of parking structures be designed to minimize the use of blank concrete facades." The code calls for the use of textured concrete, planters and trellises on each level, or other architec-







San Diego's urban design guidelines discourage ground-level parking on pedestrian-oriented streets (above); *they encourage one or two levels of ground-floor retail space in garages* (below). *(San Diego Planning Department)*

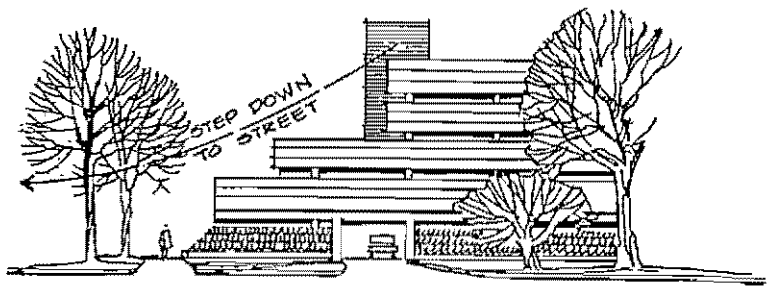


tural treatments that improve the appearance of parking garages. The Orlando downtown development code requires that garages achieve "architectural unity" with the main building or principal use. The Oak Brook code requires that "all exterior walls . . . visible from adjacent roadways, shall be finished with a material so as to maintain a common architectural character . . . with the principal building." Architectural character is defined in the ordinance as "the composite or aggregate characteristics of a structure—form, materials, function of a building" and its other details.

Some California codes are tougher. They regulate height and bulk as well as appearance. According to the Glendale downtown urban design code, parking structures must not be higher than 45 feet or five parking levels above grade along a street's edges. The design guidelines state that a parking structure's exterior should be "harmonious with surrounding buildings and integral with the treatment of buildings they are built to serve." Los Angeles's zoning code for the San Vincente Boulevard special district is similar to the Glendale code. Along this heavily landscaped boulevard in the city's Brentwood area, parking garages are limited to 45 feet. The code requires that structures have staggered setbacks (see illustration), that they have landscaping at each level, and that the structure's facade be architecturally similar to the building it serves.

The urban design plans of Ann Arbor, Michigan, and Boulder, Colorado, include specific architectural recommendations for parking garages. For example, the Boulder urban design plan states that designers of parking garages should:

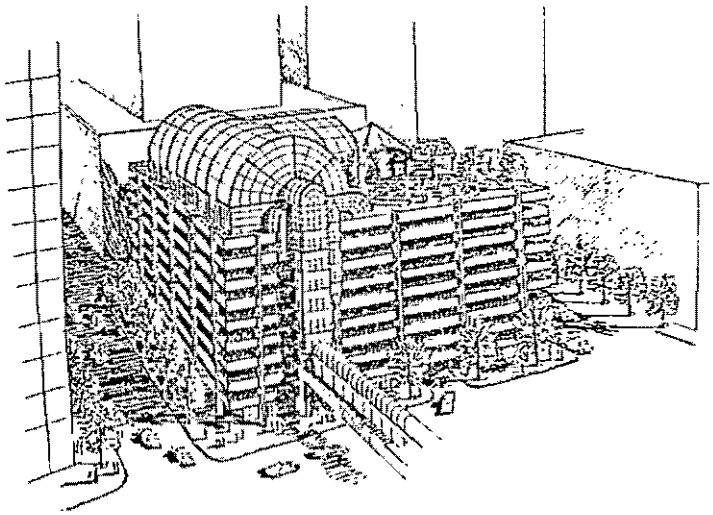
> Incorporate, at a minimum, an equal portion of vertical and horizontal architectural elements;
>
> Replicate the regular window pattern and other architectural elements of adjacent buildings; and
>
> Incorporate art into the structure's facade in order to maintain an active and interesting streetscape.



The upper stories of this garage are set back to reduce the apparent bulk of the building. (Ann Arbor, Michigan, Planning Department)

The Ann Arbor plan states that parking structures should not look like concrete monoliths and should not be built on corner lots. It further specifies that their dimensions along the street should be minimized. The plan also calls for the scale of parking structures to fit positively into the surrounding development context and that structures use upper-story setbacks to reduce the apparent bulk of the building when viewed from the street.

Portland uses substantial zoning bonuses to encourage more spectacular use of garage rooftops, including such things as rooftop gardens. (Portland, Oregon, Planning Department)



Landscaping

Most zoning codes do not include any special landscaping requirements for parking structures. Generally, zoning ordinances mandate only that these structures comply with minimal setbacks and yard requirements. A few local codes, however, have specific landscaping requirements.

The Irvine, California, and Oakbrook, Illinois, zoning codes require that parking garages comply with the street frontage and perimeter landscaping standards for surface parking lots. Irvine also requires the planting of at least one tree for every 20 feet of the structure's perimeter. The Fairfax County, Virginia, landscaping guide requires rooftop plantings for garages and encourages the use of parapets for hanging vines. The Orlando, Florida, code also requires that parking garages meet the perimeter landscaping requirements of surface parking lots—structures must have landscaped bufferyards, street trees, and other improvements. In place of interior parking lot landscaping, parking structure designers must provide landscape planters, hanging baskets, or flower boxes around each level of the structure's perimeter. In the case of very large parking structures with wide street frontages, the zoning administrator may require extra landscaping along the perimeter in amounts equal to what would be required for interior landscaping of a surface parking lot of equal size.

Planners and landscape architects report that narrow, column-like trees can be effective in reducing the predominantly horizontal "line" of parking structures. They also report that planters and trellises on each level can adequately "break up" the harsh concrete facades of the structures.

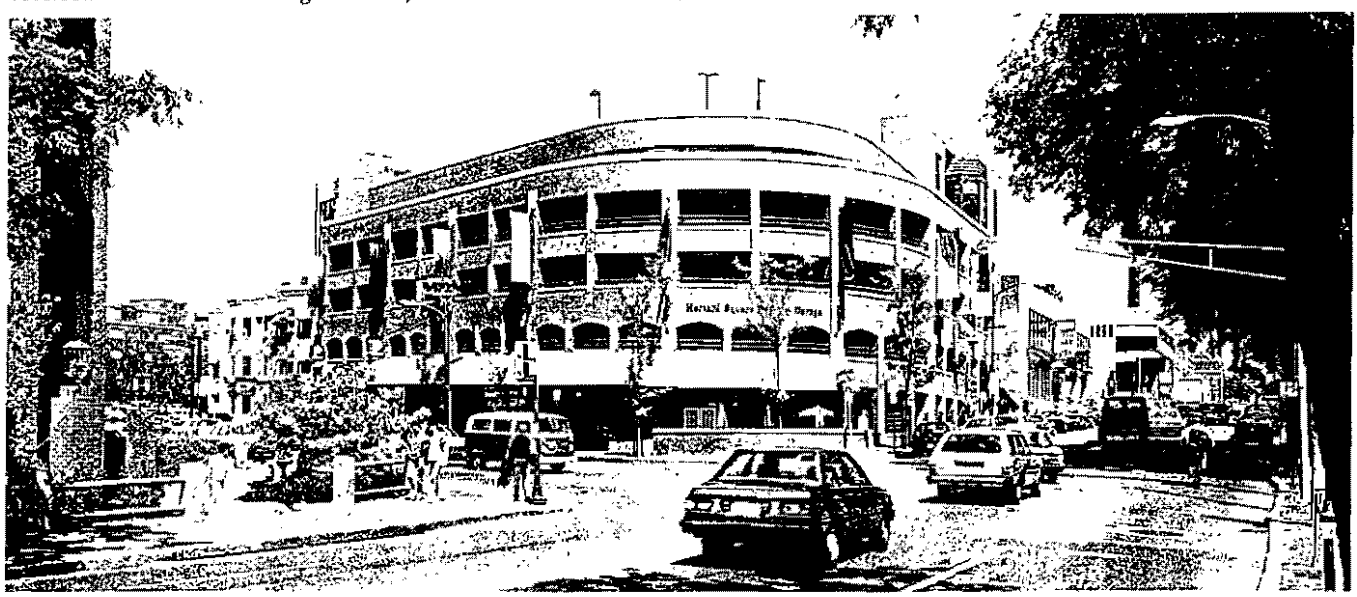
The columnar shape of these trees provides some relief from and contrast to the long horizontal lines of the parking garage.

Garages With Ground-Floor Retail

City planning agencies have used zoning codes, urban design regulations, and the power of persuasion to get builders to include ground-floor retail businesses into parking garages. In many cases, these methods have been enhanced by a stronger market for space for specialty shops, restaurants, and convenience stores. The result has been streetscapes with greater vitality, activity, and visual interest.

Big cities, like New York, Seattle, Portland, San Francisco, and San Diego, have codes that require ground-floor retail in parking garages or other buildings that front on designated pedestrian streets. Furthermore, many middle-size cities, such as Beverly Hills, Palo Alto, and Sacramento, California; Raleigh, North Carolina; Orlando, Florida; and Myrtle Beach, South Carolina, also have these re-

The Harvard Square Garage in Cambridge contains about 15,000 square feet of retail space plus an arcade and sidewalk cafe. The 210-space, five-level garage occupies a triangular-shaped lot and provides an entry to Harvard Square from the Charles River. It received the Governor's Design Award for Massachusetts in 1986. (Peter Vanderwarker)



quirements. Many of these cities have designated specific streets where they want to maintain a high level of pedestrian activity and where they want to preserve a continuous pattern of retail shops along the street.

The Orlando code requires that parking garages on designated pedestrian streets and malls have "at least 75 percent of the ground-floor frontage consisting of active uses other than parking, such as offices, retailing, services, and entertainment." The Orlando code exempts entrances and exits from measures of a garage's ground-floor frontage. The Portland downtown code is similar, requiring that "at least 60 percent of the structure's ground-level frontage be available for retail, service, or office commercial uses." The San Diego code is precise; it requires that the ground floor be devoted to small shops with large display windows.

The Sacramento code goes further. It lists allowable ground-floor uses in parking structures and office and institutional buildings. The list includes:

1. Retail shops selling apparel, books, cameras, fabrics, gifts, luggage, paint, plants, records, shoes, and sporting goods;
2. Walk-in businesses like arcades, art galleries, museums, and theaters;
3. Convenience stores and shops like bakeries, candy stores, delicatessens, pharmacies, florist shops, grocery stores, and restaurants; and
4. Personal service shops like banks, barber shops, beauty parlors, repair stores, dry cleaners, laundromats, printing, photographic studios, tailor shops, and travel agencies.

Most codes mandate that a parking garage's street frontage be used exclusively for retail, personal service, or convenience uses, except for the garage's entrance and exit ramps and service doorways. In many of these cities, the retail uses must occupy a significant percentage (up to 75 percent) of the street-level frontage, and any blank facades along the street are limited to 15- to 30-foot segments.

Architectural and Functional Standards

Some cities, like Bellevue, Washington, San Francisco, and Pasadena, California, have very broad, comprehensive codes for parking structures. These codes not only have aesthetic controls, they have standards for traffic safety, pedestrian safety, and parking structure operations. Pasadena's standards are simple but thorough:

The exterior surface materials and structures of the garage must be compatible with the main structure;

The location of parking structure entrances and exits must be planned so as to have the least impact on residential streets and busy intersections;

Facade length and height must be limited so as not to create large blank walls without the benefit of architectural relief and landscaping; and

Setbacks and buffering must be consistent with what is required for adjoining properties.

The Bellevue zoning code is similar but stresses traffic and pedestrian safety as much as architectural compatibility.

The design of the Schoolhouse garage in Pasadena, California, was the subject of 130 meetings of the city planning, design review, and cultural heritage commissions. (City of Pasadena, California, Public Works and Transportation Department)

Bellevue has a regional shopping mall downtown and large-scale office developments that generate a significant need for parking. In the downtown area, parking garages are permitted only if:

Driveway openings and access lanes are minimized;

The dimensions of the structure abutting pedestrian areas are minimized, except where the ground floor of garages is devoted to retail, service, or commercial activities;

The structure exhibits a horizontal rather than a sloping building line;

Screening or other improvements are made so that parked vehicles are shielded from view at each level of the parking structure;

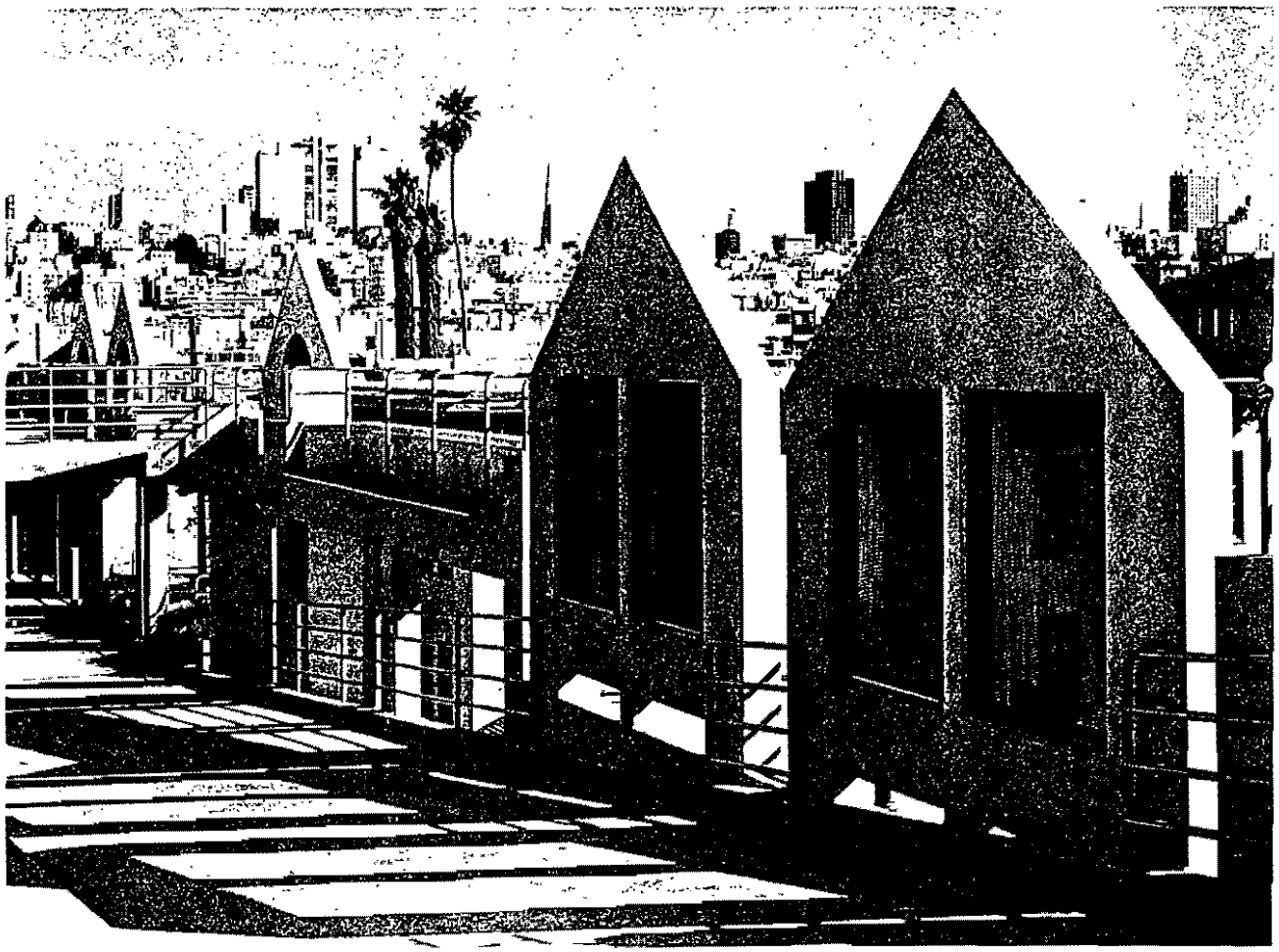
Developers include safe pedestrian connections between the parking structure and the principal use; and

Structures comply with other setback and landscaping requirements.

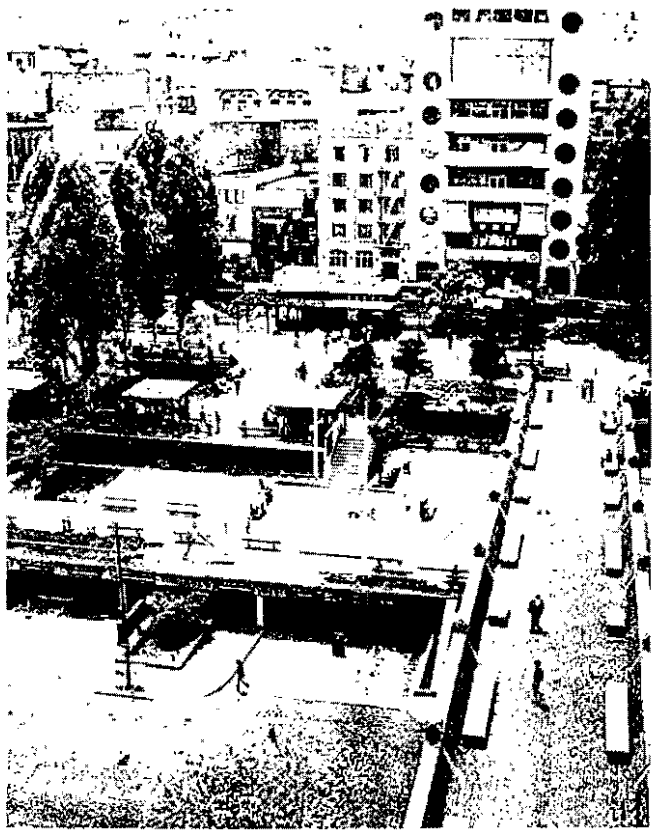
The San Francisco downtown code for parking structures goes much further than the Bellevue or Pasadena codes. It controls the appearance, location, and function of structures *and* regulates the price structure of parking. The object behind regulating the cost of parking is to encourage short-term parking used by shoppers and to discourage long-term (employee) parking. According to the city code, the city planning commission is responsible for the review of any major parking structure (i.e., a garage that is not classified as accessory parking). The code includes the following provisions.

Parking structures must be highly accessible from freeway ramps and major thoroughfares;

The location of structures must be convenient to concentrated commercial development areas;



(Above) San Francisco's Lombard Street garage fits into the fabric of the neighborhood. Shown here is the black mesh screening used in the facade to give the illusion of glass. The A-frame facade mimics the surrounding buildings. (Gordon H. Chong and Associates, Inc.; Douglas Salin, photographer) (Below) The city's Portsmouth Square underground garage, built in 1960, is topped by a public park that is the center of street life in Chinatown. (Parking Authority of the City and County of San Francisco)



The design of entrances and exits must minimize conflicts with pedestrians;

Ground floors must maintain the retail continuity of streets;

Traffic operations must minimize conflict with other forms of transit; and

The fee parking structure must encourage short-term parking and discourage long-term (employee) parking.

The city actually establishes limits on the fees for short-term parking and discourages discounted parking rates for long-term, weekly, monthly, or other time-specific periods. Generally, the rate for short-term parking may not be higher than the hourly rate for long-term parking. Exceptions to the limits on discounting weekly and monthly fees are granted for parking garages serving downtown residential properties.

Copied by FAX
Carmen Moran
Andy Oakley
Bryan Nail

TOWN OF ADDISON

FIRE DEPARTMENT
Post Office Box 144 Addison, Texas 75001
(214) 450-7200 FAX (214) 450-7208
4798 Airport Parkway

MEMORANDUM

January 4, 1996

TO: **John Baumgartner, Director/City Engineer**
FROM: **Gordon C. Robbins, Fire Prevention Chief**
SUBJECT: **Addison Circle - suspended lighting over mews**

Several weeks ago I attended a meeting at which the possibility of suspended lighting was discussed. My understanding at the time was that cables with light fixtures would be suspended over the mews between the buildings at 75-foot intervals and at a height greater than 20-feet above the street.

Yesterday I learned the proposed design also calls for cables to be suspended longitudinally down the middle of the mews, connecting each cable suspended between the buildings.

As you know, we have serious concerns about access to the buildings in the area due to the narrow width (24') of the mews and the possibility of parked cars and other obstructions. And, while we are prepared to work within a 24' x 75' "box" as I originally understood it; we believe the proposed design with the additional cable (a 12' x 75' box) would render our aerial firefighting equipment virtually unusable. We are therefore opposed to it.

If you have any questions, please contact me at ext. 7220

Thank you.

Gordon

A-
Copy Kern
Thks
GB

TOWN OF
ADDISON

PUBLIC WORKS

To: Andy Oakley

Company: Huitt Zollars

FAX #: 871-0757

Date: 1/4/96

# of pages (including cover): 2

From: John Baumgartner, P.E.
Director
Phone: 214/450-2886
FAX: 214/931-6643

16801 Westgrove
P.O. Box 144
Addison, TX 75001

☐ Original in mail ☐ Per your request ☐ FYI ☐ Call me

Comments:

TOWN OF
ADDISON

PUBLIC WORKS

To: Bryant Nail

Company: Columbus Realty Trust

FAX #: 770-5129

Date: 1/4/96

# of pages (including cover): 2

From: John Baumgartner, P.E.
Director
Phone: 214/450-2886
FAX: 214/931-6643

16801 Westgrove
P.O. Box 144
Addison, TX 75001

☐ Original in mail ☐ Per your request ☐ FYI ☐ Call me

Comments:

TOWN OF
ADDISON

PUBLIC WORKS

To: Carmen Moran

Company:

FAX #:

Date: 1/4/96

# of pages (including cover): 2

From: John Baumgartner, P.E.
Director
Phone: 214/450-2886
FAX: 214/931-6643

16801 Westgrove
P.O. Box 144
Addison, TX 75001

☐ Original in mail ☐ Per your request ☐ FYI ☐ Call me

Comments:

32 TRANSACTION REPORT FOR HP FAX-700 SERIES VERSION: 01.00

FAX NAME: SERVICE CENTER DATE: 04-JAN-96
FAX NUMBER: 9316643 TIME: 15:06

DATE	TIME		REMOTE FAX NAME AND NUMBER	DURATION	PG	RESULT	DIAGNOSTIC
03-JAN	14:45	S	386 0938	0:03:21	8	OK	A73840100160
03-JAN	14:51	S	214 871 0757	0:01:28	3	OK	563340100198
03-JAN	15:46	R	2145571552	0:00:50	2	OK	663113001100
03-JAN	15:53	R	386 0938	0:00:54	2	OK	A7381300116C
03-JAN	16:01	R	214 637 4905	0:01:17	3	OK	663813001100
03-JAN	16:14	S	214 631 8428	0:00:43	2	OK	6638401001A4
03-JAN	16:31	R		0:02:39	6	OK	663813001000
03-JAN	16:44	S	3850396	0:00:57	2	OK	55334010006A
03-JAN	16:46	S	1 214 991 2740	0:00:56	2	OK	663840100190
03-JAN	16:55	S	214 701 0840	0:00:41	1	OK	663840100160
03-JAN	17:07	R	1	0:00:56	1	OK	553113001100
03-JAN	19:15	R		0:05:00	12	OK	663813001100
04-JAN	07:47	R		0:00:11	0	ERROR	510551112001000
04-JAN	07:55	S	512 719 0262	0:01:00	2	OK	663840100188
04-JAN	07:57	R	2149607684	0:00:38	1	OK	653813001100
04-JAN	09:07	S	214 387 0350	0:01:47	2	OK	A73840100160
04-JAN	09:15	S	855 0219	0:03:28	8	OK	563340100198
04-JAN	09:31	S	386 0938	0:00:28	1	OK	A73840100160
04-JAN	11:34	S	386 0938	0:00:12	1	ERROR	030A73840100160
04-JAN	11:36	S	386 0938.	0:00:52	2	OK	A73840100160
04-JAN	11:41	S	2149607684	0:00:42	2	OK	65384010016A
04-JAN	11:44	R	386 0938	0:00:36	1	OK	A7381300116C
04-JAN	11:52	R	817 488 8945	0:04:33	9	OK	663813001100
04-JAN	12:22	S	8174812886	0:00:00	0	NO ANS	4236B4740000000
04-JAN	13:11	R		0:14:55	25	OK	563113001000
04-JAN	13:26	R		0:01:34	2	OK	5A3313001000
04-JAN	13:39	R	214 891 5119	0:01:25	2	OK	563113001100
04-JAN	14:26	S	386 0938	0:00:27	1	OK	A73840100160
04-JAN	14:33	S	TU ELEC 7916706	0:01:03	1	OK	664840100098
04-JAN	14:36	S	2149607684	0:00:52	2	OK	65384010016A
04-JAN	14:40	S	855 0219	0:00:51	2	OK	563340100198
04-JAN	14:46	S	214+770+5129	0:00:46	2	OK	663840100192

****

S=FAX SENT
R=FAX RECEIVED
I=POLL IN(FAX RECEIVED)
O=POLLED OUT(FAX SENT)

Penny & Associates

Transportation Engineers

June 8, 1995

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

Dear John:

I have included two articles from the Transportation and Traffic Engineering Handbook published by the Institute of Transportation Engineers. I am still looking for some articles that were published a few years ago in our transportation engineers periodical, the ITE Journal. The information in the ITE Journal concerned practices in Great Britain and may or may not be useful.

I may bring to your attention that there are several concerns that should be considered before installing a roundabout, also known as a traffic circle or a rotary intersection.

1. The first concern is the tremendous amount of right of way that may be required to properly design and install one in an area other than in a residential subdivision. You may have been familiar with the circle at Loop 12 and Harry Hines in Dallas, or with the circle at Camp Bowie Boulevard and Alta Mere Drive in Fort Worth. Both these circles required many acres of land.

2. Second, access around a traffic circle is severely restricted. Obviously no driveways can be located inside the circle, but driveways must be located away from the entry and departure legs of the circle for it to operate safely. This is extremely detrimental to property owners adjacent to the circle.

3. The larger the traffic volumes, the larger the circle must be. Once traffic volumes exceed 3000 vehicles per hour (note "ROTARY INTERSECTIONS") the level of service severely deteriorates.

Also, the roundabout should be used where there are roughly equal traffic volumes on all legs of the intersections, and where turning movements, both right and left, are high. The intersections are very low speed because of the required weaving and turning traffic. They also will cause delay in instances where volumes are higher and cars will stack on the adjacent streets waiting to enter the circle.

Very briefly, that's an overview. Have your traffic engineer perform a very detailed study and analysis before agreeing to install one. They may or may not work for you.

Sincerely,

Don Penny, P.E.

1411 Natchez Drive, Arlington, Texas 76014 fax 817/465-3791 817/465-1072

BARTON-ASCHMAN
Barton-Aschman Associates, Inc
8435 Bec[illegible] Road Suite 199 • Dallas, Texas 75240 • (214) 991-1900 • Fax (214) 490-9261

Memorandum

TO: John Baumgartner
Town of Addison

FROM: Gary Jost

DATE: January 5, 1996

SUBJECT: Addison Roundabout - Additional comments

We have completed our review of the sensitivity analysis completed by Ourston and Doctors and design plans prepared by Huitt-Zollars for the proposed Addison Roundabout. This memorandum presents our findings.

Sensitivity Analysis

Ourston and Doct[illegible] based on 50 percent and 85 percent confidence levels [illegible] ercent confidence level, this means that one can be 8[illegible] greater than the calculated values. Based on the un[illegible] ndabout in North Texas, we would recommend that [illegible] culating operating conditions of the planned roundab[illegible]

It should also be [illegible] e transportation profession regarding the most approp[illegible] ern roundabouts. The Transportation Research Board [illegible] nt capacity analysis techniques and develop a new F[illegible] This committee, chaired by Mr. John Zegeer of Barto[illegible] nclude a recommended procedure for analyzing mode[illegible]

Send a copy to Ron Wright as indicated RB ✓

The sensitivity analysis reports that at the 85 percent confidence level traffic volumes can be increased, from volumes originally projected, by 4 percent in the A. M. peak period and 11 percent in the P.M. peak period while still maintaining a level of service D. This suggests that the current design is highly sensitive to small increases in traffic volumes. With an 11 percent increase in traffic volumes, and assuming that 10 percent of daily traffic occurs during the P.M. peak hour, one could estimate that the effective capacity of Quorum Drive, assuming 10,000 vehicles per day (vpd) on

Mildred, would be less than 30,000 vpd.

Of particular note is the comparison of average and maximum queue lengths between the original projections and the maximum volumes that can be accommodated at Level of Service D. Tables 1.0 and 2.0 present this comparison for the A.M. and P.M. hours, respectively.

Table 1.0
Average and Maximum Queues
A.M. Peak Hour

APPROACH LEG	AVERAGE QUEUES (VEH)		MAXIMUM QUEUES (VEH)	
	ORIG.	LOS D	ORIG.	LOS D
NB Quorum	0	1	1	1
WB Mildred	1	1	1	1
SB Quorum	17	30	35	69
EB Mildred	4	5	6	9

Table 2.0
Average and Maximum Queues
P.M. Peak Hour

APPROACH LEG	AVERAGE QUEUES (VEH)		MAXIMUM QUEUES (VEH)	
	ORIG.	LOS D	ORIG.	LOS D
NB Quorum	4	12	6	25
WB Mildred	5	30	10	57
SB Quorum	1	1	1	2
EB Mildred	1	2	2	3

As shown in these tables, average and maximum queues increase significantly with very little increase in total volume entering the roundabout.

Based on the sensitivity to small increases in peak-hour volumes identified in the analysis conducted by Ourston and Doctors, it is our recommendation that the design of the planned Addison Roundabout be analyzed further to provide more stable conditions at these anticipated volumes.

OTHER DESIGN CONSIDERATIONS

Parking

On -street parking along Quorum and Mildred should be restricted within 150 feet of the roundabout on the departure legs of the roadways to provide adequate sight distance.

Paving Typical Section

The typical section for Quorum Drive specifies a full sawcut with existing steel to remain. The full depth sawcut will also cut the steel. If a full depth sawcut is desired, steel dowels will need to be drilled and inserted into the existing concrete pavement.

Signing and Markings

- The stop sign at Witt Mews and Mildred should be moved behind the barrier free ramps.
- The no parking signs on Mildred appear to conflict with the paving plans.
- If pedestrians are to be restricted from entering the roundabout island, then "No Pedestrian" signs should be installed in the island.
- All discussions to date regarding pedestrian crossings at the roundabout have indicated that the crossings should be located one to two vehicles behind the yield line. This needs to be reflected on the plans.
- Addison has typically utilized pavement markers rather than striping for lane delineation.
- Advance warning signs for the roundabout should be provided.
- Additional signs (i.e. chevrons) identifying the roadway curvature are recommended.

Miscellaneous

- There appears to be an abrupt change in crossfall on the north side of the roundabout at Quorum.
- Loading and unloading areas should not be allowed in the area of the roundabout.

If you have any questions, please do not hesitate to call.

TOWN OF
ADDISON

PUBLIC WORKS

To: Bryant Nail

Company: Columbus Realty Trust

FAX #: 770-5129

Date: 1/5/96

# of pages (including cover): 4

From: John Baumgartner, P.E.
Director
Phone: 214/450-2886
FAX: 214/931-6643

16801 Westgrove
P.O. Box 144
Addison, TX 75001

☐ Original in mail ☐ Per your request ☐ FYI ☐ Call me

Comments:

TOWN OF
ADDISON

PUBLIC WORKS

To: Carmen Moran

Company:

FAX #:

Date: 1/5/96

# of pages (including cover): 4

From: John Baumgartner, P.E.
Director
Phone: 214/450-2886
FAX: 214/931-6643

16801 Westgrove
P.O. Box 144
Addison, TX 75001

☐ Original in mail ☐ Per your request ☐ FYI ☐ Call me

Comments:

TOWN OF
ADDISON PUBLIC WORKS

To: Andy Oakley

Company: Hutt-Zollars

FAX #: 871-0757

Date: 1/5/96

# of pages (including cover): 4

From: John Baumgartner, P.E.
Director
Phone: 214/450-2886
FAX: 214/931-6643

16801 Westgrove
P.O. Box 144
Addison, TX 75001

☐ Original in mail ☐ Per your request ☐ FYI ☐ Call me

Comments:

32 TRANSACTION REPORT FOR HP FAX-700 SERIES VERSION: 01.00

FAX NAME: SERVICE CENTER DATE: 05-JAN-96
FAX NUMBER: 9316643 TIME: 16:35

DATE	TIME		REMOTE FAX NAME AND NUMBER	DURATION	PG	RESULT	DIAGNOSTIC
04-JAN	16:42	S	18002329488	0:00:32	1	OK	663840100198
04-JAN	16:44	S	817 752 0050	0:00:32	1	OK	663840100188
04-JAN	16:50	S	2149607684	0:02:07	5	OK	65384010016A
04-JAN	18:12	R	2142428203	0:00:58	1	OK	653813001100
05-JAN	03:01	R		0:02:14	1	OK	553113001100
05-JAN	06:27	R		0:00:36	1	OK	563113001100
05-JAN	08:53	R	214 490 9261	0:05:06	13	OK	6A3813001100
05-JAN	09:48	R	214 745 7806	0:00:49	2	OK	663813001100
05-JAN	09:58	R	2146703154	0:00:54	2	OK	663813001100
05-JAN	10:44	R	2146703154	0:01:44	5	OK	663813001100
05-JAN	11:15	S	214 423 2917	0:00:43	1	OK	55314010016A
05-JAN	13:10	S	2144507208	0:00:44	2	OK	65384010016A
05-JAN	13:12	S	2144507208	0:00:44	2	OK	65384010016A
05-JAN	13:29	R		0:01:12	1	OK	553113001000
05-JAN	13:37	R	2149607684	0:01:41	3	OK	653813001100
05-JAN	13:41	S	2149316011	0:01:31	3	OK	563140100170
05-JAN	13:45	R	817 871 8116	0:05:20	7	OK	553113001100
05-JAN	13:55	R	214 991 0704	0:00:55	2	OK	663813001100
05-JAN	13:58	S	PD UPSTAIRS 7020643	0:00:42	2	OK	65384010006A
05-JAN	15:06	S	2149607684	0:01:46	4	OK	65384010016A
05-JAN	15:09	S	855-0219	0:01:49	4	OK	563340100198
05-JAN	15:29	R		0:00:55	1	ERROR	5025531130000100
05-JAN	15:31	S	214+770+5129	0:01:41	4	OK	663840100192
05-JAN	15:33	S	817 752 0050	0:00:32	1	OK	663840100188
05-JAN	15:34	S	TU ELEC 7916706	0:01:02	1	OK	664840100098
05-JAN	15:35	R		0:01:31	2	OK	553113001100
05-JAN	15:39	S	817 752 0050	0:00:32	1	OK	663840100188
05-JAN	15:52	R	214 466 3535	0:03:40	6	OK	663813001100
05-JAN	16:03	S	386 0938	0:00:30	1	ERROR	031A7384010016C
05-JAN	16:06	S	386 0938	0:00:29	1	STOP	A7384010216C
05-JAN	16:08	S	386 0938	0:00:30	1	OK	A7384010016C
05-JAN	16:10	S	FINANCE UP 4507065	0:03:04	7	OK	553340100192

S=FAX SENT
R=FAX RECEIVED
I=POLL IN(FAX RECEIVED)
O=POLLED OUT(FAX SENT)

TOWN OF ADDISON

FIRE DEPARTMENT

Post Office Box 144 Addison, Texas 75001

(214) 450-7200 FAX (214) 450-7208

4798 Airport Parkway

MEMORANDUM

December 27, 1995

TO: **John Baumgartner, Director of Public Works**
FROM: **Gordon C. Robbins, Fire Prevention Chief**
SUBJECT: **Addison Circle - Street and Water plans**

I have received and reviewed the above plans and have the following comments:

STREET PLAN
The Fire Department finds no issues of concern with this submittal.

WATER PLAN
Hydrant locations are not shown on this submittal. In order to make an appropriate review of the proposed water supply system, fire hydrant locations and main sizes must be available.

Please contact me if you require additional information.

Gordon

c: Carmen Moran, Director of Development Services

JOHN:

IF YOU HAVE A SET WITH HYDRANT LOCATIONS, LET ME KNOW + I'LL COME LOOK AT THEM.

THANKS

GORDON

LAST TRANSACTION REPORT FOR HP FAX-700 SERIES VERSION: 01.00

FAX NAME: SERVICE CENTER
FAX NUMBER: 9316643

DATE: 27-DEC-95
TIME: 15:45

DATE	TIME		REMOTE FAX NAME AND NUMBER	DURATION	PG	RESULT	DIAGNOSTIC
27-DEC	15:37	S	855 0219	0:00:47	2	OK	563340100198

****

S=FAX SENT
O=POLLED OUT(FAX SENT)

TO PRINT THIS REPORT AUTOMATICALLY, SELECT AUTOMATIC REPORTS IN THE SETTINGS MENU.
TO PRINT MANUALLY, PRESS THE REPORT/SPACE BUTTON, THEN PRESS ENTER.

BARTON-ASCHMAN A PARSONS TRANSPORTATION GROUP COMPANY

Barton-Aschman Associates, Inc.
5485 Belt Line Road, Suite 199 • Dallas, Texas 75240 • (214) 991-1900 • Fax: (214) 490-9261

Memorandum

TO: John Baumgartner
Town of Addison

FROM: Gary Jost

DATE: January 5, 1996

SUBJECT: Addison Roundabout - Additional comments

We have completed our review of the sensitivity analysis completed by Ourston and Doctors and design plans prepared by Huitt-Zollars for the proposed Addison Roundabout. This memorandum presents our findings.

Sensitivity Analysis

TOWN OF
ADDISON

PUBLIC WORKS

To: Andy Oakley
Company: Huitt-Zollars
FAX #: 871-0757
Date: 12/27/95
# of pages (including cover): 2

From: John Baumgartner, P.E.
Director
Phone: 214/450-2886
FAX: 214/931-6643

16801 Westgrove
P.O. Box 144
Addison, TX 75001

☐ Original in mail ☐ Per your request ☐ FYI ☐ Call me

Comments:

Mildred, would be less than 30,000 vpd.

Of particular note is the comparison of average and maximum queue lengths between the original projections and the maximum volumes that can be accommodated at Level of Service D. Tables 1.0 and 2.0 present this comparison for the A.M. and P.M. hours, respectively.

Table 1.0
Average and Maximum Queues
A.M. Peak Hour

APPROACH LEG	AVERAGE QUEUES (VEH)		MAXIMUM QUEUES (VEH)	
	ORIG.	LOS D	ORIG.	LOS D
NB Quorum	0	1	1	1
WB Mildred	1	1	1	1
SB Quorum	17	30	35	69
EB Mildred	4	5	6	9

Table 2.0
Average and Maximum Queues
P.M. Peak Hour

APPROACH LEG	AVERAGE QUEUES (VEH)		MAXIMUM QUEUES (VEH)	
	ORIG.	LOS D	ORIG.	LOS D
NB Quorum	4	12	6	25
WB Mildred	5	30	10	57
SB Quorum	1	1	1	2
EB Mildred	1	2	2	3

As shown in these tables, average and maximum queues increase significantly with very little increase in total volume entering the roundabout.

Based on the sensitivity to small increases in peak-hour volumes identified in the analysis conducted by Ourston and Doctors, it is our recommendation that the design of the planned Addison Roundabout be analyzed further to provide more stable conditions at these anticipated volumes.

OTHER DESIGN CONSIDERATIONS

Parking

On -street parking along Quorum and Mildred should be restricted within 150 feet of the roundabout on the departure legs of the roadways to provide adequate sight distance.

Paving Typical Section

The typical section for Quorum Drive specifies a full sawcut with existing steel to remain. The full depth sawcut will also cut the steel. If a full depth sawcut is desired, steel dowels will need to be drilled and inserted into the existing concrete pavement.

Signing and Markings

- The stop sign at Witt Mews and Mildred should be moved behind the barrier free ramps.
- The no parking signs on Mildred appear to conflict with the paving plans.
- If pedestrians are to be restricted from entering the roundabout island, then "No Pedestrian" signs should be installed in the island.
- All discussions to date regarding pedestrian crossings at the roundabout have indicated that the crossings should be located one to two vehicles behind the yield line. This needs to be reflected on the plans.
- Addison has typically utilized pavement markers rather than striping for lane delineation.
- Advance warning signs for the roundabout should be provided.
- Additional signs (i.e. chevrons) identifying the roadway curvature are recommended.

Miscellaneous

- There appears to be an abrupt change in crossfall on the north side of the roundabout at Quorum.
- Loading and unloading areas should not be allowed in the area of the roundabout.

If you have any questions, please do not hesitate to call.

BARTON-ASCHMAN
A PARSONS TRANSPORTATION GROUP COMPANY
9468 Bell Line Road, Suite 199 • Dallas,Texas 75240 USA • (214) 991-1900 Fax (214) 490-9281

Memorandum

TO: John Baumgartner
Town of Addison

FROM: Gary Jost

DATE: November 27, 1995

SUBJECT: Review of Design Study for Addison Circle Modern Roundabout

This memorandum presents the findings of a review conducted by Barton-Aschman Associates Inc. of the above referenced study. The study, dated November 14, 1995, was prepared by Huitt-Zollars, Inc. in association with Ourston and Doctors. The study presents the geometric design parameters and estimated operating conditions of a modern roundabout planned for the intersection of Quorum Drive and Mildred Street in the Town of Addison. Barton-Aschman's review focuses on the operational and safety considerations of the planned roundabout assuming projected traffic volumes at build-out of the proposed development and currently undeveloped sites along the Quorum Drive Corridor. Our findings are contained in the paragraphs below.

PROPOSED LAND USE

The proposed development consists of approximately 5,050 multi-family dwelling units and 207,887 square feet of commercial floor area. The commercial land uses will be located adjacent to Quorum Drive and Mildred Street.

The proposed land use plan represents land use densities much greater than typically found in the Dallas area. Because of these higher densities, one can expect that the development will generated significantly higher traffic volumes (on a per acre basis) than other multi-family developments in the area. These increased traffic volumes could impact the ability of the area roadway system to accommodate future development along the Quorum Drive Corridor.

TRIP GENERATION

The report estimates that the proposed development will generate approximately 40,000 vehicle trips per day, with 2,900 and 3,950 trips generated during the A.M. and P.M. peak hours, respectively.

While Barton-Aschman estimates of trip generation for the proposed development generally fall within this order of magnitude of daily and peak hour trips, we would request that further documentation be supplied on specific rates, equations, and other assumptions used in this projection of site generated traffic.

Given that Quorum Drive will be the main thoroughfare serving the development, a significant number of the site generated trips will utilize Quorum Drive. Assuming that 50 percent of the site generated traffic will utilized Quorum Drive on any given day, approximately 75 percent (assuming 30,000 vpd as capacity) of the capacity of the of this roadway will be consumed by the proposed development. With other land available for development along the corridor, it can be concluded that demand on Quorum Drive could exceed the 30,000 vpd for assumed in the report.

TRAFFIC ASSIGNMENTS

The peak hour traffic volume assignments for the proposed roundabout indicate 3,064 and 3,150 vehicles entering the roundabout during the A.M. and P.M. peak hours, respectively. Of the total approaching volumes approximately 55.4% of the A.M. peak hour site generated traffic and 64.7% of the P.M. peak hour site generated traffic is assigned through the roundabout. We request that additional documentation of the traffic assignment assumptions be provided. Non-site traffic makes up the remainder of the total volumes entering the roundabout during the peak hours (1,696 vehicles in the A.M. and 1,111 vehicles in the P.M.). These non-site generated traffic volumes seem conservative given the development potential in the corridor. We request that further documentation be provided on the generation of non-site traffic volumes.

The total traffic volumes entering the roundabout appear conservative given the assumed capacities for Quorum Drive(30,000 vpd) and Mildred Street (10,000 vpd). Assuming that 10 percent of the daily traffic occurs during each of the peak hours, it can be assumed that the roundabout should expect approach volumes of approximately 4,000 vehicle during each of the peak hours. Given the findings regarding the percentage of Quorum Drive capacity utilized by the proposed development, higher projected peak hour volumes should be evaluated.

GEOMETRIC DESIGN PARAMETERS

The report states that design parameters were developed to reflect "space limitations imposed by the proposed right of way, proposed development and existing streets." Given that the planned roundabout is currently proposed on undeveloped land with no immediately adjacent buildings, it is not felt that space limitations should constrain the development of design parameters that will provide optimum flow conditions through the roundabout. Given the relationship between the diameter of a roundabout and its capacity, further analysis should be conducted without such a limitation.

SAFETY CONSIDERATIONS

The design report properly identifies lighting requirements, signing and striping requirements, and and adequate sight distance as critical elements of the design of the roundabout. The design of these elements should be carefully reviewed given the unfamiliar nature of modern roundabouts to drivers in the United States.

CONCLUSIONS

The design report provides design parameters to accommodate the projected traffic volumes identified in the report. Given the trip generation characteristics of the proposed development, the development potential of the Quorum Drive corridor, actual volumes could be considerably higher than those projected in the report. In lieu of a detailed analysis of projected corridor volume, it is requested that a sensitivity analysis be conducted on the proposed design to increases in traffic volumes. These iterative increases in traffic volumes should be consistent with the development potential in the corridor and identify at what level of traffic volume the roundabout would cease to operate at an acceptable level of service during the peak hours. For purposes of the study, we would recommend that average vehicle delays greater than 40 seconds per vehicle (level of service D) be considered as unacceptable.

p:\wp\gary\addison\addcir.mcm

INFORMATION RETRIEVAL SHEET

Title: Roundabouts — A Design Guide

Keywords: Roundabout, rotary intersection design, road, heirarchy, capacity, traffic delay, speed, control, accident reduction, circulating roadway, splitter island.

Summary: Roundabouts are safe and efficient forms of intersections control. They have been used extensively in Great Britain for many years and are now being used increasingly in Australia.

Roundabouts have application at a wide variety of intersections ranging from intersections on heavily trafficked arterial roads to intersections on local streets. The capability of handling heavy right turn traffic movements and the reduction in accidents and delays are major advantages of roundabouts.

The aims of this Guide are:

(a) to give guidance on locations where roundabouts may be used;

(b) to describe the performance and operation of roundabouts;

(c) to give guidance on design standards for roundabouts to encourage high standard, uniform designs.

ROUNDABOUTS
a design guide

National Association of Australian State Road Authorities

1986

NATIONAL ASSOCIATION OF AUSTRALIAN STATE ROAD AUTHORITIES

MEMBER AUTHORITIES

New South Wales	Department of Main Roads
Victoria	Road Construction Authority
Queensland	Main Roads Department
Western Australia	Main Roads Department
South Australia	Highways Department
Tasmania	Department of Main Roads
Northern Territory	Department of Transport and Works
Commonwealth Government	Department of Housing and Construction

STANDING COMMITTEES

Principal Technical Committee

Bridge Engineering Committee
Construction & Maintenance Practice Committee
Information and Computing Services Committee
Materials Engineering Committee
Planning Committee
Plant and Equipment Committee
Road Design Committee
Traffic Engineering Committee

Principal Administrative Committee

SECRETARIAT

5th Floor,
Legal & General House
2 Dind Street,
Milsons Point N.S.W. 2061

Mail: P.O. Box 489,
Milsons Point N.S.W. 2061

FOREWORD

The National Association of Australian State Road Authorities works towards ensuring uniformity of practice in design, construction and user aspects of roads and bridges and with this purpose in view arranges for the preparation and publication of Specifications, Manuals and Guides dealing with standards and general procedures.

An increasing number of roundabouts are being constructed in Australia, and this Guide is intended to assist the Designer by giving advice on:

(i) where roundabouts may be used;
(ii) the performance and operation of roundabouts; and
(iii) design standards.

Conditions will be encountered where the principles described in this Guide cannot be fully implemented. In this event, it is expected that the Designer will modify the details while maintaining the concepts of safety and design expressed by the Guide.

CONTENTS

LIST OF FIGURES

1 INTRODUCTION

Well designed roundabouts are safe and efficient forms of intersection control. They have been used extensively in Great Britain for many years and have been introduced into Australia, particularly in Victoria, over recent years.

Roundabouts operate by gap acceptance, in that approaching drivers must give way to circulating traffic on the roundabout. The proven safety performance of most roundabouts is due to the low relative speeds of all vehicles and the relative simplicity of decision making to drivers. They can also cater for a wide range of traffic volumes and achieve low delays.

The aims of this Guide are;

(a) to give guidance on where roundabouts may be used;
(b) to describe the performance and operation of roundabouts;
(c) to give guidance on design standards for roundabouts so that high standard and uniform designs will be encouraged.

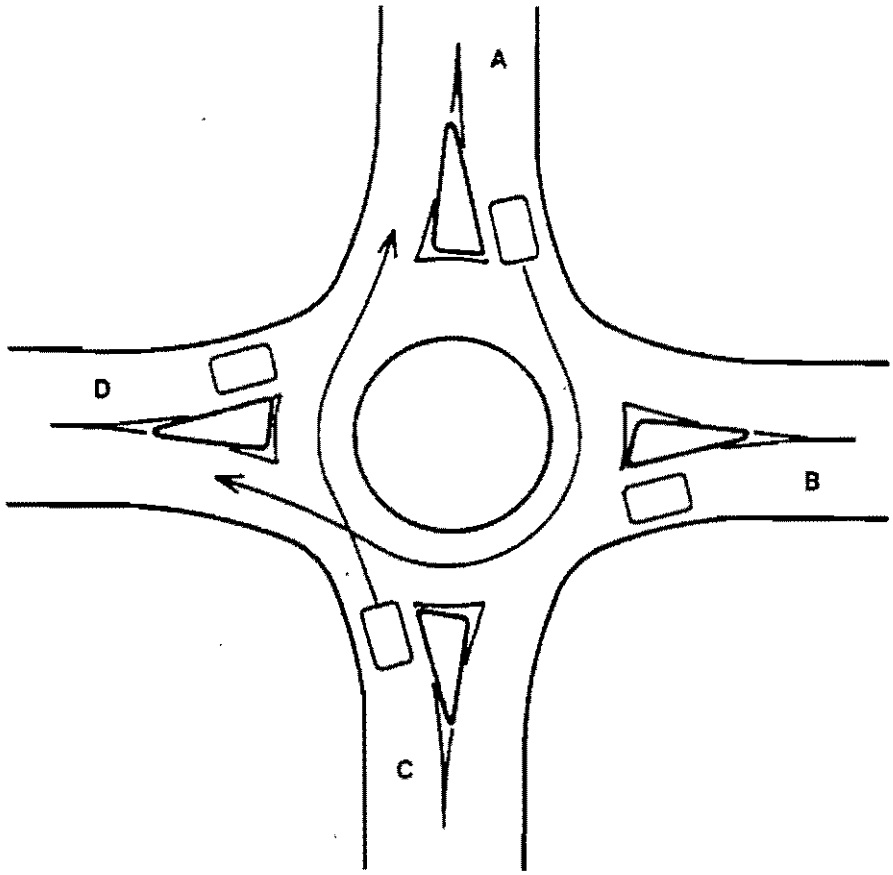
An example of a temporary roundabout at the intersection of urban local roads.

Assessment of the most appropriate type of treatment at an intersection can be complex with safety considerations always being of great importance. In most instances, a roundabout may be considered as one possible option and compared with others (both signalised and unsignalised) in terms of the design aims.

The assessment may be influenced by:

- traffic management strategy
- traffic volumes and percentage of turning vehicles;
- types of vehicles using the intersection;
- public transport vehicle usage;
- adjacent land use (such as the proximity of schools and elderly citizens' community facilities, etc);
- pedestrian usage;
- cyclist usage;
- access to adjacent properties;
- parking requirements;
- compatibility with adjacent intersections;
- existing intersection type;
- safety aspects;

(b) At intersections where there are high proportions of right-turning traffic. Unlike most other intersection treatments, roundabouts can operate efficiently with high volumes of right-turning vehicles. Indeed, these right-turning vehicles contribute to good roundabout operation as is illustrated in Figure 2.1.



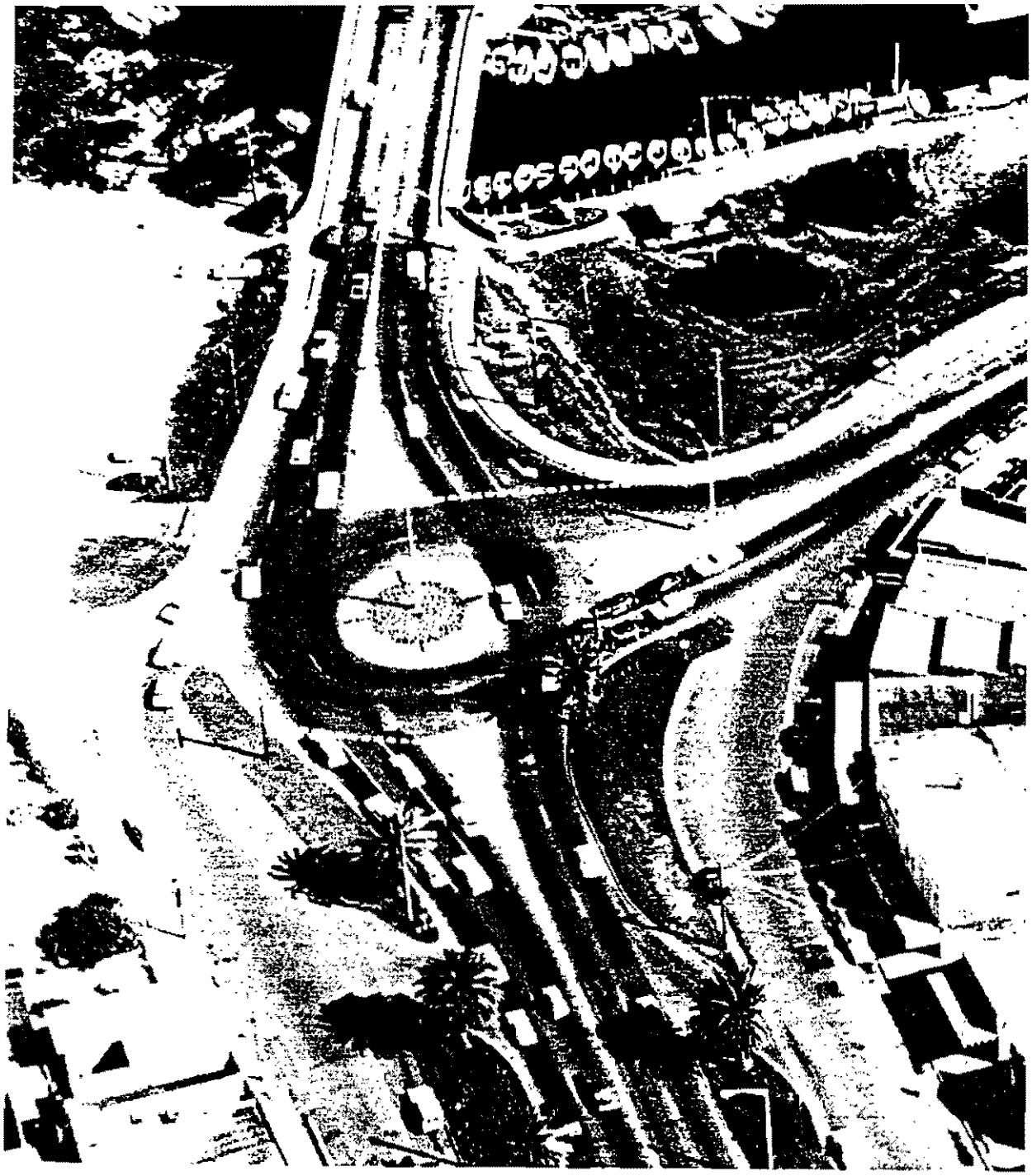
EFFECT OF TURNING VEHICLES ON ROUNDABOUT OPERATION FIGURE 2.1

In this example the right turner from A to D would stop the through movement from C to A thus allowing traffic from D to enter the roundabout. Traffic from D would then stop the through movement from A thus allowing traffic from B to enter the roundabout. Right turners from A in this example would initiate traffic flow on adjacent entry's B and D which would otherwise experience longer delay.

(c) At intersections with more than four legs, roundabouts can provide a convenient and effective treatment whereas:

(i) with 'Stop' or 'Give Way' signs, it is often not practical to define priorities adequately;

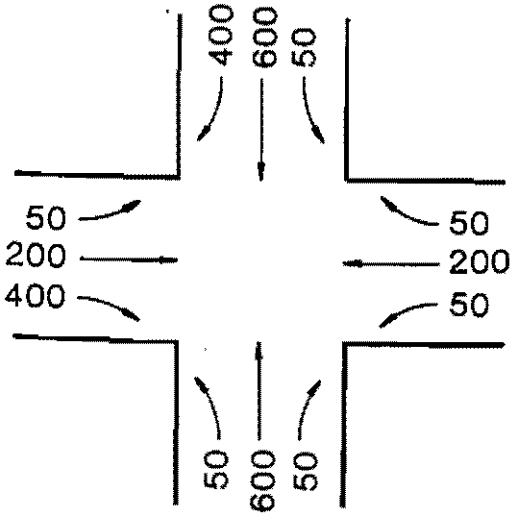
(h) Where traffic flows leaving the roundabout would be interrupted by a down-stream traffic control which could result in queueing back into the roundabout.



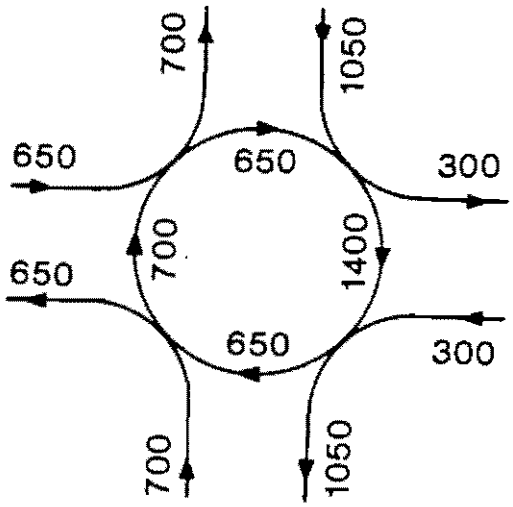
An aerial view of a well-designed urban roundabout.

No. of lanes on circulating road	Critical Acceptance Gap, T (seconds)	Follow-up Headway, T_o (seconds)	Minimum Headway for Circulating Traffic, t_c (seconds)
Single lane roundabouts	4	2	2
Multilane	4	2	0

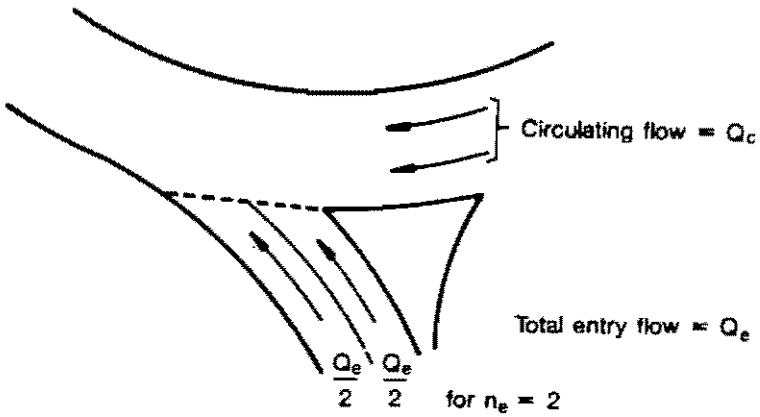
Papers by Horman and Turnbull[16], and Avent and Taylor[1] describe the basis of these parameters.



TYPICAL TURNING MOVEMENT DIAGRAM
FIGURE 3.1a



ROUNDABOUT ENTRY AND CIRCULATING FLOWS
FIGURE 3.1b



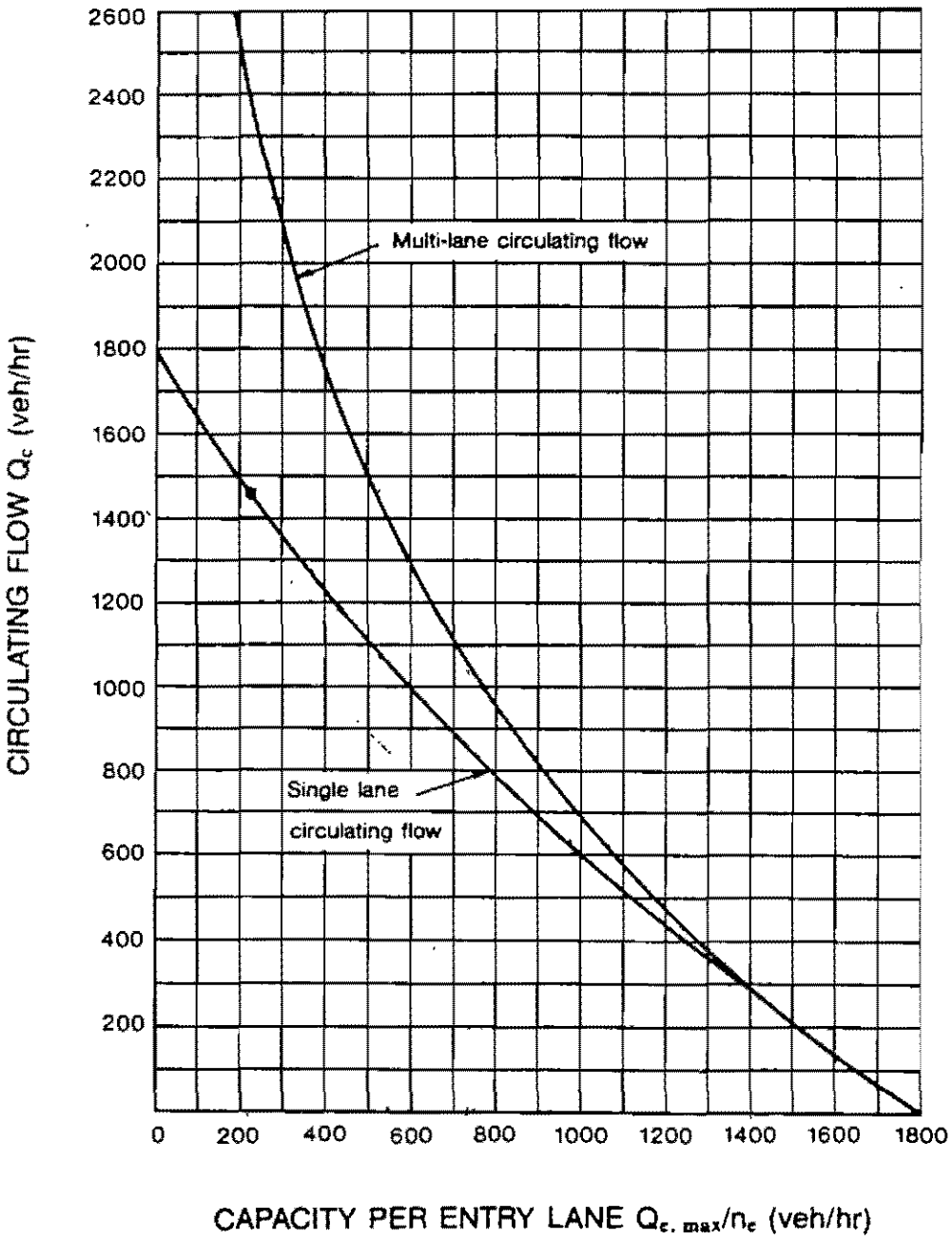
ENTRY FLOWS
FIGURE 3.1c

CAPACITY FOR MULTI-LANE CIRCULATING FLOW ROUNDABOUTS

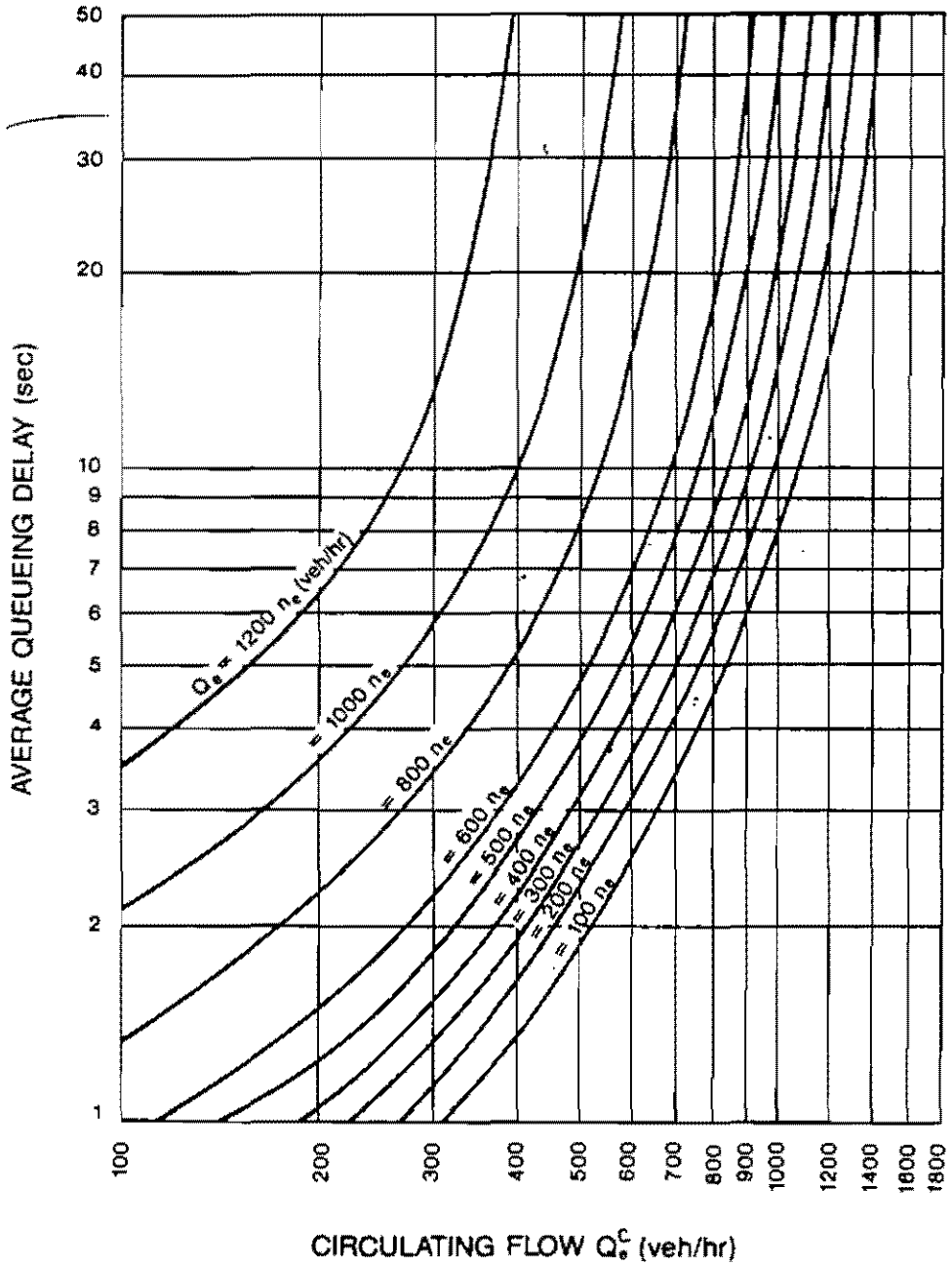
$$Q_{e,max} = \frac{n_e Q_c \exp(-q_c T)}{1 - \exp(-q_c T_o)}$$

CAPACITY FOR SINGLE LANE CIRCULATING FLOW ROUNDABOUTS

$$Q_{e,max} = \frac{n_e Q_c (1 - q_c t_c) \exp[-q_c (T - t_c)]}{1 - \exp(-q_c T_o)}$$



ROUNDABOUT CAPACITY
FIGURE 3.2



Q_c = Circulating flow (veh/h)

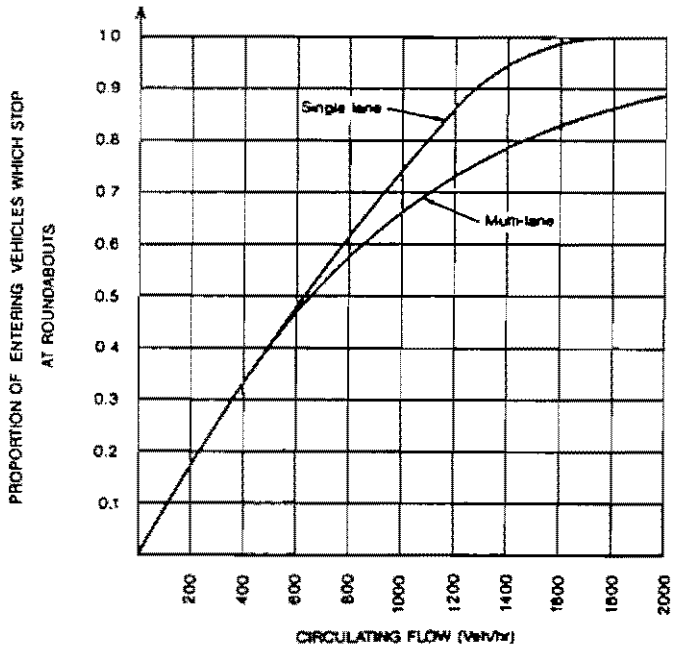
$\frac{Q_e}{n_e}$ = Entry volume per lane (veh/h)

T = Critical acceptance gap = 4 secs

T_o = Follow-up headway = 2 secs

t_c = Minimum headway for circulating traffic = 2 secs

AVERAGE QUEUEING DELAY TO VEHICLES ENTERING SINGLE LANE CIRCULATING FLOW ROUNDABOUTS FIGURE 3.3a



PROPORTION OF ENTERING VEHICLES WHICH STOP AT ROUNDABOUTS
FIGURE 3.4

TABLE 3.1a

GEOMETRIC DELAY FOR STOPPED VEHICLES

Negotiation Speed through Roundabout V_n (km/h)	Approach Speed V_a (km/h)																			
	40 km/h					60 km/h					80 km/h					100 km/h				
	D (m)					D (m)					D (m)					D (m)				
	20	60	100	140	180	20	60	100	140	180	20	60	100	140	180	20	60	100	140	180
	DELAY IN SECONDS																			
15	10	19				13	23				17	26				20	30			
20	8	15	22			11	18	26			15	22	29			18	25	33		
25	7	12	17			10	15	21			13	19	25			17	22	28		
30	7	9	13	18		10	13	18	22		13	17	21	26		17	20	25	30	
35	7	7	10	14	18	10	10	15	19	23	13	14	19	23	27	17	18	22	26	30
40						10	10	12	15	19	13	13	16	19	23	17	17	20	23	27
45						10	10	10	12	15	13	13	13	16	19	17	17	17	20	24
50						10	10	10	10	10	13	13	13	13	16	17	17	17	17	20

where D = distance around roundabout (m)

3.4 SAFETY OF ROUNDABOUTS

3.4.1

The safety performance of roundabouts has been documented in a number of Australian and UK studies. "Before" and "after" type accident studies carried out at intersections involving a wide range of site and traffic conditions at which roundabouts have been constructed, indicate very significant reductions in casualty accident rates.

Details of the results of some studies carried out in Victoria and in the United Kingdom are given in Appendix A.

3.4.2

The following tabulation (Table 3.2) illustrates the result of comparative studies carried out in Victoria[22].

TABLE 3.2

TYPICAL CASUALTY ACCIDENT RATES FOR DIFFERENT INTERSECTION TYPES IN VICTORIA

Intersection Type	Mean Casualty Accident Rate	90% Confidence Interval For The Mean
URBAN INTERSECTIONS, MODERATE TO HIGH VOLUMES		
T-Intersections — Unsignalised	1.5	1.3 — 1.7
— Signalised	1.4	1.2 — 1.6
Cross-Intersections — Unsignalised[14]	2.4	2.1 — 2.7
— Signalised	1.7	1.6 — 1.8
Multi-leg Intersections — Signalised	3.2	2.8 — 3.6
Roundabouts (high volumes)	0.8	0.6 — 1.1
Roundabouts (low volumes)	0.4	0.1 — 1.0

Note: See Appendix A for definitions

3.4.3

The good safety record of properly designed roundabouts can be attributed to the following factors:

(a) The general reduction in conflicting traffic speeds (desirably limited to less

3.6 ENVIRONMENTAL EFFECTS

3.6.1

Roundabouts can offer considerable scope for environmental enhancement and are sometimes favoured over other forms of intersection treatment in environmentally sensitive areas. The central island can be landscaped and planted provided:

(a) the treatment does not block any of the sight triangles (refer Section 4.2.5);
(b) any planting and landscaping will yield to out-of-control vehicles and not be a hazard;
(c) the treatment does not constitute an unnecessary distraction to drivers.

Planting can be used to discourage pedestrians from crossing at undesirable locations.

3.6.2

Compared to traffic signals, roundabouts usually operate with generally reduced queue lengths and shorter average delays. This results in:

— less air and noise pollution;
— lower fuel consumption;
— less parking restrictions;
— better access to private driveways.

In addition, the use of a roundabout eliminates potential traffic safety and disruption problems associated with the malfunction of traffic signals.

3.6.3

Roundabouts can be used on local streets to discourage high traffic speeds and intrusion by very large vehicles. Provisions for emergency and service vehicles need to be considered in the design of these roundabouts.

3.7 PEDESTRIANS AND CYCLISTS AT ROUNDABOUTS

3.7.1

In most circumstances roundabouts can be designed to provide satisfactorily for pedestrian movements at an intersection.

3.7.2

Preliminary information suggests that roundabouts are at least as safe for pedestrians as other forms of intersection control. This is probably because pedestrians are able to cross one direction of traffic at a time by staging on the splitter islands.

Furthermore, vehicles are travelling at slow speeds and the pedestrians cross with care because, unlike traffic signals, roundabouts do not give positive priority messages to pedestrians. Particular groups of pedestrians, such as the elderly or children may, however, find traffic signals a more secure control for crossing a road.

4 GEOMETRIC DESIGN OF ROUNDABOUTS

4.1 GENERAL

The principles of roundabout design as they apply to urban arterial and rural intersections are similar, and consequently will be considered together. Because of the high traffic speeds in rural areas, it is much more important to achieve the criteria designed to slow down traffic entering the roundabout. Fortunately, in urban areas, where the cost to achieve ideal standards in respect to speed control is higher, the consequences of not doing so are less critical.

In local streets because of constraints such as cost and space and because of differing objectives, design standards may be quite different to those applicable to arterial roads.

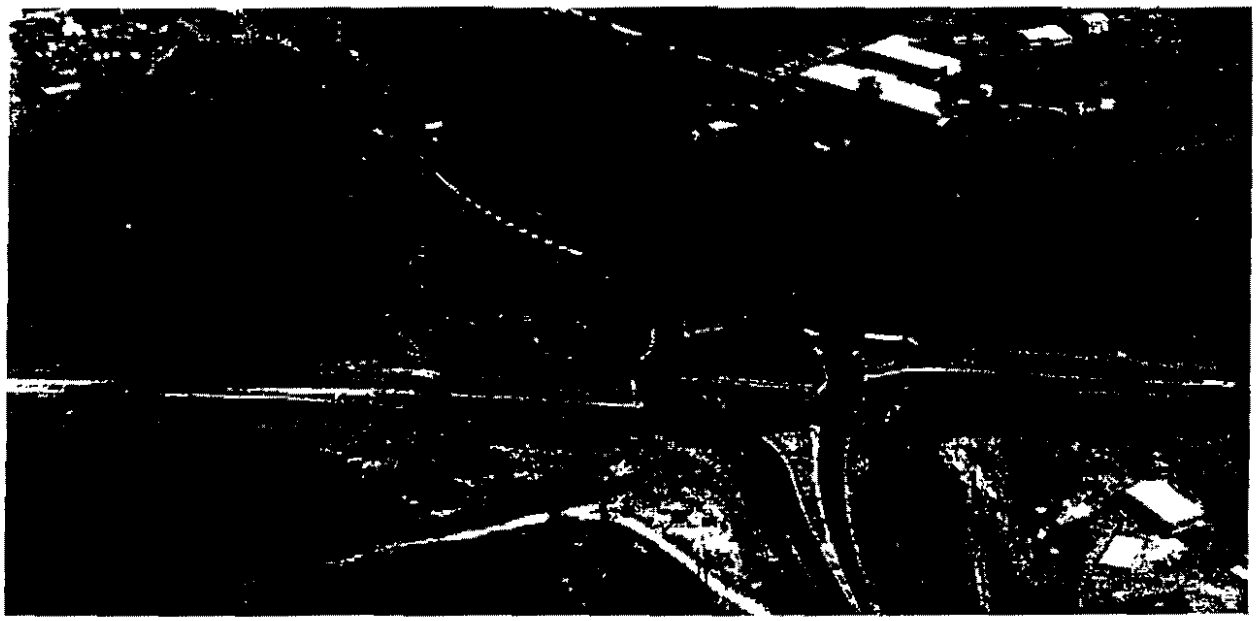
4.2 URBAN ARTERIAL AND RURAL ROUNDABOUTS

4.2.1 Design Speed and Deflection Through Roundabouts.

Adequate deflection through roundabouts is the most important factor influencing their safe operation. *Roundabouts should be designed so that the speed of all vehicles within the intersection will be less than 50 km/h.* This is done by ensuring that through vehicle paths are significantly deflected by one or more of the following means:

(i) provision of a suitable size and position of central island;
(ii) introduction of a staggered or non-parallel alignment between any entrance and exit;
(iii) position, shape and size of approach splitter islands.

The desired design speed is obtained if no vehicle path (assumed 2 metres wide) has a radius greater than 100 metres. This degree of curvature corresponds approximately to 50 km/h with a sideways force of 0.2 g. The required vehicle



This view illustrates the deflection of traffic through a rural roundabout.

The design speed through roundabouts can be calculated from the formula:

$$V^2 = 127\ R\ (e + f) \qquad [4.1]$$

where V is speed in km/h
R is the maximum path radius of a vehicle in metres (see Figure 4.2)
e is the superelevation in m/m (negative if the fall is from the central island)
f is acceptable coefficient of sideways friction between vehicle tyres and road pavement

For roundabouts, values of f ranging from about 0.2 at 50 km/h and about 0.3 at 25 km/h should be used. Designers should interpolate for speeds between 25 km/h and 50 km/h.

4.2.2 Central Island.

Central islands should preferably be circular as changing curvature of the circulating roadway increases the driving task demand. However, oblong or other shapes may need to be adopted to suit unusual site conditions. The size of the central island is determined principally by the need to obtain sufficient deflection to reduce through vehicle speed. If this can be achieved by other means, there is no theoretical limit on the minimum size of the central island. However, the larger the central island the easier it is for entering drivers to determine whether vehicles already on the circulating roadway are turning right or passing straight through. With small central islands, particularly where high approach speeds are prevalent, adjacent conflict areas tend to be inadequately separated and this increases doubt for entering vehicles. Larger central islands are usually necessary to clearly separate conflict areas at multi-leg intersections and they generally improve driver recognition of the form of intersection treatment.

In this particular case:
R_2 = 12 m, Table 4.1 gives a width of 10.3 m
R_1 = 50 m, Table 4.1 gives a width of 12.6 m

Therefore the circulating width would be 12.6 m.

TABLE 4.1

WIDTHS REQUIRED FOR VEHICLES TO TURN ONE, TWO OR THREE ABREAST

Turning Radius R(m)	Desirable Turning Width required for		
	one articulated vehicle (m)	one articulated vehicle plus one passenger car (m)	one articulated vehicle plus two passenger cars (m)
5	7.6	11.7	*
8	7.1	11.2	*
10	6.7	10.8	*
12	6.5	10.3	*
14	6.2	10.1	*
16	6.0	9.9	*
18	5.9	9.7	*
20	5.7	9.6	13.5
22	5.6	9.5	13.4
24	5.5	9.4	13.3
26	5.4	9.3	13.2
28	5.4	9.2	13.0
30	5.3	9.1	12.9
50	5.0	8.8	12.6
100	4.6	8.4	12.2

*Three lane wide turning paths are most unlikely to occur on a turn radius less than 20 m.

Analyses may be required for each section of circulating roadway. In some cases, a roundabout may have a varying circulating roadway width.

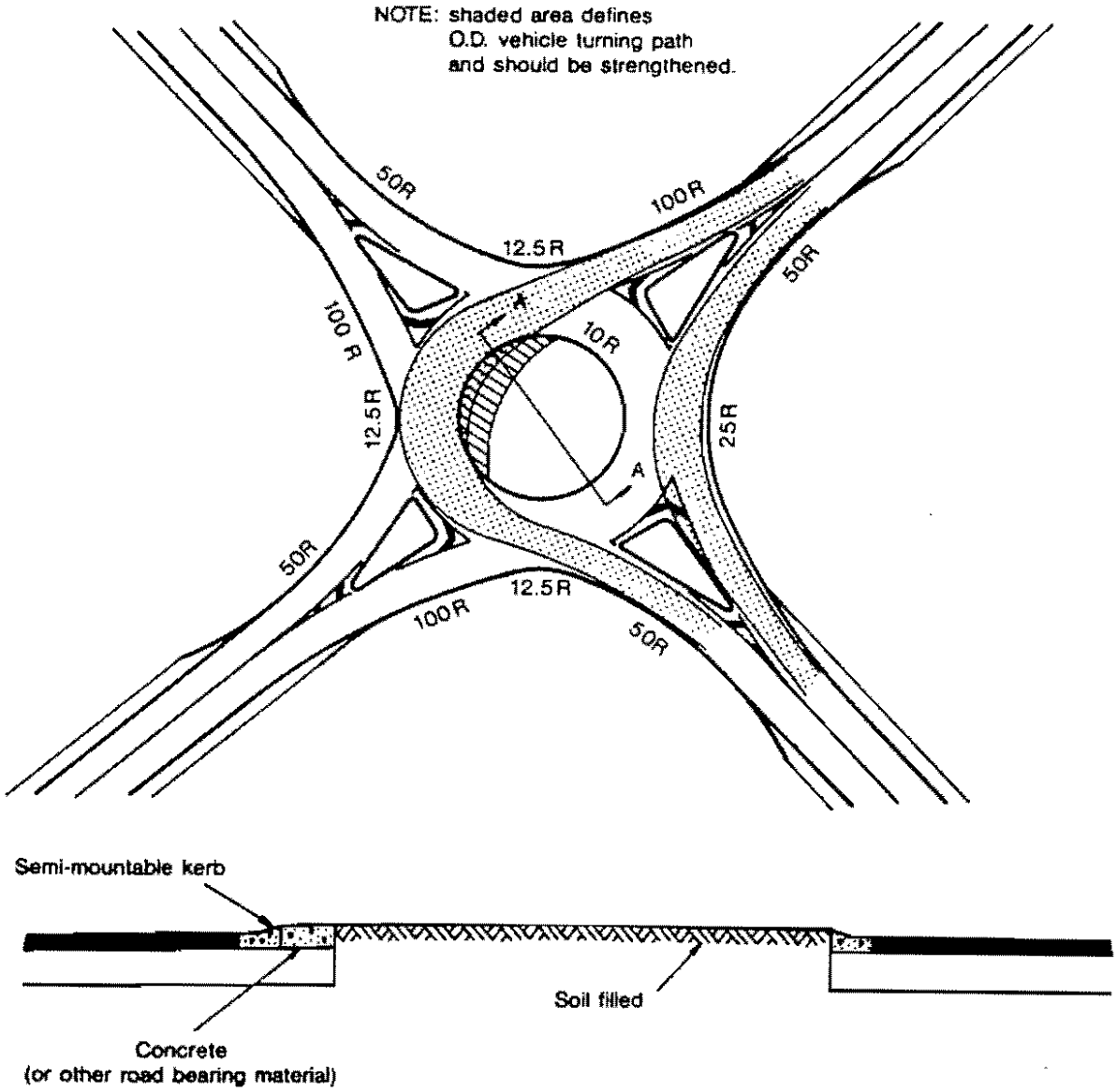
Truck turning templates should also be used to ensure that trucks can negotiate the roundabout. In some instances it may be appropriate to narrow the widths slightly to achieve an adequate deflection.

An example of where provision has been made for an overdimensional vehicle to turn from north to east (and vice versa) is shown in Figure 4.3.

4.2.4 Splitter Islands, Entrance and Exit curves

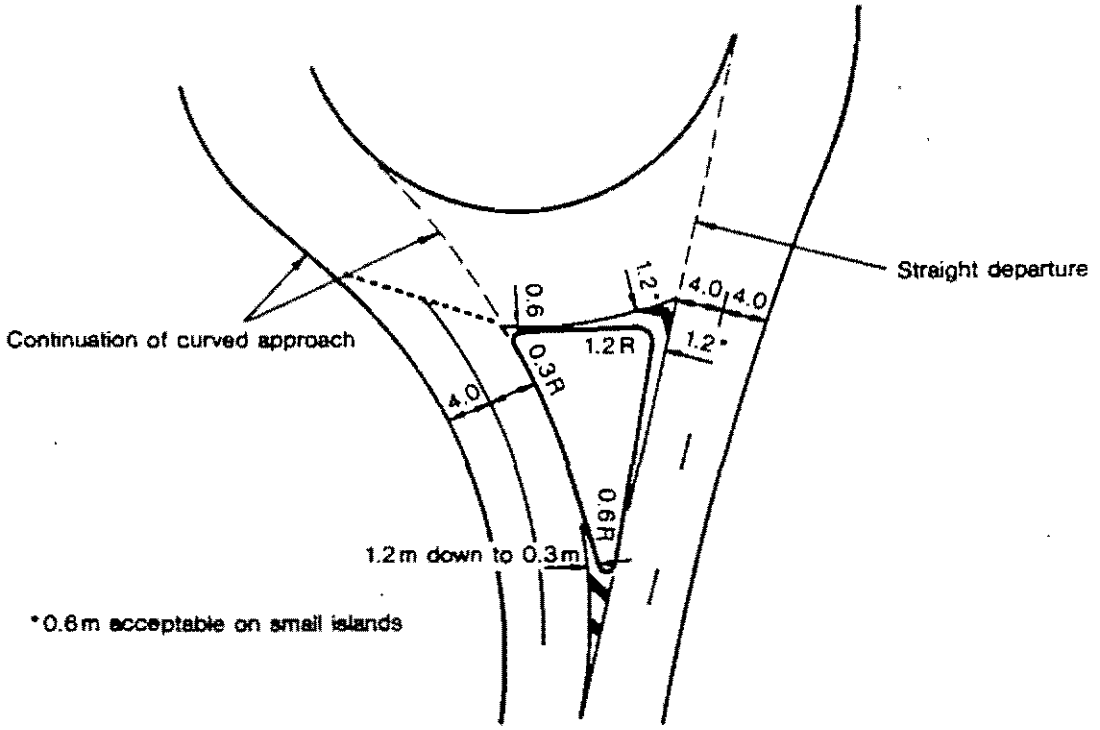
4.2.4.1

Splitter islands should be provided on all roundabouts installed on arterial and collector roads in rural and urban areas. They provide shelter for pedestrians, guide



ROUNDABOUT CROSS-SECTION A-A

PROVISION FOR OVER DIMENSIONAL VEHICLES
FIGURE 4.3



TYPICAL ROUNDABOUT ENTRANCE/EXIT CONDITIONS FOR URBAN AREAS
FIGURE 4.5

4.2.4.2
Entry and Exit lane widths should be determined using vehicle turning templates. Generally, lane widths will fall within the range 3.4 m to 4.0 m. Exceptions are for kerbed single lane entrances and exits where a minimum of 5.0 m between kerbs is usually provided to allow traffic to pass a disabled vehicle.

4.2.4.3
On high speed roads, the splitter island should, if possible, extend across the whole of the approach lanes as seen by the approaching driver. This is illustrated in Figure 4.6.

In high speed areas the splitter island should also be relatively long (ideally about 60 m) to give early warning to drivers that they are approaching an intersection and must slow down. The lateral restriction and funnelling provided by the splitter island encourages speed reduction as vehicles approach the entry point. Kerb and channel should be placed on the left-hand side of the approach road for at least half the length of the splitter island to strengthen the funnelling effect. Kerbs should always be provided on the splitter islands, central islands and outer edge of pavement to improve delineation and prevent corner cutting.

4.2.4.4
The approach curves to roundabouts should be the same radius or smaller than the radius of the curved path that a vehicle would be expected to travel through

a good view of both the splitter island and the central island. Adequate stopping sight distance should be provided, preferably to the 'Give Way' lines and, at an absolute minimum, to the nose of the splitter island.

Table 4.2 indicates the required stopping sight distances. This Table is based on Table 4.1, Interim Guide to the Design of Intersections at Grade[7].

To enhance the prominence of the roundabout, the kerbs on both the splitter island and central island should be light coloured or painted white. As with other types of intersections, it is better to position a roundabout in a sag vertical curve than on a crest.

TABLE 4.2

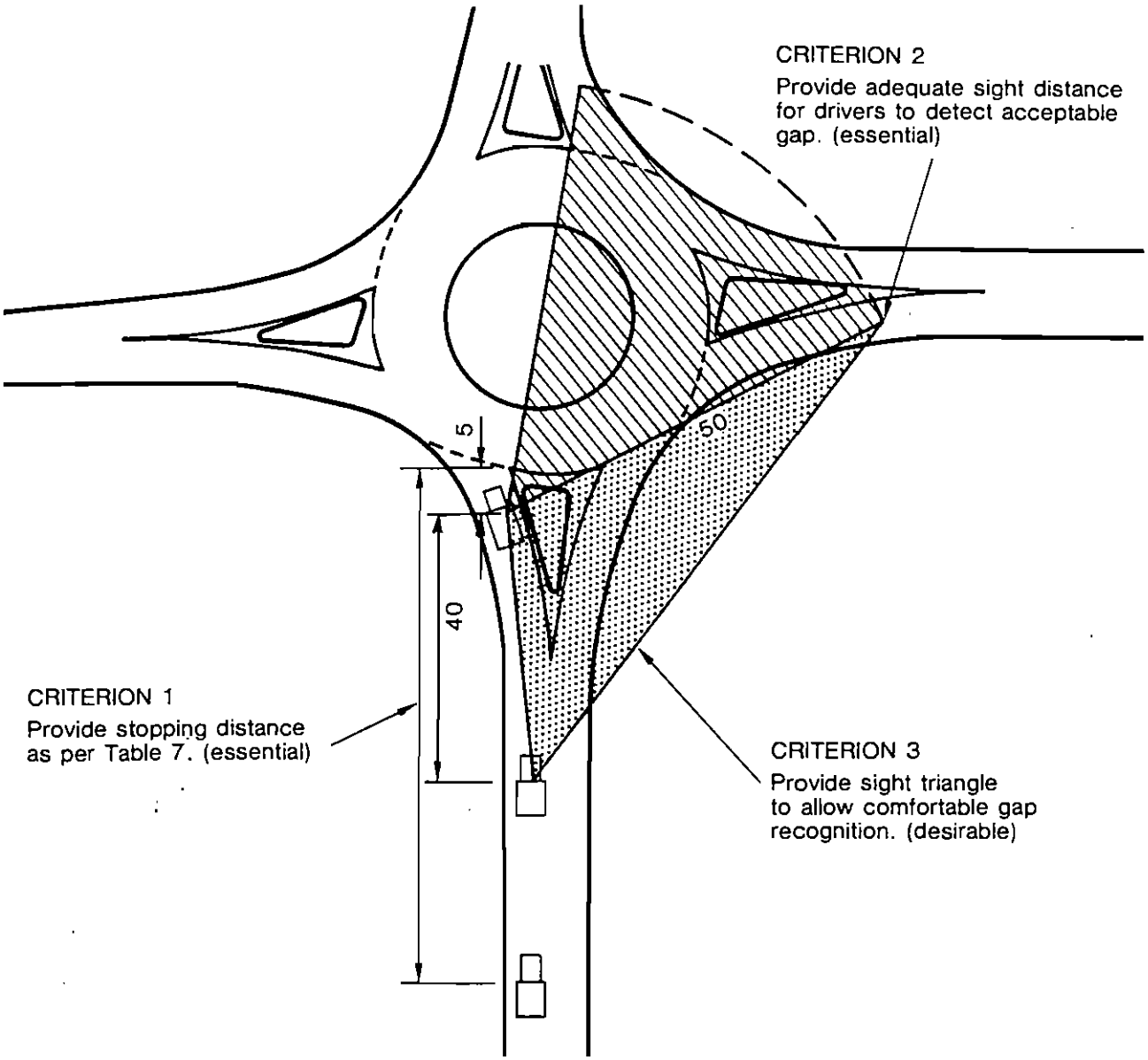
STOPPING SIGHT DISTANCE

Approach Speed (km/h)	Stopping Distance* (m)
40	45
50	60
60	80
70	100
80	120
90	140
100	170
110	210
120	250

* measured 1.15m to zero

Criterion 2
A driver, stationary at the 'Give Way' line, should have a clear line of sight to approaching traffic for a distance representing at least four seconds of travel time. Since, as covered in Section 4.2.1, the speed of all vehicles within the intersection should be constrained to 50 km/h or less, the corresponding sight distance to vehicles approaching from the right should be at least 50 m, measured from the position of the driver about 5 m from the 'Give Way' line. This is illustrated in Figure 4.7.

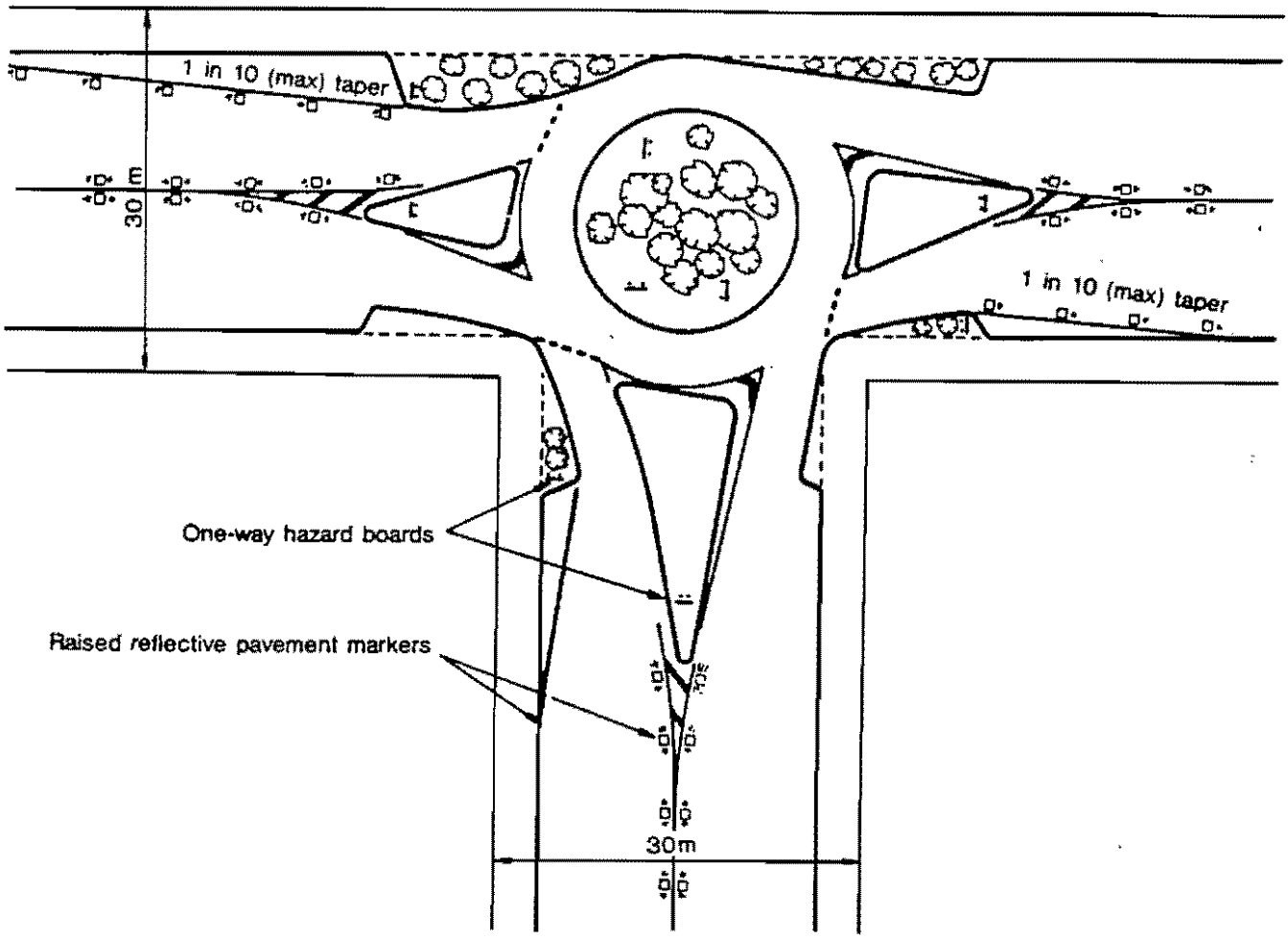
Criterion 3
It is also desirable that drivers approaching the roundabout are able to see other entering vehicles well before they reach the 'Give Way' line. The 40 m–50 m sight



SIGHT DISTANCE REQUIREMENTS
FIGURE 4.7

Where a roundabout is proposed, special care should be taken to ensure that the design is in accordance with the standards listed in Sections 4.2.1 to 4.2.6. In particular, sufficient deflection for through traffic should be achieved. Generally, a cheap solution which does not require roadworks encroaching onto existing nature strips and/or the median will not be possible. Figure 4.8 is an example of a roundabout designed to adequate standards for a sub-arterial road crossing an arterial road with a wide median.

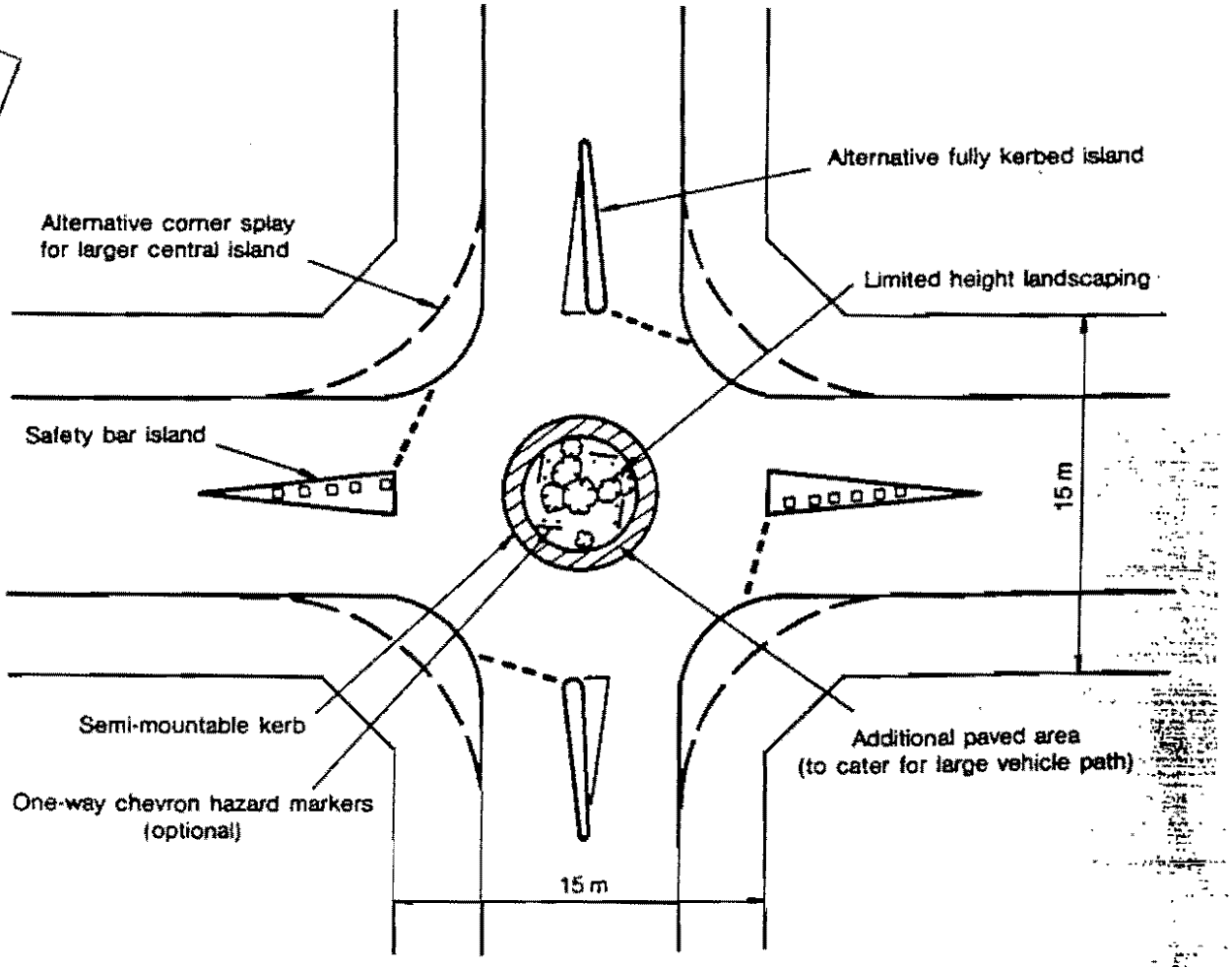
Where kerblines are to be built out on approaches to roundabouts, special care should be taken to ensure that adequate delineation is provided, particularly in instances where there are no parked vehicles on the approach. A suitable treatment using linemarking, raised reflective pavement markers (rrpm) and semi-mountable kerbs is shown on Figure 4.9.



ROUNDABOUT AT T-JUNCTIONS
FIGURE 4.9

Footnote: The layout has been devised with the objective of providing a safe, well delineated, but sufficiently deflected path through the roundabout, while limiting the amount of parking that has to be restricted. State Road Traffic Regulations generally restrict parking close to the intersection. When vehicles are parked close to the intersection, there is no difficulty in deflecting vehicles away from the kerb on approach to the roundabout. Thus, it is acceptable to allow vehicles to park on top of delineating devices.

might restrict sightlines between conflicting traffic or pedestrians, or create an unnecessary hazard.



LOCAL STREET ROUNDABOUT
FIGURE 4.10

5 PEDESTRIAN AND BICYCLE CONSIDERATIONS

5.1 PEDESTRIANS

In the planning and design of roundabouts, special thought should be given to the movement of pedestrians. Section 3.7 discusses some aspects of the performance of roundabouts in respect to pedestrians. In respect to geometric design, the provision for pedestrians does not differ greatly to that required for other intersection treatments, however, certain roundabout designs, particularly large roundabouts, can result in greater walking distances, and thus inconvenience, for pedestrians. Some designs can also result in doubt with regard to priority between pedestrians and vehicles which may result in minor problems.

Pedestrian crossing lines should not be painted on the entrances and exits of roundabouts. It is important not to give pedestrians a false sense of security but, rather, to encourage them to identify and accept gaps in traffic and to cross when safe to do so. Notwithstanding this, pram crossings incorporating pedestrian refuges will generally be required. It is suggested that these crossings be provided close to the entrances and exits of roundabouts.

Consideration should be given to providing priority crossings for pedestrians where pedestrian volumes are high, where there is a high proportion of young, elderly or infirm citizens wanting to cross the road, or where pedestrians are experiencing particular difficulty in crossing and are being delayed excessively. It is desirable that these crossings be placed at least 20 m downstream of the exit from the roundabout. This will reduce the probability of vehicles delayed at the pedestrian crossing queueing back into the roundabout and "blocking" of the whole intersection, causing potential hazards associated with rear-end collisions. It may be desirable that fencing be installed to ensure that pedestrians use the crossing facility provided.

6 LINEMARKING AND SIGNING

6.1 GENERAL

To ensure effective and safe operation of roundabouts, high standards of delineation and signing should be provided. It is important that consistent arrangements of signs and other devices be provided to enhance driver expectation.

6.2 LINEMARKING

The linemarking used at the 'Give Way' point consists of a series of 600 mm × 300 mm white stripes separated by gaps of 600 mm. This line is painted on the approach to the roundabout, generally parallel with the circulating roadway. Where there are two or more traffic lanes on a particular approach the roundabout "Give Way" line should be angled so that drivers in vehicles in the left lane can see past adjacent vehicles on their right.

There should be no painted lines across the exits from roundabouts.

Lane lines delineating circulating lanes within the roundabout should not be provided because they may confuse rather than help drivers in the performance of their task of negotiating the roundabout. They may also mislead drivers into thinking that right turn manoeuvres should be made by circulating around the outer lane of the roundabout.

Lane direction arrows should not be used on the approach to the "Give Way" line, except when an exclusive left turn lane is provided. Arrows are generally unnecessary and right turn arrows may mislead some drivers into turning right before the central island. (i.e. wrong way around the circulating roadway)

Linemarking on the approach to roundabouts should be as shown on Figure 6.1. The linemarking may be emphasised by the placement of rrpm's as shown.

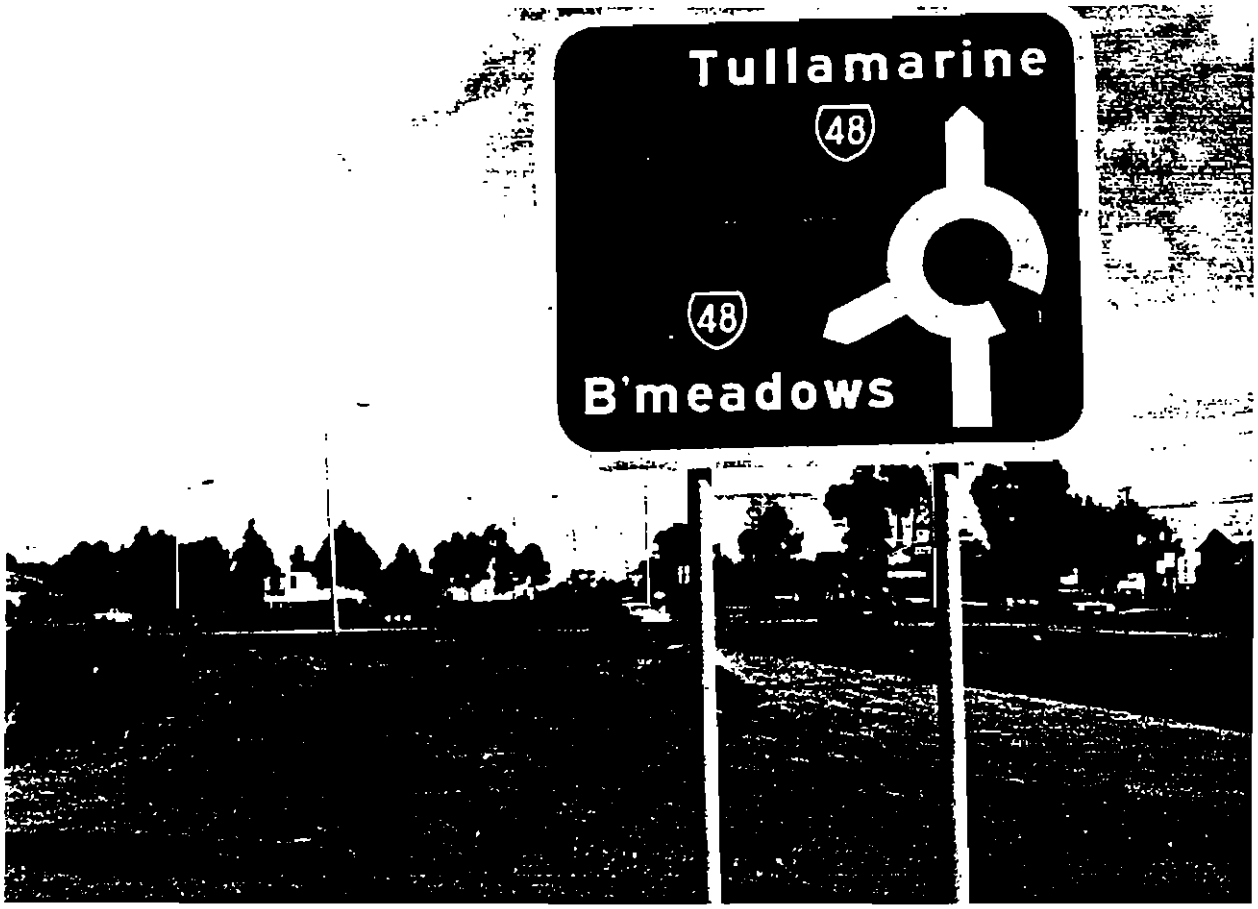
Regulatory signs should be placed on each approach to the roundabout. The sign should be located on the splitter island near the 'Give Way' line. For roundabouts with multi-lane approaches, a second sign should be positioned on the left hand side to reinforce the first one. If a raised splitter island is not provided on local street roundabouts, the sign should be placed on the left hand side.

6.3.2 Splitter Island and Central Island Signing

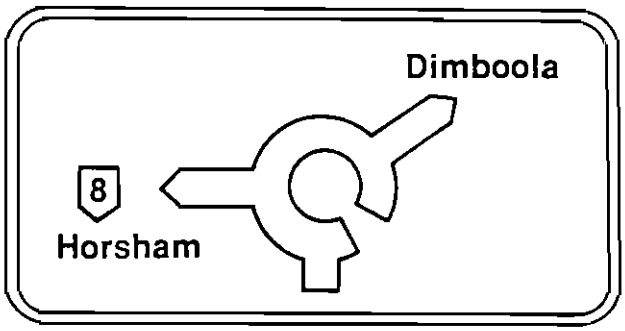
Standard KEEP LEFT signs should be provided on the approach nose of splitter islands. On small splitter islands it may be possible to combine the KEEP LEFT sign and the regulatory sign on one pole. For large splitter islands, hazard boards are desirable to emphasise the curved approach into the roundabout.

Signposting at a roundabout.

It may also be desirable to place a two-way hazard board on large splitter islands where the circulating and departing roadways fork. These hazard boards should be low mounted so that they do not impair sight distance across the island. Figure 6.3 shows suitable arrangement.

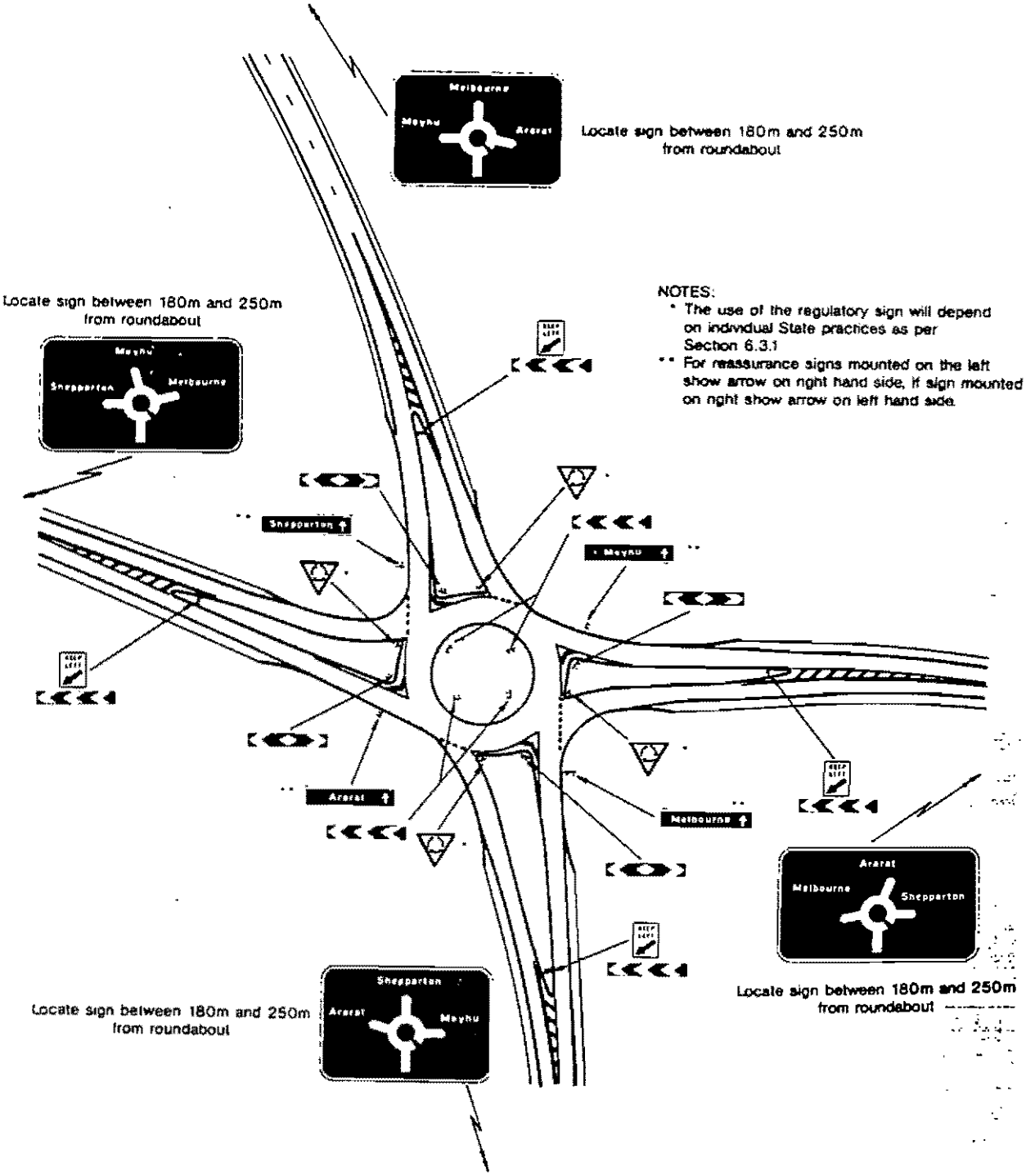


An example of an advance direction sign for a roundabout.



DIAGRAMMATIC ADVANCE DIRECTION SIGN
FIGURE 6.4

(b) Intersection Direction Signs: Generally, it will be necessary to supplement advance direction signing with intersection direction signs at the roundabout. These signs are best placed on the left-hand side of the circulating roadway at each exit from the roundabout. Where an appropriate location cannot be found in this area, signs may be placed on the splitter island at a height such that visibility for entering traffic is not obscured. The mounting height of such signs will depend on the vertical geometry on the approach to the roundabout.



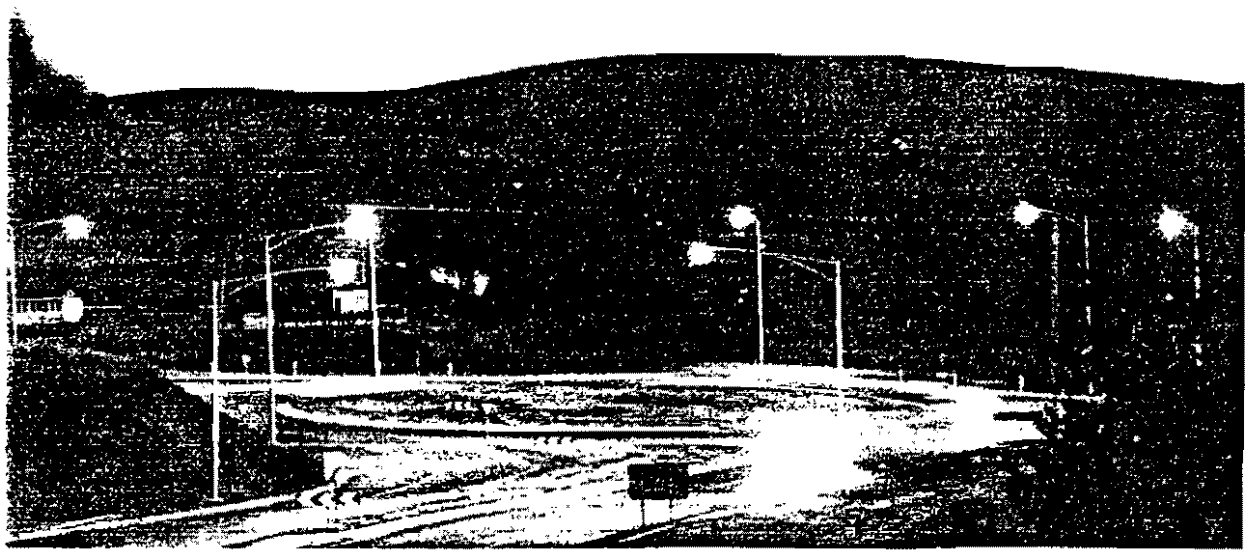
TYPICAL SIGNING AND LINEMARKING SCHEME FOR A RURAL ROUNDABOUT FIGURE 6.5b

7 LIGHTING OF ROUNDABOUTS

7.1 GENERAL

The satisfactory operation of a roundabout relies heavily on the ability of drivers to enter into, and separate safely and efficiently from a circulating traffic stream. To do this, it is important that the driver must perceive the general layout of the intersection in sufficient time.

It is therefore recommended that some form of lighting be provided at roundabouts on all classes of roads. This recommendation is supported by the results of a study of roundabouts[25] which showed that 87 percent of accidents involving fixed objects off the road, occurred at night.



Adequate lighting is essential for the safe and efficient operation of a roundabout at night.

(a) Minor Local Road/Local Road Intersection (On intersecting roads of less than 7.5 m width). One high pressure 250W sodium light could be used.
(b) Major Local Road/Local Road Intersection One high pressure 250W sodium light on two major approaches; and
(c) Roads of Higher Traffic Volume or Operational Problems One high pressure 250W sodium light on all approaches.

In general, because of the lower level of lighting provided on the local street system, supplementary means of improving delineation, such as painted and reflectorised kerbs, low mounted hazard markers and reflective pavement markers are recommended for more important traffic routes.

Figure 7.1 illustrates typical examples of fixed lighting at urban arterial and local street roundabouts.

8 LANDSCAPING AND ROAD FURNITURE

Roundabouts can offer advantages over other forms of channelisation with respect to landscaping. However, the constructing authority must ensure that the landscape design does not create a danger to road users.

Structures associated with the roundabout such as kerbs, signs and utility poles should be selected or designed to minimise their adverse effect on impacting vehicles, or located clear of areas most likely to be traversed by out-of-control vehicles. In all cases, kerbs should be of the mountable or semi-mountable types and signs should be mounted on frangible posts.

The landscaping should not inhibit sight distance, obscure the form of the layout to drivers, restrict the visibility of signs, or present roadside hazards in the form of large trees, boulders or planter boxes. To avoid a danger to any out-of-control vehicles, the central island should not have obstacles higher than 400mm above the level of the circulating roadway. The central island should:

- clearly indicate to drivers that they cannot pass straight through the intersection. This may be achieved through planting, landscaping or hazard boards etc.
- allow drivers approaching the intersection adequate sight distance, as described in Section 4.2.5.
- ideally prevent the passage of pedestrians. (Seats or similar attractions should not be provided).

9 TRIAL INSTALLATIONS

9.1 GENERAL

The use of trial installations, built of removable materials, may be appropriate to verify the effectiveness of the treatment. This procedure is widely practised for other forms of channelisation. Trial installations should be used for only a limited period, desirably no longer than about three months, and not more than six months. This Section provides some guidance on the procedures to follow when installing trial roundabouts.

An example of a trial roundabout installation.

APPENDIX A

SAFETY PERFORMANCE OF ROUNDABOUTS
RESULTS OF ACCIDENT STUDIES

A.1

Well designed roundabouts have been shown to operate with a high degree of safety. In 1981, the Country Roads Board of Victoria carried out a "Before and After" study[22] of 73 roundabout sites throughout Victoria to assess their safety performance. The form of control during the "before" period was either 'Give Way to the Right', 'Stop' or 'Give Way' sign controls, or in one case a police control. The sites were primarily in urban areas although some rural sites were included. The major results of the study are summarised below:

(a) The casualty accident rate for all sites combined decreased by 74 percent after roundabout installation.

(b) Sites were grouped according to entering traffic volumes. All groups showed a statistically significant reduction in accident rates as shown in Table A.1.

(c) Minor Accidents. It is difficult to gauge the effect of roundabout installation on minor accidents in Victoria because not all property damage accidents are reported. However, there was a 32 percent reduction in the property damage accidents which were recorded at the study sites. While this is not conclusive, it would appear that roundabouts have led to a reduction in property damage accidents as well as casualty accidents.

(d) Roundabouts in High Speed Areas (i.e. on road with 100 km/h speed limits). In 1981 the only roundabouts in Victoria installed on high speed roads had produced very large reductions in casualty accidents. Both locations were at cross intersections formerly controlled by 'Give Way'/'Stop' signs. Table A.2 shows the improvement.

The probability of the reduction occuring by chance is less than 0.001

(e) Pedestrian Safety. There was a 68 percent reduction in casualty accidents per year involving pedestrians after roundabout installation for all sites combined. This result is encouraging, but owing to the low numbers of pedestrian accidents, the reduction was not statistically significant at the 0.10 level.

A.2

The results of the Country Roads Board Studies described above are consistent with other studies on roundabout safety. In particular:

(a) A study[26] of 31 roundabout sites in Melbourne carried out by the Road Safety and Traffic Authority which showed a statistically significant reduction in reported accidents after roundabout installation.

(b) A study[24] of 150 roundabout sites in the United Kingdom carried out by the Transport and Road Research Laboratory discussed below

A.3

The study[24] of 150 roundabout sites in the United Kingdom indicated that:

Casualty accident rate = $(A\ 10^7) / (2\ n \times V_1 V_2)$

Where:

A = number of casualty accidents in 'n' years. Casualty Accidents are defined as the sum of fatal accidents and personal injury accidents.

n = number of years

V_1, V_2 = total number of vehicles entering the intersection on Roads 1 and 2 in 'n' years.

TABLE A2

CASUALTY ACCIDENT REDUCTION RATE ACHIEVED BY ROUNDABOUT INSTALLATION AT TWO HIGH SPEED LOCATIONS IN VICTORIA (STUDY PERIOD JANUARY 1975 TO DECEMBER 1980)

Number of sites	BEFORE Roundabout Installation			AFTER Roundabout Installation		
	Total years	Total Casualty Accidents	Average Casualty Accidents Per year	Total years	Total Casualty Accidents	Average Casualty Accidents Per year
2	8	39 (including four fatal accidents)	4.9	3	0	0

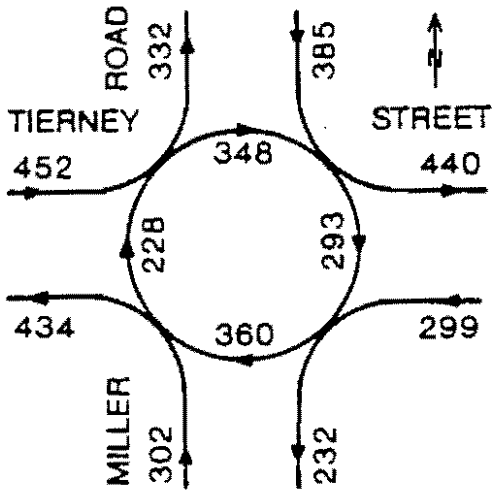
B.1.2 Consideration of Alternatives

Traffic signals or a roundabout can be considered as alternatives to the existing arrangement. Both treatments should be analysed and compared with regard to safety, capacity and delays, parking spaces and cost.

In this regard only the analysis of the roundabout is provided in detail. Analysis procedures for a traffic signal alternative may be carried out in accordance with ARRB Bulletin ARR No.123 or preferably in terms of SIMSET-2 or SIDRA-2. SIMSET-2 at this stage is more user friendly.

Roundabout Alternative

The critical peak hour traffic volumes were transcribed as follows:
(Refer Section 3.2)



The degree of saturation and delays for each leg of a one-lane roundabout were calculated as follows:

Approach	Circulating Flow	Capacity Per Entry Lane (Fig.4)	Entry Flow Per Lane	Degree of Saturation	Average Queueing Delay (Fig.5a)
N	348	1320	385	0.29	1.7 sec
S	360	1300	302	0.23	1.5 sec
E	293	1390	299	0.22	1.2 sec
W	228	1480	452	0.31	1.2 sec

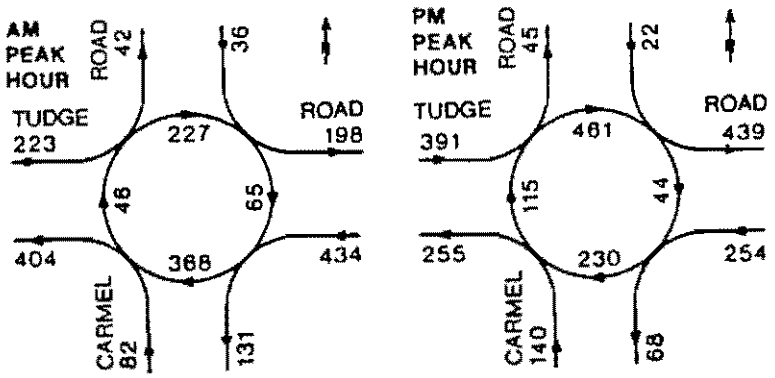
This table illustrates that a one-lane roundabout could easily cater for the traffic volumes. (The highest degree of saturation is 0.31). Average delays would be very low.

B.2.2 Consideration of Alternatives

The alternatives of a roundabout, signalisation and staggered-T intersection were considered, and compared with the criteria outlined above.

Roundabout Alternative

The critical peak hour traffic volumes were transcribed as follows:
(Refer Section 3.2)

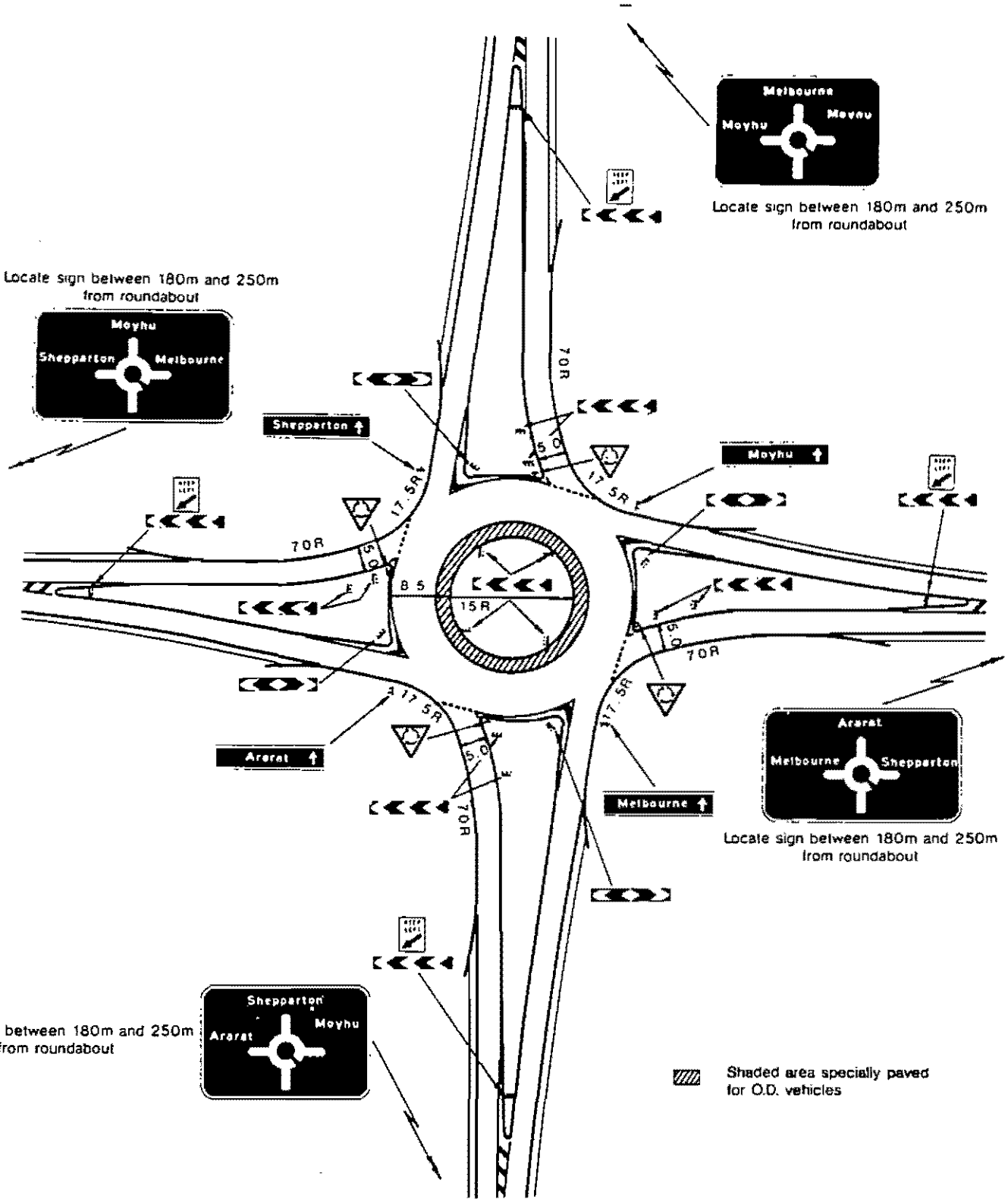


The degree of saturation and delays for each leg of a one-lane roundabout were calculated as shown below:

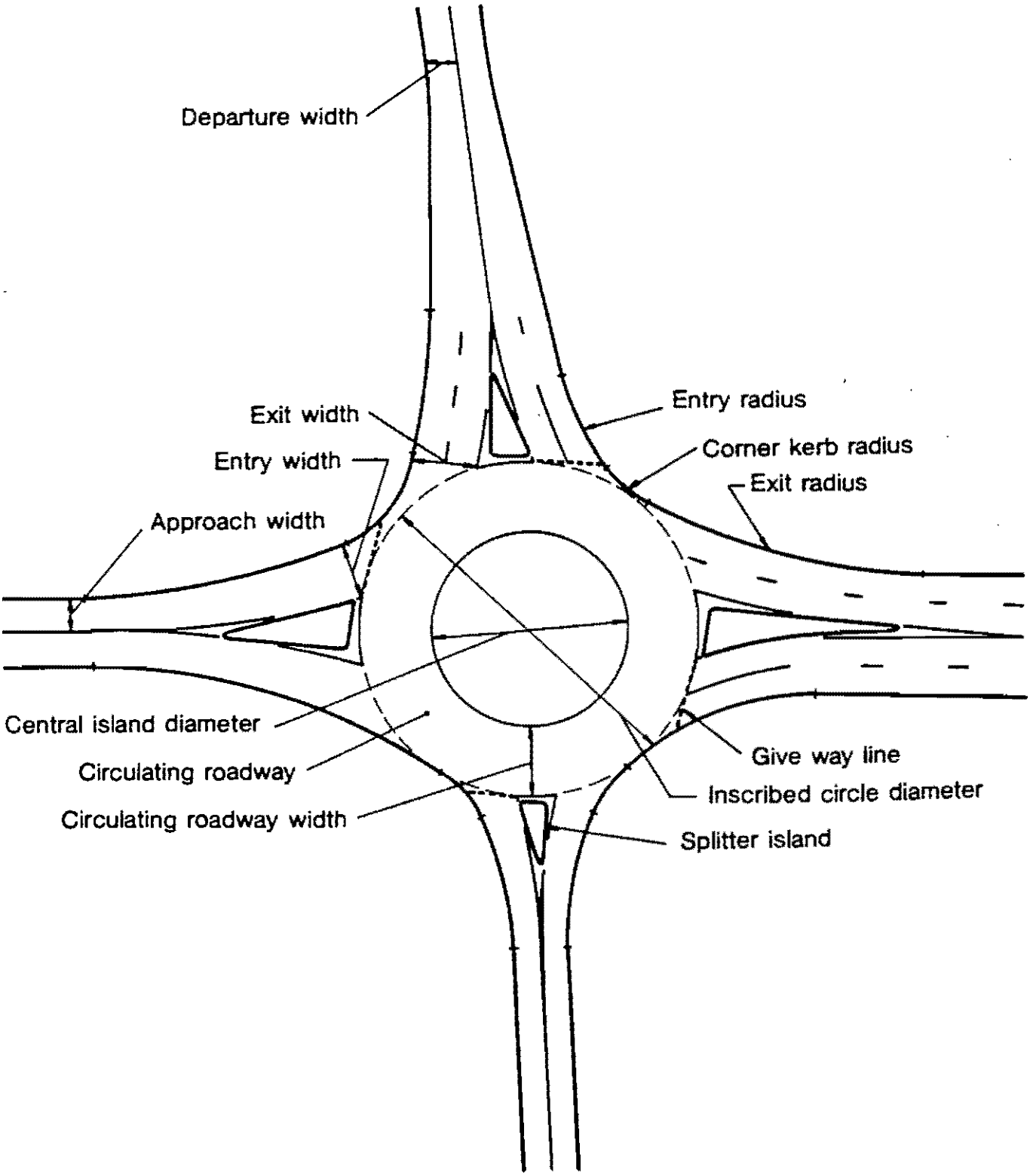
	Leg	Circulating Flow	Capacity Per Entry (Figure 3.2)	Entry Flow	Degree of Saturation
AM	N	227	1470	36	0.02
	S	368	1270	82	0.06
	E	65	1700	434	0.26
	W	46	1730	223	0.13
PM	N	461	1160	22	0.02
	S	230	1470	140	0.10
	E	44	1730	254	0.15
	W	115	1630	391	0.24

From Figure 3.3a the average queueing delay on each approach (AM and PM) would be about 1 second.

This table indicates that a one-lane roundabout could easily cater for the traffic volumes. A roundabout could also be expected to reduce the accident rate significantly at the intersection (refer Section 3.4).



EXAMPLE OF RURAL ROUNDABOUT DESIGN
FIGURE B.2



ELEMENTS OF A TYPICAL ROUNDABOUT
FIGURE C.1

SAFETY

22. CRB — Before and After Accident Analysis of Roundabouts (Inter-office memorandum), 1981.
23. CRB — Various studies reported in Inter-office memorandum, 1981.
24. Green H. TRRL Report 774. Accidents at off-side priority roundabouts with mini or small islands, 1977.
25. Lalani N. "The Impact of Accidents . . . priority junctions". Greater London Road Safety Unit — Greater London Council, December 1975.
26. RoSTA — Accidents at Roundabouts, July 1980.

MISCELLANEOUS

27. Lawrence C.J.D. Roundabouts — Evaluation of the I.H.E. May 1980.
28. Marconi W. Speed Control Measures in Residential Areas. Traffic Engineer, March 1977.
29. Martin, D.J. Incremental Operating Costs of Cars at Roundabouts. TRRL Report SR 60VC, Crowthorne, 1974.
30. Swaminathon M.S., Hazel B.J. Roundabouts — A discussion paper — Traffic Authority of N.S.W. September 1980.
31. Todd K, Modern Rotaries ITE Journal July 1979.

F;le

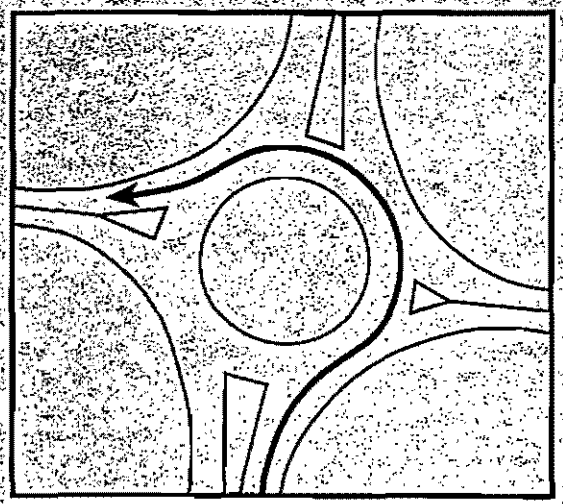
HOW TO DRIVE A ROUNDABOUT

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

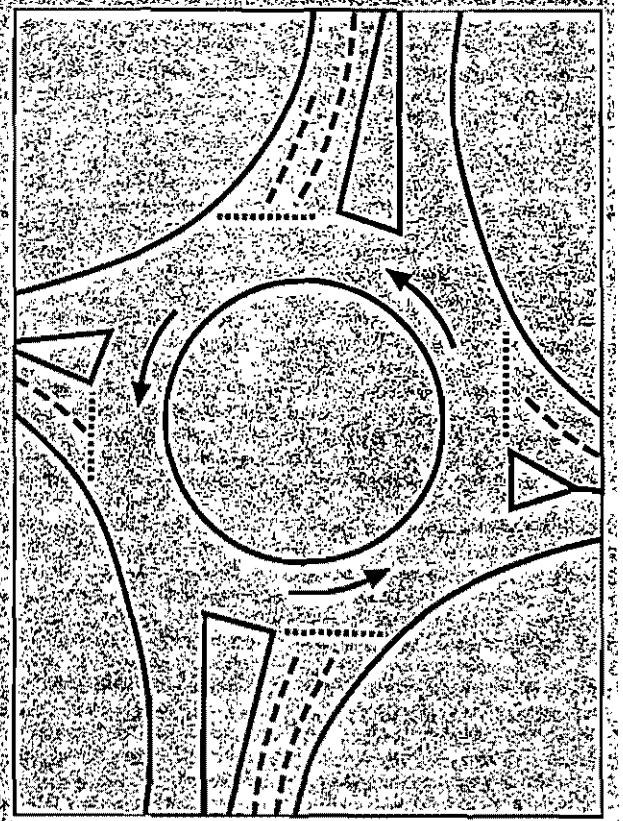
Other Traffic Information brochures available:

- 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

ROUNDABOUTS



CITY OF SAN BUENAVENTURA · FOUNDED 1782

ENGINEERING DIVISION

ROUNDABOUTS

Each year the City receives numerous requests to reduce the traffic congestion on streets throughout the City. Citizens also express concerns about the safety of the streets on which they live. In an effort to find appropriate ways to deal with these concerns, reduce traffic congestion and improve safety, the City has recently considered the use of roundabouts.

Roundabouts are used throughout Europe and in several countries around the world to reduce injury accidents, traffic delays, fuel consumption, air pollution and construction costs, while increasing capacity and enhancing intersection beauty. They have also successfully been used to control traffic speeds in residential neighborhoods and are accepted as one of the safest types of intersection design.

A roundabout is a circular intersection similar to the traffic circle used previously in this country. The major differences between a traffic circle and a roundabout are:

- **Yield at Entry**

At roundabouts the entering traffic yields the right-of-way to the circulating traffic. This yield-at-entry rule keeps traffic from locking-up and allows free flow movement.

- **Deflection**

The entry and center island of a roundabout deflects entering traffic to slow traffic and reinforce the yielding process.

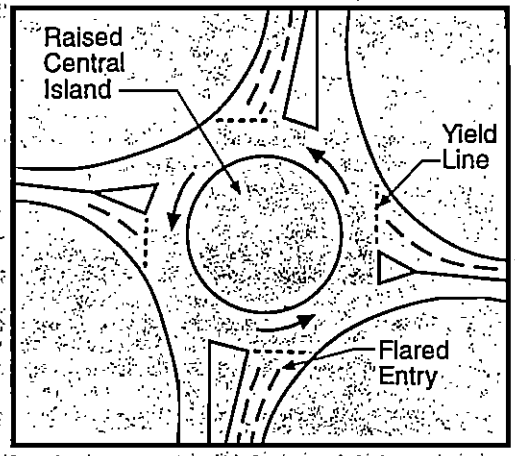
- **Flare**

The entry to a roundabout often flares out from one or two lanes to two or three lanes at the yield line to provide increased capacity.

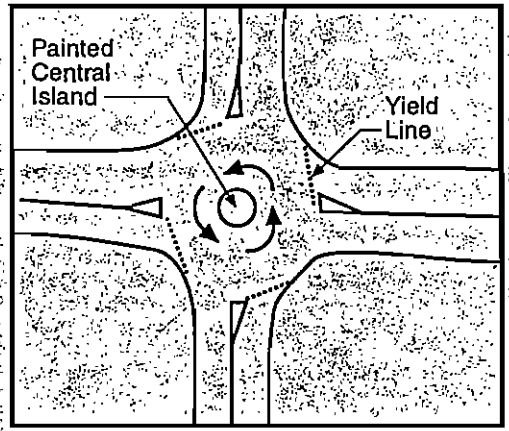
TYPES OF ROUNDABOUTS

There are two basic types of roundabouts *(See Figure 1)*:

- Conventional roundabout - A one-way circular roadway around a curbed central island for circulat-



Conventional Roundabout



Mini-Roundabout

Figure 1

- Mini-roundabout - A one-way circular roadway around a flush or slightly raised central island of up to 13 feet in diameter, usually without flared entries.

WHY USE A ROUNDABOUT?

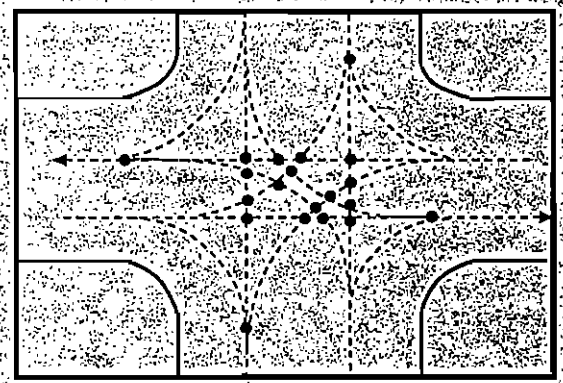
1. Safety - Roundabouts have been shown to reduce fatal and injury accidents as much as 75% in Australia and 86% in Great Britain. The reduction in accidents is attributed to slower speeds and reduced number of conflict points. *(See Figure 2)*.

proximately $3,500 per year per intersection. In addition, electricity costs are reduced with a savings of approximately $1,500 per year per intersection.

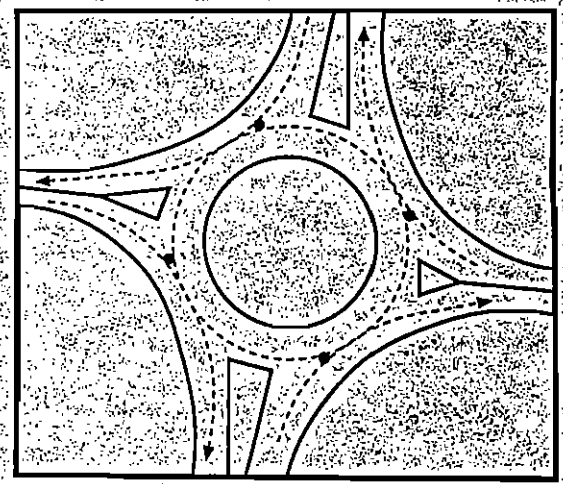
3. Reduced Delay - By yielding at the entry rather than stopping and waiting for a green light, delay is significantly reduced.

4. Capacity - Intersections with a high volume of left turns are better handled by a roundabout than a multi-phased traffic signal.

5. Aesthetics - A reduction in delay corresponds to a decrease in fuel consumption and air pollution. In addition, the central island provides an opportunity to provide landscaping.



Standard Intersection



Roundabout Intersection

TOWN OF ADDISON

PUBLIC WORKS DEPARTMENT (972) 450-2871

Post Office Box 9010 Addison, Texas 75001-9010 16801 Westgrove

27 November 2000

City of Colleyville
P.O. Box 185
Colleyville, TX 76034

ATTENTION: CURTIS HAWK

SUBJECT: INFORMATION RE ADDISON ROUNDABOUT

Dear Curtis:

Per direction of Chris Terry, Assistant City Manager, Town of Addison, the following documents are attached for your information:

Roundabouts – A Design Guide
Addison Urban Center
Modern Roundabout for Addison Circle w/Drawings
Memo to John Baumgartner from Gary Jost re Addison Roundabout
Letter from John Baumgartner to Gary Jost re Sensitivity Analysis
Traffic Info from Engineering Div. – City of San Buenaventura

If you need further assistance, please do not hesitate to call.

Sincerely,

Michael E. Murphy, P.E.
Director of Public Works

cc: Chris Terry, Assistant City Manager

Attachments (As noted above)

Michael Murphy

From: Chris Terry
Sent: Thursday, November 09, 2000 1:34 PM
To: Michael Murphy
Subject: RE: ADDISON CIRCLE TRAFFIC ENGINEERING INFO. REQUEST

No thank you.

-----Original Message-----
From: Michael Murphy
Sent: Tuesday, November 07, 2000 11:35 AM
To: Chris Terry
Cc: Carmen Moran
Subject: RE: ADDISON CIRCLE TRAFFIC ENGINEERING INFO. REQUEST

I'll be glad to forward study information to him. Do you want to see any of the stuff i plan on sending him?

Mike

Michael E. Murphy, P.E.
Director of Public Works
Town of Addison
(972)450-2878

-----Original Message-----
From: Chris Terry
Sent: Tuesday, November 07, 2000 9:30 AM
To: Michael Murphy; Carmen Moran
Subject: ADDISON CIRCLE TRAFFIC ENGINEERING INFO. REQUEST

I received a request for information from Curtis Hawk (former Southlake city manager and my former boss) who is working as a consultant for the City of Colleyville. Curtis is interested in acquiring any early research or traffic studies we did on roundabouts. Evidently Colleyville wants to introduce roundabouts into their street system. Could one or both of you visit with Curtis on this issue and then provide him with the materials he has requested.

Curtis can be reached at either of these numbers: 817/577-7575 or 817/577-7587

Thanks.

Take Binders of T. C Roundabout Info to Colleyville. Goes to CM: 76034

City of Colleyville
ATTN: Curtis Hawk
P.O. Box 185
5400 Bransford Rd.
Colleyville, TX 76034

Send to:

TOWN OF
ADDISON

PUBLIC WORKS

To: Gary Jost

Company: Barton-Aschman

FAX #: 490-9261

Date: 12/14/95

# of pages (including cover): 12

From: John Baumgartner, P.E.
Director
Phone: 214/450-2886
FAX: 214/931-6643

16801 Westgrove
P.O. Box 144
Addison, TX 75001

☐ Original in mail ☐ Per your request ☐ FYI ☐ Call me

Comments:

TOWN OF ADDISON

PUBLIC WORKS DEPARTMENT (214) 450-2871

Post Office Box 144 Addison, Texas 75001 16801 Westgrove

December 14, 1995

Mr. Gary Jost
Barton-Aschman, Inc.
5485 Belt Line Rd. Suite 199
Dallas, TX 75240

Re: Addison Circle

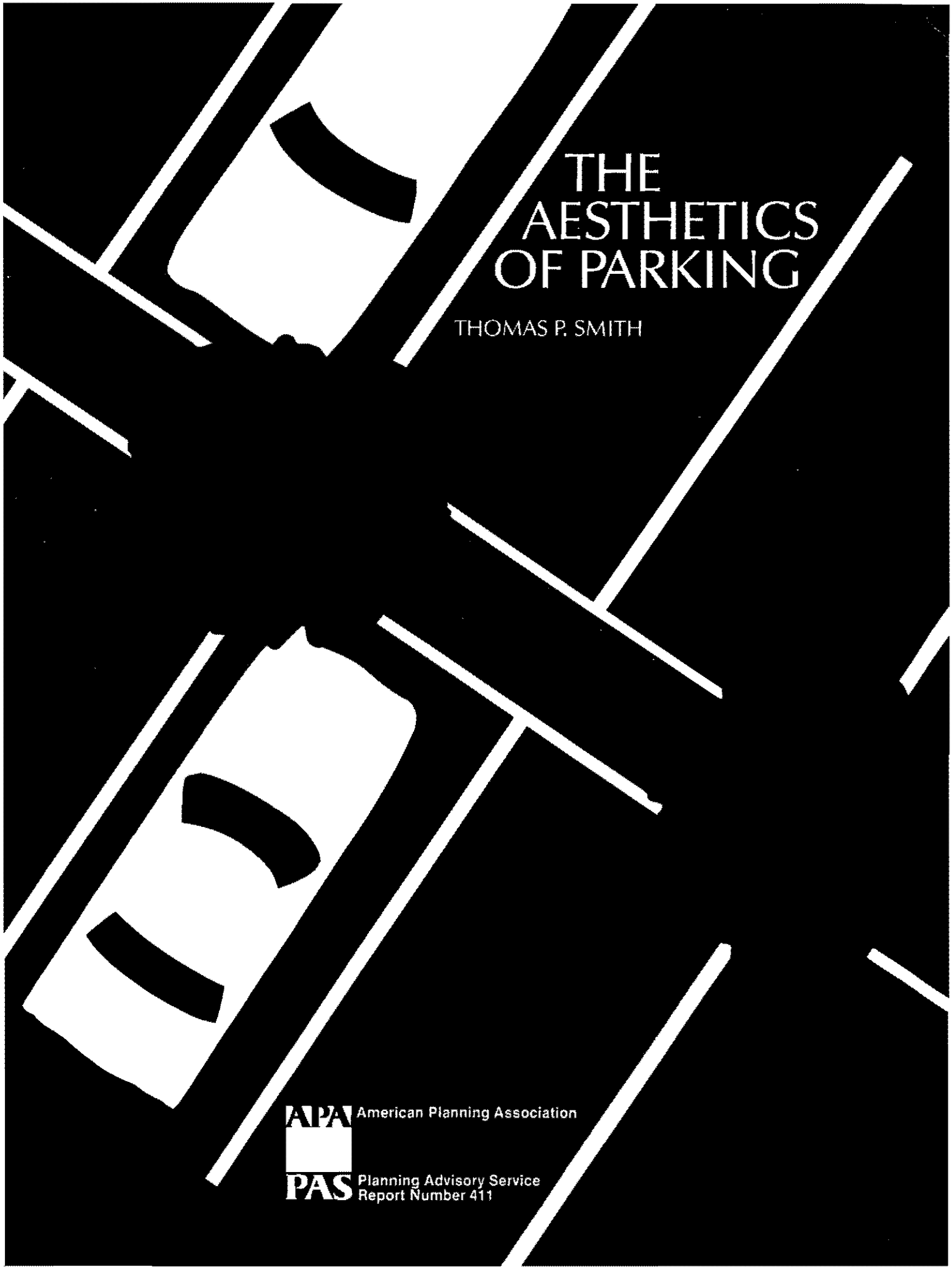
Dear Gary:

Attached is the sensitivity analysis provided by Columbus' design professionals.

Please review and comment at your earliest convenience..

Thanks,

John R. Baumgartner, P.E.
Director of Public Works



THE AESTHETICS OF PARKING

THOMAS P. SMITH

APA American Planning Association

PAS Planning Advisory Service
Report Number 411

Thomas P. Smith is the associate director of research for APA. This report was supported by a grant from the National Endowment for the Arts in Washington, D.C., a federal agency.

Numerous photos and illustrations were submitted by organizations, public agencies, and businesses for use in this report. Special thanks go to Marie E. Witmer, Director of Technical Services for the Institutional and Municipal Parking Congress; Robert Weant, Director of the ENO Foundation for Transportation; Kevin M. Hagerty, Assistant Director of the San Francisco Parking Authority; and Susan Slesinger, Parking Coordinator, Pasadena, California.

Cover design by Dennis McClendon

Planning Advisory Service is a subscription research service of the American Planning Association. Eight reports are produced each year. Subscribers also receive the *PAS Memo* each month and have use of the Inquiry Answering Service. Israel Stollman, Executive Director; Frank S. So, Deputy Executive Director; Sylvia Lewis, Publications Director; Welford Sanders, Associate Director of Research; Thomas P. Smith, Associate Director of Research.

Planning Advisory Service Reports are produced at APA. James Hecimovich, Editor; Adele Rothblatt, Assistant Editor.

The Aesthetics of Parking: An Illustrated Guide

By Thomas P. Smith

TABLE OF CONTENTS

Chapter 1. Better Standards for Parking Design

Planning commissions across the country have been involved in the design of parking areas for more than 50 years. Columbus, Ohio, is generally considered the first municipality to have adopted parking requirements as part of its zoning code. In August 1923, the city adopted a zoning amendment requiring parking for multifamily dwellings. About 15 years later, the American Society of Planning Officials (ASPO) newsletter began reporting regularly about municipalities adopting parking requirements as part of their zoning codes. ASPO reported that Riverside, Illinois, adopted parking requirements for theaters in 1937, and, in 1938, the ASPO newsletter reported on parking requirements for department stores in Los Angeles and for residential buildings in Bronxville, New York.

Surveys by the ENO Foundation for Transportation showed that the greatest number of zoning code amendments for parking came in the post–World War II period.[1] A March 1947 survey disclosed that only 71 of the 1,060 U.S. municipalities with a population of 10,000 or more had parking requirements in their zoning codes, but a January 1951 recanvass of the same cities found that the number had grown to 203 and that many more cities were working on codes. The objective of these early codes was simply to increase the supply of parking. Many cities at that time were trying to deal with the problems of existing business and residential areas that were built without any parking.

1. Edward G. Morgen and Wilbur S. Smith, *Zoning and Traffic* (Westport, Conn.: ENO Foundation for Transportation, 1952), 41.

A consortium of 19 nearby business owners in Boston's Post Office Square area recently purchased and began demolition of this 900-car garage. By 1991, the group plans to transform the old, dilapidated garage into a seven-level, 1,400-car underground facility covered by a 1.7-acre, richly landscaped public park. The city condemned the property, transferred it to the business group, and sponsored a design competition for the park. (The Boston Globe)

Times have certainly changed. Parking lots and parking garages are now numerous and large, but there is still more need for parking. And the need for parking has extended well beyond the business district and multifamily complex. Parking areas have expanded because of changes in the way people live, work, and learn. Universities, for example, have greatly enlarged their parking areas because of new evening programs for commuters and an increase in the number of students with cars; hospital parking has grown because of a new emphasis on short-term out-patient care; and parking for theaters and entertainment activities has expanded because people have more free time and place a greater value on recreation.

Planners who write parking ordinances and create the standards to regulate parking lots and structures are often asked to balance the need for parking with other community goals—a more compact urban form, improved pedestrian systems, and enhanced urban design, for example. Virtually all communities want businesses to provide on-site parking in order to prevent congestion on public streets and spillover of traffic to surrounding neighborhoods. Most communities believe that providing for off-street parking maintains and even increases property values. But these communities have come to realize that the goal of providing adequate parking also conflicts with some economic development, urban design, and environmental goals.

Planners understand that large parking lots reduce the land available for development and contribute to drainage and flooding problems. In some major cities, they report that the increased availability of parking encourages people to abandon mass transit for the use of their cars, which, in turn, means making serious air pollution problems worse. And some planners question whether parking is not often overbuilt—stadium parking that is only used a dozen times a year; shopping mall parking built to handle the number of cars that will use the mall on the weekends between Thanksgiving and Christmas; and special event parking for fairgrounds, concert halls, and festival areas that might be used only once a year.

The prevalence of parking lots and structures has led to

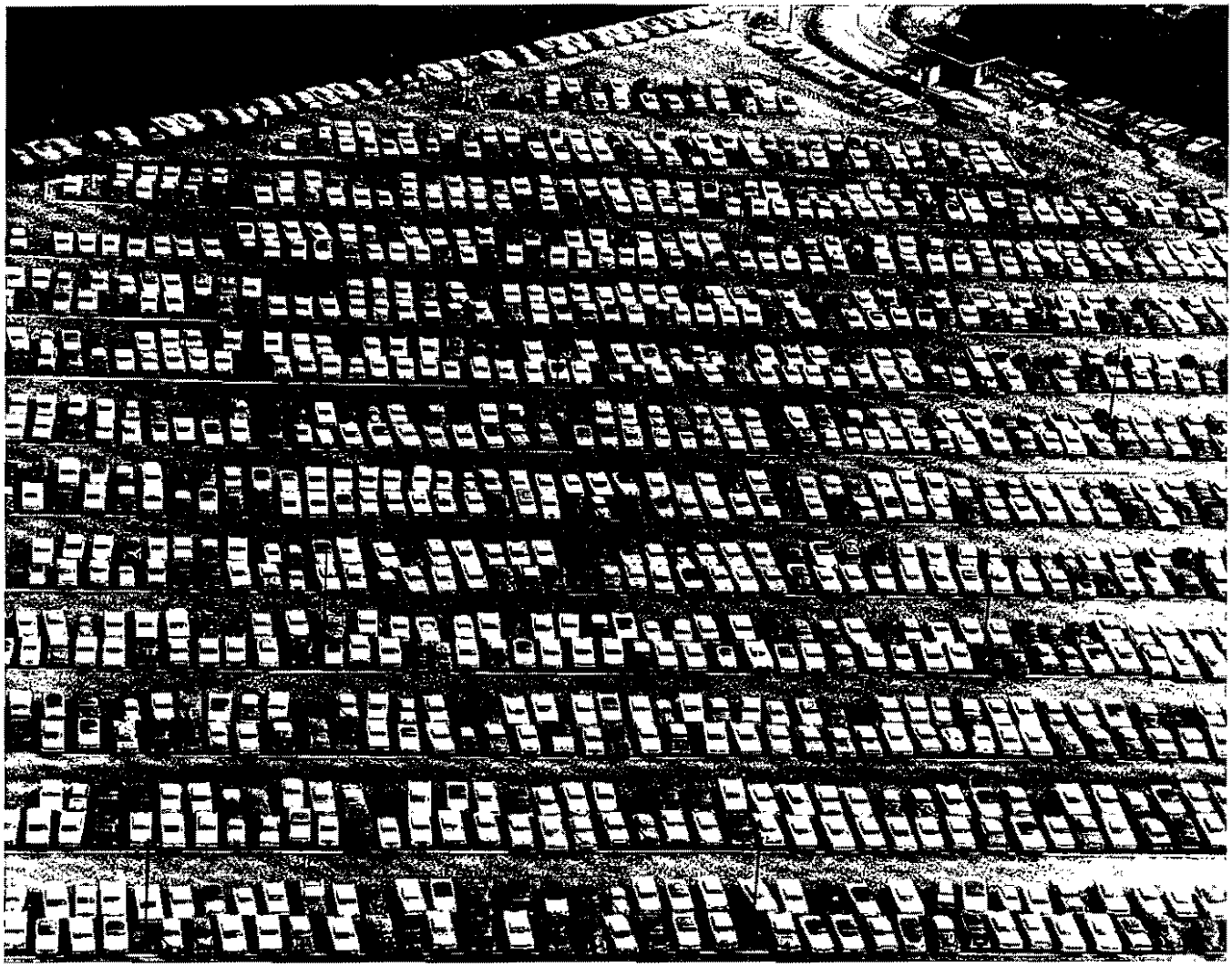
another serious problem that, until recently, did not receive much attention. A major complaint about parking areas is their appearance. Visually, parking lots and parking structures can be a mess. They are often too big, contain too much asphalt or concrete, and have little or no relationship to the buildings and activities around them. They are not inviting places for pedestrians, and they do not have the interest or attraction of other urban open spaces. The size and scale of parking lots and parking garages causes them to break up the links between buildings and destroy the continuity of some streetfronts.

Architecturally, many parking areas are just afterthoughts and accessories to urban life. To the public they are a "necessary evil" and often considered "eyesores" and "wasted or dead spaces." Large surface parking lots in downtown and suburban centers can give these areas the appearance of being only half developed.

The long-term solution to improving the aesthetics of parking may be tougher controls on the overall amount of parking constructed. These types of controls can be especially significant in districts where large parking areas conflict with important urban design objectives. Boston and Portland have absolute caps on the amount of parking constructed in their downtowns. Portland's cap is 40,855 parking spaces for its downtown; it currently has almost 38,000 spaces. Boston's cap of 35,500 spaces has already been reached. In certain parts of downtown San Francisco, no surface parking is allowed, and parking structures may not exceed seven percent of the main building's floor area. Portland, Toronto, Seattle, and Bellevue, Washington, have also used zoning to limit the maximum amount of parking that businesses may construct. These controls prevent overbuilding of parking and help reduce the amount of land devoted to parking.

Given that the demand for parking is likely to continue into the foreseeable future, strictly controlling the amount of parking constructed is infeasible. Instead, it will be necessary to draft policies, plans, and ordinances that work at solving the aesthetic problems with parking lots and structures. This report, based on a survey of over 300 local codes, pulls together information about design improvements and innovations for parking lots and parking structures. The

In Chicago, much of Grant Park and the city's famous lakefront was originally used for parking. In 1954, the city removed the surface parking in what is now northern Grant Park and constructed a 2,100-car underground garage. (Chicago Historical Society)



It was not until the mid-1970s that Chicago removed surface parking along Monroe Street on the lakefront. Now the underground Monroe Street garage (over 3,700 spaces) is topped by a skating rink and garden. (Chicago Historical Society)

local planners who administer these codes report that they have been effective. Their successes and improvements can help provide ideas for other communities.

This report offers examples of local design standards that work to reduce the ugliness and deadening effects of parking facilities, including requirements for landscaping and design improvements that can soften the harshest visual effects of parking lots and structures. It also reports on how parking facilities can be designed so that they improve the relationship between these structures and surrounding buildings and activities, preventing them from disrupting or degrading the quality of commercial areas. Numerous photographs are used to illustrate these standards and to provide examples of well-designed parking facilities.

Chapter 2. The Aesthetic Problems With Surface Parking Lots

For retail business owners, parking is essential to success in the marketplace. In order to compete, many developers of commercial buildings may devote up to two or three times as much space for parking, usually in surface lots,[2] as there is floor space in the building being served by the parking. Surface parking lots for regional shopping malls can take up more than 50 or 60 acres. Parking lots for major stadiums and busy airports can take up hundreds of acres. And these lots can dominate urban landscapes. In fact, as a recent parking study indicated, between 80 to 90 percent of all parking demand in the U.S. is satisfied by surface parking lots.[3]

All too often, however, planners give no attention to improving the appearance of parking lots. They overlook the possible effectiveness of parking lot landscaping as a way of maintaining community appearance and property values. In some cases, landscaping[4] is considered too pedestrian a concern for site planners and architects. In many cases, landscaping is deleted from development plans because of unexpected construction costs or unanticipated space requirements for parking. Because of this, parking lot landscaping often looks like, and is, an afterthought. Landscaping improvements end up being awkwardly spread out over the building site.

Sam Hall Kaplan, architecture critic for the *Los Angeles Times*, says that this lack of planning results in "architectural schizophrenia" because well-detailed, welcoming buildings often stand in striking contrast to their parking. Kaplan complains that the schizophrenia deepens as a person steps through the maze of gritty vehicles, and the dark, oil-stained, and seemingly dangerous lot, finally arriving at a sparkling, marble-encrusted lobby.

To make the appearance of parking areas more consistent with the buildings they serve, many cities have adopted parking lot landscaping codes. But, frankly, many of these codes just do not work. Typically, they require a few feet of sod along the lot's perimeter and little or no greenery inside the lot. In most cases, the codes lack any appreciation of the potential function of landscaping or the effectiveness of landscaping as a screen or buffer.

A good zoning code for surface parking lots focuses on all the details of appearance, including setbacks, buffers, berms, trees, fencing, landscaping, lighting, signage, and paving materials. Chapter 3 explains how local planning commissions, through site plan or special reviews, have improved the appearance of surface parking lots. It explains how they have related site improvements to the size of the lot, the zoning district in which it is located, nearby land uses, and even cost. The following discussion uses some general landscaping principles that can be applied when drafting requirements for surface parking lots. Most of these guidelines are applicable to large lots serving shopping centers, offices, and industry. These recommendations may not be applicable to very small parking lots (say, six spaces or less), which are often exempt from landscaping requirements. In some large cities, this exemption may extend to lots of 20 or fewer spaces.

2. Surface parking lots are broadly defined to include any open area, other than a street, used for parking vehicles. The definition covers parking spaces, loading spaces, maneuvering aisles, and other areas used for access to parking and loading spaces. Typically, zoning codes exempt small parking areas (those up to six spaces) from the definition of parking lots and therefore make them exempt from requirements for screening and landscaping.

3. Gerald R. Stocks, "Surface Lot Design," in *The Dimensions of Parking* (2d ed.) by the Urban Land Institute and the National Parking Association (Washington, D.C.: Urban Land Institute, 1983), 51.

4. Local zoning codes define landscaping to include grass, ground cover, shrubs, vines, hedges, trees, fountains, pools, sculpture, benches, berms, fences, patios, walkways, and artwork. Some also allow the preservation of existing trees and vegetation to be applied to the requirements for landscaping. Most cities do not allow artificial or plastic plant-like materials to qualify as landscaping.

Providing a single tree to landscape the acres of parking in this suburban shopping mall is ridiculous. It does nothing to break up the bleak landscape or reduce the monotony of rows and rows of parking. (Thomas P. Smith. Unless noted otherwise, all photos by Thomas P. Smith)

Without proper maintenance and care, trees die and compound the aesthetic problems of parking lots.

THE AMOUNT OF LANDSCAPING

Generous landscaping is the simplest method of enhancing the appearance of parking lots. It can break up the wide expanses of parking areas and improve the appearance of new construction. It can also be used to separate pedestrian and vehicular traffic and to delineate the different functional areas of the lot, such as long-term, employee parking and short-term, visitor parking. Using landscaping to define different parking areas typically helps to control traffic and lower traffic speeds, thereby ensuring greater traffic safety and efficiency in the operation of the lot. The use of deciduous and flowering trees in a parking lot's interior can provide shade for the cars and the lot's surface. Dense perimeter landscaping can also muffle the noise of automobiles and reduce the glare of automobile headlights and parking lot lighting.

But what is generous landscaping? What is the minimum amount of landscaping needed to screen lots from adjacent residences? How much is needed to enhance the overall appearance of the lot itself? In most cases, the answer requires a judgment that balances concerns about aesthetics, community appearance, and costs.

In 1964, when the American Society of Planning Officials published *Parking Lot Aesthetics*, research suggested that a minimum of 10 percent of the lot area be used for landscaping. Although this may still be a rule-of-thumb for planners, there is no general consensus. In some communities, 10 percent would be a significant increase, while in others the required percentage has increased to as much as 17 percent.

The gross percentage of required landscaping is difficult to calculate in modern zoning codes because these codes distinguish between landscaping for perimeter areas adjacent to other properties, perimeter areas adjacent to public rights-of-way, and interior parking lot landscaping. These areas are regulated separately because the landscaping for each serves a different purpose and each requires a unique design.

BUFFERING AND SCREENING

Many local planners feel the most important part of parking lot landscaping is screening[5] the lot from the street or nearby residential properties. Many codes include requirements for specific screening techniques, including berming, evergreen plantings, and densely planted hedges. The codes distinguish between walls and landscape screens and typically include standards for the height, width, type, and density of plant materials. Some even specify the required opacity of vegetative screens. For example, the Hillsborough County, Florida, zoning code requires parking lots with small setbacks (less than 10 feet) from the street to have six-foot screens consisting of masonry walls, wooden fences, or "a row of evergreen shrubs that will grow to six feet in height and 75 percent opacity within two years of planting."

According to many local planners, berms and graded slopes can be excellent screens. Although berms may be expensive to construct, they are easy to maintain and more visually pleasing than fences and walls. Berms are particularly appropriate for parking areas because low-height berms (three to four feet) effectively screen most automobiles.

Small hedges or fences (three feet in height) can also be effective. These screens can be maintained on small landscaped strips (five to 10 feet in width) and constructed at low cost. In some northern climates, communities require these screens to be nondeciduous shrubs to ensure screening all year round. Where wooden fences and masonry walls are permitted, many communities also require the planting of vines or shrubs. Some zoning codes (e.g., Greenacres, Florida) allow the principal building to qualify as the screen to the parking lot.

The difference between street frontage landscaping and other perimeter area landscaping is typically the degree of screening required. It is more common to require screens (e.g., berms, fencing, walls, or hedges) along the street front than along other perimeter areas. The only exception is when the adjacent lot is zoned residential. In that case, both

5. Screening means "to conceal" or "to shield," and some zoning code definitions specify that this may only be accomplished with the use of walls, berms, opaque fences, or densely planted shrubs or vegetation.

the street frontage and the side yard abutting residential properties require screening. Where the perimeter areas abut other parking lots or commercial or industrial buildings, most communities simply require a landscaped setback. In addition, trees may be required along a parking lot's street front but not be required along other parts of the lot's perimeter.

PERFORMANCE SCREENS OR BUFFERS

Although most zoning codes rely on very specific requirements for screening and buffering, a growing number of communities allow flexibility in landscape design. Many of these new codes take a performance approach to landscaping and buffering, basing the density of required landscaping on the degree of conflict between land uses.

The Annapolis, Maryland, code takes a performance approach to buffers and screens. When parking lots of 15 or fewer spaces abut a residentially zoned area, a minimum 15-foot buffer is required. When a parking lot contains more than 15 spaces, a 20-foot buffer is required. When parking lots abut business zoning districts, a 10-foot minimum buffer is required. The buffer yards for parking areas adjacent to roads and road rights-of-way are more complex. Generally, the width of the buffer is based on the width of the road right-of-way and the width of the parking lot. Buffers adjacent to roads and road rights-of-way must be increased five feet for every 64 feet of parking area running perpendicular to the buffer. Table 1 indicates the minimum buffer widths.

Raleigh, North Carolina, also uses a performance approach. It classifies land uses by their land-use characteristics (size, scale, and environmental impacts) and the amount of activity, turn over, or storage in the parking lot. The classification system distinguishes between residential uses, "low-impact" uses, "medium-impact" uses, and "high-impact" uses. For example, high-impact uses are bus, train, and truck terminals; stadiums; and heavy industries that handle or distribute materials used in manufacturing, assembly, or fabrication. Medium-impact uses include shopping areas; lodging; colleges and universities; hospitals; outdoor theaters or amusement activities; and nonresidential uses allowed in residential areas. The low-impact uses are offices; cemeteries; fire stations; schools; and churches, synagogues, convents, or monasteries.

The Raleigh system establishes "transition yards" for each of these classifications. A transition yard can be a wide setback of turf or a narrow strip with a high density of shrubs and trees. The narrower the yard between the parking lot and its neighbor, the more shrubs and trees required. The possible trade-offs between various widths of turf and various densities of landscaping are specified in the ordinance, and builders may choose from this range of options. For example, when a parking lot for a truck terminal or stadium abuts a single-family residential area, the code requires either a deep, 200-foot, transition yard (primarily turf) or a yard as small as 40 feet if it is densely planted. The code is written so that a wide variety in the depths of yards and density of plantings is allowed between these two extremes.

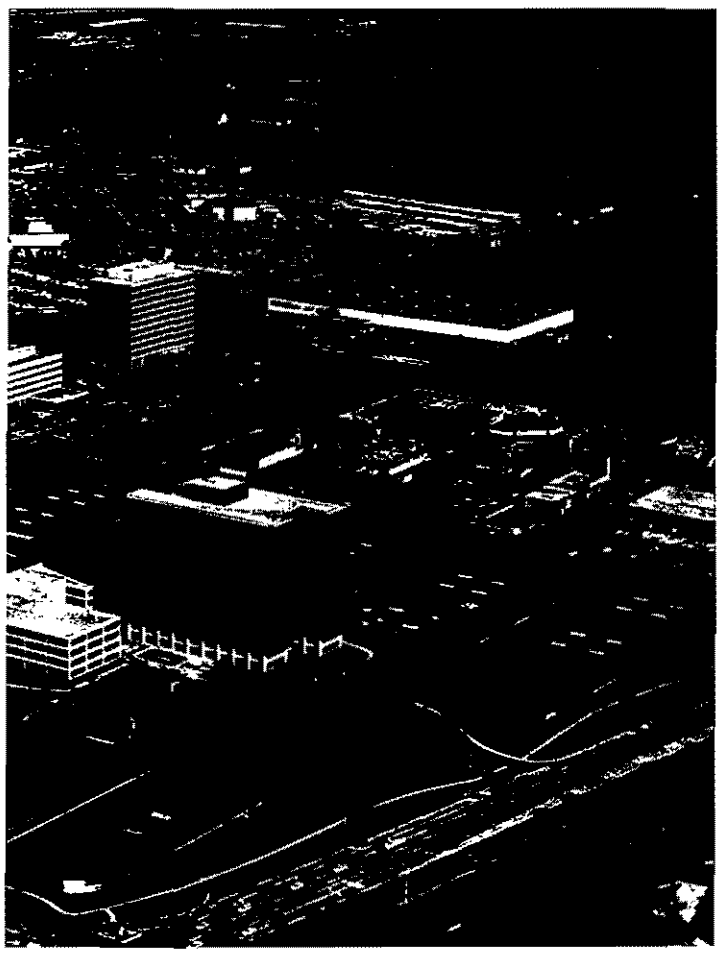
Some planners argue that screens and buffers are not the best solution to minimizing the adverse visual impact of parking lots. They argue that, instead of hiding these spaces, communities should look for opportunities to make them

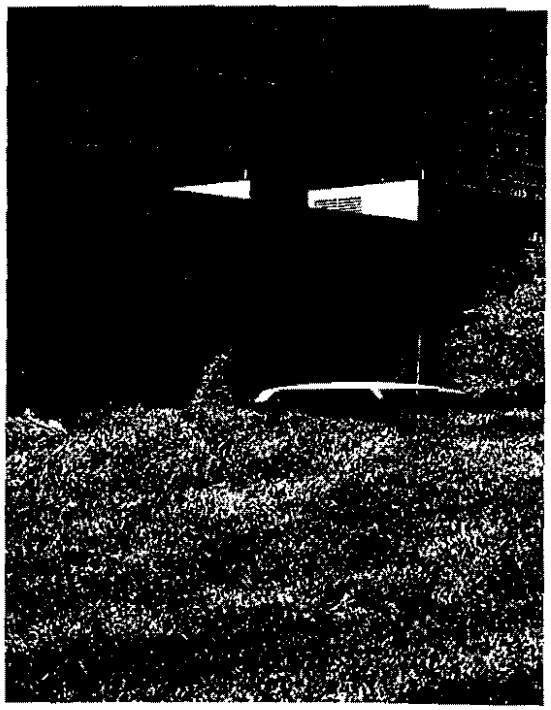
TABLE 1. BUFFER REQUIREMENTS FOR PARKING LOTS, ANNAPOLIS, MARYLAND

Width of Parking Lot*	Width of Adjacent Right-of-Way	Required Buffer Width
1–64 ft.	60 ft. or less	15 ft.
	More than 60 ft.	20 ft.
64–128 ft.	60 ft. or less	20 ft.
	More than 60 ft.	25 ft.
129–192 ft.	60 ft. or less	25 ft.
	More than 60 ft.	30 ft.
193–256 ft.	60 ft. or less	30 ft.
	More than 60 ft.	35 ft.
257–320 ft.	60 ft. or less	35 ft.
	More than 60 ft.	40 ft.
321–384 ft.	60 ft. or less	40 ft.
	More than 60 ft.	45 ft.
385–448 ft.	60 ft. or less	45 ft.
	More than 60 ft.	50 ft.

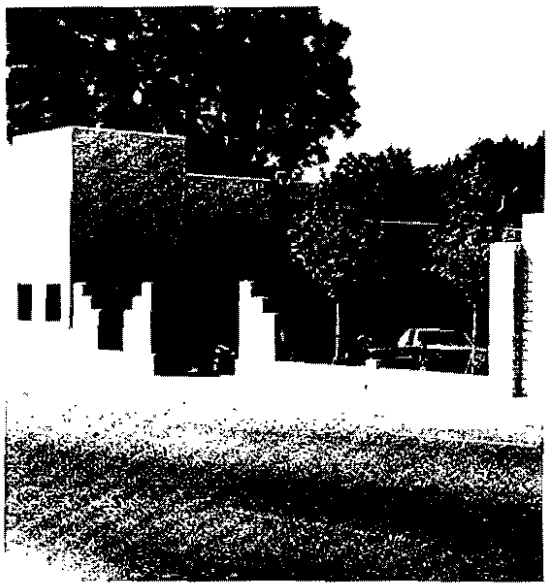
*The width of a parking lot is measured along a line perpendicular to the right-of-way.

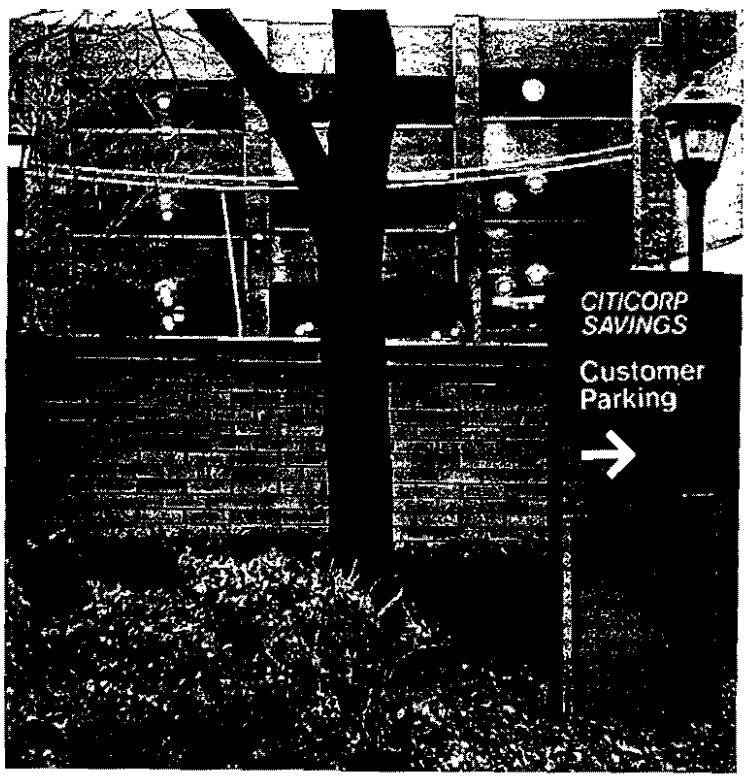
This Schaumburg, Illinois, office building includes wide setbacks and an extensively landscaped entranceway. (Tigerhill Studios, Inc.)

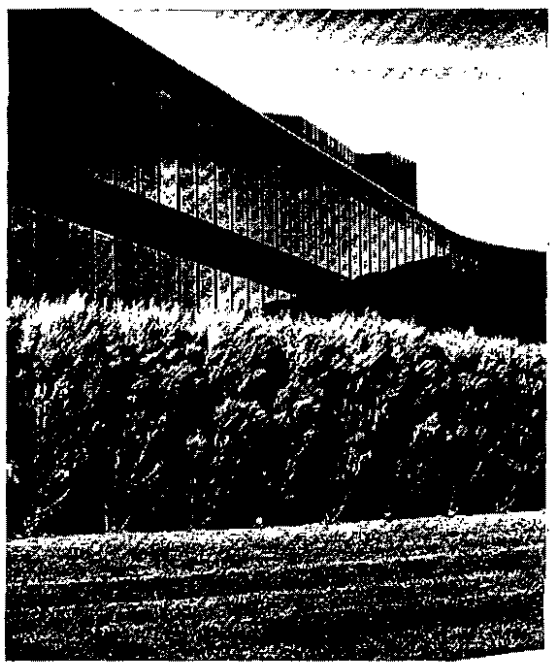


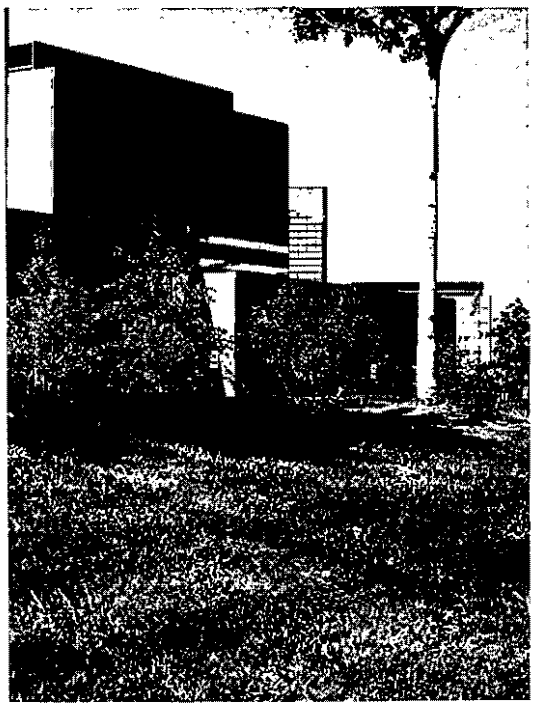


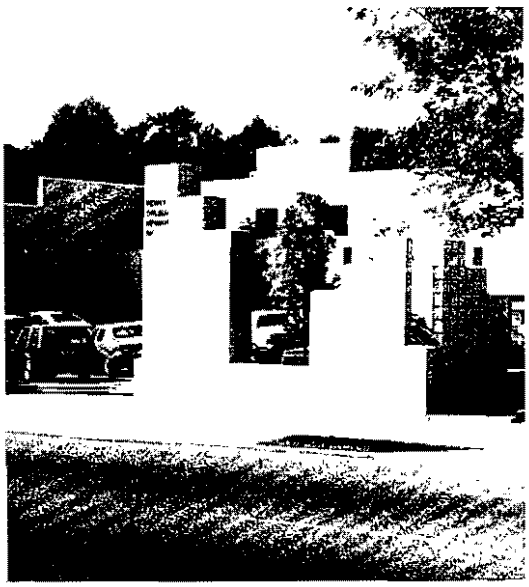
Screens come in all shapes and sizes, and many are very effective in shielding automobiles. Most screens are inexpensive, require very little land, and do not need extensive maintenance. A fence (above photo) *screens a side yard; the berm* (top right) *shields all but the top of the automobiles; the office building* (center) *uses a false facade to screen the parked cars; and the remaining photos show other uses of landscaping and walls or screens.*

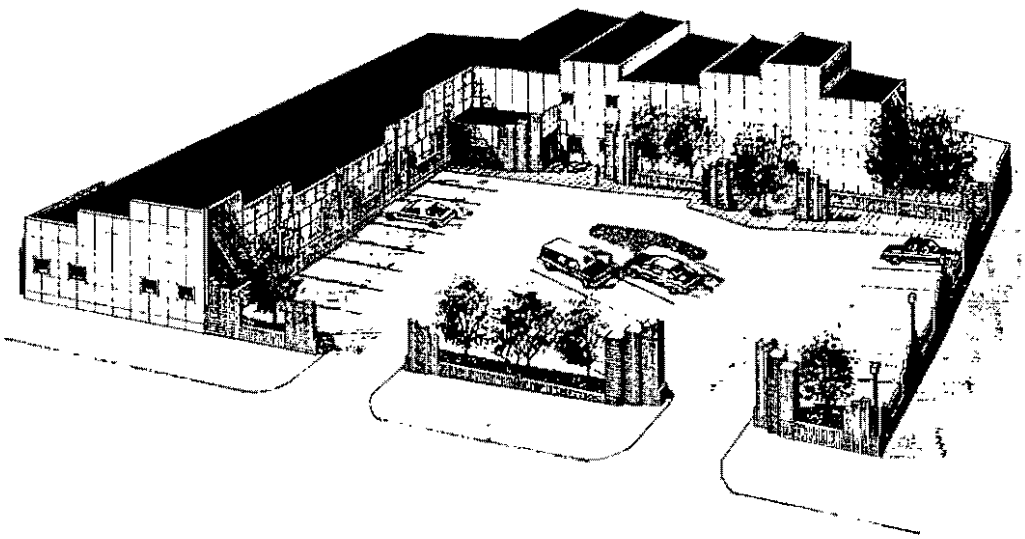












more attractive and useful. These planners suggest more attention to the appearance of the interior of parking lots and interior landscaping. The discussion that follows explains ways of improving the appearance of interior parking areas.

SLIDING-SCALE REQUIREMENTS FOR INTERIOR LANDSCAPING

Some zoning codes require interior landscaping to enhance the appearance of parking lots, especially of large lots that have significant visual impacts. The parking lot landscaping codes of Bellevue and Redmond, Washington; Palo Alto, California; the town of Waterford, Connecticut; and San Buenaventura, California, use sliding-scale standards that require interior landscaping in amounts determined by the size of the parking lot. In some cases, the standards for large parking lots provide incentives to encourage builders to break up the lot into distinct sections. These smaller sections usually have less impact on the environment.

In Palo Alto, five percent of the interior of parking lots smaller than 15,000 square feet must be landscaped. This figure rises to 7.5 percent for lots between 15,000 and 29,999 square feet, and to 10 percent for lots larger than 30,000 square feet. A business's parking lot may be treated as several separate parking lots if the site design makes each clearly distinct and separate. This separation may be achieved by yards or buildings.

The Bellevue, Washington, zoning requirements are similar to those of Palo Alto, but they are expressed in terms of landscaping per parking stall. For parking lots smaller than 50 spaces, the Bellevue code requires 17.5 square feet of landscaping per parking stall; for lots having between 50 and 99 spaces, it requires between 17.5 and 35 square feet of landscaping per stall, as determined by the planning director; and for parking lots with more than 99 spaces, the code requires 35 square feet of landscaping per stall. Nearby Redmond, Washington, uses similar but slightly less restrictive standards. Five percent of the interior of lots between 6,000 and 30,000 square feet must be landscaped, and seven percent of the interior of lots larger than 30,000 square feet must be landscaped. Parking lots smaller than 6,000 square feet do not have to have any interior landscaping.

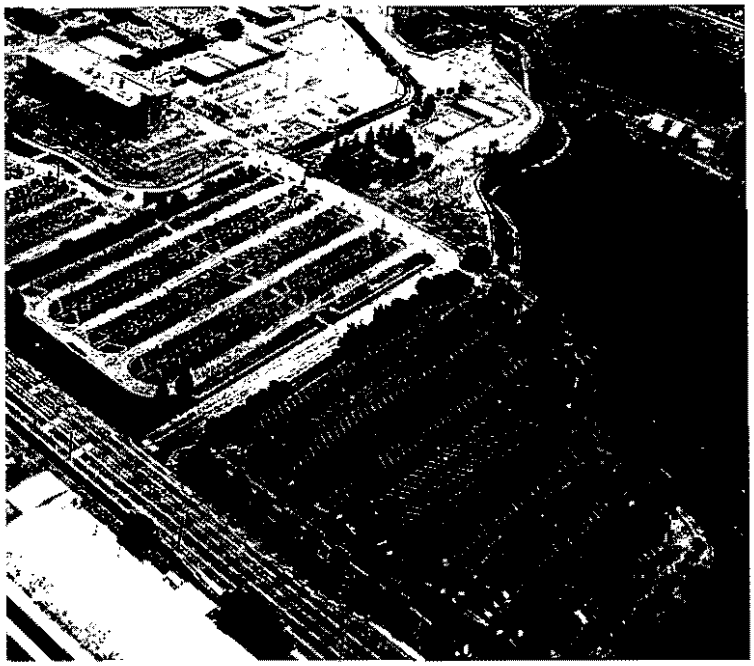
The San Buenaventura zoning code is a little tougher than the Palo Alto, Bellevue, and Redmond codes. It requires that 10 percent of the interior of a lot with 22 or more parking spaces be landscaped; the requirement is five percent for lots with 10 to 21 parking spaces. There is no landscaping requirement for lots with fewer than 10 parking spaces.

SHADING INTERIOR AREAS OF PARKING LOTS

Many local landscaping codes place a premium on the use of trees (particularly shade trees) to satisfy local parking lot landscaping requirements. In warm weather climates, such as southern California, Florida, some southwestern states, and even in parts of Colorado, trees are considered essential to moderating the heat gained by asphalt parking lots.

A number of California communities, including Agoura Hills, Sacramento, Woodland, Sacramento County, and Modesto, require that shade trees be placed in such numbers and locations so that a certain percentage of the total parking area is shaded within 15 years of the issuance of all development permits. In Sacramento, tree canopies must shade 60 percent of the lot within 15 years, and, in Agoura Hills, 50 percent of the lot must be shaded within 15 years. In Sacramento County, trees in small lots of five to 24 spaces must provide 30 percent shading of the entire lot; in lots of 25 to 49 spaces, they must provide 40 percent shading; and in lots larger than 50 spaces, trees must provide 50 percent shading. In Woodland, shade trees must be distributed so that 40 percent of the parking stalls are shaded at high noon when trees are at full foliage. The Modesto code is less

Palm trees in the this Bal Harbour, Florida, shopping center break up the wide expanses of parking and enhance the appearance of the shops and stores. Palm trees, however, do not offer much shade.



Trees in the parking area of this new office building in Livermore, California, will eventually shade the majority of the lot. (Pacific Aerial Survey)

precise; it states only that "a minimum of one deciduous shade tree is required for every 10 parking spaces" and that "the distribution of the trees must maximize shading during the summer months."

Some cities require shade trees based on the number of parking stalls and do not specify that a certain percentage of the lot must be covered by a tree canopy. Typically, however, these codes require trees to be distributed so as to maximize the amount of the lot shaded. A sample of standards follows.

"One tree for every 15 parking spaces in parking lots of 15 or more spaces." The code further requires that the trees be distributed to break up the lot and create a canopy effect. (Colorado Springs, Colorado)

"One tree for every 10 parking spaces and three shrubs for every 10 spaces." (Leesburg, Virginia)

One deciduous shade tree and three shrubs for every 10 parking spaces are required in parking lots that exceed 12,000 square feet or 40 spaces. (Santa Fe, New Mexico)

In parking lots for commercial and industrial development, "a minimum of one 15-gallon tree for every five parking stalls, plus a minimum of 15 percent landscaping for the total site devoted to parking are required. (Irvine, California).

"One shade tree for every 10 parking spaces [is required] in parking lots of over 20 parking spaces." (Redding, California)

Trees are required at a rate of "one for every 2,000 square feet of parking area." (Raleigh, North Carolina)

"At least one tree not less than 2.5-inches caliper at a height of three feet [is required] for each 12 parking spaces." (Wilton, Connecticut)

Parking lots for more than 20 cars must have at least "one tree of two-inch caliper or larger for every eight parking spaces." (Town of Yarmouth, Massachusetts)

POINT SYSTEMS FOR OVERALL LANDSCAPING

Some new zoning codes use point systems that allow a variety of designs for screening and interior landscaping of parking lots. Communities as diverse as Madison, Wisconsin; Dallas, Texas; and Orlando, Florida, use such systems. In Madison, the number of points required are determined on the basis of the following formula:

$$5n-(1+n/1,000)$$

In this case, n is equal to the total number of parking spaces or equal to the total square footage of the lot divided by 300 square feet (the city's average for parking stall size). Once the number of points is calculated, a landscape designer may use trees, shrubs, and other landscape elements to gain the necessary points for code compliance. The following point values are assigned for different types of landscaping.

Element	Point Value
Canopy Tree, 2" to 2.5" caliper	75
Deciduous Shrub, Variety of plant sizes recommended	3
Evergreen Shrub, Variety of plant sizes recommended	5
Decorative Wall or Fence, minimum height three feet (points per 10 lineal feet)	10
Earth Berm, average height 30" (points per 10 lineal feet)	10
Earth Berm, average height 15" (points per 10 lineal feet)	5
Evergreen Trees, minimum height 36"	30
Canopy Tree or Small Tree (e.g., Crab, Hawthorne, etc.), 1.5" to 2" caliper	30

In addition, the Madison code applies the formula

$$n/12-(1+n/1,000)$$

to caluclate the number of trees required. As above, n is equal to the total number of parking spaces or to the total square footage of the lot divided by 300 (the city's average stall size). The number of trees required by this formula can not be included in the point count for other landscaping. The Madison code does not specify where the landscaping must be placed, except that, in lots with 50 or more spaces or two or more driving aisles, at least one-half of the trees must be in the lot's interior.

The Orlando, Florida, development code has the most elaborate point system for parking lot landscaping. In Orlando, the easiest way to get the necessary points is to retain or install trees. The code requires trees and other landscaping in order to screen parking from adjoining land uses and to provide shading within parking lots. The minimum requirements are expressed in terms of tree points. (See the excerpt from the Orlando code in the appendix.) For example, the perimeter parking lot landscaping standard requires "sufficient canopy trees to receive at least three tree points per 100 lineal feet of frontage." The interior parking lot landscaping standard requires "sufficient canopy trees to receive at least one tree point per 100 square feet of landscaped area within the lot." Small native canopy trees are worth between .85 and 1.25 tree points; medium-size native trees are worth

2.5 points; and large or specimen-size native trees are worth five points. The classes of trees (small, medium, and large) are defined by their height and the diameter of the tree trunk. According to Orlando planners, the point system strongly discourages the clear-cutting of trees for parking lots and creates a strong incentive for preserving patches of landscaping. Developers are given points for saving a tree and are given added points for protecting large trees or clusters of trees.

The Dallas code, adopted in 1986, also establishes a point system for measuring compliance with its parking lot landscaping code. The code applies to all new development except duplexes and single-family homes, and new buildings within the central business district. Developers of parking lots for retail, office industrial, or multifamily projects must submit landscaping plans and must earn a minimum number of points before the city will grant development approval. The number of points required varies; for example, the code requires 30 points for parking lots that abut a residential use but only 20 points for a lot that abuts a nonresidential use.

Ten points are awarded for any of the following:

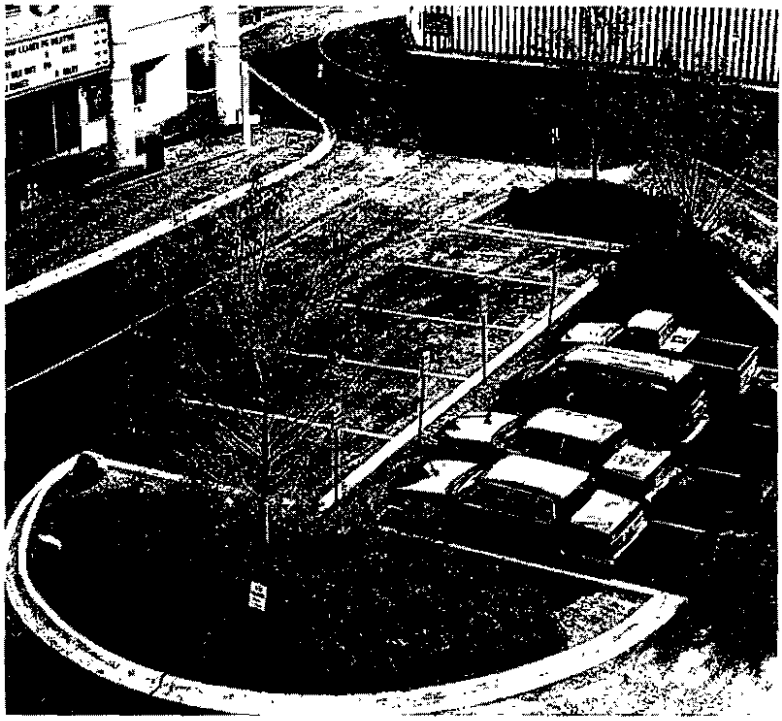
1. Screening of lots to a height of at least three feet;
2. Interior landscaping of at least seven percent;
3. The planting of canopy trees at a rate of one per 10 parking spaces; or
4. Buffer strips of at least 20 feet in width along a lot's perimeter.

Five points can be awarded when one large evergreen shrub is planted for every 10 feet of perimeter area or when one large, noncanopy tree is planted for every 30 feet of perimeter area. The building official may also grant points for the preservation of existing trees. Up to five points can be awarded for the use of unique and pleasing paving materials. Finally, one point is awarded "for each one percent increment of a lot" that is used for fountains, covered walkways, seating areas, or outdoor recreation areas.

REGIONAL DIFFERENCES IN LANDSCAPING CODES

Significant regional differences exist in parking lot landscaping codes. In the Midwest and Northeast, a number of communities allow developers to transfer some required interior landscaping to the perimeter of a parking lot. This transfer is permitted typically in high-turnover parking lots because of problems with snow removal. It is usually much easier to clear parking lots of snow when landscape islands do not prevent the operation of snow plows.

The most significant regional trend, however, is the enactment of parking lot landscaping codes that require the use of plants and designs that conserve water. These are "xeriscape" codes (derived from the Greek word, xeros, meaning dry). In California, Los Angeles, Contra Costa County, Santa Barbara County, and Ventura County require the use of water-conserving plants. Many of these codes also limit the amount of turf used in the landscaping of parking lots (grass requires large amounts of water to be maintained). These water-conserving codes also require the use of irrigation systems that are electronically set for night and/or early morning irrigation and the use of stormwater collection designs that collect and recycle water.



The landscape islands of this Oakbrook, Illinois, shopping center include ample space to protect the root system of trees and curbing that prevents cars from encroaching on the landscaping.

The Pima County, Arizona, code is probably the premier example of a code that requires low-water-use landscaping. The Pima code promotes conservation of the desert environment. The ordinance encourages the use of low-water-use plants and limits the use of water-intensive turf. The Pima code also allows developers to cluster landscaping into a "mini-oasis" where it is much easier to harvest rainwater for irrigation and centralize maintenance of vegetation.

Other regional differences appear in the types of trees and shrubs permitted. Most zoning codes encourage the use of native plants and trees. When the types of permitted trees or shrubs are specified in local codes, such lists should be developed in cooperation with local nurserymen, landscape architects, and horticulturists.

PROTECTION OF LANDSCAPING

To ensure the long-term protection of landscaping, developers must coordinate landscape designs with grading and excavation plans. Such planning is particularly critical when landscaping plans include the retention of existing vegetation. When retaining existing trees in parking areas, enough ungraded ground around the tree should be left to allow for its survival. Standards in Fairfax County, Virginia, state that "grading should not be permitted within the drip line of trees to be retained." The "drip line" is a vertical line from the outer edge of a tree canopy to the ground. The county requires this area to be staked out and protected (e.g., by fencing) from heavy equipment traffic or from use for the stockpiling of equipment, dirt, or construction materials.

Grading must not encroach on a tree's root zone in ways that threaten the survival of the tree. According to some

landscape horticulturists, even shallow cuts of six to eight inches can remove a tree's or shrub's feeder roots and expose deeper roots to drying and freezing. Deeper cuts may sever a large portion of the root system, depriving trees of water and increasing the chance of wind damage to weakened plants. Finally, even shallow grading in the vicinity of trees removes top soil, natural mulch, and ground vegetation that is important to the health of trees and shrubs.

Excavation for new utilities, foundations, and basements must also be planned so that it does not adversely affect important vegetation. Generally, such excavation should be kept out of the area within the drip line of trees. When utilities are installed, all lines (electrical, phone, and even cable television lines, if possible) should be laid so that additional excavation is not required at a later date.

New trees, shrubs, and turf must be installed carefully and protected from damage that can be caused by encroaching cars and trucks. Landscaping needs to be able to grow without being bumped or banged by parking cars. Raised planters, fences, or curbs and edges can be used to stake out a landscaped area.

Typically, landscape architects must also determine whether the root development of new trees will ultimately cause any interference with walls, walks, drives, patios, and other paved surfaces. The same is true when considering possible interference with sewer lines, septic systems, and underground drainage systems.

Installation plans also require the selection of appropriate planting materials. Local owners of plant nurseries, agricultural extension agents, and landscape architects are good sources of advice or consultation. When choosing trees for parking lots, the primary concerns are longevity, crown size (for shading purposes), aesthetics, and nuisance factors. Trees that drop sap should be avoided, and trees that drop large amounts of blossoms, seeds, and pods that might clog drains may also have to be avoided. Deciduous trees that drop leaves can be used if parking lots are periodically cleaned. Hearty trees resistant to motor exhaust fumes, dirt, and soot should be used. Trees that are susceptible to insects and disease should be avoided, and trees with expansive roots that could disrupt paving and underground lines should be discouraged. In cold climates, the use of trees that are tolerant of road salt and deicing compounds must be encouraged.

MAINTENANCE OF LANDSCAPING

Requiring proper installation of trees, shrubs, and turf is not enough. Methods must be developed to ensure that responsibility for maintenance is clear and that plant materials are, in fact, maintained over time.

Most communities do a poor job of enforcing maintenance requirements. The problem is the cost of inspection programs to ensure compliance. Ultimately, the responsibility for maintenance rests with the property owner or the owner's agent. The property owner's responsibility usually includes keeping plant materials healthy, maintaining fencing and screens in an orderly way, and keeping landscaped areas free from debris.

In many communities, special maintenance safeguards are required to keep plant materials alive. In Southern and Southwestern states with insufficient rainfall to maintain landscaping, it is often critical that codes require sprinkler systems or nearby water outlets. Some communities encourage the harvesting of runoff from parking lots as a water source for landscaping or to supplement the water supply. In many locations, however, parking lot runoff would have to be filtered or treated to remove heavy metals and oils before it would be appropriate for irrigating landscaping. The best solution in dry climates is to use water-conserving and drought-resistant plants.

Some ordinances are brief, tough, and clear on maintenance responsibilities. The Coral Gables, Florida, code simply states that "the owner, tenant, and their agent, if any, shall be jointly and severally responsible for the maintenance of all landscaping in good condition so as to present a healthy, neat, and orderly appearance and shall be kept free from refuse and debris." The city's code further requires that "all landscaped areas shall be provided with a readily available water supply with at least one outlet located within 150 feet of all plant material to be maintained." The Rochester, New York, code is similar. The code authorizes zoning officials to revoke permits for the principal use if parking lot landscaping is not maintained. The Rochester code states that "failure to comply [with maintenance standards] shall be grounds to revoke a parking lot approval and [the approval] for the principal use which the parking lot serves."

Some codes go well beyond the minimum requirements for landscape maintenance and spell out all necessary standards. The Vista, California, zoning code, for example, requires that:

> All plant growth in landscaped areas be controlled by pruning, trimming, or other suitable methods so that plant materials do not interfere with public utilities, restrict pedestrian or vehicular access, or otherwise constitute a traffic hazard;
>
> All planted areas be maintained in a relatively weed-free condition and clear of undergrowth;
>
> All plantings be fertilized and irrigated at such intervals as are necessary to promote optimum growth; and
>
> All trees, shrubs, ground covers, and other plant materials must be replaced if they die or become unhealthy because of accidents, drainage problems, disease, or other causes.

Furthermore, the Vista code requires that replacement plants conform to all standards that govern the original installation of plantings.

Some planners claim that covenants or deed restrictions for landscape maintenance are highly effective in guaranteeing long-term care of plantings. When maintenance is required by such covenants, the property owners have a greater incentive to maintain the plantings because, legally, failure to maintain landscaping may affect the sale of the property. When property is sold, maintenance requirements can be enforced by a prospective buyer because, technically, the buyer would assume responsibility for landscape maintenance upon gaining title to the property. The Pima County, Arizona, code requires that the final approval of subdivision or development plans include covenants that guarantee the continued maintenance of required landscaping, buffering, and associated irrigation systems and assign the responsibility for such maintenance to the property owner or agent, a homeowner's association, or other "liable entity."

Chapter 3. Site Planning for Parking Lots

Enhancing the appearance of parking lots is more than just a matter of good landscaping. It is a matter of site planning details. For planners, the important details are often parking lot layout, lighting, signage, and pedestrian improvements. For the operators of parking lots and garages, the important details are often more minute and concern asphalting, striping, and parking angles.

Good site planning can greatly influence whether a parking lot enhances a development or detracts from its overall design. Many of the factors—access, design, layout, internal circulation—must be resolved in the earliest planning stage. In this early phase of site planning, urban planners can greatly influence the overall appearance of parking lots.

PARKING LOT LAYOUT

Generally, parking must be located in close proximity to the building it serves. To do otherwise will result in underused parking and confused motorists. One exception to this may be for long-term, employee parking. Studies have shown that employees will walk further from parking to their work destinations than shoppers will walk from parking to stores.[6] Parking for shopping and retail businesses must be close and convenient. For employees, the availability of parking, rather than its convenience, is the critical concern. This parking can be located out of the way in side or rear yards.

Local zoning codes include a variety of special layout requirements designed to reduce the visual impacts of parking lots. San Diego and Upland, California, and Raleigh, North Carolina, for instance, require builders in special zoning districts to locate parking at the rear of a building and to eliminate parking lot driveways along certain street fronts.

In San Diego's historic Gaslamp zoning district, "no off-street parking shall be visible from the street frontage." Instead, the San Diego code requires that parking be restricted to the rear half of the parcel.

The Raleigh code is similar but gives developers more options. In Raleigh's pedestrian business district, the city prohibits parking on any "portion of the site parallel to and adjoining a thoroughfare between the principal building and perpendicular to the recorded public right-of way." In this pedestrian zone, Raleigh allows builders to reduce their off-street parking by 45 percent of what is normally required. The code also allows customer parking to be built off site as long as it is within 600 feet of any entrance and allows off-site employee parking up to 1,200 feet from any entrance.

The Upland ordinance strongly discourages parking lots from abutting designated scenic corridors. Driveways and curb cuts to parking areas for commercial, industrial, or multifamily developments are prohibited along these scenic corridors. All vehicular access to these areas must be off the corridor, through intersecting streets.

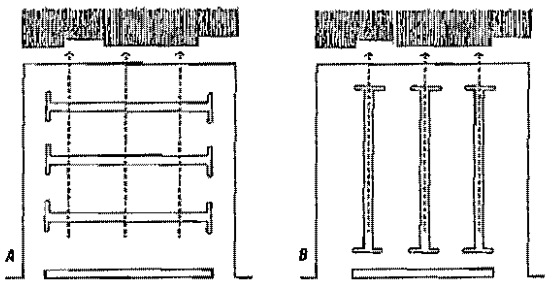
Some communities, including Palo Alto, California; Fairfax County, Virginia; Schaumburg, Illinois; and Multnomah County, Oregon, encourage developers to break up surface parking lots into smaller parking areas to reduce the size of individual lots. Some zoning codes allow reductions in the required amount of landscaping for parking lots that are broken up and distributed around a building site. The Multnomah County development manual and the Fairfax County parking lot manual show developers how to split up parking areas between side and rear yards in order to reduce the overall size and visual impact of any one parking lot.

A number of cities also encourage or require parking to be broken up into distinct modules of a certain number of spaces. This is most frequently required in multifamily

6. Highway Research Board, *Parking Principles*, Special Report No. 125 (Washington, D.C.: U.S. National Research Council, 1971), 15.

The landscaping of this San Ramone, California, office complex virtually achieves an art form. Its formal layout and detail give it the appearance of a garden. (Pacific Aerial Surveys)

FIGURE 1. PARALLEL VS. PERPENDICULAR PARKING ROWS



Orienting parking rows parallel to the building (A) increases the potential for pedestrian and vehicle accidents because people must walk through all the driving aisles. Arranging parking perpendicular to the building (B) enhances pedestrian safety. (Fairfax County, Virginia, Parking Lot Landscaping Guide)

residential projects for which detailed site plan review is required. The Schaumburg, Illinois, PUD guidelines, for example, state that "no more than 15 parking spaces shall be permitted in a continuous row and no more than 60 parking spaces shall be accommodated in any single parking area."

INTERIOR DESIGN AND CIRCULATION

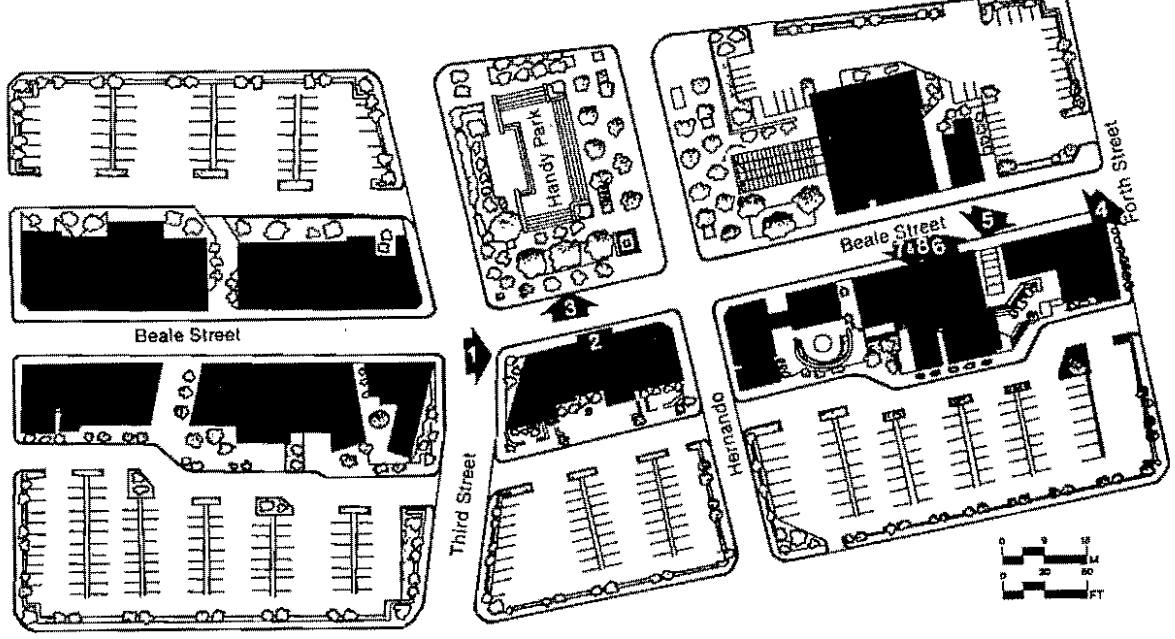
Design factors, such as the shape of parking lots, the orientation of aisles, and the layout of entrances and exits and pedestrian improvements influence how well parking facilities function. They also affect appearance.

Parking lots that are rectangular in shape are typically the most efficient in terms of layout, circulation, and overall space requirements. Irregularly shaped parking areas are inefficient and are typically used only where site constraints—terrain or other environmental limitations—require unconventional layouts. The usual long lines of stalls in some parking lots, however, can be minimized by employing some curves and irregular shapes. In other instances, the visual impact of parking can be reduced by breaking up the parking area into discrete islands or clusters of spaces.

In large parking lots with rows and rows of parking, the orientation of parking aisles must be planned for pedestrian safety. When driving aisles are oriented perpendicular to the stores or businesses they serve, the number of aisles pedestrians must cross are minimized. (See Figure 1.)

Both the driveway entrances and exits to parking lots should be located away from nearby street intersections. When these access points are close to intersections, they can easily be blocked, impeding the flow of traffic in the parking lot and increasing the hazards of street traffic. Parking lot design should minimize such traffic conflicts. Entrances should provide some "channelized" storage space so that cars entering a lot to park do not end up in queues out in the street. Channelization and storage are most important when parking lot access is to or from an arterial street where cars

(Above) *Small islands of parking dispersed over a site reduce the visual impacts of parking.* (Below) *In the three-block Beale Street Historic District, the city of Memphis, Tennessee, has successfully encouraged shop owners to maintain the old pattern of parking in rear yards. (Urban Land Institute)*



This hotel maintains excellent sidewalks and landscaping within its parking lot.

move at high speed and smooth traffic flow is a primary goal of the street's design. Speed bumps and special paving materials or colors may be used to slow down traffic as it approaches the parking lot. Signs should be posted near entrances to warn pedestrians of entering and exiting traffic.

Developers should be encouraged to consolidate parking lot entrances and exits where there are opportunities to do so. When the number of parking lot access points is kept small, it is easier to maintain safe and smooth traffic flow on adjacent streets and easier to plan for pedestrian safety.

In large parking lots, separate, raised walkways should be provided for pedestrian safety. The Montgomery County, Maryland, zoning code allows the planning director to require walkways for large, high-turnover parking lots. In specified zoning districts, Bellevue, Washington, officials may also require walkways that ensure safe access from buildings to parking areas, adjacent properties, and sidewalks along street rights-of-way. The walkways must be integrated with existing sidewalks and pedestrian trails and coordinated with the city's overall plan for pedestrian improvements. They must be constructed of concrete, asphalt, stone, brick, tile, or other hard surface material and enhanced with landscaping to help distinguish them and make them pleasant.

PARKING LOT LIGHTING

Parking lot lighting is used to illuminate the lot for traffic safety and for security. Most lots use high (30- to 50-foot) overhead lamps because they distribute the light over a large area. Fewer lamp posts are needed when tall posts are combined with strong illumination. Requirements for illumination vary by parking lot, based on the amount of activity within a lot during evening hours. Illumination levels are typically measured in terms of "footcandles," a standard measure of illumination over a surface area of one square foot.

Most zoning codes regulate parking lot lighting by simply requiring that it be shielded or aimed away from homes and apartments. A few zoning codes go further and regulate the height of lamp posts, the intensity of parking lot lighting, and the hours such lighting may operate. The Agoura Hills and Poway, California, zoning codes require the use of small (16- to 18-foot) lamp posts and low-level illumination. These controls apply because the parking lot lights of commercial and industrial activities are often adjacent to residential areas in these cities. The Poway zoning code, for example, restricts free-standing, parking lot lamp posts to a height of no more than 18 feet. The intensity of this lighting must also be controlled.

The Boulder, Colorado, and Madison, Wisconsin, parking codes place limits on the hours that lights may remain operating. The Boulder code requires "all parking luminaires, except those required for security, [to be] extinguished within one hour after the end of business hours." The exception for security purposes may only apply to 25 percent of the total luminaires used. The Madison code states that "all lighting for business uses shall be extinguished or reduced in intensity . . . no later than 30 minutes after the close of business."

Lane Kendig's *Performance Zoning* includes a detailed treatment of illumination standards for parking lot and other outdoor lighting. Kendig's standards control the maximum amount of illumination based on zoning classifications, the height of a luminaire, and the degree to which lighting is cut off or shielded. The objective of these standards is to reduce glare and the spillover effects of outdoor lighting.

The *Performance Zoning* approach gives property owners various options. Landowners may use lower light posts, without any cutoff or shielding, or a higher pole (up to 60 feet) with a luminaire design that significantly reduces

Parking lot lighting comes in all sizes. Highmast posts (100 feet tall) are used in the parking lot of a Cook County building; 30-foot posts are used in a garage for a high-rise condominium building; and seven-foot decorative lighting is used in a suburban downtown.

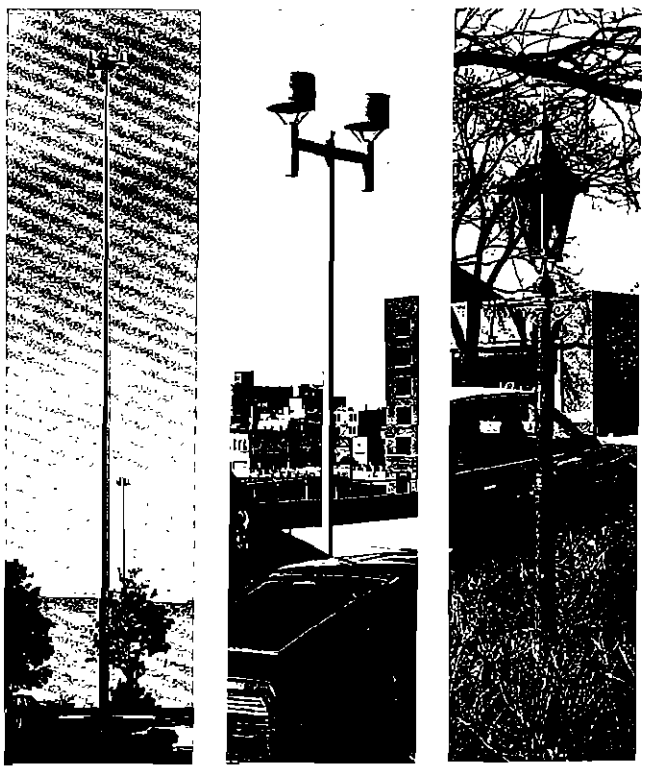


FIGURE 2. SAMPLE EXTERIOR LIGHTING STANDARDS

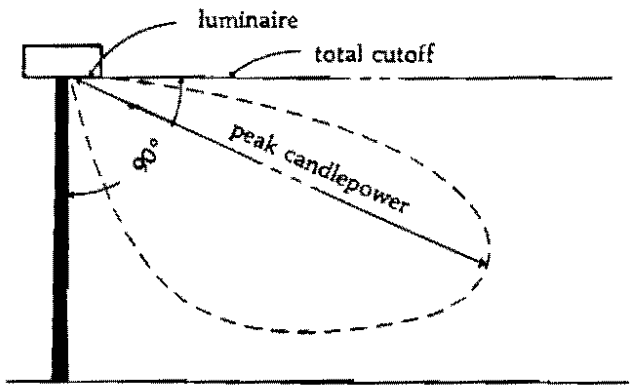
1. When light source or luminaire has no cutoff.[1]

Use/Density Category	Maximum Permitted Illumination[2]	Maximum Permitted Height of Luminaire
Residential	.2	10 ft.
Low-density nonresidential	.2	15 ft.
Medium- and high-density nonresidential	.3	20 ft.

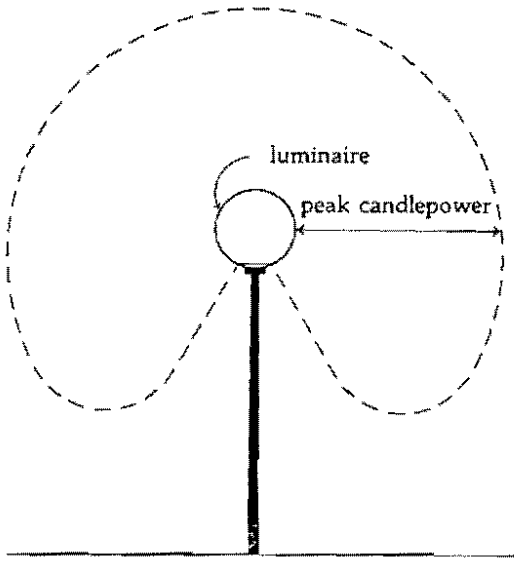
2. When a luminaire has total cutoff of light at an angle of 90 degrees or greater.

Use/Density Category	Maximum Permitted Illumination[2]	Maximum Permitted Height of Luminaire
Residential	.3	15 ft.
Low- and moderate-density nonresidential	.5	20 ft.
	.75	25 ft.
	1.0	30 ft.
High-density nonresidential	1.5	35 ft.
	2.0	40 ft.

2. CUTOFF LUMINAIRE



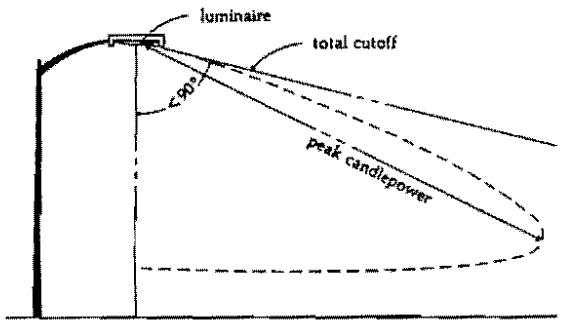
1. NO CUTOFF LUMINAIRE



3. When a luminaire has total cutoff of light at an angle of less than 90 degrees and is located so that the bare light bulb, lamp, or light source is completely shielded from the direct view of an observer five feet above the ground at the point at which the cutoff angle intersects the ground.

Use/Density Category	Maximum Permitted Illumination[2]	Maximum Permitted Height of Luminaire
Residential	.5	20 ft.
Low- and moderate-density nonresidential	1.0	25 ft.
	2.0	30 ft.
	3.0	40 ft.
High-density nonresidential	4.0	50 ft.
	5.0	60 ft.

3. LUMINAIRE WITH LESS THAN 90 CUTOFF



Source: Performance Zoning, p. 173–74.

1. The cutoff is the point at which all light rays are completely shielded.

2. The maximum permitted illumination is measured in footcandles at the interior buffer yard line at ground level. Lighting levels must be measured in footcandles with a direct-reading, portable light meter. The equipment used must allow accurate measurements, and all measurements must be made after dark with the lights on and then again with the lights off. The difference between the two readings must be compared to the standard for maximum permitted illumination.

(Above) *This very small garage uses a billboard to attract the attention of drivers on an expressway about a block away.* (Below) *This fortified attendant booth, combined with the numerous signs and perimeter security fencing, gives this commercial lot the ambience of a prison yard.*

spillover light at a cut-off angle less than 90 degrees. Figure 2 explains this approach.

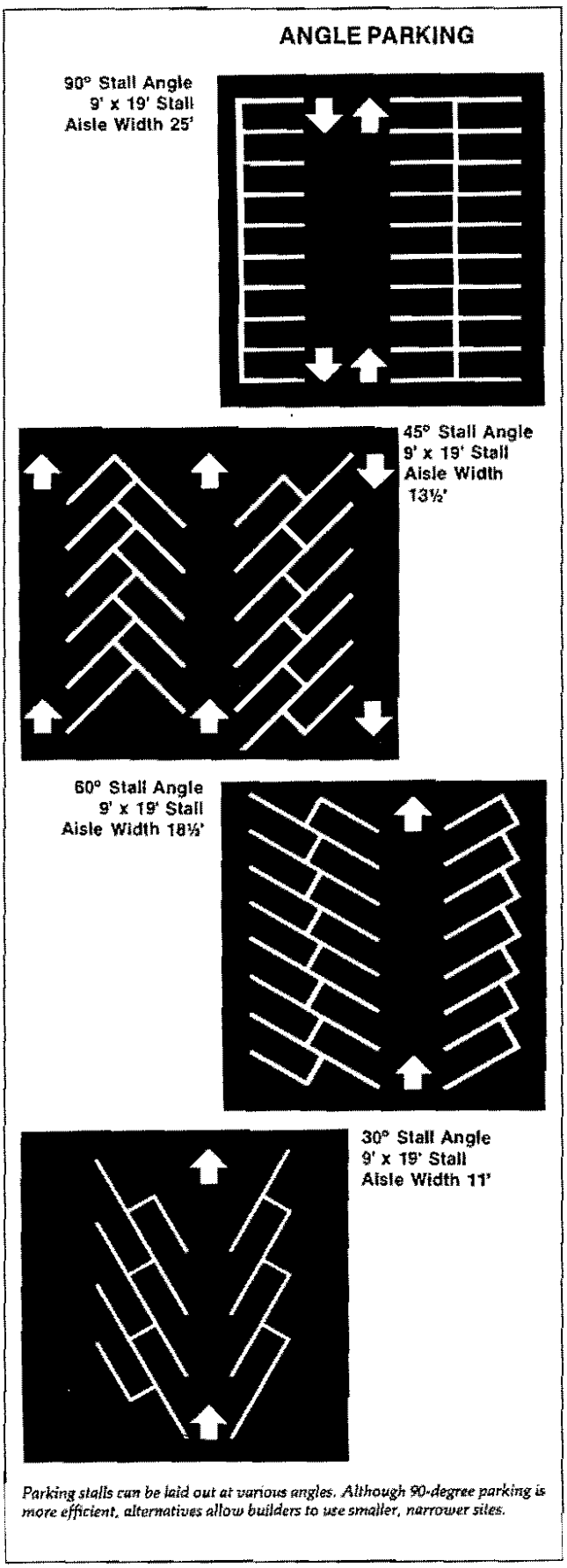
Kendig's model makes exceptions for outdoor lighting needed for ball diamonds, playfields, and tennis courts. This lighting is exempt from the illumination standards and the height restrictions for lighting posts, but this kind of lighting must be shielded at a 90-degree angle.

PARKING AREA SIGNAGE

Most parking lots are littered with directional signs, visitor parking signs, signs indicating the stalls reserved for handicapped drivers, small car parking signs, and signs prohibiting parking. Commercial parking areas[7] are the worst offenders. In addition to the signs already noted, these lots include large advertising signs, signs posting rates, and signs explaining how to pay for parking after hours.

Big cities have the most detailed standards for signage associated with commercial parking areas. The Los Angeles zoning code allows commercial parking areas to have business identification signs with the name of the operator, hours of operation, and parking charges. The size of total signage area is based on the parking area's frontage. Signage area is calculated at the rate of .25 square feet of sign area for the first 100 feet of frontage; at a ratio of .5 square feet for frontage beyond 100 feet but less than 200 feet; and at the rate of .75 square feet for frontage beyond 200 feet and up to 300 feet. In no case may the signage area exceed 150 square feet in area. Los Angeles's code also permits internal traffic directional signs for entrances and exits as needed, but these signs are limited to no more than six square feet in area.

7. Commercial parking facilities are surface lots or garages that are not accessory to any principal use. They are lots or garages that are operated as a separate business and that charge fees for the privilege of parking.



Parking stalls can be laid out at various angles. Although 90-degree parking is more efficient, alternatives allow builders to use smaller, narrower sites.

The Rochester, New York, code allows commercial parking lots to have three types of signs—one business sign per parking lot not to exceed 24 square feet in area; one parking rate sign per street front; and directional signage as is needed. The code does not place a restriction on the size of parking rate signs because, as local planners report, parking lot operators intentionally keep those signs small.

The Boston zoning ordinance requires standardized signage. For commercial parking lots and garages, the city requires a blue rectangle with a white letter "P" in sans serif gothic typeface. This permitted sign may not exceed 24 square feet on its face, may only have two faces, and may not be placed more than 25 feet above grade.

Irvine, California, treats an advertising sign in a commercial parking area like any other on-premises sign. It limits other noncommercial parking lot signage to "parking area notices, each not to exceed two square feet in area, and directional marking lettered on paved surfaces of driveways and parking areas." The National City, California, zoning code also limits accessory parking lot signage, stating that such signs "should only identify the facility and direct traffic rather than advertise the use the lot serves." The size of parking signs, according to the National City code, must be kept to the minimum necessary to identify the location of parking and direct traffic to appropriate entrances and exits.

AESTHETICS OF PARKING ENTRANCES

Parking lots are often the principal entryways to major commercial or industrial developments. A person's first impression of a development is usually the one provided by this access point. Often, there is no consistency between the quality of a building's design or doorway and the entryways to the site. Whereas many developers will include lavish improvements on the building's front door, this attention is lacking in the design of the driveways leading to the building.

A few cities, like Santa Fe, New Mexico, and Albany, Oregon, require landscaping treatment of building entryways. Along designated arterials in Santa Fe, an entranceway, whether to a parking area or interior roadway, must be accentuated by large-scale trees. According to the code, two deciduous trees must be planted on each side of the entrance. At least one tree on each side must be a large canopy tree and the other may be an ornamental tree. The trees must be contained within landscaped areas at least 200 square feet in area, and these areas must be planted with shrubs, ground cover, or grasses. The Albany code is simpler. It requires all entryways to be bordered by landscaping, including one tree at least 10 feet high, and decorative ground cover.

After cars enter parking areas, landscaping should be reduced so that motorists can determine where different functional areas—visitor parking, pick-up or drop-off points, and building entrances—are located. The relationship between parking areas and the building's entrance should be direct and clear.

ANGLE PARKING

The layout of parking is often determined by the angle (usually 90, 75, 60, or 45 degrees) between the curb and the parking stalls. Usually, the decision as to which angle is best

Some zoning codes require 90-degree parking and mandate excessively wide driving aisles. The result can be a waste of land and an excessive amount of asphalt. The driving aisles in this suburban office development are wide enough for landing a small plane.

depends on the available space for parking and the number of vehicles that require storage. Many communities, however, require or strongly encourage the use of 90 degree or right-angle parking. But this restriction can work against smaller parking areas that are less visible.

Builders prefer 90-degree parking because the land survey costs for this type of layout are lower and the size and shape of the parking module are very predictable. Drivers also prefer this parking layout because of the wide, two-way driving aisles. These advantages are significant, but they should not preclude the use of alternative parking angles. Where planners want to use smaller sites for parking, they should examine the use of one-way driving aisles and parking angles less than 90 degrees.

Parking angles of 45 and 60 degrees can be used in small areas when the width of the parking area is restricted. Parking areas using double parking bays set at 45-degree angles and one-way driving aisles can be accommodated easily in a space as narrow as 40 to 45 feet, and 60-degree parking requires a lot only 50 to 55 feet wide. Right-angle (i.e., 90-degree) parking requires more space because it is typically designed with two-way traffic aisles. The width of such a parking area is typically at least 60 to 65 feet.

OTHER SITE PLAN CONSIDERATIONS

In site plan review of parking facilities, planning staffs or commissions can examine a great number of details. Too often, however, local planning officials get bogged down on the issue of whether or not there are an adequate number of parking spaces, and important details are forgotten. In many cases, it would be useful for planning departments to develop a checklist of site improvements for parking areas.

Many site improvements can be checked during internal staff reviews of development plans. These details may include plans for surfacing the lot, striping, the layout of concrete curbing, and the dimensions of stalls, driving aisles, and parking bays. Staff may also review plans for trash and refuse collection areas, loading and service bays, emergency access routes, outside storage in parking areas, and security. Standards within an ordinance should guide staff review of all of these details.

Broader site planning concerns may not fit easily into checklist considerations. These issues may concern the compatibility of parking lots and structures with surrounding land uses, the traffic impacts of parking areas on adjoining streets, and the environmental impacts of such facilities. Large parking facilities may require off-site roadway improvements or additional traffic signalization. Runoff from parking areas may adversely affect drainage systems or contribute to local flooding problems. Parking facilities may also conflict with long-range land-use plans or roadway plans. Planning officials can consider all of these broader issues within the context of the site plan review process.


SELF PARK
SELF PARK
SELF PARK

Chapter 4. Parking Structures and Urban Design

Parking structures[8] are a far more efficient use of land than are surface parking lots. A parking structure typically takes up less land because parking is "stacked" in levels. Most parking structures are constructed in a way that maximizes efficiency and economy. For example, a recently constructed 1,000-space parking garage in Indianapolis was built in 60 days.[9] Because of such efficiency, these large garages are the trend. According to Robert Weant of the ENO Foundation, 500- to 700-space garages are now the norm, and 1,000- to 3,000-space structures are no longer considered exceptional. Weant reports that the old attendant garages of 90 to 200 spaces are found only in big cities and most are considered remnants of a bygone era.

In downtown locations and employment centers, planners encourage construction of parking garages rather than parking lots in order to maintain urban densities and to prevent any waste of land. Strict requirements for the use of underground or aboveground parking structures, however, are rare. Instead, planners encourage underground or structured parking by providing floor area bonuses or other zoning incentives.

Modern zoning codes also encourage or require street-level retail space; staggered setbacks to soften the impact of parking structures at street level; and architectural compatibility between parking structures and the buildings they serve.

The most advanced codes for parking structures not only address the aesthetics of parking garages, they also examine how structures function. These codes evaluate whether parking structures adversely affect existing traffic and commuting patterns or conflict with city goals for continuous retail frontages and safe pedestrian streets.

In the coming generations, these aesthetic and functional issues may fade away. The technology for excavating underground may substantially improve and the costs of building underground parking structures may be substantially reduced. This, however, does not appear probable in the near future. Building aboveground parking is still substantially less expensive than building underground parking. The cost per space is approximately $7,400 in multilevel garages, compared to nearly $10,000 dollars per space for underground parking.[10] These cost comparisons include all costs for design and professional services, equipment, and construction, but they do not include land acquisition.

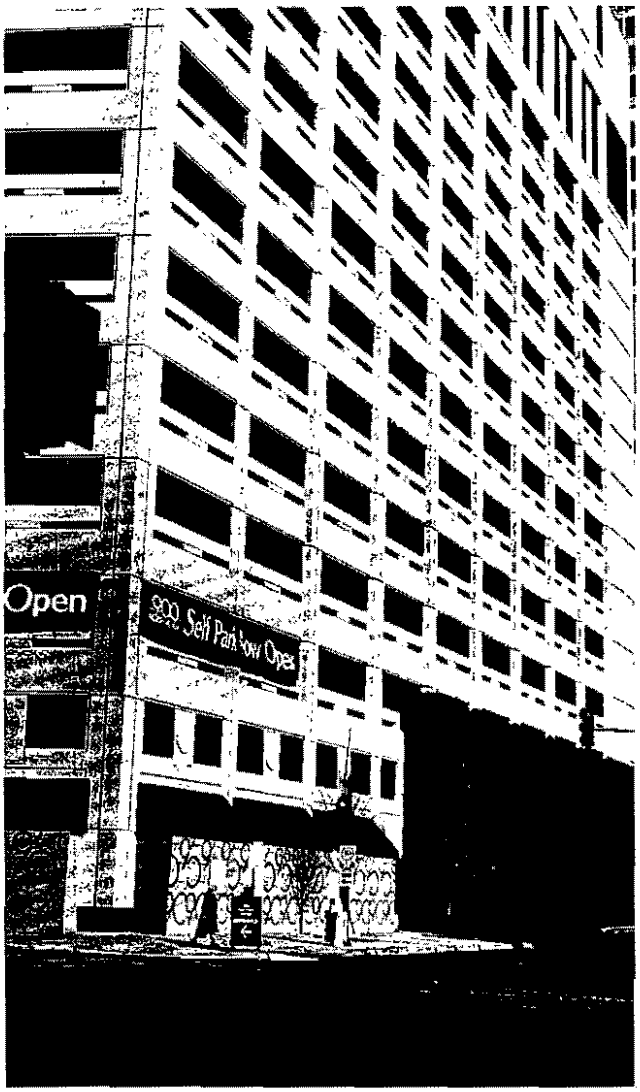
In the foreseeable future, it will remain much less expensive to improve the design of parking structures than to require parking to be underground. The costs of facade improvements, landscaping, and ground-floor retail are often minimal. Ground-floor retail space typically shows a positive economic return, and aesthetic improvements increase the property values and marketability of garage space. The following sections look at the current boom in garage construction, what cities are doing in terms of encouraging (or, in some cases, discouraging) garage construction, and what they are doing to improve the appearance of garages and their compatibility with surrounding buildings.

8. Parking structures are often referred to as garages or ramps. They are usually multilevel structures in which one or more levels are stacked and supported above the lowest level. These structures may be publicly or privately owned.

9. Richard F. Roti, "Construction and Development Costs," in *The Dimensions of Parking* (2d ed.) by the Urban Land Institute and the National Parking Association (Washington, D.C.: Urban Land Institute, 1983), 24.

10. *What's Going on Out There?: A Statistical Analysis of Construction Trends in the Parking Industry, 1986-1989* (Alexandria, Va.: Parking Market Research Co., 1987), p. 11 of summary.

Architect Stanley Tigerman had fun designing the facade of this small, 200-space garage in downtown Chicago. The front is the grill of a 1930s Rolls Royce. The grill is topped by what Tigerman calls a "general hood ornament"—a man holding a torch. Flanking the grill are two fenders and two "tire-like" canopies over the pedestrian entranceways. (Roger Stevens)



Parking garages are getting enormous. This garage, built to serve a new Bloomingdale's in Chicago, is 15 stories high and contains 1,450 parking spaces.

THE BOOM IN GARAGE CONSTRUCTION

The urban design issues related to parking structures are of increasing importance and interest due to the tremendous boom in garage construction. According to a 1986 survey by the Parking Market Research Company, more than 1,181 parking decks over 300 spaces were either under construction or planned for the period 1986 to 1989.[11] These decks include over 1,140,000 parking spaces. Many, of course, were being constructed or planned in big cities—Los Angeles (22 decks); Atlanta (16 decks); and New York City (13 decks)—but many were also underway in middle-size towns— Raleigh, North Carolina (11 decks); Indianapolis, Indiana (15 decks); and Orlando, Florida (11 decks).

In Chicago, between 1985 and 1987, construction was completed or begun on garages containing more than 6,500 spaces. One that recently opened is a 15-story, 1,450-space colossus just off the city's fashionable North Michigan Avenue shopping area. The *Chicago Tribune* reported that the structure boosted that shopping district's off-street parking capacity by 30 percent. Three newly opened structures in the city's downtown Loop have boosted that area's parking capacity by 2,720 spaces, an estimated gain of 25 percent.

Planning commissions and citizen groups have responded to the parking garage construction boom with new requirements that force parking decks to respect their surroundings. In some cases, this has meant keeping parking facilities off certain pedestrian-oriented streets. In other cases, it means that parking garages must include ground-floor retail space; be architecturally compatible with the buildings they serve; and include landscaping improvements that enhance their appearance.

PROHIBITIONS ON PARKING GARAGES

In a few locations, even well-designed parking garages simply do not fit. For example, in 1986, a developer proposed a parking structure along one of Chicago's most important pedestrian areas, the State Street Mall. Actually, the garage was planned for the corner of Washington and State Streets with access only off of Washington. Despite developers' promises of ground-level retail space and a facade treatment (with an estimated cost of over $200,000) that respected the Marshall Field's department store (across the street) and the Carson Pirie Scott department store (two blocks away), the city planning commission and city council strongly rejected the proposal. The city's rejection was based on the importance of State Street as a pedestrian shopping area and the city's long-range plans to intensify shopping and retail space in this area.

Other cities, both large and small, have prohibited parking garages in certain locations. In downtown San Francisco, commercial parking garages (i.e., garages that are not accessory to a business) are only permitted in locations on the periphery of downtown and only after review and approval by the city planning commission. This prohibition on parking garages is intended to maintain the pedestrian character of the city's shopping area and to promote the use of mass transit. The New York City zoning code also prohibits parking structures along stretches of pedestrian-oriented streets such as Fifth Avenue and the Avenue of the Americas. Other cities, such as Seattle and Toronto, have, with varying success, tried to control the construction of parking garages in areas in which they may conflict with other development goals.

These total prohibitions against parking structures are not unique to big cities. In the central core of Vail, Colorado, the zoning code prohibits any on-site parking, including surface parking lots and parking garages.

MANDATES OR INCENTIVES FOR PARKING GARAGES

Some zoning codes require parking structures or provide incentives to developers to build garages rather than surface parking. More and more communities want parking to be built up rather than spread out. In pedestrian-oriented commercial areas, cities combine the requirements or incentives for parking structures with requirements or incentives for ground-floor retail space.

Cities as diverse as San Diego and Beverly Hills, California, and Vail and Aurora, Colorado, require parking to be enclosed in structures in certain circumstances. Within sections of Vail's commercial core, the city mandates that at

11. Ibid., p. 6 of summary.

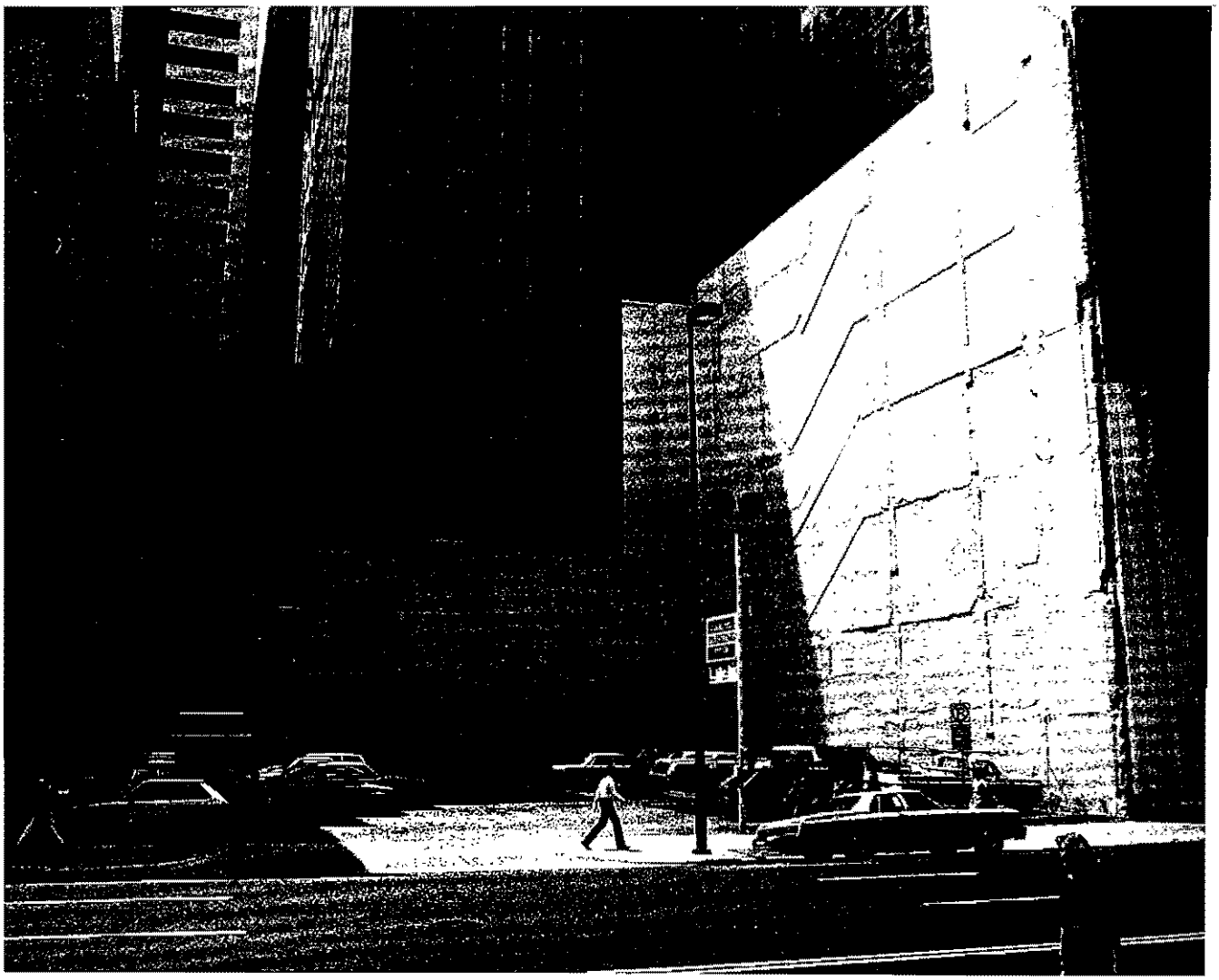
least one-half of the required parking be enclosed within the main building or buildings. The Aurora code is very similar. Within Aurora's city center district, the zoning code requires offices, shops, hotels, and other businesses with large amounts of parking to provide for at least half of the parking within a garage, an underground facility, or on the building's rooftop. In the Beverly Hills commercial-retail overlay zone (Rodeo Drive and other posh retail streets), the city not only requires parking in multilevel structures, but it also requires that two complete levels of these garages be underground. In San Diego's central city area zoning district, the city requires any developer building parking "at a ratio greater than one space per 2,000 square feet of gross building area to enclose the parking within the principal building or a parking garage."

Zoning incentives for builders using parking garages are far more common than mandatory requirements for parking structures. The object of these bonus systems is to shape downtowns or employment centers so that they remain compact, dense, and urban. Many of the communities offering these bonuses do not want to end up with commercial areas in which businesses are surrounded by a sea of asphalt. Short descriptions of various bonus systems for underground and multilevel structured parking areas are described in the following paragraphs.

- Bellevue, Washington, is a major office and retail center in the Seattle metropolitan area. The city's downtown zoning code includes bonuses for plazas, public art, pedestrian improvements, and parking facilities. For underground parking, bonuses range from .5 to three square feet of added floor area depending on the zoning district) for each square foot of underground parking constructed. According to local planners, this bonus has proven highly effective.

  For structured parking, the bonuses range from one to four square feet of added floor area for each square foot of parking area provided. This bonus, however, applies only to residential development and only if the parking is part of the main building and architecturally

Surface lots can break up the continuity of busy retail areas and give downtowns a vacant, desolate look. (Dennis McClendon)



compatible with the principal structure.

- In Hamden, Connecticut, the zoning ordinance allows developers to build bulkier or taller buildings in high-density business districts and the town center area if they also build underground or structured parking. If underground parking is chosen, the percentage of the site that can be covered by buildings may be increased by 50 percent. If structured parking is part of the principal building, the number of floors devoted to parking is not counted in calculating the building's height.

- In commercial and industrial districts in Irvine, California, one story can be added to a building's permitted height if parking is enclosed in the principal building and if the structure's facade is consistent and architecturally compatible with the main building.

- In various special zoning districts, Austin, Texas, grants an additional one-half square foot of floor area for each square foot of parking built in a parking structure. An additional one square foot of floor area may be permitted for each one square foot of parking constructed below grade.

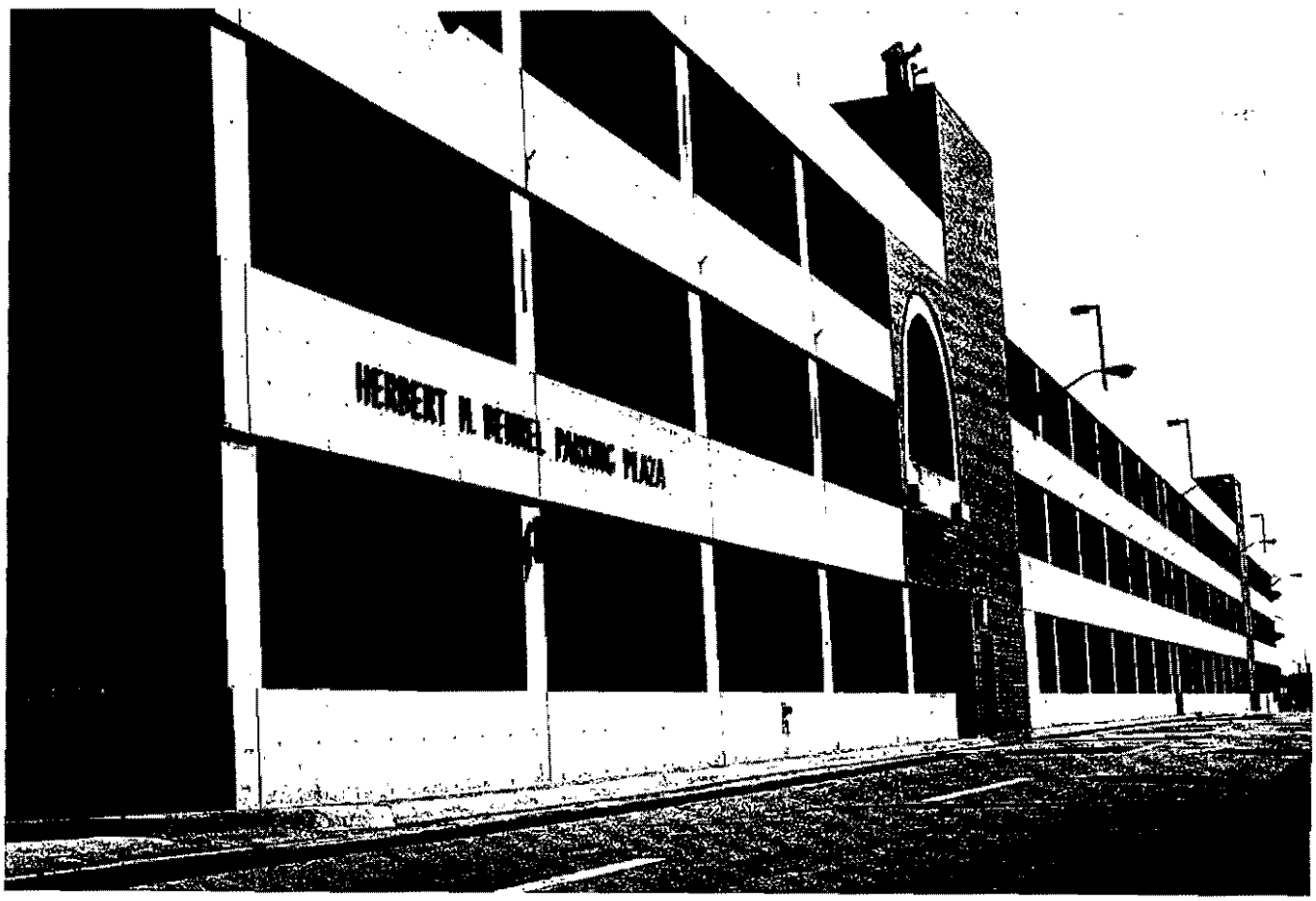
- In high-density development projects around Washington Metro stops and in designated town center areas in Prince George's County, Maryland, the county authorizes floor area bonuses for developments using parking structures and underground parking. A 50 percent increase in permitted floor area is allowed if structured or underground parking is used. The county's elected board may also grant reductions in the required amounts of parking as an incentive for developers to use structured or underground parking.

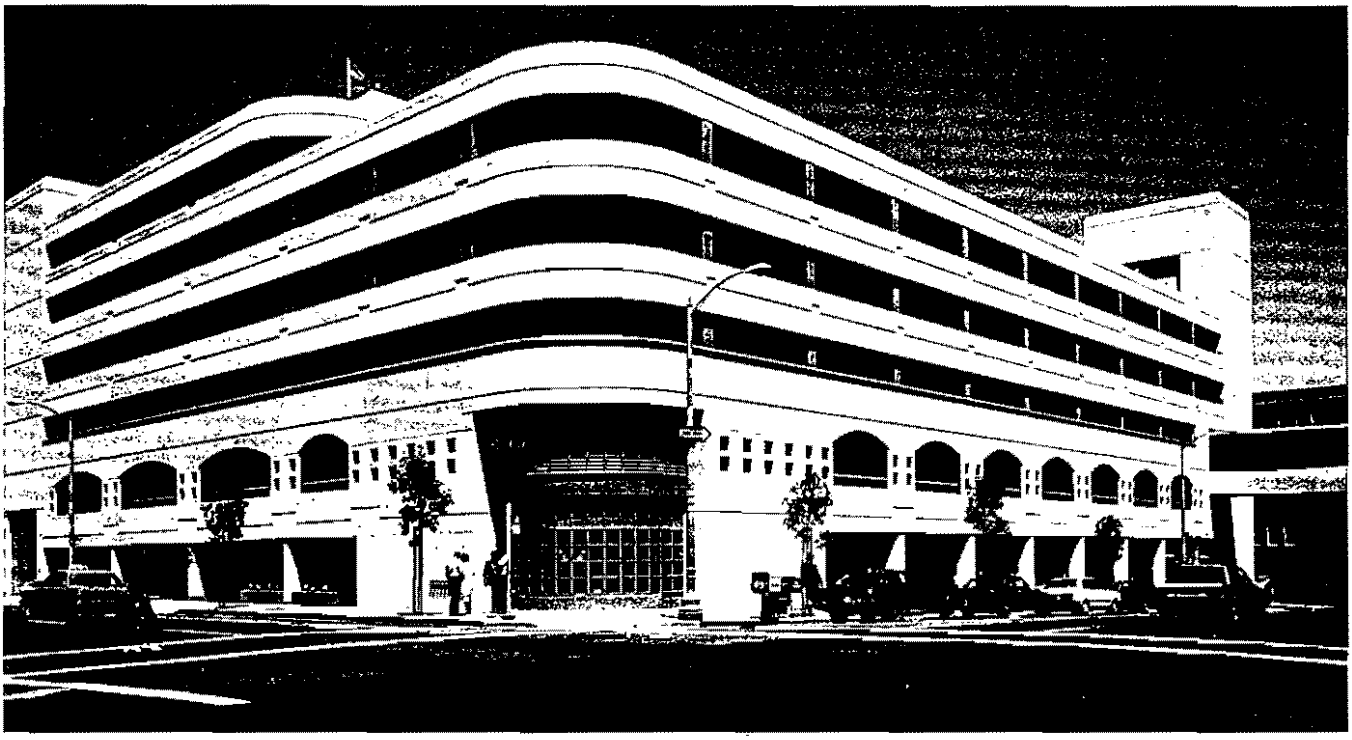
DESIGN STANDARDS FOR PARKING GARAGES

Most new parking structures are built with concrete columns and slabs with little or no attention to screening or facade treatments. When screening is used, it is typically for safety and security purposes and usually consists of chain link fencing, wire mesh panels, corrugated sheet metal, steel or aluminum bumpers, and precast concrete. The overall effect of this type of construction led the *Chicago Tribune's* architecture critic to conclude that parking structures "have given America some of the ugliest urban architecture for several decades."

Citizen groups and planners have described multilevel parking structures as monolithic, deadening, empty, cavernous, and contributors to urban blight. The Herbert H. Behrel parking garage in downtown Des Plaines, Illinois, for example, has been called a "concrete casket" and the "Berlin Wall." Some local aldermen refer to it simply as "the zit." The 385-space facility is four stories high and runs for about

This garage in downtown Des Plaines, Illinois, has been called the Berlin Wall and a concrete casket. Local alderman refer to it as "the zit."





(Above) *This seven-story, 690-space garage in Oakland, California, includes ground-floor retail space, a rooftop garden, and a penthouse. (Kaiser Hospitals and Maintenance Organization.)* (Below) *Many older parking and service garages included facade treatments that helped identify their use.*

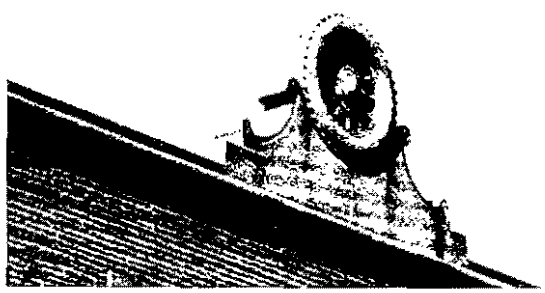
600 feet in the middle of the city's downtown. The structure and a series of railroad tracks split the downtown in two. The garage has had such an adverse impact on the appearance of the city's downtown that there have been calls for its demolition. Community opinion appears in favor of the wrecking ball, but the city fathers are resisting such action because Des Plaines still owes about $1 million on the 1976 structure.

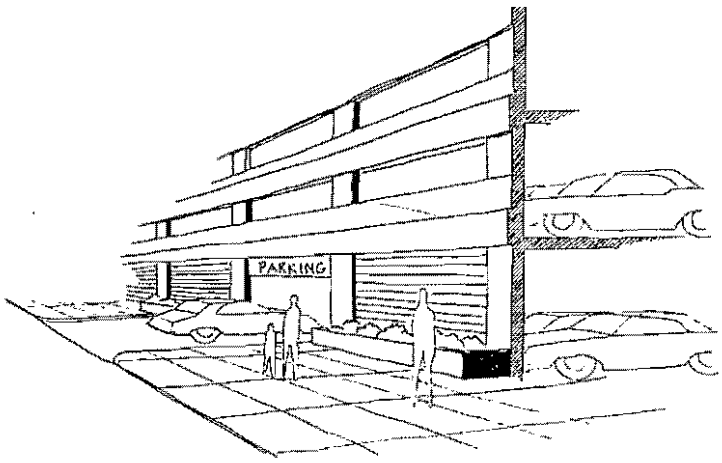
In small business districts like Des Plaines' downtown, parking structures can be the most prominent structure. Their aesthetic, traffic, and economic impacts can extend for blocks. Too often they are simply made of concrete slabs, built for strength and durability rather than appearance. Some cities have tried to change this standard. They have established architectural standards, required street-level improvements, and set comprehensive standards for the design, operation, and appearance of structures.

Architectural Standards

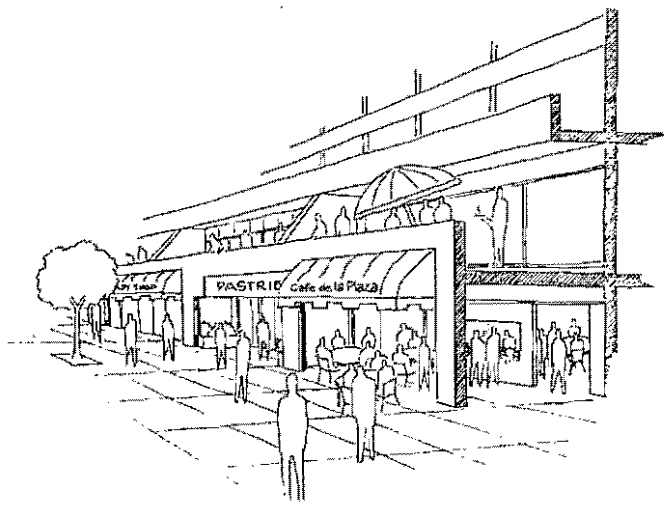
Some city zoning codes and urban design plans have stressed the importance of architectural compatibility in the parking structure design. The zoning codes of Orlando, Florida; Oak Brook, Illinois; and Irvine, Glendale, and Los Angeles, California, have architectural standards for parking structures. The urban design plans of Boulder, Colorado; Ann Arbor, Michigan; and Portland, Oregon, also stress compatibility in the appearance, size, scale, and bulk of parking structures with their surroundings.

The Irvine code requires that "the exterior elevations of parking structures be designed to minimize the use of blank concrete facades." The code calls for the use of textured concrete, planters and trellises on each level, or other architec-





San Diego's urban design guidelines discourage ground-level parking on pedestrian-oriented streets (above); *they encourage one or two levels of ground-floor retail space in garages* (below). *(San Diego Planning Department)*

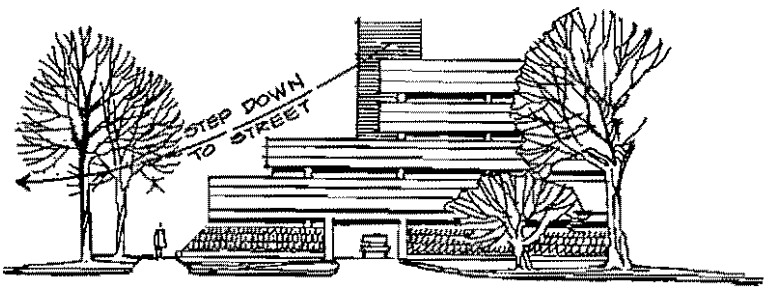


tural treatments that improve the appearance of parking garages. The Orlando downtown development code requires that garages achieve "architectural unity" with the main building or principal use. The Oak Brook code requires that "all exterior walls . . . visible from adjacent roadways, shall be finished with a material so as to maintain a common architectural character . . . with the principal building." Architectural character is defined in the ordinance as "the composite or aggregate characteristics of a structure—form, materials, function of a building" and its other details.

Some California codes are tougher. They regulate height and bulk as well as appearance. According to the Glendale downtown urban design code, parking structures must not be higher than 45 feet or five parking levels above grade along a street's edges. The design guidelines state that a parking structure's exterior should be "harmonious with surrounding buildings and integral with the treatment of buildings they are built to serve." Los Angeles's zoning code for the San Vincente Boulevard special district is similar to the Glendale code. Along this heavily landscaped boulevard in the city's Brentwood area, parking garages are limited to 45 feet. The code requires that structures have staggered setbacks (see illustration), that they have landscaping at each level, and that the structure's facade be architecturally similar to the building it serves.

The urban design plans of Ann Arbor, Michigan, and Boulder, Colorado, include specific architectural recommendations for parking garages. For example, the Boulder urban design plan states that designers of parking garages should:

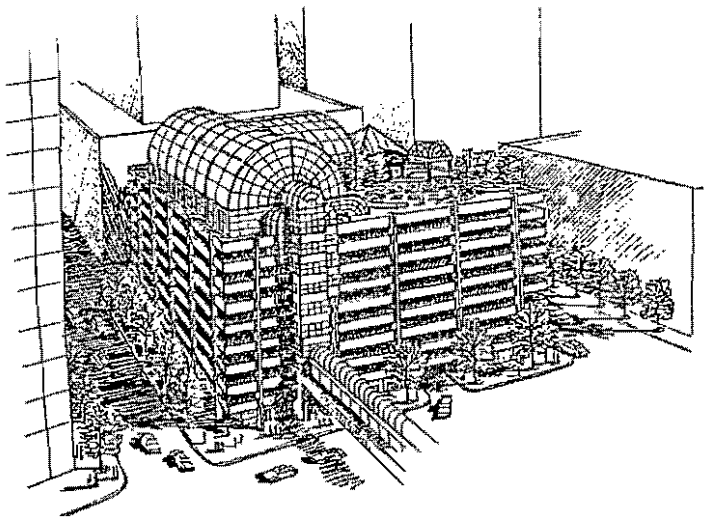
> Incorporate, at a minimum, an equal portion of vertical and horizontal architectural elements;
>
> Replicate the regular window pattern and other architectural elements of adjacent buildings; and
>
> Incorporate art into the structure's facade in order to maintain an active and interesting streetscape.



The upper stories of this garage are set back to reduce the apparent bulk of the building. (Ann Arbor, Michigan, Planning Department)

The Ann Arbor plan states that parking structures should not look like concrete monoliths and should not be built on corner lots. It further specifies that their dimensions along the street should be minimized. The plan also calls for the scale of parking structures to fit positively into the surrounding development context and that structures use upper-story setbacks to reduce the apparent bulk of the building when viewed from the street.

Portland uses substantial zoning bonuses to encourage more spectacular use of garage rooftops, including such things as rooftop gardens. (Portland, Oregon, Planning Department)

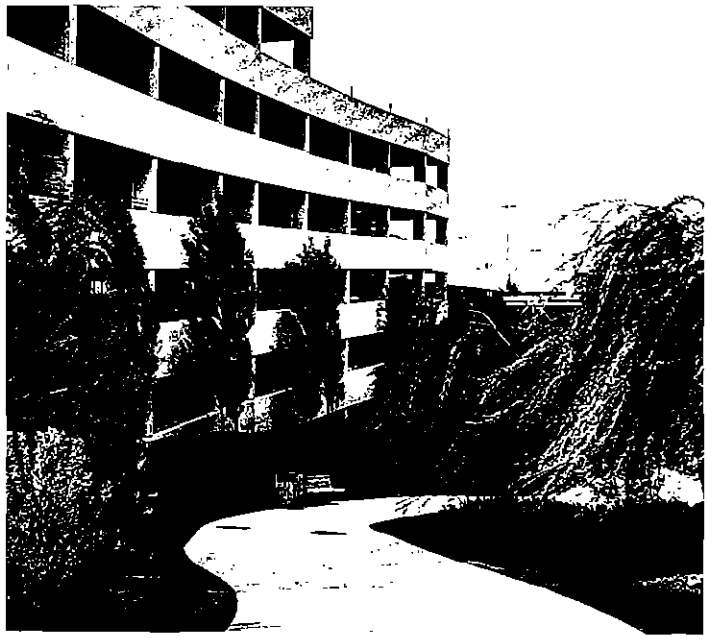


Landscaping

Most zoning codes do not include any special landscaping requirements for parking structures. Generally, zoning ordinances mandate only that these structures comply with minimal setbacks and yard requirements. A few local codes, however, have specific landscaping requirements.

The Irvine, California, and Oakbrook, Illinois, zoning codes require that parking garages comply with the street frontage and perimeter landscaping standards for surface parking lots. Irvine also requires the planting of at least one tree for every 20 feet of the structure's perimeter. The Fairfax County, Virginia, landscaping guide requires rooftop plantings for garages and encourages the use of parapets for hanging vines. The Orlando, Florida, code also requires that parking garages meet the perimeter landscaping requirements of surface parking lots—structures must have landscaped bufferyards, street trees, and other improvements. In place of interior parking lot landscaping, parking structure designers must provide landscape planters, hanging baskets, or flower boxes around each level of the structure's perimeter. In the case of very large parking structures with wide street frontages, the zoning administrator may require extra landscaping along the perimeter in amounts equal to what would be required for interior landscaping of a surface parking lot of equal size.

Planners and landscape architects report that narrow, column-like trees can be effective in reducing the predominantly horizontal "line" of parking structures. They also report that planters and trellises on each level can adequately "break up" the harsh concrete facades of the structures.



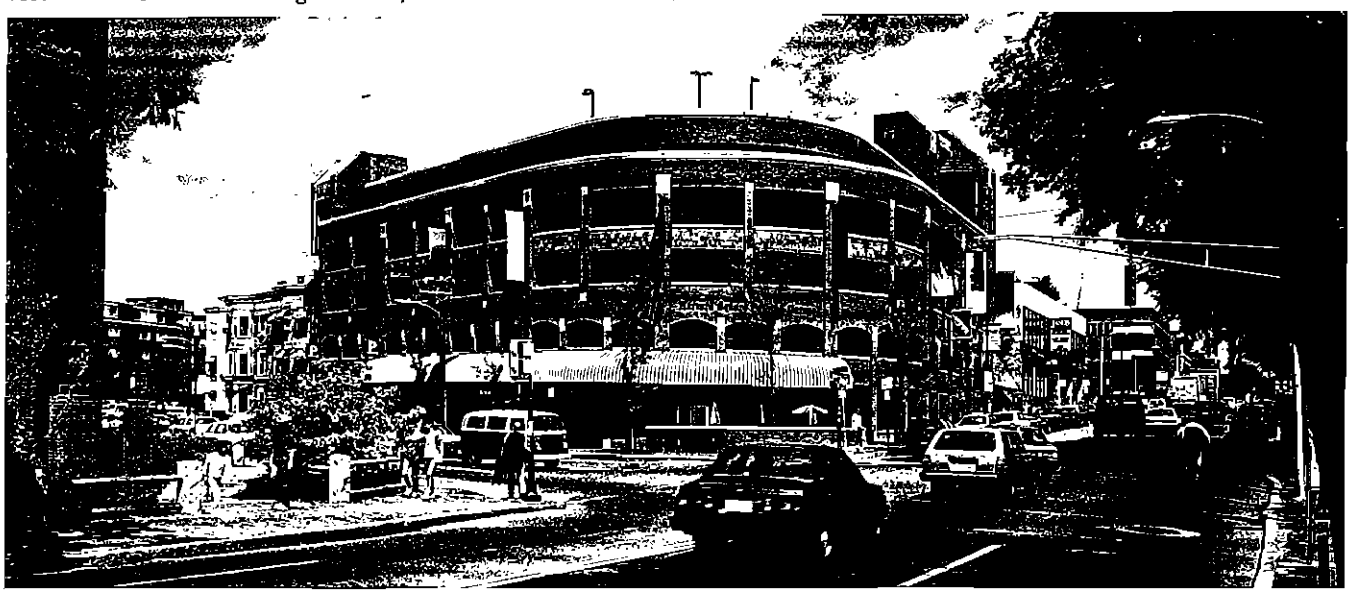
The columnar shape of these trees provides some relief from and contrast to the long horizontal lines of the parking garage.

Garages With Ground-Floor Retail

City planning agencies have used zoning codes, urban design regulations, and the power of persuasion to get builders to include ground-floor retail businesses into parking garages. In many cases, these methods have been enhanced by a stronger market for space for specialty shops, restaurants, and convenience stores. The result has been streetscapes with greater vitality, activity, and visual interest.

Big cities, like New York, Seattle, Portland, San Francisco, and San Diego, have codes that require ground-floor retail in parking garages or other buildings that front on designated pedestrian streets. Furthermore, many middle-size cities, such as Beverly Hills, Palo Alto, and Sacramento, California; Raleigh, North Carolina; Orlando, Florida; and Myrtle Beach, South Carolina, also have these re-

The Harvard Square Garage in Cambridge contains about 15,000 square feet of retail space plus an arcade and sidewalk cafe. The 210-space, five-level garage occupies a triangular-shaped lot and provides an entry to Harvard Square from the Charles River. It received the Governor's Design Award for Massachusetts in 1986. (Peter Vanderwarker)



quirements. Many of these cities have designated specific streets where they want to maintain a high level of pedestrian activity and where they want to preserve a continuous pattern of retail shops along the street.

The Orlando code requires that parking garages on designated pedestrian streets and malls have "at least 75 percent of the ground-floor frontage consisting of active uses other than parking, such as offices, retailing, services, and entertainment." The Orlando code exempts entrances and exits from measures of a garage's ground-floor frontage. The Portland downtown code is similar, requiring that "at least 60 percent of the structure's ground-level frontage be available for retail, service, or office commercial uses." The San Diego code is precise; it requires that the ground floor be devoted to small shops with large display windows.

The Sacramento code goes further. It lists allowable ground-floor uses in parking structures and office and institutional buildings. The list includes:

1. Retail shops selling apparel, books, cameras, fabrics, gifts, luggage, paint, plants, records, shoes, and sporting goods;
2. Walk-in businesses like arcades, art galleries, museums, and theaters;
3. Convenience stores and shops like bakeries, candy stores, delicatessens, pharmacies, florist shops, grocery stores, and restaurants; and
4. Personal service shops like banks, barber shops, beauty parlors, repair stores, dry cleaners, laundromats, printing, photographic studios, tailor shops, and travel agencies.

Most codes mandate that a parking garage's street frontage be used exclusively for retail, personal service, or convenience uses, except for the garage's entrance and exit ramps and service doorways. In many of these cities, the retail uses must occupy a significant percentage (up to 75 percent) of the street-level frontage, and any blank facades along the street are limited to 15- to 30-foot segments.

Architectural and Functional Standards

Some cities, like Bellevue, Washington, San Francisco, and Pasadena, California, have very broad, comprehensive codes for parking structures. These codes not only have aesthetic controls, they have standards for traffic safety, pedestrian safety, and parking structure operations. Pasadena's standards are simple but thorough:

The exterior surface materials and structures of the garage must be compatible with the main structure;

The location of parking structure entrances and exits must be planned so as to have the least impact on residential streets and busy intersections;

Facade length and height must be limited so as not to create large blank walls without the benefit of architectural relief and landscaping; and

Setbacks and buffering must be consistent with what is required for adjoining properties.

The Bellevue zoning code is similar but stresses traffic and pedestrian safety as much as architectural compatibility.

The design of the Schoolhouse garage in Pasadena, California, was the subject of 130 meetings of the city planning, design review, and cultural heritage commissions. (City of Pasadena, California, Public Works and Transportation Department)

Bellevue has a regional shopping mall downtown and large-scale office developments that generate a significant need for parking. In the downtown area, parking garages are permitted only if:

Driveway openings and access lanes are minimized;

The dimensions of the structure abutting pedestrian areas are minimized, except where the ground floor of garages is devoted to retail, service, or commercial activities;

The structure exhibits a horizontal rather than a sloping building line;

Screening or other improvements are made so that parked vehicles are shielded from view at each level of the parking structure;

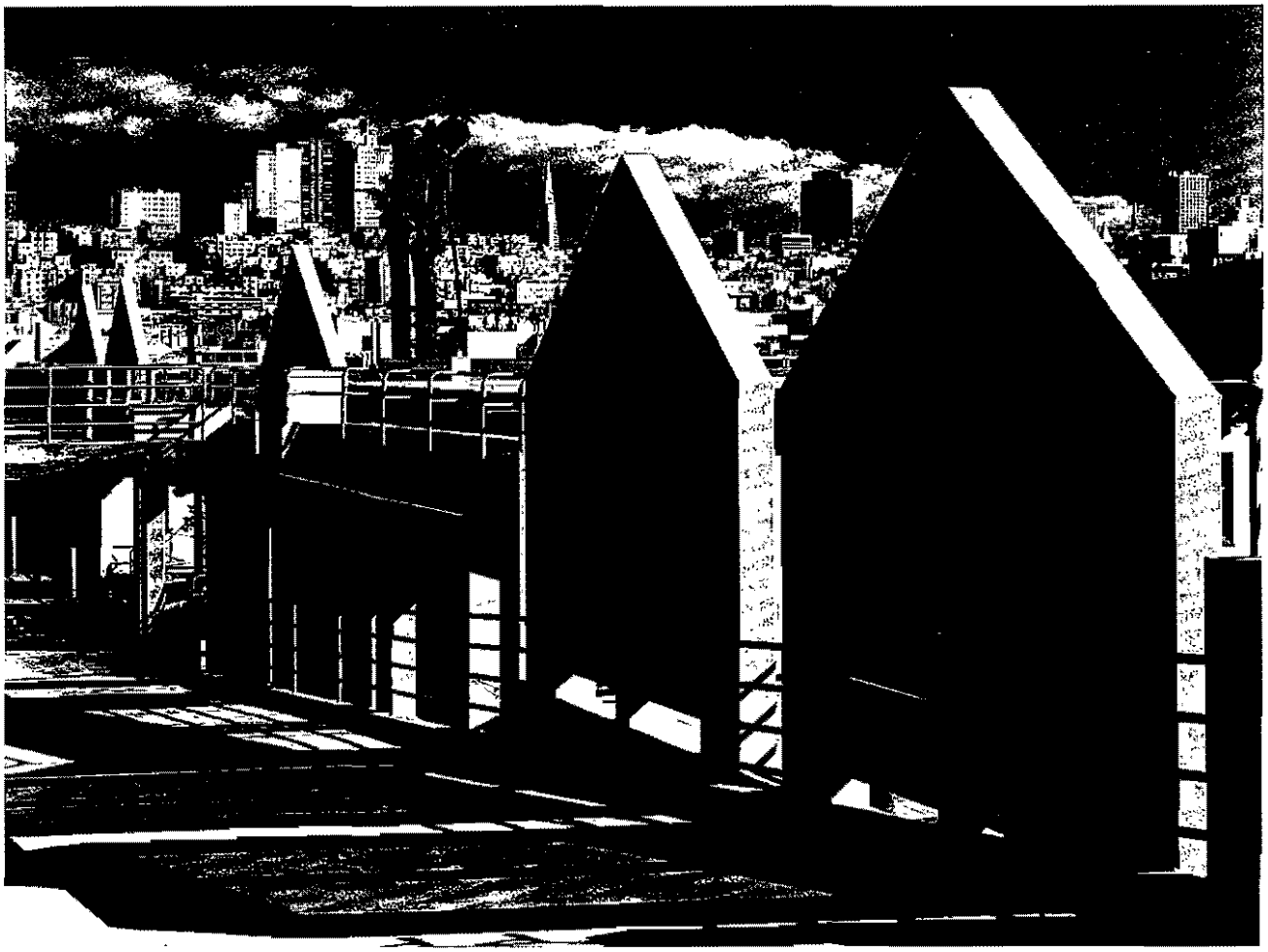
Developers include safe pedestrian connections between the parking structure and the principal use; and

Structures comply with other setback and landscaping requirements.

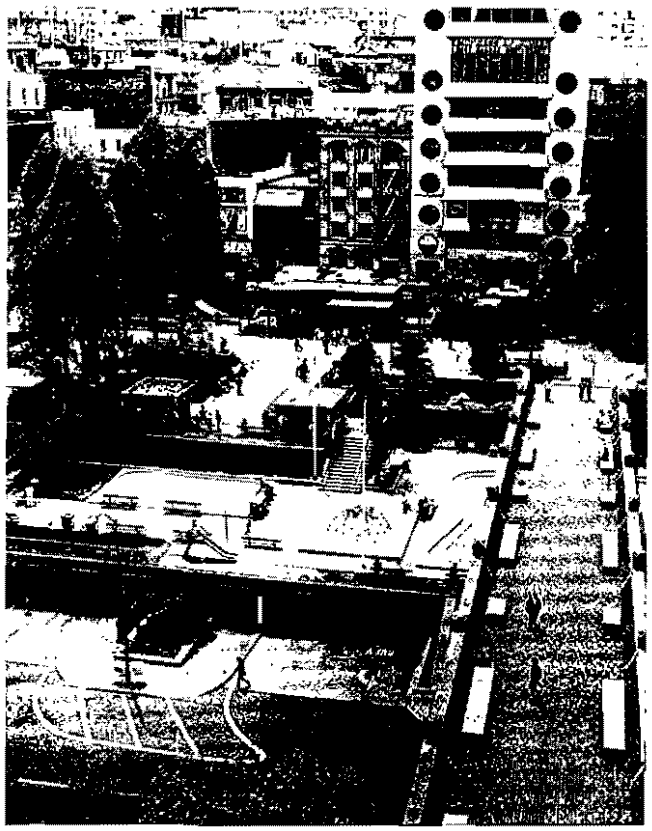
The San Francisco downtown code for parking structures goes much further than the Bellevue or Pasadena codes. It controls the appearance, location, and function of structures *and* regulates the price structure of parking. The object behind regulating the cost of parking is to encourage short-term parking used by shoppers and to discourage long-term (employee) parking. According to the city code, the city planning commission is responsible for the review of any major parking structure (i.e., a garage that is not classified as accessory parking). The code includes the following provisions.

Parking structures must be highly accessible from freeway ramps and major thoroughfares;

The location of structures must be convenient to concentrated commercial development areas;



(Above) *San Francisco's Lombard Street garage fits into the fabric of the neighborhood. Shown here is the black mesh screening used in the facade to give the illusion of glass. The A-frame facade mimics the surrounding buildings. (Gordon H. Chong and Associates, Inc.; Douglas Salin, photographer)*
(Below) *The city's Portsmouth Square underground garage, built in 1960, is topped by a public park that is the center of street life in Chinatown. (Parking Authority of the City and County of San Francisco)*



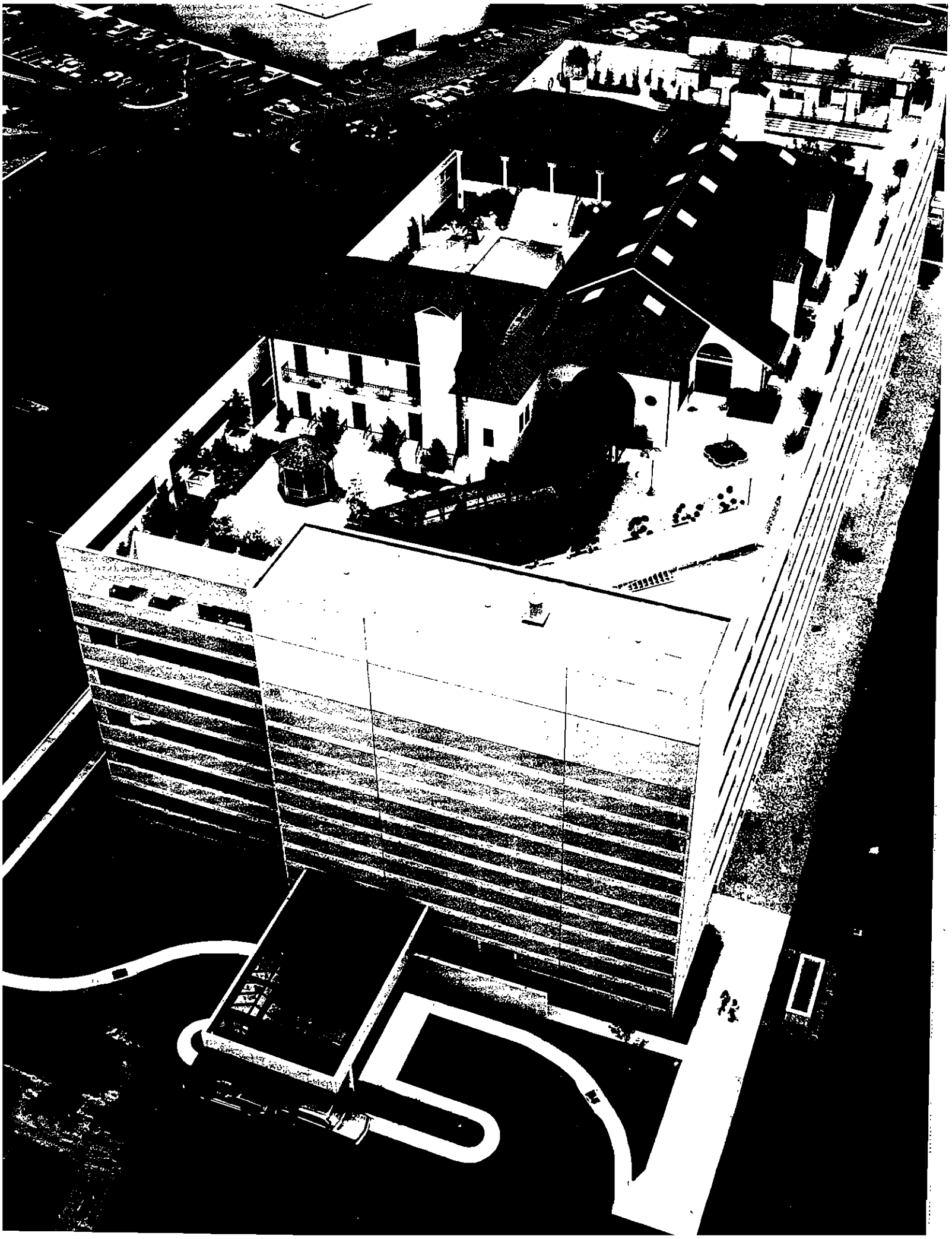
The design of entrances and exits must minimize conflicts with pedestrians;

Ground floors must maintain the retail continuity of streets;

Traffic operations must minimize conflict with other forms of transit; and

The fee parking structure must encourage short-term parking and discourage long-term (employee) parking.

The city actually establishes limits on the fees for short-term parking and discourages discounted parking rates for long-term, weekly, monthly, or other time-specific periods. Generally, the rate for short-term parking may not be higher than the hourly rate for long-term parking. Exceptions to the limits on discounting weekly and monthly fees are granted for parking garages serving downtown residential properties.



Chapter 5. Recommendations Based on Current Innovations

Zoning codes are most effective in requiring small improvements in the quality of urban development. In parking areas, zoning can be used to require yards and setbacks, limit excessive signage, and encourage architectural or site planning improvements. Setting higher standards for the design of parking areas is important because of the cumulative visual impacts of these lots and structures. The asphalt area or concrete mass of one lot or structure may not seem significant, but, when added to a multitude of parking areas, the result can be deadening.

Modern zoning codes can require more advanced planning for the design of parking lots and structures. Parking lots can be planned with effective screening and internal landscaping that help conceal these lots and reduce their apparent size. Parking structures can be made to meet standards for attractiveness and architectural compatibility. Such structures can also be designed to respect the size, scale, and bulk of surrounding buildings, and the size and capacities of surrounding streets.

As demonstrated by the illustrations within this report, however, there are no simple formulas. Instead of formulas, local zoning officials need to share ideas and techniques for improving the appearance of parking facilities. Many of these ideas will require businesses, institutions, and municipalities to go beyond conventional practice and to avoid the trap of basing parking facility designs solely on economic considerations. Many of these designs and innovations have been pioneered by private developers without local requirements or incentives. A broader application of design improvements, however, will require local policies that are consistently applied.

To further encourage these efforts, communities will need to adopt design guidelines for parking structures and enact provisions for the landscaping of parking lots. Based on the findings of this study, communities can further improve their parking area standards in the following ways.

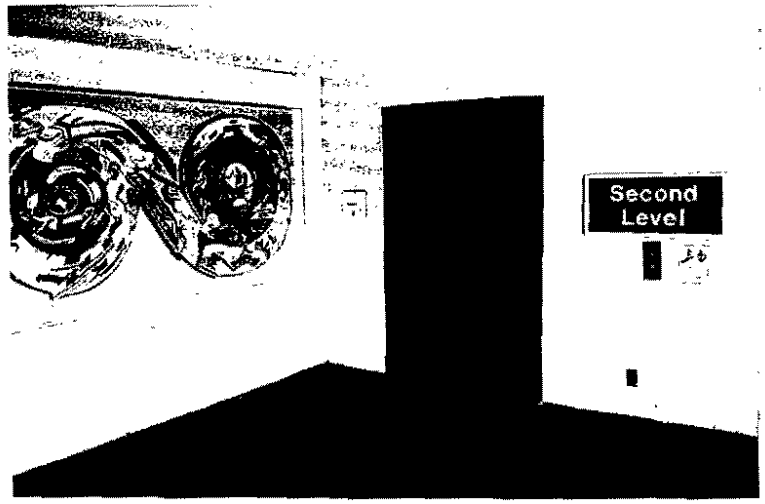
Provide zoning incentives. Zoning codes should provide incentives to create more efficient and attractive parking areas. Underground parking should receive the most generous bonuses because it totally eliminates the aesthetic problems of surface lots and garages. Parking structures should also be encouraged through zoning bonuses, especially where architectural and landscaping guidelines exist. Because garages are stacked, these structures reduce the land area devoted to parking and, therefore, reduce the visual impacts of parking.

Beyond zoning incentives, local governments should examine opportunities for direct financial incentives for more attractive parking facilities. Boston, for example, recently assisted a consortium of businessmen in the construction of a 1,400-space underground garage, topped by a 1.7-acre park, in the Post Office Square. The city condemned the land for the garage and transferred it to the consortium at a reduced price. Other creative partnerships that improve the appearance and function of parking facilities should be encouraged.

Encourage mixed-use parking areas. Ground-floor retail space should be required in parking structures built along busy pedestrian streets and important retail strips. Cities should also encourage the use of garage rooftops for gardens, restaurants, and other uses. The concept of mixed-use parking facilities should also be extented to apply to surface parking lots. *Carscape: A Parking Handbook* suggests that surface parking lots be designed for evening or weekend "conversion" to plazas, parks, market places, and recreational areas.[12] This approach will certainly mean more planning. (How will you include facilities for tennis or paddleball or display areas for markets?) The result, however, will almost certainly be more satisfactory than what currently exists.

This 552-space, seven-level garage in Columbus, Georgia, is topped with a virtual palace—a private home with over 12,000 square feet, marble halls, crystal chandeliers, curving staircases, 11 bathrooms, fountains, a swimming pool, and an arbor-sheltered garden. (People; Jay Leviton, photographer).

12. Catherine G. Miller, *Carscape: A Parking Handbook* (Columbus, Ind.: Washington Street Press, 1988), 39–50.



In San Francisco's Moscone Center garage artwork is used both to beautify the structure and to help patrons remember where they parked. (Parking Authority of the City and County of San Francisco)

Require performance landscaping. Local zoning codes should require more landscaping for large parking lots with significant visual impacts. The screening and buffer yard requirements for parking lots with wide street frontages should be more stringent. The screening required for a parking lot abutting residential properties should also be more extensive. The same rule applies to parking areas with high traffic turnover or heavy truck traffic. When parking garages have wide street frontages or when they abut residential properties or a busy retail street, they also should have more extensive landscaping or other aesthetic treatments. Anytime that parking structures are highly visible from streets or sidewalks, builders should be concerned with their attractiveness and appearance, and planners should set more rigorous standards for their size, scale, and design.

Encourage unconventional landscaping. Zoning codes should encourage alternative landscaping treatments. As mentioned above, the Pima County, Arizona, code authorizes the construction of "mini-oases" in which landscaping is clustered and irrigation systems are centralized. Many zoning codes are too regimented—they require some minimal street front landscaping, interior lot landscaping, and some perimeter landscaping. These minimums should be abandoned when there are opportunities to preserve stands of existing trees or to use creative landscaping designs. Such alternative landscaping schemes can enhance the appearance and design of pedestrian areas as well.

Unconventional landscaping plans may also help break up the monotony of the parking grid. The grid typically emphasizes rectangular shapes and 90-degree parking angles. Creative landscaping may add some contrast to the monotonous repetition of these shapes.

This parking structure (right), *designed by the Watry Design Group, was the winning entry in a Stanford University design-build competition. It uses curved walls, step-back upper levels, and an open, natural lighting system to enhance the structure's appearance. (Watry Design Group, Inc.; Douglas Salin, photographer)*

Allow the use of new types of landscaping and screening. Zoning codes should be flexible enough to permit unconventional landscaping and screens. As mentioned in this report, many zoning codes have been amended to include various amenities within the definition of landscaping. This broader, more flexible definition includes fountains, pools, sculpture, benches, plazas, and walkways as landscaping. And this trend should continue.

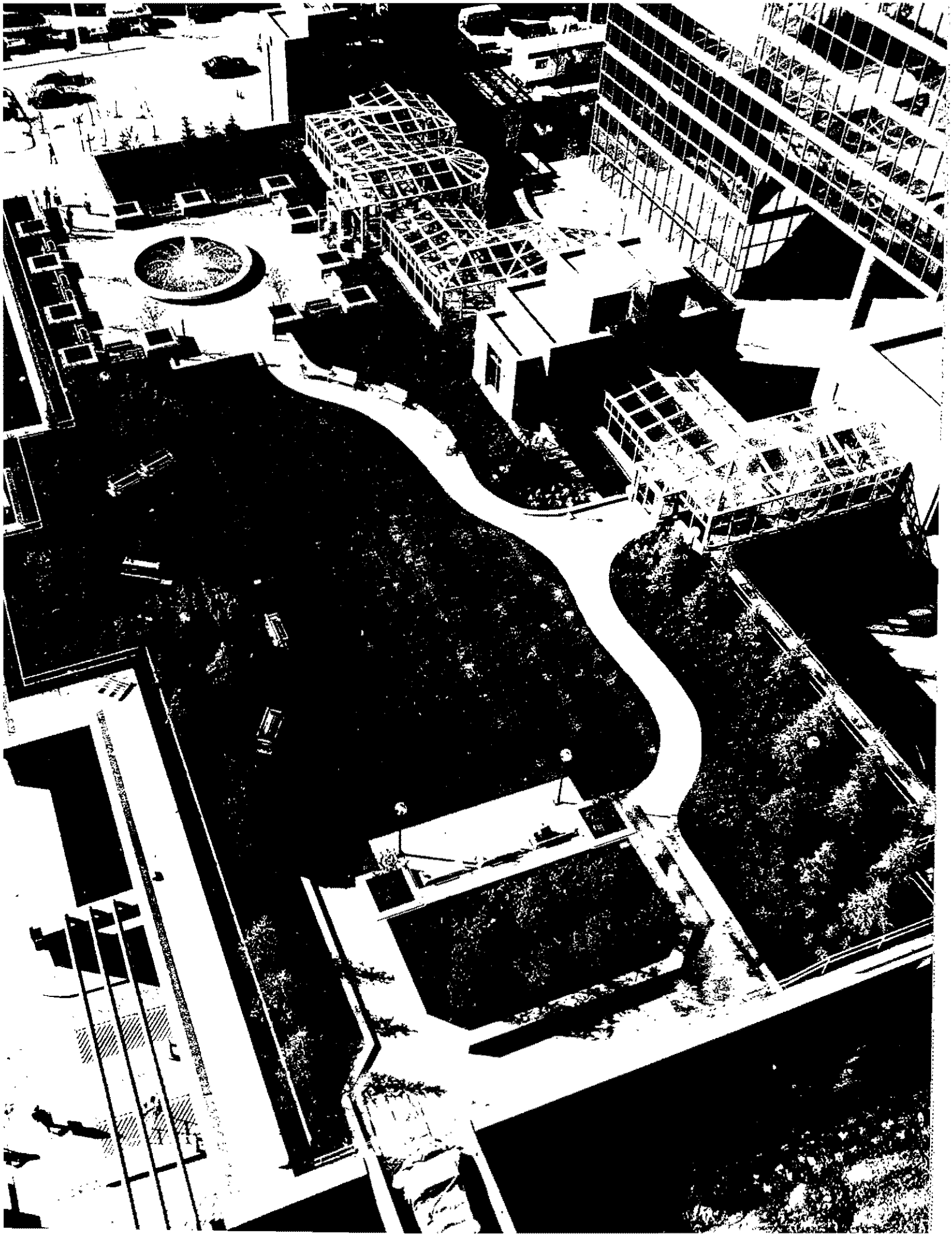
Other alternatives may also work. In *Carscape: A Parking Handbook*, a number of architects suggested the use of false facades as parking lot screens.[13] The types of facades suggested included fences painted with the designs of classic automobiles; "ghost" facades with the outlines of buildings that previously stood on the site; and false facades of homes for parking lots that abut residential streets. These alternatives can add fun and interest to cityscapes.

Allow unconventional layouts. Where it is appropriate, zoning codes should require that parking be placed at the rear of a building or scattered into small, distinct islands around a building site. Codes should also be amended to allow a wider variety of parking angles in the design of parking areas. Restricting the layout of parking to 90-degree stalls eliminates the possibility of more efficient designs. Smaller parking angles using one-way driving aisles can take up much less space and can allow developers to use odd-shaped or smaller lots more efficiently. If parking modules can be reduced by the use of stalls set at an angle less than 90-degrees, the opportunities for added landscaping may also increase.

Planners, architects, and engineers need to examine the opportunities for reducing the monotony of parking lot design. They need to develop plans for the use of lots during the long hours that parking areas remain empty. The planning and design recommendations provided above can be a starting point for solving unique community parking problems. The ideas presented in this report have demonstrated the wide range of possibilities for improving the function and appearance of parking lots and structures.

13. Ibid., 63–81.

The height of this Santa Barbara, California, garage and its "window" design are consistent with neighboring buildings; it also maintains the continuity of the street's commercial activities. (Santa Barbara Planning Department)



Appendix. A Sample of Landscaping Standards for Parking Lots and Garages

1. Fairfax County, Virginia, Landscaping Guidelines for Parking Lots and Garages
2. Orlando, Florida, Parking Lot and Garage Landscaping Requirements
3. Landscaping Standards for Nonconforming Parking Lots, Raleigh, North Carolina

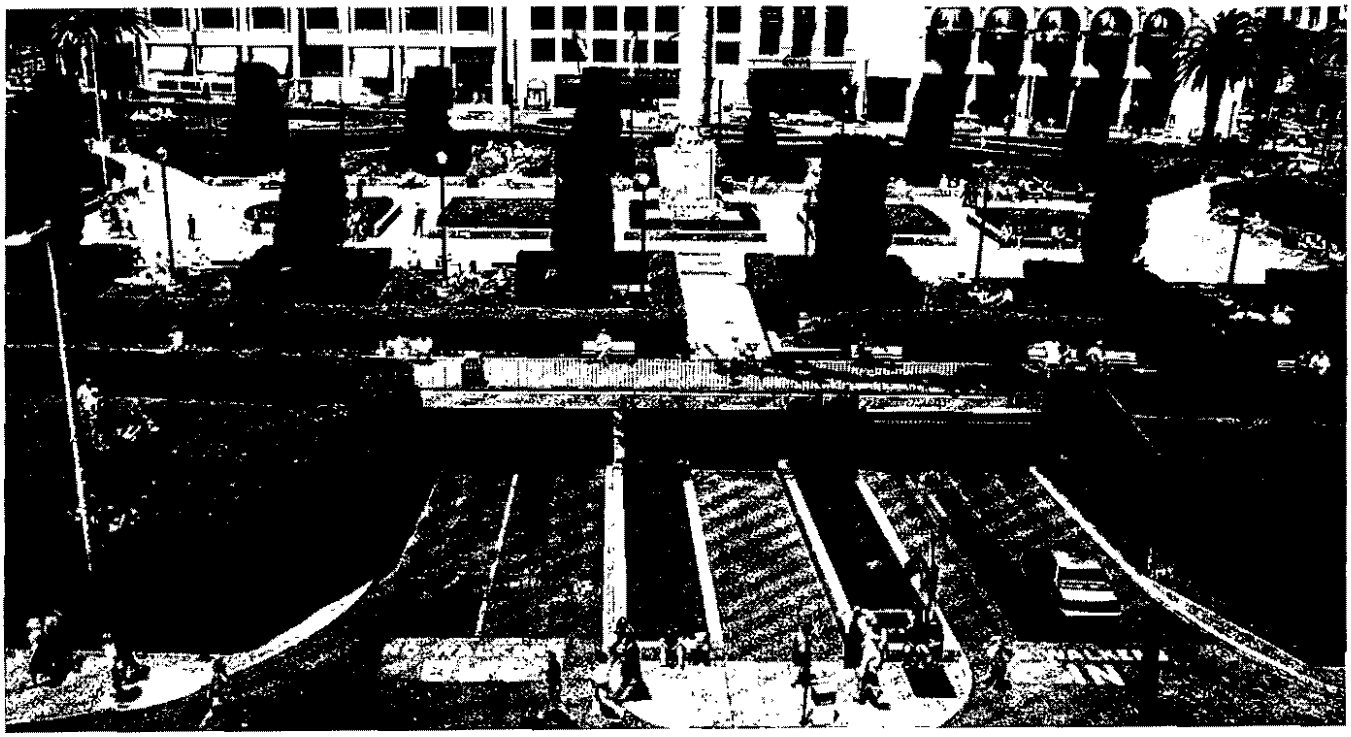
1. Fairfax County, Virginia, Landscaping Guidelines for Parking Lots and Garages

Section 3. Part 2.

Parking lots should be effectively landscaped with trees and shrubs to reduce the visual impact of glare, headlights, and parking lot lights from the public right-of-way and from adjoining properties. In addition, parking lots should be adequately shaded to reduce the amount of reflected heat. The guidelines listed below are intended to be used in conjunction with, rather than as a substitute for, the requirements in the Zoning Ordinance and Public Facilities Manual.

1. When a lot is located adjacent to a public right-of-way, alternatives should be considered to reduce the visual impact of the parking lot. Some alternatives are:
   a. *Landscape Setbacks.* Provide at least a 10-foot-wide landscaped area exclusive of that required for sidewalks or utility easements, as specified in the Zoning Ordinance, between the right-of-way and the parking lot, to be planted with shade or ornamental trees, and at least a three-foot-high evergreen hedge, wall, or fence.
   b. *Grade Changes.* In cases where substantial grading is necessary that results in a parking lot lower in elevation than the surrounding or adjacent right-of-way, the resulting embankment should be planted with low shrubs and shade or ornamental trees. A minimum of 10 feet of landscaping should be provided between the right-of-way and the parking lot.
   c. *Landscape Berms.* Where feasible, create at least a two-and-one-half-foot-high berm with slopes not to exceed 25 percent for lawn areas. Berms planted with ground cover and shrubs can be steeper; however, no slope should exceed 50 percent.
   d. *Woodland Preservation.* In cases where quality woodland exists, preserve existing trees between the parking lot and the right-of-way. Provide additional evergreen shrubs if needed to achieve an effective visual buffer. The vegetation should be saved.
2. Along the perimeter of the parking lot, to reduce its visual impact:
   a. Provide an eight-foot-wide landscape strip around the perimeter of the lot, to be planted with shade trees and low shrubs. Provide a minimum of one shade tree per every 40 feet of lot perimeter. However, this does not mean that shade trees must be located 40 feet on center. Additional shade trees may be necessary to effectively shade/screen the parking lot.
   b. In cases where quality woodland exists, preserve a minimum of 25 feet of vegetation along the perimeter of the lot. Provide additional evergreen shrubs if needed.
3. In accordance with the Fairfax County Zoning Ordinance, provide a minimum of five percent [interior] landscaping for the purpose of planting shade trees. This is necessary to break up the visual expansiveness of lots and to reduce glare and heat. Greater than five percent interior lot landscaping may be necessary to effectively shade the parking lot. To achieve these objectives, the following alternatives should be considered:
   a. Provide a continuous landscape strip between every four rows of parking. This should be a minimum of eight feet in width to accommodate a low hedge and shade trees.
   b. Create large planting islands (over 600 square feet) to be located throughout the lot and planted with shade trees, low shrubs, and/or ground cover. These should preferably be located at the ends of parking rows.
   c. Provide planting islands (a minimum of nine feet wide) between every 10 to 15 spaces to avoid long rows of parked cars. Each of these planting islands should provide at least one shade tree having a clear trunk height of at least six feet.
4. Within the interior of the parking lot, landscaping should be used to delineate vehicular and pedestrian circulation patterns. Clear and legible signs, different color and texture paving materials, raised areas, and other techniques should be used to further direct the flow of both vehicular and pedestrian traffic within the lot.
5. Structured parking facilities require special landscaping considerations due to the fact they can significantly contribute to the building bulk on a site. These landscaping considerations need to be incorporated at the

The rooftop of the Civic Plaza Parkade in Calgary, Alberta, serves as a park for city hall employees and people attending events at the Centre for Performing Arts. The design includes an elaborate covered and uncovered pedestrian system. (Calgary Parking Authority; Michael Hulloh, photographer)



Constructed in 1941, San Francisco's Union Square parking garage was the nation's first municipally owned underground parking structure. (Parking Authority of the City and County of San Francisco)

design stage, to ensure that the structure can accommodate the weight of the landscaped areas, and to provide for adequate watering, drainage, etc. At a minimum, the visual impact of such structures should be reduced by:

a. *Rooftop Landscaping.* On the top level, landscape areas should be provided, and planted with shade trees and shrubs. These should be provided at a minimum at the end of each row of parking.

b. *Landscaped Setbacks.* The perimeter of the parking structure should be landscaped at ground level.

c. *Multilevel Plantings.* The use of planting boxes and trellises should be considered on the exterior parapet of parking structures.

d. All the above landscaping applications will need to have special detailed designs developed to ensure proper drainage within the landscaped areas.

6. The general guidelines listed below should be followed for all parking lots.

   a. Use deciduous shade trees with ground cover or low shrubs as the primary landscape material within parking lots. Avoid tall shrubs or low-branching trees that will restrict visibility.

   b. For planting islands that are parallel to spaces, islands should be a minimum of nine feet wide to allow doors to open.

   c. For planting islands that are perpendicular to spaces, islands should be a minimum of eight feet wide to allow for overhang of parked cars. If parking is only on one side of the island, an eight foot width is still required.

   d. Screening of mechanical equipment, trash, and loading areas should be provided. This can be achieved using walls, fences, and/or landscaping.

   e. Where appropriate, the use of porous pavement and/or specially designed brick or block should be considered to increase on-site water retention for plant material and groundwater supplies and to reduce problems associated with runoff.

7. In large parking lots, separate pedestrian walkways should be provided to allow safe movement within the lots. These walkways should generally be oriented perpendicular to and between parking bays. Adjacent to the walks, trees should be planted. These plantings will aid in the identification of walkway locations within the lot and also aid in providing shade for the pedestrian. The following guidelines apply to the development of walkways within large parking lots.

   a. One walkway can serve as a collector for up to four bays of parked cars.

   b. The walkways should be a minimum of four feet wide, allowing an additional 30 inches on each side for overhanging of automobiles.

   c. All walkways should be raised to a standard sidewalk height and should be constructed of different paving material than the parking lot.

2. Orlando, Florida, Parking Lot and Garage Landscaping Requirements

Section 58.3321. Purpose of Parking Lot Landscaping Requirements

Parking lot landscaping required by this part is intended to promote the public health, safety, and general welfare by providing minimum requirements for installation and maintenance of landscaped areas in connection with parking lots and other vehicular use areas; to protect the character and stability of residential, business, institutional, and industrial areas; and to conserve the value of land and buildings on surrounding properties and neighborhoods.

Section 58.3322. General Requirements

The requirements of this part shall apply to all new vehicular use areas and those altered or improved subsequent to the adoption of these regulations, and whenever a structure is enlarged or a change of use occurs so that an increase in required parking or loading results under this chapter. Landscaping shall be provided in accordance with this part prior to issuance of any determination of zoning compliance required for a certificate of occupancy.

Section 58.3323. Landscaping Adjacent to Street Right-of-Way

Landscaping shall be provided between vehicular use areas and any adjacent public street, walk, or right-of-way as follows:

(a) A landscaped area at least five feet wide.

(b) Sufficient canopy trees to receive at least three tree points per 100 lineal feet or fraction thereof, in planting areas of the size required by Section 58.3326 below, and arranged so that the trees are dispersed along the distance.

(c) A masonry wall, solid fence, berm, or hedge maintained at least 30 inches in height above grade, except as provided in Section 58.3327 below. When a berm is used to form a visual screen in lieu of, or in conjunction with, a hedge or wall, such berm shall not exceed a slope of 30 degrees and shall be completely covered with shrubs, grass, or other living ground cover. Shrubs used to form hedges shall be of a non-deciduous species, shall be a minimum of 24 inches in height above grade at the time of planting, and shall be spaced not more than 36 inches apart and maintained so as to form a continuous visual screen 30 inches in height above grade, under normal growing conditions, within one year after planting.

(d) In order to break the visual monotony of a masonry or wood wall when such walls are used, at least one shrub or vine shall be planted abutting the wall within each 10 feet but not necessarily evenly spaced 10 feet apart; and if a wood wall is used, at least one shrub shall be planted along the street side of the screen or be of sufficient height at the time of planting to be readily visible over the top of the screen.

(e) In lieu of the vine or shrubbery requirements above, the Zoning Official shall be authorized to approve a masonry wall having a significant design variation evenly spaced at intervals of not more than 20 feet.

(f) The remainder of the required landscaped areas shall be landscaped with grass, ground cover, or other landscape materials.

(g) All ground between the right-of-way and vehicular use area shall be landscaped.

Section 58.3324. Landscaping Adjacent to Contiguous Properties

Landscaping shall be provided between vehicular use areas and the contiguous property as follows:

(a) A masonry wall or solid fence at least five feet high, or a durable landscape screen at least four feet in height above grade when planted, to grow to five feet within one year, between the common property line and the vehicular use areas. If a masonry or wood wall is used, the same vine, shrubbing, or design variation requirements as in Section 58.3323 above shall apply. Where contiguous properties are located within commercial or industrial districts, only the tree provision with its planting areas as prescribed in this subsection shall apply to the rear and sides.

(b) Living screening materials (except trees) shall be planted in areas not less than five feet in width.

(c) Sufficient canopy trees to receive at least two tree points (as explained below) per 100 lineal feet or fraction thereof, in planting areas of the size required by Section 58.3326 below.

Section 58.3325. Landscaping in Interior Areas

Landscaping areas shall be provided for interior vehicular use areas so as to provide visual and climatic relief from broad expanses of pavement and to channelize and define logical areas for pedestrian and vehicular circulation.

(a) Interior vehicular use areas shall be deemed to be all vehicular use areas except those parking spaces contiguous to a perimeter for which a landscape screen is required or parking spaces that are directly served by an aisle abutting and running parallel to this perimeter.

(b) At least 2.5 percent of the gross area of the interior vehicular use area shall be landscaped. This interior landscaped area shall contain sufficient canopy trees to receive at least 1.0 tree points per 100 square feet of gross landscaped area or fraction thereof.

(c) Interior landscaped areas shall be dispersed so as to define aisles and limit unbroken rows of parking to a maximum of 100 feet.

(d) Each separate required landscaped area shall contain sufficient canopy trees to receive at least one tree point, in a planting area of the size required by Section 58.3326 below.

(e) If the specific application of the interior landscape requirements will seriously limit functions of the building site, the Zoning Official shall have authority to permit consolidation and relocation of these landscaped areas on the building site.

Section 58.3326. Minimum Planting Areas for Trees

Small Trees—Each small tree shall be located in a planting area of at least 90 square feet (plus 25 spare feet for each additional tree in a group) with a minimum interior dimension of five feet.

Medium and Large Trees—Each medium and large tree shall be located in a planting area or undisturbed area that conforms to the minimum following standards:

	Medium Tree	*Specimen or Large Tree*
Interior dimension	NA	NA
Setback from trunk perimeter	6 ft.*	10 ft.*
Area—single tree	250 sq. ft.	800 sq. ft.
Area—each additional tree in a group**	90 sq. ft.	200 sq. ft.

*Trees located in certain bufferyards are exempt from these setbacks.

**The largest tree in any group will be considered as the first tree for counting purposes.

Section 58.3327. Sight Distance for Landscaping Adjacent to the Public Right-of-Way and Points of Access

No landscaping, tree, fence, wall, or similar item shall be maintained in the vicinity of any corner, street intersection, or accessway intersecting a public right-of-way that the Transportation Engineering Department of the city of Orlando determines is an obstruction to visibility, extends into street corner visibility areas set forth in Article II, Part 1A, or is a traffic hazard.

Section 58.3328 Parking Garages

All parking garages shall be required to meet the parking lot landscaping requirements of this part.

Perimeter Landscaping—Perimeter landscaping for parking garages shall be the same as for parking lots.

Interior Landscaping—Interior landscaping requirements for parking garages may be met in either of the following ways:

(a) Providing hanging baskets, landscape planters, and/or flower boxes around the exterior of the first three levels of the parking garage structure; or

(b) Providing within the perimeter landscape area additional landscaping equivalent to that which would be required for interior landscaping for a surface parking lot of equal capacity, as determined by the Zoning Official.

Table A-1. Tree Size Classifications*

Wherever the requirements of this part specify the use of small, medium, or large trees, the following minimum standards shall apply:

Height/Caliper	Crown Diameter	Number of Points: Retained Native	Number of Points: Installed Native	Number of Points: All Non-Native
Small tree				
8 ft./1 in.	NA	0.7	0.7	0.6
10 ft./1½ in.	NA	1.0	1.0	0.8
12 ft./2 in.	NA	1.4	1.4	1.0
15 ft./3 in.	NA	2.0	2.5	1.5
Medium tree				
18 ft./4 in.	12 ft.	2.5	3.0	2.0
25 ft./NA	NA	3.0	3.2	2.5
30 ft./NA	NA	3.5	3.5	3.0
35 ft./NA	NA	4.0	4.0	3.5
Large tree				
40 ft./NA	35 ft.	5.0	5.0	4.0
Specimen tree				
NA/NA	NA	7.0	NA	5.0

Small trees must meet both the height and caliper standards; medium and large trees need only meet either the height, caliper, or crown diameter to qualify.

**Editor's note:* These tree size classifications are taken from the tree and plant species list mentioned in the ordinance. Space constraints prohibited the full publication of that list here.

The nation's largest parking garage rooftop garden serves the Kaiser Center Building in Oakland, California. The garden atop this five-story, 1,500-space garage requires the care of three full-time gardeners and includes a reflecting pool built in the shape of nearby Lake Merritt. (Theodore Osmundson and Associates—Landscape Architects)

Section 58.3308. Standards for Trees: General Requirements

Tree Points—Wherever the requirements of this chapter specify the attainment of a certain number of tree points, the number of points awarded per tree shall be as shown [in Table A–1].

Canopy and Understory Trees—The term "canopy tree" refers to a species of tree that normally grows to a mature height of 40 feet or more, while "understory tree" refers to a species that normally grows from 15 to 35 feet. Wherever the requirements of this chapter specify the use of canopy trees or understory trees, refer to the tree and plant species list [in Table A–1] to determine the approved tree species within each of these categories. Understory trees may be substituted for up to a maximum of 50 percent of the number of canopy trees required; provided, however, that two understory trees shall be provided for each canopy tree replaced.

Small, Medium, and Large Trees—The terms "small," "medium," and "large" refer to the size of a tree at the time it is installed or retained, regardless of its species. Wherever the requirements of this part specify the use of small, medium, or large trees, the minimum standards of the tree and plant species list shall apply. Small trees must meet *both* the height and caliper standards of the tree and plant species list; medium and large trees need only meet either the height, caliper, or crown diameter to qualify.

3. Landscaping Standards for Nonconforming Parking Lots, Raleigh, North Carolina

Section 10-2068.6. Preexisting vehicular surface areas landscape regulations

(a) Intent and purpose. The city of Raleigh recognizes that the planting and growing of trees can improve the air quality of the community, ameliorate the microclimates of urban and urbanizing areas of the city, greatly improve the appearance of the city, reinforce the civic pride Raleigh takes in being known as the "City of the Oaks," and, to some extent, improve noise attenuation. To this end, the city of Raleigh has established and funded an urban tree-planting program.

In funding this program and in requiring new development to retain or replace trees and other natural vegetation, Raleigh has established standards of growth and development that will maintain and improve the quality of life that makes the city attractive and desirable. Moreover, the city of Raleigh recognizes that patterns of growth, development, and urbanization of the past have resulted in the loss of Raleigh's natural tree cover to the detriment of the microclimate, air quality, and the appearance and perception of the city. The city also recognizes that to fail to amortize these nonconformities jeopardizes not only the physical revitalization of the city, but will not provide the environmental benefits associated with living trees equally to all regions of the city and will provide preexisting developments an unfair competitive advantage over newer developments.

It is also recognized that designing preexisting developments to meet new regulations is more difficult and expensive than applying these standards to [new] properties. To this end, greater flexibility is provided herein for preexisting developments. The practical effect of 10-2068.6(c), below, is to bring these preexisting areas into conformity with the regulations governing ratio of required living trees and parking spaces, which was adopted June, 1979, and which existed prior to the passage of this Code section. No expenditure made for removing existing asphalt, constructing planting areas, and adding dirt and plant materials, which is required to comply with subsection 10-2068.6(c) below, shall be required in excess of two percent of the total assessed real property tax value of the property on which these improvements are being made.

(b) Any preexisting vehicular surface area that expands in excess of [25 percent of existing land area or floor area] shall provide [landscaping in an amount similar to that required of new development].

(c) No later than five (5) years following the application of this section (January 1, 1987), all vehicular surface areas shall be brought into compliance with all of the following provisions:

(1) Existing vehicular surface areas shall provide and maintain landscaped planting areas within the interior or adjacent or both to the vehicular surface areas. Each landscaped planting area shall contain a minimum of 150 square feet in area with minimum dimensions of seven feet and, except for vehicular display areas [e.g., a car dealership] shall contain at least one locally adapted shade tree in conformance with the requirements of this Code. However, existing plant areas of 112 square feet and existing trees that formerly met the requirements of this chapter may still be used to meet these newer requirements provided that, if these existing trees die or become unhealthy, they shall be replaced by shade trees. "Shade tree" as used herein means any tree, evergreen or deciduous, whose mature height of its species can be expected to exceed 35 feet and that has an expected crown spread of 30 feet or more is considered a shade tree in accordance with American Standards of Nursey Stock, set forth by the American Association of Nurserymen. The shade tree, existing or planted, shall be at least eight feet in height and 6.25 inches in circumference (two inches in diameter) measured at one-half foot above grade for new planted trees and measured at 4.5 feet above grade for existing trees.

(2) Trees shall be provided at the minimum rate of one shade tree for every 4,000 square feet of the total vehicular surface area. All vehicular surface areas located within the same block that serve one or more businesses or uses of land or share unified ingress and egress shall be considered as a single vehicular surface area for the purpose of computing the required rate of trees, notwithstanding ownership.

(3) Landscaped planting areas shall be located at the owner's discretion provided that no parking space be more than 100 feet from the trunk of a natural shade tree, with no intervening building. Existing trees located within the rights-of-way, but outside medians, may be used to meet the distribution requirements of this subsection only. For vehicular display areas that are not required to have trees, measurements shall be made from the edge of the landscaped planting areas, and no stored vehicle shall be farther than 100 feet from the edge of any landscaped planting area.

(4) The number of required parking spaces may be reduced by the following ratio: the square footage of required landscaped planting areas divided by 150, but no fraction thereof, provided that no reduction in the number of off-street parking spaces authorized by this section in excess of 10 percent shall occur without the prior approval of the city council, which shall first determine if further reductions will cause on-street parking congestion.

RECENT PLANNING ADVISORY SERVICE REPORTS

362 **Loft Conversions: Planning Issues, Problems, and Prospects.** August 1981. 38 pp. $16; PAS subscribers $8.

363 **Linking Plans and Regulations: Local Responses to Consistency Laws in California and Florida.** September 1981. 26 pp. $16; PAS subscribers $8.

364 **Reducing Earthquake Risks: A Planner's Guide.** October 1981. 82 pp. $18; PAS subscribers $9.

365 **Accessory Apartments: Using Surplus Space in Single-Family Houses.** December 1981. 24 pp. $16; PAS subscribers $8.

366 **Planners' Salaries and Employment Trends, 1981.** January 1982. 22 pp. $16 (photocopy).

367 **Zero Lot Line Development.** March 1982. 22 pp. $16; PAS subscribers $8.

368 **Designing Effective Pedestrian Improvements in Business Districts.** May 1982. 60 pp. $16; PAS subscribers $8.

369 **A Planner's Guide to Low-Level Radioactive Waste Disposal.** August 1982. 53 pp. $16; PAS subscribers $8.

370 **Regulating Videogames.** September 1982. 30 pp. $16; PAS subscribers $8.

371 **Changing Development Standards for Affordable Housing.** October 1982. 30 pp. $20; PAS subscribers $10.

372 **Using Microcomputers in Urban Planning.** November 1982. 22 pp. $8 (photocopy).

373 **Water Conservation in Residential Development: Land-Use Techniques.** December 1982. 34 pp. $16 (photocopy).

374 **Preparing a Historic Preservation Ordinance.** February 1983. 46 pp. $16; PAS subscribers $8.

375 **Planning for Underground Space.** April 1983. 54 pp. $16; PAS subscribers $8.

376 **Improving Street Climate Through Urban Design.** June 1983. 34 pp. $16; PAS subscribers $8.

377 **Flexible Parking Requirements.** August 1983. 38 pp. $16; PAS subscribers $8.

378 **Working With Consultants.** October 1983. 33 pp. $16; PAS subscribers $8.

379 **Appearance Codes for Small Communities.** October 1983. 26 pp. $16; PAS subscribers $8.

380 **Analyzing the Economic Feasibility of a Development Project: A Guide for Planners.** November 1983. 38 pp. $16; PAS subscribers $8.

381 **Increasing Housing Opportunities for the Elderly.** December 1983. 16 pp. $16; PAS subscribers $8.

382 **Planners' Salaries and Employment Trends, 1983.** February 1984. 18 pp. $16 (photocopy).

383 **How To Set Up a Planning Agency Library.** April 1984. 38 pp. $16; PAS subscribers $8.

384 **Regulating Radio and TV Towers.** June 1984. 38 pp. $16; PAS subscribers $8.

385 **Affordable Single-Family Housing: A Review of Development Standards.** August 1984. 117 pp. $24; PAS subscribers $12.

386 **State and Local Regulations for Reducing Agricultural Erosion.** September 1984. 42 pp. $16; PAS subscribers $8.

387 **Traffic Impact Analysis.** October 1984. 34 pp. $16; PAS subscribers $8.

388 **Planning Software Survey.** November 1984. 32 pp. $16; PAS subscribers $8.

389 **Tax Increment Financing: Part 1. What Is TIF? Part 2. Determining Potential Gains and Losses of TIF.** December 1984. 19 pp. $16; PAS subscribers $8.

390 **Infrastructure Support for Economic Development.** September 1985. 38 pp. $16; PAS subscribers $8.

391 **Home Occupation Ordinances.** October 1985. 38 pp. $16; PAS subscribers $8.

392 **Innovative Capital Financing.** December 1985. 38 pp. $16; PAS subscribers $8.

*393 **Managing Municipal Information Needs Using Microcomputers.** April 1986. 22 pp. PAS subscribers $8.

394 **Regulating Satellite Dish Antennas.** May 1986. 30 pp. $16; PAS subscribers $8.

*395 **Planners' Salaries and Employment Trends, 1985.** June 1986. 18 pp. PAS subscribers $8.

*396 **Standards for Self-Service Storage Facilities.** September 1986. 22 pp. PAS subscribers $8.

397 **Siting Group Homes for Developmentally Disabled Persons.** October 1986. 46 pp. $16; PAS subscribers $8.

398 **Regulating Manufactured Housing.** December 1986. 38 pp. $16; PAS subscribers $8.

399 **Aesthetics and Land-Use Controls.** December 1986. 46 pp. $16; PAS subscribers $8.

*400 **The Planning Commission: Its Composition and Function, 1987.** May 1987. 11 pp. PAS subscribers $8.

*401 **Transferable Development Rights Programs: TDRs and the Real Estate Marketplace.** May 1987. 38 pp. $16; PAS subscribers $8.

*402 **Seven Methods for Calculating Land Capability/Suitability.** July 1987. 22 pp. PAS subscribers $10.

403 **Computer Applications in Economic Development.** August 1987. 38 pp. $20; PAS subscribers $10.

*404 **How to Conduct a Citizen Survey.** November 1987. 24 pp. PAS subscribers $10.

405 **New Standards for Nonresidential Uses.** December 1987. 26 pp. $20; PAS subscribers $10.

406 **Housing Trust Funds.** December 1987. 25 pp. $20; PAS subscribers $10.

*407 **Planners' Salaries and Employment Trends, 1987.** December 1987. 15 pp. PAS subscribers $10.

408 **The Calculation of Proportionate-Share Impact Fees.** July 1988. 38 pp. $20; PAS subscribers $10.

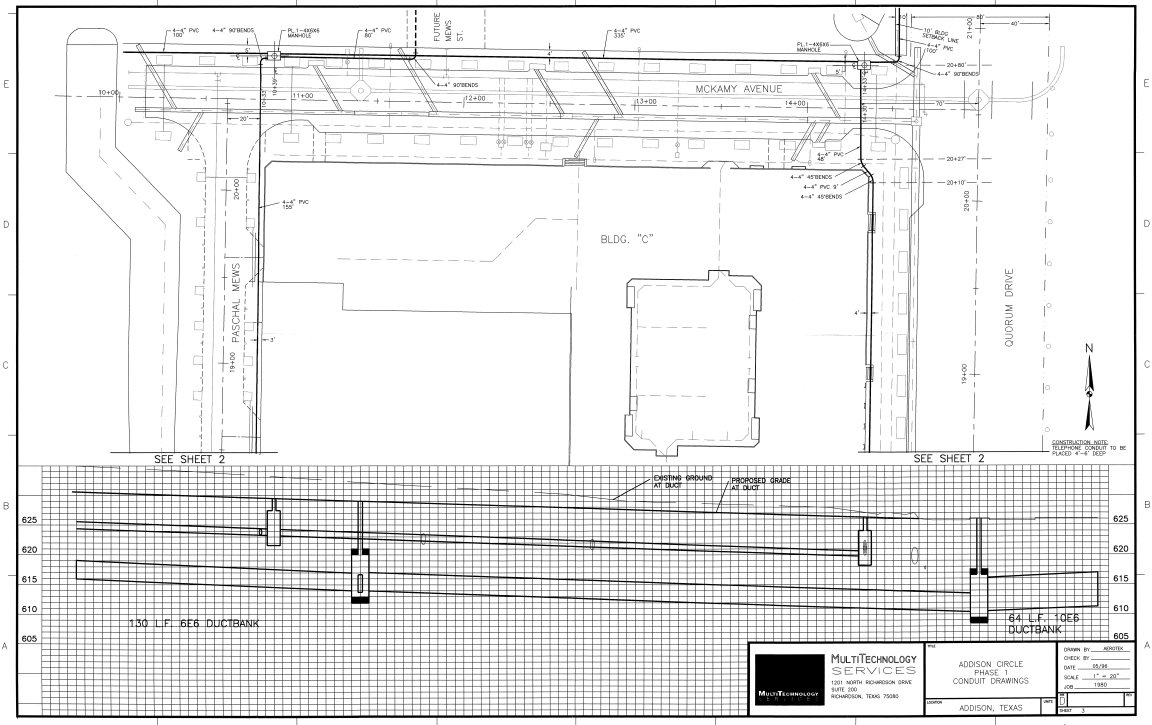
*409 **Enforcing Zoning and Land-Use Codes.** August 1988. 30 pp. PAS subscribers $10.

*410 **Zoning Bonuses in Central Cities.** September 1988. 30 pp. PAS subscribers $10.

411 **The Aesthetics of Parking.** November 1988. 34 pp. $20; PAS subscribers $10.

*Available only to subscribers of Planning Advisory Service.

American Planning Association
Planning Advisory Service


MCKAMY AVENUE
PASCHAL MEWS
QUORUM DRIVE
FUTURE MEWS ST.
BLDG. "C"
10' BLDG. SETBACK LINE
SEE SHEET 2
SEE SHEET 2
CONSTRUCTION NOTE:
TELEPHONE CONDUIT TO BE PLACED 4'-6" DEEP
EXISTING GROUND AT DUCT
PROPOSED GRADE AT DUCT
130 L.F. 6E6 DUCTBANK
64 L.F. 10E6 DUCTBANK
625
620
615
610
605
MULTITECHNOLOGY SERVICES
1201 NORTH RICHARDSON DRIVE
SUITE 200
RICHARDSON, TEXAS 75080
ADDISON CIRCLE
PHASE 1
CONDUIT DRAWINGS
ADDISON, TEXAS
DRAWN BY AGH/TEH
CHECK BY
DATE 05/96
SCALE 1" = 20'
JOB 1980
SHEET 3